



Community-based adaptation: enhancing community adaptive capacity in Druadrua Island, Fiji

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This article describes the process and outcomes of a pilot community-based adaptation (CBA) project implemented on Druadrua Island in Fiji. Although many people promote the use of CBA, written material about the topic is limited and poorly informed by theory or evidence. This article aims to contribute to the literature on CBA by describing the theory and process used to implement a CBA project and the changes that resulted in a small island community in the northeastern part of Fiji. The project outcomes include a renewed focus on community adaptive management of natural resources, increased awareness of climate change, and an increase in the community's access to resources from external organizations. The article concludes with a summary of lessons learned and recommendations for future CBA projects. © 2010 John Wiley & Sons, Ltd. *WIREs Clim Change* 2010 1 751–763

INTRODUCTION

Many people promote the use of a community-based approach (CBA) to climate change adaptation (CCA), yet the literature on the topic is largely unpublished, limited, and poorly informed by theory or evidence. CBA is described as adaptation with a community focus that seeks stakeholder engagement and which recognizes that adaptation to climate change occurs within the context of other risks and is implemented through existing institutions and decision-making processes.¹ This is in contrast to model-based methods of assessment, which are top-down, and treat communities as homogenous entities for the purpose of both research and policy.²

Compared to other adaptation projects, CBA projects prioritize the use of local institutions and the communities' participation in the process of assessing climate risks as well as in planning, implementing, and monitoring adaptation measures. Of the numerous past and current CCA projects in the Pacific Islands, most are focused on risk or vulnerability assessment and mainstreaming climate change at the sector or macro level.^{3,4} Adaptation projects that work through

village or community institutions and promote the participation of local people are few but growing. They include the Capacity Building to Develop Adaptation Measures in the Pacific Countries Project, the Fiji CCA Project, which is the focus of this article, the WWF Climate Witness Project, and the Red Cross Preparedness for Climate Change Programme.³

By assessing the currently available literature and examining the process and outcomes of a CBA project in Fiji, this article aims to contribute to theoretical and practical knowledge of CBA.

COMMUNITY-BASED ADAPTATION

A focus on community adaptation is necessary because this is the scale where climate change will be experienced most by people, and to which they will have to adapt.^{2,5,6} The need to channel adaptation efforts at the local level is even more critical in the Pacific Islands. Most local communities are resource dependent and so are sensitive to climate change,⁷ most people do not live in systems that are closely supported or integrated with government, and most of the land and some inshore fishing areas are communally owned and so decisions that involve the use of local natural resources have to be taken at the community level.⁸

The primary aim of CBA is to facilitate the adaptation process in communities as well as enhance the adaptive capacity of communities for the purpose

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of reducing their vulnerability to climate change.^{1,9–13} Adaptation, as defined by the Intergovernmental Panel on Climate Change (IPCC), is the change made or actions taken to reduce the vulnerability of a system to current or future changes in climate.¹³ Hence, CBA is a method of undertaking adaptation in local communities, which emphasizes on indigenous resources and institutions and the empowerment of the most vulnerable groups.¹¹ Adaptive capacity is a system's ability to take action to reduce vulnerability to climate change^{13–16} and is dependent on: economic resources (to pay for adaptation); awareness and information (identification of problems and knowledge of solutions); technology (the tools needed to adapt); skilled labor (the ability to use available technologies); and infrastructure (the means by which the services, information, and resources needed to adapt reach communities).^{7,13} Adaptation can be reactionary—by responding to a climate-related problem or anticipatory—by reducing a community or a system's vulnerability to possible future climate change impacts. As such, enhancing the adaptive capacity of local communities to climate change may imply an approach to adaptation that is anticipatory.

CBA shares similar features with other community-based approaches such as participatory development, community-based natural resource management (CBNRM), and community-based disaster risk management (CBDRM). Hence, while CCA at the community level is a new concept, the community-based approach has been widely studied.

CBAs have two main discerning features: awareness raising on climate change and the incorporation of future climate risks into the design of project activities.¹¹ While communities have extensive knowledge of local environment changes, they nevertheless often have limited knowledge of the causes and effects of climate change.¹⁷ Hence, several CBA initiatives have used co-learning approaches, whereby local and external scientific knowledge on climate change and adaptation complement each other through a process of knowledge sharing between communities, scientists, and development workers.¹⁷ As such, CBA projects do not necessarily reject the use of external scientific information and experts.

