Pacific islands foretell future of climate change

When the people of Tuvalu, an island nation in the Pacific, first encountered Europeans in the 19th century, they gave them the name *palangi*. Victorian travellers translated the word to mean "heaven bursters". The name has an uneasy resonance now that climate change, a bad spell escaped from the Pandora's box of the rich world, is disrupting the lives of the region's people.

Stretched over 600 kilometres of ocean, Tuvalu is a string of nine coral atolls no more than a few metres above sea level at their highest point. Since their ancestors arrived around 2,000 years ago, the islanders have adapted to cope with living in one of the earth's most fragile and extreme environments. But Tuvalu's way of life, along with that of other low-lying islands and coastlines around the world, is now threatened by both a changing global climate and misguided development priorities.

During spring tides, the airport runway floods on Funafuti, Tuvalu's main administrative centre. Last year, for the first time in living memory, it flooded for five consecutive months at high tide. As a result, this tiny Pacific nation of 10,000 people attracted media headlines worldwide for the dangers it faces from rising seas. The government has asked neighbouring countries to help relocate its people. In March 2002, the prime minister announced he was considering taking the world's worst polluters to court (see Box 4.1).

But while scientists debate the precise nature of sea-level rise around Tuvalu, there are many other equally serious risks posed to all Pacific islands by global warming. Climate change threatens to make cyclones more intense and unpredictable. Storm surges associated with cyclones are already eroding coastlines and contaminating freshwater supplies. Rising temperatures are increasing the spread of infectious disease vectors. Droughts in some regions are predicted to become more frequent. The latest data show that the number of people in the Oceania region affected by weather-related disasters has soared by a staggering 65 times over the past 30 years (see Figure 4.1).

These disasters threaten to make life unviable for many coastal communities long before they finally succumb to rising tides. Still rusting in Funafuti's lagoon is the wreck of a large fishing boat that fruitlessly sought shelter during a cyclone in 1972. The island was flattened. Miraculously only a handful of people died. To avoid being blown out to sea many tied themselves to trees. The island recovered. But during the 1990s Tuvalu suffered seven cyclones. The United Nations (UN) Fiji-based regional disaster expert, Charlie Higgins, argues that, because of climate change, "the frequency

Photo opposite page: From 1992-2001, Kiribati's population was the fourth most disaster-affected on earth. Low-lying islands and coastlines are especially vulnerable to the weather-related disasters associated with global warming

Caroline Penn/Panos, Kiribati.

Box 4.1 Relocation – the last resort

On 5 March 2002, the prime minister of Tuvalu, Koloa Talake, announced at the Commonwealth Heads of Government Meeting in Australia that his nation was planning to sue the world's worst greenhouse gas polluters at the International Court of Justice, as predicted by the *World Disasters Report 2001*. According to the *Pacific Islands Report*, he stressed that global warming was an issue threatening both his people and country. "It is frightening," said Talake, "islands that used to be our playgrounds have disappeared. Some scientists say there is no rise in sea level, but the tide is rising. We have seen it with our own eyes."

Last year, Tuvalu's government attracted the world's attention by declaring it would start evacuating its citizens in the face of climate change and rising sea levels. When Australia rejected their proposal for special immigration status, Tuvalu began to negotiate a deal with New Zealand whereby a number of its citizens would be accepted each year, effectively as "environmental refugees". Tuvalu only has a population of around 10,000, and the arrangement is projected to last for 30 to 50 years.

In response to criticism that they are admitting defeat by taking the precautionary approach and planning for gradual relocation, Paani Laupepa, who represents Tuvalu at international climate negotiations, responds, "We have to plan for the future, any responsible government would do that. They are finalizing the number and exact criteria for people to go and when it will start... New Zealand has agreed to our scheme but it is under negotiation."

It is easy for urban-dwelling people in developed countries to underestimate the importance of land to Pacific islanders, and hence the deep personal and cultural significance of its loss. One woman from Kiribati explains, "We can't just move to another country. I would love to go to Fiji. But there I have no land. There I am no one."

The spectre of wholesale relocation raises challenging questions. Once land has been lost, will a residual nationality be able to persist, or does there need to be a new category of "world citizen"? Could such a status be created in acknowledgement of the fact that climate change is a collective problem and requires a collective solution? One of the greatest obstacles in preparing for potential mass movements of environmental refugees is the lack of flexibility in the designation of refugee status. Refugee law needs revising to cope with the problem.

