Top–down, Bottom–up: Mainstreaming Adaptation in Pacific Island Townships

Melchior Mataki, Kanayathu Koshy and Veena Nair

Introduction

Climate change, whether due to natural variability or human activity, is one of the most pressing issues for the Pacific island countries. The impacts of climate variability and extreme events such as cyclones, floods, droughts and sea level rise are rapidly pushing people beyond their coping range. The already strained economies are being drained trying to keep up with the impacts of these stresses on livelihoods. In the 1990s alone, the Pacific island region bore up to US$1 billion costs related to climate extremes (Campbell, 1999; Feresi et al, 2000), and the costs are expected to rise even further with a rise in the frequency and intensity of extreme events.

Climate projections for the South Pacific indicate warming of 0.8 to 1.8°C and precipitation changes that range from -8 to +7 per cent by mid-century (Ruosteenoja et al, 2003). By the end of the century, projected warming is 1.0 to 3.1°C and precipitation changes range from -14 to +14 per cent. Projections of globally averaged sea level rise range from 0.18m to 0.58m in 2090–2099 relative to 1980–1999, while tropical cyclones are likely to become more intense, have higher peak wind speeds and bring heavier rainfall (IPCC, 2007). Small islands share a number of characteristics that increase their vulnerability to climate variability and change, including small land area, proneness to natural disasters and climate extremes, limited water supplies, high concentrations of population and infrastructure close to coasts, open economies, low adaptive capacity, and adaptation costs that are high relative to national incomes (Mimura et al, 2007).

Analyses by Feresi et al (2000) predict up to 14 per cent loss of coastal lands in Fiji due to sea level rise and flooding by 2050, lands that are prime areas for economic activities and human settlements. In some areas, the demand for water resources is expected to outstrip supply by 5–8 per cent by 2050 (Feresi et al, 2000). Agriculture, human health and fisheries are also expected to be impacted negatively because of climate change, which in turn will have a negative impact on the economies of Pacific island countries.
Following a ‘do-nothing’ option, a small island such as Viti Levu (Fiji) could incur a cost equivalent to 2–4 per cent of Fiji’s gross domestic product, or US$23–52 million, by 2050 in damages associated with climate-related disasters (World Bank, 2000).

The capacity to mitigate the impacts of climate change and extreme events is beyond the island countries of the Pacific. Even if the developed nations reach the target of reducing emissions as proposed by the Kyoto Protocol, climate will continue to change, and the Pacific islands, among other poor countries of the world, will have to bear the consequences. The only logical option for Pacific island countries is to proactively learn to adapt to climate variability and extreme events.

Several adaptation options have been implemented in the Pacific islands through the actions of individuals, national governments and externally-funded climate change adaptation projects. The most common step being taken is the construction of seawalls to protect settlements against coastal erosion and storm surges.

However, some options have proven to be unsuccessful in solving the underlying problems. For example, in Qoma, Fiji, the community reported experiencing frequent inundation further downstream after the construction of a sea wall upstream (World Bank, 2000). Given the uncertainties regarding impacts and adaptation strategies, varying approaches have been experimented with in the islands. For example, the Secretariat of Pacific Regional Environment Program (SPREP) carried out the project Capacity Building for the Development of Adaptation Measures in Pacific Island Countries (CBDAMPIC), which focused on community and national capacity building and identification and implementation of adaptation measures through community participation (Nakalevu et al, 2005). The Asian Development Bank- and Canadian Cooperation Fund for Climate Change-funded project Climate Change Adaptation in the Pacific (CLIMAP) has focused on developing case studies that demonstrate climate change adaptation through risk reduction. The case studies cover the spectrum from immediate project-level actions to longer-term national-level development planning.

This chapter presents lessons learned from a case study of vulnerability to river flooding and adaptation in Navua township of Viti Levu in Fiji, a typical community of the Pacific islands. The Navua case study is one component of a larger study implemented as part of the Assessments of Impacts and Adaptation to Climate Change (AIACC) programme. The project expanded an integrated framework for assessing climate change vulnerability and adaptation to incorporate both natural and human systems and applied the framework to Viti Levu in Fiji and Aitutaki in the Cook Islands (Koshy, 2007).