The factoring of climate risks into project designs is still not evident in most CBA projects and is the reason why the IPCC stresses the need to consult climate modelers when designing CBA projects.^{9,18} Ayers and Forsyth⁸ argue that failing to incorporate future climate scenarios into CBA activities 'may discourage the kind of technological or engineering-based approaches to adaptation that a community-based approach seeks to supplement', although this implies

that there is a clear separation between community-based approaches and engineering approaches, which in practice is not the case: community-based projects can include engineering and engineering approaches should include communities in decision making and implementation.

For its part, the development community is fast accepting that 'good development' requires the incorporation of climate change factors,^{13,20,21} and development institutions such as the United Nations Development Programme (UNDP) have committed to factoring in climate change in future investments, recognizing that climate change is a serious threat to achieving development objectives such as the Millennium Development Goals.¹³ Additionally, these views are being brought up in various international development fora.^{19,20} Despite this shift, it remains to be seen if 'good development' that includes consideration of climate risks may indeed be sufficient for adaptation.

The idea and practice of CBA are still developing. There is a need to learn from the experiences of other cognate fields of research and practice, as well as from piloted CBA projects in order to further develop the theory and practice of CBA.

The next section reviews concepts and debates around 'participation in development', 'CBNRM', and 'CBDRM' in order to contextualize the understanding of CBA in a larger theoretical and policy context.

Participation in development

Participation in development is essentially about the empowerment of the powerless and arose out of the need to more effectively manage failed top-down development projects that were prevalent in the 1960s and 1970s.^{21–24} Often, however, empowerment is forsaken to the interests of more powerful stakeholders in the development industry such as donors and development agencies.^{21,24–26} Other guiding principles of 'participation in development' include: the recognition of traditional knowledge systems; redirecting development from an economic growth-centered to a people-centered approach; and ensuring that basic needs are met.²⁴

Two factors continue to challenge the process of empowering vulnerable groups in development: the unchanged structural factors required to facilitate the empowerment process and the limitations of traditional knowledge systems. Structural factors refer to institutional (formal and informal), political, and social structures that have the potential to perpetuate or reduce unequal power relations.²² Disappointingly, three decades after the wide

acceptance of participatory ideals, few successful examples of improvements in the general quality of life of the vulnerable are evident, those that have achieved success have done so mainly at the microlevel, while the structural factors that determine the allocation of power and resources remain fundamentally unchanged.^{27,28} It is clear that the structural factors hindering the advancement of vulnerable groups may need to be addressed if community-based approaches to development (and adaptation) are to be meaningful.

The trend toward the recognition of and learning from traditional knowledge systems, while generally empowering for local communities, requires sophistication in their application to ensure that decisions made at the local level are appropriate, and that the interests of the various groups within the community are served. Decisions made from a purely traditional or local perspective may be based on a limited understanding of opportunities or consequences in relation to modern scientific knowledge and macro policies and programs.²⁶ Furthermore, Kothari²⁹ argues that community 'local knowledge' masks the power relations and inequalities that may exist within communities and may further strengthen the interests of elites given that community norms or local knowledge is founded on a process of social control by the more dominant players in society. Because traditional knowledge is not static but evolves via adaptive processes from one generation to another,³⁰ traditional practices and internal social structures may be adapted to respond to new challenges and opportunities. As such, although there is a role for modern science and policies in informing and shaping local decisions, care should be taken to ensure that the decision-making process continues to be driven by the community and is beneficial to their interest, in particular those with the least power.

Community-based natural resource management

Similar to participation in development, CBNRM is a contrast to the top-down approach it replaced.^{30–33} CBNRM aims to ensure sustainable outcomes from natural resource management through the involvement of local communities.^{31,34,35} CBNRM initiatives are largely characterized by four defining features: the participation of local communities in natural resource management; the devolution of power from government to local institutions; the desire to reconcile social justice and environmental goals; and the recognition and incorporation of traditional knowledge and practices in modern resource management.^{30–34,36} These principles evidently entail a shift toward empowering

local communities as well as improving natural resource management.