In the event of full-scale national evacuation, there are as yet no plans to deal with an abandoned country's exclusive economic zone, its territorial waters and nationhood. Paani Laupepa expresses a desire to preserve national integrity, even if it means doing it somewhere else, "I think we could have a state within a state, that has to be negotiated with other governments... It will enable us to preserve our sovereign integrity."

Few things could be more sensitive than carving out new territory to create space for a nation. A process that carries a stamp of legitimacy from the UN General Assembly will be needed to handle such a challenge. Poni Favae from Tuvalu's environment department picks up the point, "The UN has the IPCC [to discuss climate change] but it has no equivalent panel to talk about migration." ■

of extreme weather-related events will increase, their intensity will increase, and as these events increase, the countries will really be in a cycle that they can't break out of".

Pacific island nations are on the front line of confrontation with climate change – a change which far from being scientific theory is now described by UN experts as "inevitable".

Atolls like Tuvalu reveal the threats in microcosm. Their fate is echoed around the region and among vulnerable communities across the world. "Our early experience with the real consequences of global warming should be the canary in the coal mine," says Leo A. Falcam, president of the Federated States of Micronesia.

This chapter will focus on the immediate threats to Pacific island nations posed by climate change, and the ways in which conventional development may be fuelling rather than fending off vulnerability. It will examine the options for disaster preparedness and "adaptation" at community, national and regional levels. It will argue that all development decisions from now on have to be viewed through the lens of risk reduction. And it will conclude that far more resources and political will are needed to make meaningful progress in protecting Pacific islanders, and coastal dwellers worldwide, from the worst of the weather.

Rising seas only part of the problem

According to the World Meteorological Organization (WMO), 2001 was the second warmest year on record. Since 1976, the global average temperature "has risen at a rate approximately three times faster than the century-scale average". In 2001, the Intergovernmental Panel on Climate Change (IPCC), the group of scientists that advise international climate negotiations, produced their Third Assessment Report (TAR). This projects that over the period 1990-2100, global average surface temperatures will climb at a rate without precedent during the last 10,000 years.

Sea levels are projected to rise between 9 and 88 centimetres over the same period. According to the IPCC, "although there will be regional variation in the signal, it is projected that sea level will rise by as much as 5mm per year over the next 100 years as a result of greenhouse gas-induced global warming". The panel says that this rise is "two to four times greater than the rate experienced in the previous 100 years," and adds: "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."

The scientists say that "sea-level rise poses by far the greatest threat to small island states relative to other countries. Although the severity of the threat will vary from island to island, it is projected that beach erosion and coastal land loss, inundation,

flooding, and salinisation of coastal aquifers and soils will be widespread". These scenarios do not, however, take into account the possibility of sea-level rises due to melting of the Antarctic and Greenland ice sheets. Should seas rise by a metre or more, the consequences are almost unimaginable (see Box 4.2).

Low-lying atolls are not the only islands threatened by sea-level rise, and the accompanying threats of coastal erosion and saltwater intrusion. The vulnerable shorelines of many higher islands and coastal communities are home to large population settlements and critical infrastructure. Small rises in sea levels disguise much bigger effects, such as fluctuating tides and much higher storm surges. According to WMO, "sea-level rise would increase the impact of tropical cyclones and other storms that drive storm surges. The effects would be disastrous on small island states and other low-lying developing countries, such as the Maldives, Tuvalu, Kiribati and Vanuatu where 90 per cent of the population lives along the coasts".

Coastal flooding not only erodes beaches and threatens infrastructure, it inundates soils and fresh water supplies with salt. Many Pacific atolls, such as Tuvalu and Kiribati, are entirely dependent on rain-fed drinking water sources or thin underground freshwater "lenses". However, the combination of changing rainfall patterns and rising seas is threatening this crucial resource. On Tuvalu, there has been an overall decrease in rainfall over the past 50 years. Droughts can last for three or four months, but become a problem after only two or three weeks. On most of the islands the groundwater is not drinkable, according to the environment ministry. And there is not enough capacity to collect and store rainwater.

Salinization of soils and sources of drinking water by higher seas and storm surges may force some islanders to abandon their homes long before the seas swallow them up. Late last year in Vanuatu, one chief on an outlying island recommended that his people relocate to a larger island after saltwater began inundating their land. In the Marshall Islands, farmers are resorting to growing crops in old oil drums, since the islands' soil is now too saline to plant in.