**Navua Township**

Navua, characterized by rapid urbanization, meagre economic activities and low to middle incomes, is prone to recurrent flooding. The 1996 census recorded the residential population as 4220, 52 per cent higher than the
population in 1986 (Sinclair Knight Merz, 2000) and the current population is estimated to be near 7000. Urbanization and resettlement of displaced sugar cane farmers following the expiry of their land leases has contributed to this rapid growth. Our surveys found that on average a Navua resident earns $US35–46 per week, which is comparable to the average weekly earnings recorded by a consulting firm in 2000 (Sinclair Knight Merz, 2000). This indicated that the socioeconomic status of average Navua residents has not improved over the past five years. Consequently, residents also rely on subsistence farming and fishing for sustenance and to supplement their incomes.

The land area of Navua is 16.7km², with a maximum elevation of 31.4m and a minimum elevation of less than 0.6m above sea level. The Navua floodplain is characteristically low lying, increasing the potential for flooding during intense and/or prolonged rainfall episodes. A section of the Navua river measuring about 163m wide and 5.8km in length runs along the town, with the central business district and some homes only a few metres from the river banks. The greater Navua area is crisscrossed by a network of irrigation channels and floodgates at the coast, previously used to distribute and control water needed for commercial rice farming.

Before 1990, commercial rice farming was an important economic activity in the area, but it was abandoned because of competition from cheaper rice imports from Asia, floods and pest infestation (Sinclair Knight Merz, 2000). Today, the main agricultural activities are small-scale commercial and subsistence farming of root crops such as cassava and dalo, or taro, and vegetables, and raising livestock such as cattle and goats. Logging in the upper catchment of the Navua river and aggregate mining in the river are also significant activities.

In 2003, 113 properties comprising 45 business properties (private and government) and 68 residential properties in the project site were surveyed. All interviewees were adults present at the properties during the survey. Information and data were gathered concerning socioeconomic variables (population, economic activities and income level); building types, recollections of past floods, views about factors contributing to flooding, adaptive measures taken by residents to cope with flooding, the barriers to implementing adaptive measures, and perceptions of about climate change in general. A second survey was carried out in 2004 following a flash flood that affected the study area in April of that year. Sixty-five per cent of properties initially surveyed in 2003 were surveyed again to record data relating to the recent flood. Interviews were also held with officials from the Navua Rural Local Authority and persons familiar with flooding in Navua. Results of these surveys are discussed below.

Flood Risks

Navua has experienced frequent flooding in recent decades (Fiji Meteorological Service, 2004), and flooding is the major threat to livelihoods of Navua residents. In the recent flooding episode of April 2004, the national government incurred costs of approximately US$65,000 for emergency food
rations for a 30-day period for the greater Navua area. Damages to homes were estimated at over US$100,000 (SOPAC, 2003). More than 2700 people, representing about 40 per cent of Navua’s population, were displaced from their homes because of the flooding and temporarily relocated to evacuation centres (Central Division Disaster Management Council Operation Centre, 2004).

Apart from businesses and the houses of a few middle-class residents, most of the properties in Navua are not insured because of financial constraints and inability to meet basic insurance requirements. And the full social and economic impacts of the most recent and previous floods are not known. However, the impacts are deemed substantial, taking into consideration destruction of crops, loss of income and properties, diseases and, in some cases, deaths. Many may not be able to improve their standard of living if they are to sustain significant damages to life and property on an annual basis.

In the surveys of residents, five significant local flood events were recalled since 1972, three of which flooded more than 80 per cent of the land area (Table 15.1). All five of the flood events came during the wet season of November to April, also the season of tropical cyclones, and four of the events were initiated by intense and prolonged rainfall associated with tropical cyclones. However, the most recent event, which caused the most extensive flooding of the five, was due to intensive rainfall associated with two consecutive tropical depressions. Because of strong variability in daily rainfall, there is also potential for flash floods in the dry season (May–October).