CBNRM is often premised on simplified notions of 'community', 'local environment', and 'traditional resource use systems'.^{30–33,36} Critics argue that the term community often masks the structural inequities among the various social groupings (women and migrants) upon which the politics of natural resource management decision making is shaped; the simplified notion of 'local environment' disregards issues of mobility of resources like wildlife migration and the unpredictability in the flow of resources like groundwater; and that the idea that traditional resource use systems were sustainable may be false.^{30–33,36,37} An additional critique of CBNRM is its limited reference to the influence of external factors and actors that undoubtedly influence local resource management decisions as well as provide the required capacity to deal with issues that are beyond the reach of local communities and institutions.^{37,38}

The shortcomings in the theory and practice of CBNRM have prompted increasing support for an adaptive approach to natural resource management.^{30,31} Recognizing the dynamic relationships and changes that occur within socioecological systems, adaptive management involves the self-organizing of community governance regimes through a process of trialing and adapting resource management practices.^{31,37,39,40} While addressing the limitations of CBNRM, adaptive management may also be viewed as an effective means of responding to the uncertainties that surround CCA decision making at the community level.

Community-based disaster risk management

Response to disasters only recently moved from a post impact relief and reconstruction approach toward a risk management process that includes pre-disaster planning and preparatory work.⁴¹ It has been argued that the involvement of communities is essential for this shift to occur.⁴² Reducing a community's vulnerability to climatic and environmental stresses at the local level has been widely proposed to be best done via CBDRM.^{41–45} The CBDRM approach puts emphasis on decentralized decision making, access to external knowledge and resources for local decision making, community self-reliance, participatory processes of determining community vulnerabilities and identifying practical measures for problem solving, and supportive national and global policies.^{41,42,44–47} Like CBA, CBDRM stresses the need to engage with community institutions, supported by modern science and policy institutions.

The CBDRM field has much to contribute to the study of CBA because climate change is expected to affect the scale and frequency of natural disasters.¹⁷ Both approaches are also similar in that they endeavor to reduce the vulnerability of communities, although CBA focuses on adapting to changing environmental conditions in the long term while CBDRM emphasizes on specific sectors and particular hazards.⁴⁸ Because risk is largely determined by a combination of human agency and sociopolitical structures,^{22,48} community risk or vulnerability factors addressed by the CBA and CBDRM approaches may also be common.

Drawing on the many similarities between adaptation and disaster management, as well as natural resource management and poverty reduction, Thomolla and others⁴⁸ highlight the need to deal with the greater structural factors that influence the vulnerability of individuals and communities. Human risks are determined by political and economic processes—for example, poorer households are typically most vulnerable as they usually live in lower quality houses; disasters often intensify poverty^{42,43}; and disaster perceptions differ according to ethnicity, gender, socioeconomic status, or education level.⁴⁷ This means CBDRM, CBA, and CBNRM should be integrated into the wider development context and prioritize reducing the vulnerability of poor and minority groups if it is to be meaningful.

Combining many of the features of participatory approaches to development, disaster, and resource management, as well as adaptive management, McGray and others⁴⁹ propose a CCA strategy that is highly pertinent to the idea of a community-based approach to adaptation, involving: facilitating effective adaptation decision making through adaptive policies, improving climate change awareness, and monitoring and evaluation of the effectiveness of adaptation interventions. Taking this further, I propose that CBA should aim to:

- Increase the awareness of communities about climate change risks.
- Empower communities to make decisions about adaptation for themselves.
- Connect communities to the networks necessary for accessing the information and resources they need to implement adaptation actions.
- Enable adaptive approaches to adaptation decision making and implementation.

The third of these aims relating to networks implies that projects that seek to facilitate CBA can themselves be the conduit to these networks.

This article will now describe the process and outcomes of a pilot CBA project implemented in a small island community in the north eastern part of Fiji.

THE FIJI CCA PROJECT

The Fiji CCA Project was designed to pilot an integrated approach to CCA in six rural communities in Fiji, focusing on coastal ecosystems and water supply issues—two of the four most vulnerable sectors identified in Fiji's Climate Change Policy Framework. The objectives of the project were to enhance community awareness to climate change, incorporate climate change and adaptation in community governance processes, and to identify and implement appropriate adaptation measures.

The project was funded by AusAID via the Fiji Department of Environment, and implemented by the Pacific Centre for Environment and Sustainable Development (PACE-SD) and the Institute of Applied Science (IAS) of the University of the South Pacific (USP). Other stakeholders involved in the project as members of the advisory committee included various government departments, academics, conservation agencies, NGOs, regional development agencies, other donors, and private water and coastal engineering consultants.