On the Carteret atolls off the coast of Papua New Guinea, rising seas have cut one island in half, and increased soil salt levels, killing off banana and vegetable crops. According to the atolls' district manager, islanders can no longer plant food crops because when they dig they find salt water. Since August 2001, the atolls' 1,500 inhabitants have been surviving on a basic food ration of rice and sweet potatoes shipped in from the mainland. While relocation of the islanders would appear the only long-term solution, the Papuan government lacks the money to move them.

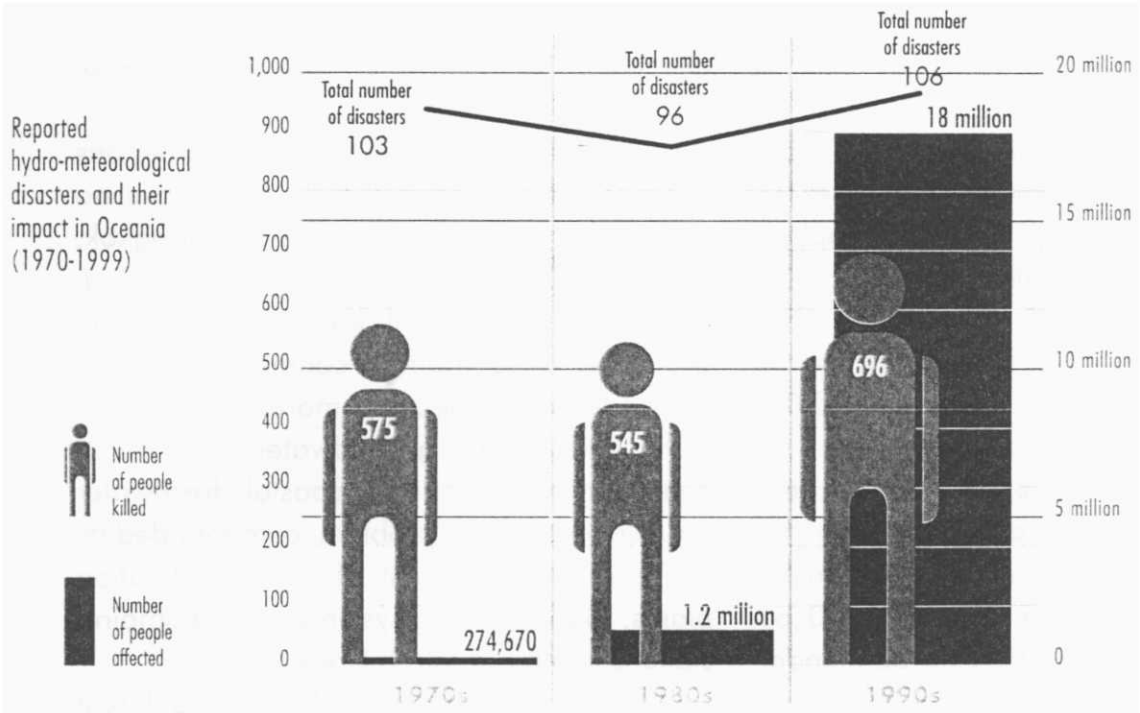
Hilia Vavae is director of Tuvalu's meteorological office, and has worked there since 1981. Her expertise marks her out as special. Hilia was approached in the street by a

woman she didn't know who noticed a bandage on her foot. "Get it mended," said the unknown woman, "you are the most important person in Tuvalu."

Because of the sheer complexity of the science involved, Vavae says that predicting the effects of climate change is an uncertain business. But pointing to 50 years of observations, she says that air temperatures have generally warmed throughout the period. And, she adds, "In the 1980s, only in February did the low-lying areas get flooded, and not very much. But since the late 1990s, and especially now, the frequency of flooding has tremendously increased. Last year we were flooded in November, December, January, February and March – it's quite unusual."

The case of Tuvalu has aroused intense debate about the extent to which sea levels are rising around the atolls. Some sources suggest that tectonic plate movements are also a factor in the atolls' position relative to the sea. In order to clarify what is happening now to absolute sea levels, taking account of land movements, a team of scientists from GeoScience Australia began setting up a series of GPS (Global Positioning System) stations around the Pacific region during late 2001.