Table 15.1 Flood extent, duration and rainfall in five recalled flooding episodes in Navua

<table>
<thead>
<tr>
<th>Climate Event</th>
<th>Dates and Duration of Event</th>
<th>Total rainfall (mm)</th>
<th>Average Daily Rainfall (mm/day)</th>
<th>Area Flooded (% of study site)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bebe</td>
<td>19 Oct–6 Nov 1972 19 days</td>
<td>652</td>
<td>34</td>
<td>86</td>
</tr>
<tr>
<td>Wally</td>
<td>1–6 Apr 1980 6 days</td>
<td>682</td>
<td>113</td>
<td>22</td>
</tr>
<tr>
<td>Oscar</td>
<td>28 Feb–2 Mar 1983 3 days</td>
<td>412</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>Kina</td>
<td>26 Dec 1992–5 Jan 1993 11 days</td>
<td>537</td>
<td>6</td>
<td>89</td>
</tr>
<tr>
<td>Two tropical depressions</td>
<td>6–15 Apr 2004 10 days</td>
<td>592</td>
<td>59</td>
<td>90</td>
</tr>
</tbody>
</table>

Flood frequency has been observed to have increased in the past decade compared to earlier periods. Survey participants were asked their opinion on the factors that contribute to increased potential for flooding in Navua. Contributing factors identified by the respondents include increased sediment
input to the river, which raises the river bed; build up of sediments at the river mouth, impeding movement of water out of the basin; the presence of abandoned irrigation channels previously used in rice farming; non-functioning floodgates, especially those at the coast; lack of regular dredging of the Navua river; and changes in rainfall patterns.

While survey respondents report their perception that rainfall patterns have changed, this is not corroborated by our analysis of weather station data for Navua obtained from the Fiji Meteorological Service. Normal rainfall for Navua, based on the average for the 1961–1990 period, is 3500mm per year, but with large interannual variations of as much as +/-40 per cent (see Figure 15.1). Analysis of observed rainfall for the 43 year period 1960–2003 does not show any discernable increasing or decreasing trend. This result is consistent with similar analyses of rainfall patterns for Suva and Nadi carried out by Mataki et al (2006). The large interannual variations are driven mainly by movements of the South Pacific Convergence Zone, the main rain-producing system of the region, and the presence and absence of the El Niño Southern Oscillation and La Niña (Mataki et al, 2006). El Niño conditions are associated with droughts while La Niña episodes are associated with enhanced rainfall across the Western Equatorial Pacific, including Fiji.

![Figure 15.1 Observed rainfall anomalies for Navua, 1960–2003 (percentage variation from normal rainfall); the trendline is not statistically significant](image)

We also analyzed the average return periods for extreme rainfall events in the two wettest months of the year, March and April, based on changes in the time period between peak rainfall events. The average return period of intense rainfall decreased from approximately 3 years in the period up to 1994 to 2 years
since that time (see Figure 15.2). However, the reduction was found to be statistically insignificant. This further reinforces the conclusion that rainfall in the most recent decade has not diverged from the established norm of 1961–1990.

Nevertheless, the study site had been flooded in recent decades more frequently than in the past. The explanation lies in the complex interplay between climatic factors and human activities in the Navua watershed. The Navua river is silted more intensely than before because of intensified human activities such as logging, aggregate mining and agricultural practices in the upper Navua river catchment (Sinclair Knight Merz, 2000; Ba, 1993; SOPAC, 2003). Siltation raises the riverbed and increases the river’s potential to burst its banks during prolonged and/or intense rainfall episodes (Central Division Disaster Management Council Operation Centre, 2004; National Institute of Water and Atmospheric Research Ltd, 2004). The homeowners interviewed also recognized this as a major contributor to increasing flooding potential. Moreover, they stated the view that accumulated silt at the river mouth acts as a barrier to the free flow of water during floods.

Logging in the Navua catchment, mainly of mahogany, takes place in both natural and planted forests. Logging practices are regulated by the Fiji Forestry Decree of 1992 (Government of the Republic of Fiji, 1992) and the National
Code of Logging Practice (NCLP), as well as by other environmental legislation and forestry regulations. These instruments have provisions to reduce the environmental impacts of logging, including soil erosion, blockage of waterways and sediment input to streams and rivers (Strehlke, 1996). Despite the regulations, however, logging operators often knowingly ignore requirements, engaging in excessive bulldozing and logging within waterway buffer zones and on steep slopes (Chand and Prasad, 2005). Such practices have been cited as contributors to recent floods in the Northern Division of Fiji that caused damages estimated at 10 million Fijian dollars (Fiji Times, 2007). Some of Fiji’s largest mahogany forests are found in the upper catchment of the Navua river. Logging of these forests is contributing to problems of sedimentation of the river and is expected to increase in future years.