Fijian villages

Over half of Fiji's 900,000 people are indigenous Fijians—with 40% having Indian heritage and the remaining 10 with Chinese, European, or other Pacific Island ancestry. Indigenous Fijians communally own 85% of the land and make up most of the rural population living in Fijian villages. The indigenous villages such as the six involved in the Fiji CCA project are governed by the Fijian Affairs Act meaning that the Local Government Act that sets standards for environmental and health practices in rural areas do not apply. Water shortages, poor water quality, coastal erosion threatening rural homes, and declining in shore fish stocks are existing challenges facing most Fijian villages (among other social problems). Furthermore, compared to other rural settlements, Fijian villages are more communal and structured in nature.

There are around 1170 villages grouped into 187 *tikina* or districts in the 14 provinces of Fiji. Typically, a *tikina* has 4–12 villages and the population in each village ranges from 100 to 500. A village has a few *mataqali*, which are subclans or land-owning units. Each *mataqali* has a chief; from these a village chief is chosen and from these a *tikina* chief and a provincial chief are chosen,

usually along hereditary lines. Each *Tikina* usually has a central village where the chief resides. The *Vanua* (people, culture, land, and sea), *lotu* (church), and *matanitu* (state) are the three pillars of governance in a Fijian village. Generically, each village has a *Turaga ni Vanua* or traditional chief, a *Turaga ni Koro* or village administrator, and a *Talatala* or church minister who is usually an outsider appointed by the church. The *Turaga in Vanua* is usually the most powerful of the three with executive powers over natural resource use in the area and is ultimately responsible for commanding unity and cooperation at the village, *Tikina* or provincial level. The *Turaga ni Koro* is chosen by the village members to coordinate the day-to-day village development and operational activities as well as liaise with the state and other external actors, in return for a modest allowance from the Ministry of Indigenous Affairs. However, the balance of power between the *vanua*, *matanitu*, and *lotu* and the factors that challenge the stability of the Fijian village governance vary according to village. Some factors include the number of church denominations that exist in each village, variation in the educational and economic achievements of each *mataqali*, the character of people in leadership positions, and disputes over land and chiefly title ownership.

Decisions are made at the (usually) weekly village meetings chaired by the *Turaga ni Koro*. At these meetings, the *Turaga ni Vanua*, *Talatala*, and male household heads sit at the more prominent parts of the village meeting house and have greater influence over decisions, while representatives of the women and youth groups are also allowed to speak. Agenda items often include the maintenance of health and hygiene standards, management of the community water or power supply, children's educational needs, agricultural and fisheries management, government initiatives in the area, youth and women's issues, and other current and future village project activities. Most villages have subcommittees to deal with particular issues. Hence, the implementation of decisions is allocated according to the various subcommittees as well as along gender roles. Men usually carry out physically laborious tasks such as construction, agriculture, and artisanal fishing, while women undertake activities that are largely domestic in nature such as food preparation, child rearing, and gleaning. It is also important to note that the described gender roles and responsibilities are traditional norms that are susceptible to external influences including market forces and modernization. At the *tikina* level, a 'bose vanua' (*vanua* meeting) is held as needed to discuss a variety of important issues.

Project implementation process

The six-step project implementation process showed that carrying out CCA activities in local communities does not necessarily require a lot of money, at least initially. The first step was the selection of the six pilot sites. This involved inviting local organizations and groups to put forward the names of communities that had sought assistance to address water and coastal problems. Six pilot sites were selected out of this via a systematic selection process involving project staff and advisory members. Four of the selected sites had marine conservation initiatives and were part of the Fiji Locally Managed Marine Areas (FLMMA) network. These sites were strategically chosen because the communities had been involved in developing local environmental management plans and were adaptively managing these over time. In the process of developing the community marine conservation plan, water or coastal erosion issues were brought up by the community members. As such, the participatory nature of problem identification, the already existing adaptive management process, and ongoing relationship with external partners were advantageous in terms of ensuring the feasibility and sustainability of the pilot project. The selection process also involved extensive consultation with communities.

For the purpose of factoring in climate change and adaptation into community decision-making processes, the second main activity delivered a 1-day climate change awareness workshop. Between 25 and 35 participants, including the *Turaga ni Vanua*, *Turaga ni Koro*, *Talatala*, and several women, were present at each of the six village workshops. A two-page climate change handout written in Fijian was developed and distributed, and it included information about the difference between 'climate' and 'weather'; the definition, causes, and potential impacts of climate change; and the importance of adaptation. Possible future climate change impacts and adaptation measures on the various sectors of community life were discussed in the areas of coastal management, water management, agriculture, health, housing and spatial planning, and economic activities. The later stages of the awareness workshop focused on the community's water problem by highlighting current and potential climate change impacts on local rainfall patterns. Both the workshop and learning materials were delivered in Fijian.