Sea-level rise, however, is only one of a range of global warming-induced changes which threaten coastal communities. For example, a rise in sea surface temperatures poses a serious threat to coral reefs. Reefs maintain natural sea defences, supply beach sand and provide habitats for marine animals and fish essential to the local diet. Coral



Box 4.2 Treading water: climate change and sea-level rise

In 2001, the IPCC projected that, within a century, global warming could raise sea-levels by up to 88 centimetres. One billion people live at sea level or just a few metres above. Of the world's 19 mega-cities (agglomerations with more than 10 million inhabitants), 16 are situated on coastlines and all but four are in the developing world. But a comprehensive global assessment of the numbers who would be displaced by a one metre rise in sea levels, or even a half metre rise, has not been made. The most vulnerable areas are found in the tropics, especially the west coast of Africa, south Asia and south-east Asia, and low-lying coral atolls in the Pacific and Indian Oceans. The nations hardest hit will be those least able to afford coastal protection measures and where inhabitants have nowhere else to go.

According to a 1998 report by the IPCC, *Regional Impacts of Climate Change*, a one metre rise in sea level would inundate 3 million hectares in Bangladesh, displacing 15 to 20 million people. Viet Nam could lose 500,000 hectares of land in the Red River Delta and another 2 million hectares in the Mekong Delta, displacing roughly 10 million people.

A one-metre rise would swamp about 85 per cent of the Maldives' main island, which contains the capital Male. It could turn most of the Maldives into sandbars, forcing 300,000 people to flee to India or Sri Lanka. "We would have no choice," said President Gayoom as long ago as 1989, "for the Maldives would cease to exist as a nation."

West Africa is at high risk. Up to 70 per cent of the Nigerian coast would be inundated by a one-metre rise, affecting more than 2.7 million hectares and pushing some beaches three kilometres inland. Close to 4 million people would be displaced. Oil production in the Niger Delta could lose US$ 6-18 billion a year. Gambia's capital, Banjul, would be entirely submerged.

In the Mediterranean, Egypt would lose at least 2 million hectares of land in the fertile Nile Delta displacing 8-10 million people, including nearly the entire population of Alexandria. The demise of this historic city would cost the country over US$ 32 billion, close to one-third of annual gross national product (GNP) in 1999.

South American cities would suffer some of the worst economic effects. A one-metre rise in sea level would displace 600,000 people in Guyana – 80 per cent of the population – and cost US$ 4 billion, or 1,000 per cent of its tiny GNP. Meanwhile, the United States has calculated that the cumulative costs of a 50-centimetre rise by 2100 could top US$ 200 billion, not including the huge extra costs of extreme weather events.

As seas rise, coastal land in some regions is sinking. Most large coastal cities have no plans to deal with this. Manila, Bangkok, Shanghai, Dhaka and Jakarta are subsiding, due to the development pressures of excessive groundwater pumping, coupled to urban sprawl (as areas become more built-up, less water seeps into groundwater reservoirs). Saltwater intrusion into coastal freshwater aquifers is a serious problem, compounded by sea-level rise. The cost of new desalination plants, flood-control systems and pumping stations could run into billions.

In Bangkok, rising sea levels would cost an additional US$ 20 million per year in

pumping costs alone. Costs for relocating displaced squatter communities would be astronomical. In Shanghai, up to a third of the city's 17 million inhabitants would be flooded, displacing up to 6 million people. Singapore, one city with a comprehensive planning culture, has nothing in its latest 50-year master plan to deal with a one-metre sea-level rise.

"We are overwhelmed right now," shuddered one of Manila's water managers, "I can't even imagine what would happen if the sea rises by a metre. Hundreds would drown during the rainy season and we would be faced with massive capital investments in new, bigger pumping stations and storm-drain systems."

If municipal governments don't begin to take sea-level rise seriously, the term "treading water" is likely to become much more than a metaphor for policy inaction. ■

reefs also provide badly needed foreign exchange earnings through tourism for many small islands. But reef-building corals die when temperatures rise beyond a narrow band.

Coral "bleaching" has already occurred over the past 20 years when sea surface temperatures warmed just one degree Celsius higher than the summer maximum. During the last El Niño in 1997-98, warmer seas affected up to 90 per cent of live reefs around some islands. Such bleaching could soon become a frequent event. According to the IPCC, "the thermal tolerance of reef-building corals will be exceeded within the next few decades". The death of reefs will increase the vulnerability of low-lying shores to rising seas and storm surges.

Cyclones, droughts and disease will worsen

While changes in sea level and temperature may seem tiny to the untrained observer, they will trigger unpredictable changes in the frequency and intensity of extreme weather events. The latest data on the Oceania region (Pacific islands plus Australia, New Zealand and Papua New Guinea) from the Brussels-based Centre for Research on the Epidemiology of Disasters (CRED) show that these changes may already be under way.