Aggravating the problem of sedimentation of the river is the failure of the national government to implement a programme of regular dredging of waterways. Dredging can facilitate the flow of rain-waters out to sea and dampen the severity and extent of flood events. However, the Navua river was last dredged in 1994 and funds that were earmarked for dredging the river in 2000 were diverted to other purposes (Auditor General of the Republic of Fiji, 2001).

Navua residents also attributed the extensive nature of flooding in April 2004 to dysfunctional irrigation channels and floodgates. Examination of the data in Table 15.1 indicates that the two most extensive floods occurred in 1993 and 2004, after commercial rice farming was abandoned. After the abandonment of rice farming, the irrigation channels and floodgates were poorly maintained, giving rise to blockages and uncontrolled movement of floodwater.

Elevation above the ground, location relative to the river and abandoned irrigation channels, other topographic features, and structural strength all influence the vulnerability of buildings to flooding. Seventy five per cent of surveyed homes were raised above ground level, while the remaining 25 per cent were built on ground level. Homes that were raised on pillars or had concrete porches were observed to be less affected by flooding, excluding factors such as the location of the home, the intensity of flooding and the strength of the building. The depth of water in homes that were flooded varied considerably. In most cases, both raised and unraised homes were flooded, but as expected, unraised homes experienced higher levels of water within them during floods, which also suggests that these homeowners generally sustain greater property losses. Nevertheless, even some homes raised nearly 2m above the ground level were also flooded during the five flooding episodes. These observations suggest that houses in Navua, especially those within a few metres of the river or confluence points of irrigation channels and those near previous flood water routes, may need to be raised by more than 2m to reduce the potential of being flooded in the future.

Adapting to Climate Change

Nearly 95 per cent of the interviewed residents and local authorities of Navua have heard about climate change, mainly through the media, though most are unaware of the human and natural factors responsible. They also associate the
recent floods with climate change, which is an indication of their limited understanding of climate change science. Most are aware of measures that can be taken to reduce vulnerability to flooding and accept that as individuals, they have a role to play in reducing their vulnerability to flooding in collaboration with the government and its agencies. Nearly all survey respondents recommended dredging of the river as an important measure to reduce flood risks, in addition to building raised and sturdy homes. Other adaptive measures identified by respondents include taking insurance coverage, relocation, and maintaining irrigation channels and floodgates.

Adaptive capacity is defined by the IPCC as the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities and to cope with the consequences (McCarthy et al, 2001). In the context of Pacific island countries, adaptive capacity is dependent on the net resources (financial, human and technological) available to national governments, communities and individuals to implement adaptation measures. Resource allocation and use are strongly influenced by factors such as governance, fiscal policies, tradition and culture, poverty, hardship, and prevailing socioeconomic and environmental conditions. On the basis of our studies, it appears that a majority of the residents in Navua lack sufficient net resources and the capacity to enable them to autonomously adapt to climate stresses and shocks to any significant extent without the government's intervention.

Adapting to present climate variability and extreme weather events is an early opportunity to enhance the resilience and the adaptive capacity of Navua residents to future climate change. Moreover, adaptation to climate change in a socioeconomically disadvantaged community such as the one in Navua is better approached from a broader development framework. Within such an approach, the government would oversee implementation of adaptation measures and incorporate adaptation measures in the development plans for the region. In addition, autonomous adaptation by individuals and communities should be encouraged with appropriate incentives and clear demarcation of responsibilities of government and communities in planning and implementing adaptation measures. Furthermore, government can also engage development partners (including funding agencies) through bilateral and multilateral arrangements to provide technical and financial support for the implementation of adaptation options. This is quite crucial for Pacific islands given the diminishing overseas development aid and the tight donor situation despite the continued requests of Pacific Islanders for donor contributions to satisfy various development objectives.