Although not part of the original project plan, a technical assessment by qualified coastal and water engineers in each pilot site became the third step of the project. This step was added to ensure that the adaptive measures decided upon would be sustainable. For example, communities faced with erosion problems had started to cut mangroves on the other side of the

river because they thought this would redirect and reduce the force of the water flow that was causing erosion on their side. Concerned about the implications of such activities, water and coastal engineers from government departments and technical agencies were approached by the project team to visit each site to provide a scientific explanation of the causes of the erosion (or water) problem and to recommend possible adaptation measures. The technical assessment outcomes, summarized and translated in Fijian vernacular, were used to inform the fourth project step—the development of a community adaptation plan (CAP).

A 1-day workshop was held at each village where the participants developed their CAP. Each CAP was based on the community's understanding of the water or coastal management problem, and informed by the outcomes of the technical assessment. Adaptation options that involved less environmental and financial risks and which were deemed manageable and sustainable by the community were favored, while more expensive, engineering-based options were held-off until the softer options were trialed.

Implementing activities from the CAP was the fifth step. The project provided up to USD20,000 specifically for material and fees required to implement the CAP activities. As this fund could not cover all the CAP activities, the community and the project implementers collectively decided on which CAP activities were to be covered by the project fund.

The combined process of implementing ongoing review and adjustment of the CAP was the sixth and final step of the project. A third workshop on community-based monitoring was conducted in each site and frequent field visits were made throughout the project with the aim of checking on the implementation of adaptation activities and to review and update the CAP, so as to keep it relevant to the existing needs and concerns of the community. A community evaluation workshop was also conducted at the end of the project, whereby they were consulted on the strengths and weaknesses of the project implementation process and where each CAP was reviewed and updated. This stage was essentially the beginning of the adaptive management process to be continued by the community.

A key element as well as outcome of the CCA project implementation process was the employment of indigenous Fijians who, while being 'outsiders' to the villages, were nevertheless familiar with the dynamics of village governance structure and the social rules and protocols that operate within this system. Employing indigenous Fijians who already speak the local language and are familiar with village governance dynamics saves much time and effort

learning about local processes, and enables more sensitive understanding of and responses to local concerns. For example, it is important for the *vulagi* (visitor) to know how and where to sit and the manner of addressing people, particularly when conversing publicly with the chief, and failure to do this correctly can jeopardize communication, while the ability to do it correctly can greatly enhance the success of the project. Traditional ties based on kinship, totems, and significant historical events (e.g., warring alliances, migration, and marriage) connect clans, villages, and provinces from various parts of Fiji, and an understanding of and interest in these relationships can help with the bonding process between the 'outsider' and the village. So, hiring local project staff enables a trusting relationship between the village and the project which greatly helps improve the project's outcome for all parties.

This project implementation process illustrates that to be effective CBA takes time and patience. Establishing and maintaining a trusting relationship with communities as well as with a network of locally available technical experts and carrying out frequent field visits are processes that initially do not require much funds, nor can they be done with haste by people who have limited knowledge of the local culture and language. The main costs for facilitating an adaptation planning process in communities are the time costs of a local project manager, domestic travel expenses, the costs of local technical experts, and the cost of materials for the implementation of adaptation measures.

CASE STUDY: FIJI CCA PROJECT IMPLEMENTATION AND OUTCOMES ON DRUADRUA ISLAND

Of the six villages involved in the CCA project, Druadrua Island is the only community that occupied the entire island. Its relative geographic isolation presents unique challenges in accessing water, income, basic government services, and consumable goods, and these difficulties mean that the capacity of people in Druadrua to adapt to climate change is arguably lower than in villages closer to markets. There are two coastal villages on the island that are 20 min walking distance from each other. Salevukoso, the main village, has about 150 people and hosts the local primary school, while Delaivadra village has a population of about 50. The nearest health center, local shop, and fisheries station (located on the Fiji's second main island, Vanua Levu) are accessed by open fiberglass boats. Labasa town is the nearest urban center and is 2 h away. Druadrua Island is located on the north eastern and leeward part Fiji and is 3.91 km² in size (Figure 1). Fish and the harvesting of other marine