While the overall number of weather-related disasters reported in Oceania has remained fairly constant between the 1970s and 1990s, the impacts of these disasters have become far heavier (see Figure 4.1). Total numbers reported killed by weather-related disasters rose 21 per cent between the 1970s and 1990s. But this rise is dwarfed by an astonishing increase in the numbers of people reported *affected* by such disasters: from 275,000 in the 1970s, to 1.2 million in the 1980s to 18 million in the 1990s – a 65-fold increase. Cyclones affected 18 times more people in the 1990s than in the 1970s, while floods and landslides affected nine times more.

The greatest increase, however, is in the reported impact on Oceania of droughts and extreme temperatures. During the 1970s and 1980s, just one fatality was reported and a total of 71,000 were affected. But in the 1990s alone, drought and extreme temperatures claimed 121 lives and affected over 13 million people. Taken together, these statistics show that the reported impacts of each disaster have escalated dramatically since the 1970s. This suggests that weather-related disasters are becoming more extreme, or that people living in the region are less well prepared and protected than before.

Scientists believe that climate change could make cyclone seasons increasingly unpredictable. Local people, used to more regular cyclone patterns, may in future be less able to prepare. A single cyclone, Kina, hit Fiji in 1993 and caused the redeployment of 32 per cent of the government's budget to pay for urgent reconstruction. In the north-west Pacific, Typhoon Paka hit Guam in 1997 with sustained winds of over 250 kilometres per hour, inflicting more than US$ 600 million of damage.

Normal life comes to a standstill when extreme weather events descend upon small nations (see Box 4.3). Tropical Cyclone Irina struck the Cook Islands in early December 2001. Heavy rains and strong winds hit with very little warning. "I have never seen the seas as high as they were then," said Niki Rattle of the Red Cross, who has lived on the Cook Islands for 29 years. "Many low-lying areas were flooded. The supply of local fruit and vegetables was ruined." International flights stopped, roads were ripped up, Christmas festivities and first-aid workshops were cancelled. On the island of Mangaia local people said flooding was the worst since 1977.

During the past 30 years, tropical cyclones have generally developed over the warmer waters of the western tropical Pacific. During El Niño events, sea temperatures increase towards the central and eastern Pacific, bringing with them more cyclone threats. Scenarios developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) suggest that "under climate change, there is likely to be a more El Niño-like mean state over the Pacific". This will increase the threat posed by tropical cyclones to islands in the central and eastern Pacific. The CSIRO research adds that, as atmospheric carbon dioxide levels increase, the intensity of tropical cyclones will also increase, bringing wind speeds 10-20 per cent higher than previously.

More permanent El Niño-type conditions could bring more drought, particularly to the islands of the south-west Pacific. During the intense El Niño of 1997-98, Papua New Guinea was hit by its worst drought of the century. Cloudless skies brought severe frost at higher altitudes, destroying a year of crops in some areas and exposing up to 650,000 people to starvation or disease. According to the South Pacific Applied Geoscience Commission (SOPAC), the drought caused an estimated US$ 100 million of damage. The same El Niño also hit Fiji and the Solomon Islands hard.

Drought slashed Fiji's vital sugar cane crop in half during 1997-98 and caused US$ 18 million in agricultural losses. During the 1982-83 El Niño, rainfall across much of the western Pacific was 70-90 per cent below average. In March 2002, there were early indications that another El Niño is on its way.

Increasingly unstable weather patterns associated with global warming are already having negative health consequences across the Pacific region. "Many tropical islands are now experiencing high incidences of vector- and water-borne diseases that are attributed to changes in temperature and rainfall regimes," says the IPCC. Outbreaks of dengue fever are becoming more common. Malaria, which was previously found mainly in the western and central Pacific, is now extending as far east as Fiji. The disease is also being found at altitudes never seen before in Papua New Guinea.

Options for mitigation and adaptation

The island nations of the Pacific are diverse in many ways, but they share some common vulnerabilities which hamper their ability to mitigate and adapt to the negative effects of climate change:

Small physical size and (often) low elevation.
Wide geographic distribution and remoteness.
Proneness to "natural" disasters.

In some Pacific islands, the local population can no longer grow their staple crops due to increased salt levels in the soil.

Jerry Galea/ International Federation, Papua New Guinea.