A lesson from our study is that a system embracing both top–down and bottom–up approaches to the adaptation process has the best chance of improving the adaptive capacity of towns in the Pacific with geographic features and socioeconomic backgrounds similar to those of Navua. This dual approach is also aligned with current regional efforts under the CBDA/MPC project to mainstream climate change adaptation into national development planning and concurrently engage and empower local communities and non-state actors to develop and implement effective and appropriate adaptation
options. The two approaches are discussed separately in this chapter for clarity purposes only.

The top–down approach

The top–down approach recognizes the weak adaptive capacity of the Navua population and similar island communities and places the onus on the national government and its agencies to mainstream adaptation by developing a framework for national adaptation policy within which to implement, promote and support adaptations that help to make society more climate-proof. National level actions should include developing and improving regulation of climate-sensitive sectors and geographic areas, investing in measures to reduce risks, and creating incentives for adaptation by local authorities, private entities and individuals. For example, incentives could be developed in consultation with local residents to enable them to afford flood-proof homes, take out insurance policies and relocate to sites that are less prone to flood risks.

Climate proofing of building codes and tourism and land-use plans can yield immediate positive results. As previously noted, Fiji has in place a variety of forestry regulations, but they are not rigorously enforced and compliance is imperfect. The result is that forestry activities have negative environmental impacts that could be avoided, including siltation of rivers that aggravate flooding. Improved enforcement of the regulations by the national government would help to climate-proof downstream communities.

Dredging of the river and proper maintenance of irrigation channels and floodgates would dampen the severity and extent of flooding in Navua. But these measures are beyond the financial capacity of the residents and require investment and action at the national level to bring the needed resources to bear. There is a national programme for dredging of rivers; however, dredging projects are implemented in an ad hoc manner and allocated funds can be diverted without proper consultation. The result is that some rivers are not dredged even several years after scheduled dates. The lack of adequate dredging equipment and faulty equipment are also partly responsible for delays, a situation that is prevalent in Pacific island countries for projects requiring specialized equipment. The government should revitalize the national dredging programme and prioritize and schedule dredging projects based on a comprehensive assessment of the vulnerability of communities and localities to flooding.

The bottom–up approach

A bottom–up approach to adaptation is a community-based approach that engages local stakeholders to identify and prioritize risks, select appropriate responses, and implement selected measures using local institutions, resources and knowledge. To be effective, individuals and local institutions need to be encouraged with proper support and incentives by the government. The approach should be underpinned by recognition and use of the positive aspects of cultural and communal-based traditions of Pacific island societies. The approach also recognizes the need to engage all stakeholders, including
non-government organizations (NGOs) and intergovernmental regional organizations such as SPREP and the University of the South Pacific.

An important aspect of Pacific island communities, including those in Fiji, is the strong communal nature of living and working together, although at times this is also viewed by some as an obstacle to development (Duncun and Toatu, 2004). The communal nature of living in the Pacific, especially in the rural and urban hinterlands, brings forth an opportunity to pool and mobilize resources (for example finance and local expertise) that are required for adaptation. Therefore the adaptation process should be taken within the context of the community as a whole, although consideration should also be given to the needs of individuals.

NGOs and regional organizations with mandates in line with reducing climate-related risks have played significant roles in community-based development and advocacy for climate change in the Pacific. Their experience with community-level development, provision of technical advice and carrying out research on climate change issues will complement efforts by the national government and individuals to promote climate change adaptation. The engagement of regional organizations has been proven to be effective in the sharing of adaptation lessons learned elsewhere in the Pacific and to engender a consolidated stand on climate-related issues in international forums.

Autonomous adaptation has been observed within Navua town, especially in the construction of homes. Discussions held with officials of the Navua Rural Local Authority (RLA) indicated that the number of newly-approved buildings raised above the ground has been on the rise, especially since the recent floods of 2004. Residents were encouraged by Navua officials to build higher than the previous flood level. Such autonomous adaptation needs to be properly encouraged, as it will contribute to reducing the vulnerability of the Navua residents to flooding and reduce financial obligations of the national government during flooding disasters.