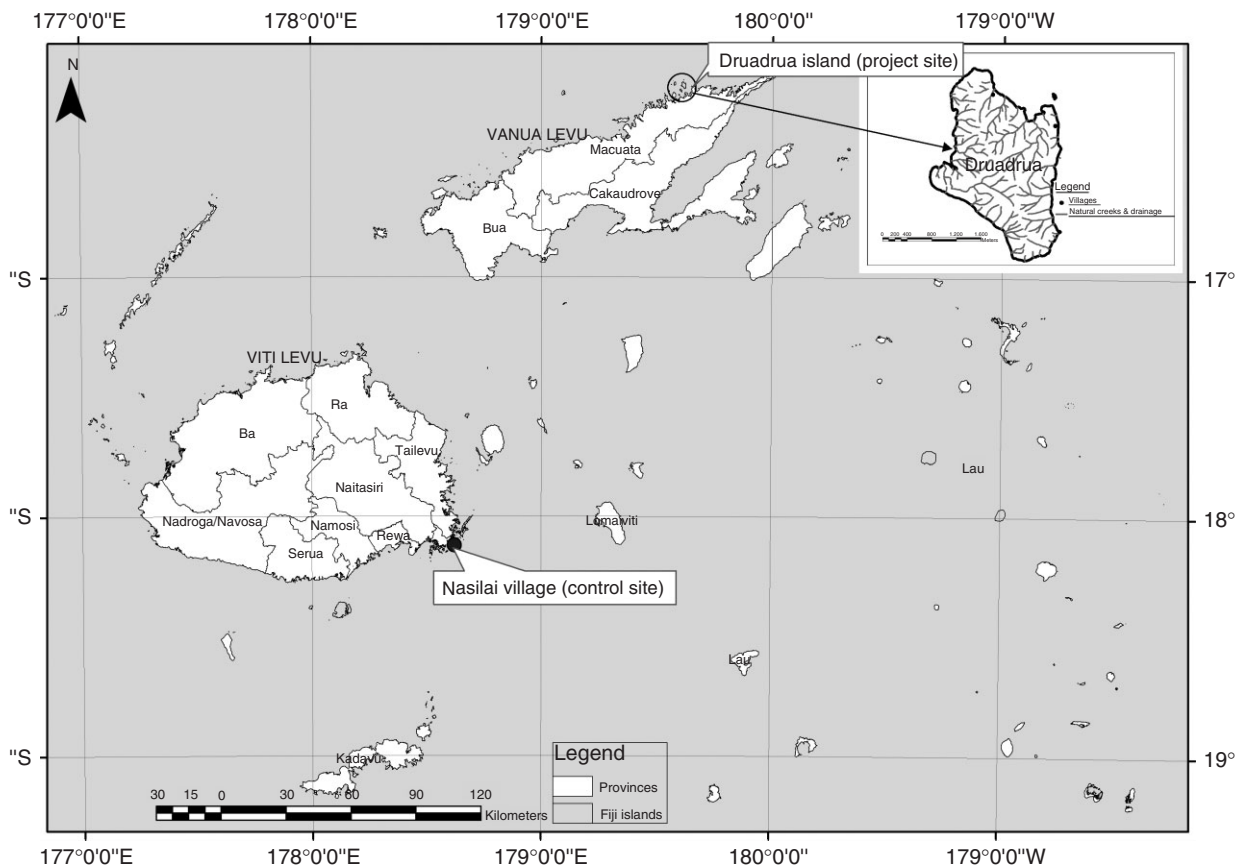


FIGURE 1 | Map of Fiji and Druadrua. Spatial data copyright Republic of Fiji Islands, Department of Lands and Survey. Map created by the University of the South Pacific, Institute of Applied Science.

resources are the sole source of income for over 80% of households.

Druadrua's most immediate climate risk concerns increasing scarcity of freshwater as freshwater availability is already a problem, particularly during the dry season. Several factors explain the water problem in Druadrua. According to the elders, water was more accessible in their youth when there were fewer households, implying that increasing demand is reducing per capita availability. The elders also speculate that the burning and clearing of forests for house building and subsistence farming, coupled with the introduction of goats and pine tree planting in the 1980s may also have contributed to the current water shortage. A poorly constructed dam by the government has lain defunct for years and maintenance visits by technicians have been minimal. According to the project engineer, this was due to poor engineering—the piping did not include breathers and were laid out above ground along the coast (making it susceptible to damage). Community members also related that they were not consulted on the design of the government-funded dam system, but engaged in

construction under the direction of the government engineers.