Our assessment of the situation in Navua, and the results from the CBDAMPIC project, indicate that local communities should be actively engaged in the full adaptation process, from planning to implementing and monitoring adaptation measures. Their involvement in this process is important, whether the technical advice on adaptation to climate change originates from local or international experts (Nakalevu, 2005). This approach will also contribute to heightening the community’s responsibility to sustain adaptation to change and to proactively internalize the adaptation process. It is anticipated that by internalizing and sustaining the adaptation process, the communities’ dependence on external assistance to implement adaptation options will progressively reduce over time.

**Challenges to Implementing Adaptation in Pacific Island Countries**

Four challenges to implementing adaptation to climate change in the Pacific are identified: (1) perceptions and competing government and individual
priorities, (2) weak governance and institutional framework, (3) weak socio-economic conditions, and (4) lack of technical capacity. We elaborate on each of these below.

**Perceptions and competing government and individual priorities**

Perceptions of the public and decision makers in the Pacific about climate change will influence the actions they take to deal with climate change risks. On the basis of our surveys, most Navau residents, local officials and national government officials have only a low level of awareness of climate change, in most cases influenced by media reports, which are seldom accurate. Only a few of them acknowledge the influence of human activities on the climate. This implies that many people are unable to perceive concrete links between climate change and the contribution humans make to aggravating climate change and variability.

Consequently, when the implementation of climate change adaptation is advocated, it is often perceived as an attempt to prepare for a future ‘unlikely adversity’, which is not as pressing as the need to meet basic daily needs such as food and shelter. Climate change is often viewed as a futuristic phenomenon and does not align well with the decision timeframes of individuals and governments, which are invariably short, at 1–5 years for governments, depending on the duration of the national parliament. Consequently, the notion of adapting to climate change is seldom regarded as a high priority and thus loses out in terms of funding and institutional support. In some cases, such perceptions are reinforced by the limited climate change awareness. A study in the Cayman Islands of the Caribbean also showed that policymakers seldom regard climate change as a priority environmental concern and therefore see little need to make policy responses to cater for it (Tomkins and Hurlston, 2003).

Perceptions that climate change is a distant and low-priority concern necessitate discussion of climate change adaptation in the context of climate variability and extreme weather events. People are better able to visualize the link between extreme weather events and climate variability and their livelihoods, and thus strategies for managing risks in this context. However, this approach to climate change discussion must be taken with care. Extreme weather events are frequent in Pacific islands and communities may perceive them as normal events. For example, Fiji is affected by an average of two tropical cyclones per year and numerous tropical depressions. Consequently, if human-caused climate change is associated with climate extremes, climate change may come to be regarded as remaining within the norms with which islanders presently have to cope. This can lead people to downgrade the importance of adaptation to climate change. The need for caution is also pertinent because national governments usually provide relief assistance during and after tropical cyclones and severe tropical depressions. Association of climate change with extremes could create expectations that individuals and communities should rely on government relief to cope with climate change. This could accentuate the local community’s dependence on the national governments while also dissuading national governments from actively participating in the
adaptation process. Proper public awareness about climate change adaptation should aim to unravel the above misconceptions.

**Institutional framework and governance**

Governments in most Pacific island countries are often challenged internally and externally to demonstrate good governance by establishing appropriate institutions with proper checks and balances to optimize the delivery of goods and services to the country as a whole. National governments can no longer afford to maintain rigid decision-making structures if they are to be effective and efficient in working towards the goal of enhancing the adaptive capacity of the population to climate change. The need to promote participatory approaches to planning and decision making in the context of climate change adaptation is pertinent to ensure the internalization and sustainability of the adaptation process. However, such changes by national governments towards participatory and decentralized decision making should be judiciously implemented with national interests at their core to avoid unnecessary delays and the continued dominance of decision making by a few stakeholders. Good governance is needed to enable climate change concerns to permeate all levels and sectors of the society, including the local communities.

The case of Navua demonstrates some of the problems with institutional frameworks in Fiji that hinder complementary decision making at local and national levels. The government activities within Fiji are undertaken through four distinct systems: the National Government Administration, the Fijian Administration (which exclusively looks after indigenous Fijian affairs), the Municipal Administrations (incorporated towns and cities) and Rural Local Authorities (RLA). Navua has not been incorporated as a town under the Local Government Act and is therefore governed as a rural local authority. The RLAs are essentially public health authorities responsible for public health, building construction and other matters coming under the Public Health Act. However, most functions and services are consolidated on a national basis for efficiency and economy of scale, and as a result RLAs have relatively limited powers.