Rainwater, the island's other potential source of water, is not fully utilized as most of the village houses do not have gutters or tanks to efficiently collect and store enough drinking water until the next rain. According to the Fiji Meteorological Service, the 10-year average rainfall in the area has reduced significantly from the 1970s to the 1990s. Due to the island's relative isolation, the cost of moving the heavy equipment needed to drill for groundwater has long been prohibitive, so that it was not until 2007 that drilling for groundwater began. Finally, the lack of community training in sourcing and sustaining a sufficient supply of water for the island has also been a significant limiting factor.

The study method

Data for this study were gathered via household census and climate awareness surveys, personal observations and unstructured interviews with individuals and groups from Druadrua Island, and others associated

with the project. These data were all collected in the Fijian language by the author while working full time as the project officer and later part time as the evaluator over a period of 40 months from August 2006 to December 2009.

The household census and climate awareness survey on the Druadrua island were carried out in June 2008 and a similar survey was conducted in a control site, Nasilai Village, which is located in Viti Levu (Fiji's largest island) and which has not been part of any climate change project. The census included details of each household member, three main sources of income, and their *mataqali*. The climate awareness surveys questioned participants on whether they had heard about climate change, source(s) of this information, causes of climate change, what some of the impacts might be, and how climate change might relate to the water problems faced in the village.

Participant observations and unstructured interviews were made during project management interactions at USP and during community project field visits to Druadrua in December 2006, April and October of 2007, June and December of 2008 and June 2009, and via telephone contact during the project life. Notes were taken about project advisory and management meeting discussions; general correspondence with project advisory and management members and technical experts; the process and outcomes of village workshops and meetings; decision-making process at Druadrua; and community participation in the implementation of project activities and feedback on these activities. Informal interviews were regularly carried out with the *Turaga ni Vanua* and *Turaga ni Koro* and their wives, the Peace Corp volunteer who lived on the island for 2 years during the project, two key members of newly formed water committee, and several women who were involved in food preparation during project visits. Issues discussed included current water supply, community cooperation in construction work, water use patterns, technical visits and linkages between experienced climate patterns, and village water supply.

Outcomes of the CCA project in Druadrua

While the Druadrua CCA project has led to a number of outcomes, for example, improvements in the systems of water supply, the three notable outcomes are: increasing awareness of the community about climate change risks, the institutionalization of an adaptive approach to water resource management, and the development of networks that enhance access to information and resources. These outcomes are now explained.

Community climate change awareness

The outcomes of the pair of household awareness surveys showed significant differences in the awareness of climate change between the project and control site. Although a similar proportion of participants in Druadrua and Nasilai indicated prior knowledge of climate change (48 and 42%, respectively), the differences in awareness were evident in the explanation of the causes and impacts of climate change. Explanations provided by the Druadrua participants were more consistent with each other and displayed an understanding of global climate science, for example about 70% of the answers given included an increase in emissions, increasing temperatures, and deforestation. Nasilai participants' answers were somewhat diverse and vague, with only 37% of the answers referring to emissions and increasing temperatures.

To ascertain that the improved knowledge in the project site was indeed an outcome of the Fiji CCA project, participants were also asked about the source of their climate change knowledge. The people of Druadrua identified project activities such as community workshops, workshop handouts, and informal discussions with the project fieldworkers as their principal forms of information, which is not surprising given that their access to national media is far less than people living in the control site, which is nearby to the capital of Suva and so saturated with electronic and print media. In contrast, the people in Nasilai identified the radio as their main source of information. This reference to the radio may be explained by climate change awareness campaigns that are broadcast on the radio from time-to-time, but we also suspect it may be because the survey was conducted in the Fijian language, where the word 'draki' is used to describe both climate and weather, meaning that it is possible that participants may have misconceived the term 'climate' to mean 'weather'. Hence, participants in the control site may have been referring to the daily weather broadcast when asked where they had come across climate change information.

Notably, while the Druadrua community was generally better informed than Nasilai about the causes and impacts of climate change, over half of the project site's participants indicated that they were not familiar with the concept. This may be because only about 30–40 community members were directly involved in the project activities including workshops, meetings, construction of the water system, as well as interacting with the visiting project fieldworkers. Also, the project budget did not commit to the production of effective learning materials. As such, Druadrua community members who were familiar with climate

change were either involved in the project or closely connected to people involved in the project.