Within this framework, as an RLA the residents of Navua do not have local-level political representatives, as is the case for incorporated town and city councils, although the Navua RLA officials work tirelessly to provide services and represent Navua residents with minimal financial and human resources. This ultimately means that local-level concerns about river flooding are often inadequately dealt with at the political and administrative levels. For example, the absence of a stronger political framework in Navua (Duncan and Toatu, 2004) made possible the easy diversion of funds earmarked for dredging in 2000 (Auditor General of the Republic of Fiji, 2001). Certain officials with the Navua RLA interviewed expressed their intention to legally incorporate Navua as a town as a means to have local-level political representation and improve the services and economic activities in Navua.

As mentioned earlier, the national government needs to establish a top–down or national framework of climate change adaptation policy and
planning within which bottom-up strategies can be implemented in localities such as Navua. To drive this process, the institutional and governance structures need to be reinvigorated and strengthened. Awareness needs to be raised within these structures of the significance of adapting to climate variability and extreme weather events as preparation for changing climate patterns.

There is also a lack of communication and coordination between relevant governmental departments (Duncan and Toatu, 2004; Raj, 2004), an institutional setback apparent in many government departments in Pacific island countries. The fragmented jurisdictions over related areas reinforce the lack of communication in some circumstances. For example, in Fiji, the Land and Water Resources Management of the Ministry of Agriculture is responsible for river engineering, drainage and irrigation, while the Public Works Department is responsible for flood control, watershed management and flood forecasting. Although there is an amicable working relationship between the two government departments (Raj, 2004), regular communication on matters of mutual interest cannot be guaranteed as they go about their day-to-day operations. Furthermore, there is no central authority for flood management and the National Disaster Management Office only plays a coordinating role during disasters.

**Weak socioeconomic conditions and lack of capacity**

Large adaptation projects are often costly, especially for socioeconomically disadvantaged communities in the Pacific, such as that in Navua. An average income of $US35–46 per week barely meets basic needs let alone affords flood-proof homes, relocation or insurance. On the other hand, there are also certain individuals who are already implementing autonomous adaptation measures to the risks posed by flooding in Navua and coastal erosion and storm surges in Samoa (Nakalevu, 2005).

The lack of capacity for climate science to evaluate changing climate trends and risks and to predict future changes is pervasive throughout Pacific island countries. The lack of capacity is also evident at the systemic and institutional levels and therefore affects the ability to properly plan and implement climate change adaptation within a development framework. Also lacking is the technical capacity to formally evaluate the potential performance, costs and impacts of adaptation measures. For example, under the CBDAMPIC project, the cost–benefit analysis of adaptation options identified in the project sites had to be contracted out to a consultant because of the lack of expertise at the national level to carry out such analysis.

**Conclusions**

Climate-related disasters put a lot of strain on the sustainable livelihoods of communities in the Pacific islands. It is anticipated that with climate change, ongoing climate variability coupled with extreme weather events will increasingly threaten people’s livelihoods. A significant and growing risk to
livelihoods in the township of Navua is river flooding. The climate driver of river flooding, rainfall, has not shown any significant increase in its pattern or intensity to suggest that it is the dominant driver of vulnerability in the study region. Instead, non-climatic drivers such as increased sedimentation in the river from logging, mining and other activities, degraded infrastructure such as irrigation channels and flood gates, failure to regularly dredge the river, and locating housing and other structures in flood-prone locations have been responsible for increasing the vulnerability of Navua residents to flooding. In the future, however, climatic factors could amplify the risks as sea level rises and, possibly, rainfall from tropical cyclones intensifies.

Navua typifies local communities in Pacific islands, which are locked in a vulnerable situation because of their poor socioeconomic conditions coupled with limited input to government decision-making processes and access to financial resources, expertise and technical knowledge. A way forward is to implement climate change adaptation embracing a connective top–down and bottom–up approach that provides a national framework for climate-proof development and resources and incentives to enable local level action. Stakeholders from national to local levels, underpinned by lessons learned through experiences with climate variability and extreme weather events, should be involved in planning, implementing and monitoring adaptation measures.

References

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