In line with the adaptive management processes, the outcome of the survey was reported to the Druadrua water committee members at a project evaluation workshop in November 2009. The committee was also consulted on possible ways of improving climate change knowledge on the island. Suggestions included a 'training of trainer' workshop for the water committee and the provision of effective awareness materials such as posters and a video so they can conduct a more comprehensive climate change awareness program as part of their work plan. USP recently received supplementary funding from UNDP for the production of awareness material and efforts to develop posters and brochures on climate change, and adaptive management of water in villages in Fijian is currently under way. This exercise also highlights the need for more community climate change awareness initiatives nationwide and the importance of adding to the Fijian vocabulary a specific word to mean 'climate' as distinct from the one that means 'weather'. Similar inquiries may also need to be conducted with the Indo-Fijian language, the second most commonly spoken language in rural Fiji. Failure to do this may be a barrier to adaptation in Fiji.

The survey result indicates that the Fiji CCA Project improved the knowledge levels of Druadrua community on the causes and possible future impacts of climate change and the importance of adaptation. While community members had already observed changes in the local environment, scientific interpretations of climate change were disseminated by the project implementers to compliment this already existing knowledge. This additional climate change awareness was particularly appreciated by community leaders and decision makers who encouraged and supported the community members' involvement in the project and accepted and recognized the new water management plan and committee as part of the community governance regime. While these outcomes are a direct improvement in community-based water management, they are also indicative of an enhanced local capacity to respond to climate change.

Community adaptive management

The Druadrua community had already established a marine protected area based on a district level marine management plan. The plan was based on the FLMMA adaptive management model and the Fiji CCA Project adapted this to improve water management in Druadrua. In this model, the implementation planning is done by identifying a future vision, threats

(especially taking climate change into account), root causes of the threats, and then actions the communities can take.

A key outcome of the Fiji CCA Project in Druadrua was the development of its first CAP shown in Table 1. The plan was based on the community's perspective on how the water problem was to be addressed, incorporating the recommendations from a water engineers' technical report that had been summarized and translated in Fijian. The CAP was developed on the understanding that it could be modified by the community in response to new knowledge and lessons learned, as well as to include other adaptation goals such as to sustain food security and health. The island's first water committee was set up following the CAP development and has since led the community in liaising with external actors in implementing the plan. This has included modifying the CAP in response to unmet expectations and new information.

The 'learning-by-doing' process was particularly exemplified in advancing CAP Activity 12 (Table 1). The community had initially decided that the pilot project funds of US\$ 20,000 be used to purchase solar pumps for the boreholes that were to be drilled by the Mineral Resources Department (MRD). However, the bore hole test results indicated that a solar pump would not be viable. Furthermore, the project advisory group was doubtful of the practicalities of maintaining a sophisticated technology at a relatively geographically isolated location. Instead, a proposal was made to use project funds to advance CAP Activity 6, the assessment of the defunct dam water system, and this was accepted by the community.

As an interim measure, the project acquired the only manual pump available for purchase in the Fiji market (costing US\$ 110), and installed it successfully into one of the boreholes. Due to the quality of the pump and its work rate exceeding its recommended level, the pump broke and more appropriate pumps are currently being sought overseas.

Without an adequate response from the local water authority, the project hired an indigenous Fijian engineer with extensive rural water experience to assess the potential of the old dam, and the outcome was positive. Led by the engineer, the water committee and other community members upgraded the unused dam and fixed the piping to the village. To date, new tanks have been installed and, for the first time, each house has a running tap. While the participatory nature of this undertaking has been relatively time-consuming, the active engagement of community members in the various stages of decision making and action should prove worthwhile in sustaining the island's water supply.

TABLE 1 | Druadrua community adaptation plan as an October 2007.

Activity	Responsible Stakeholders	Implementation Date
Ensure that the ban on bush burning on Druadrua Island is observed	Druadrua community	Ongoing
Control the chopping of trees on the island	Druadrua community	Ongoing
Ensure that the ban on pine planting on the island is observed	Druadrua community	Ongoing
Community water management workshop to particularly cover maintenance and operations of the community water system and efficient water use	USP, MRD, Department of Energy, SOPAC, Rural Water Authority (Labasa)	Some time during Nov 2007 to April 2008
Ensure that the community is consulted and views integrated into future water and other development project designs and implementation	Relevant government departments, development agencies, and Druadrua community	Ongoing
Assess the dam water system that is currently not being used due to technical problems	MRD, Rural Water Authority, Druadrua community	October–December 2007
Ensure that the ban on goat rearing is observed	Druadrua community	Ongoing
Ensure that the springs are protected from contamination	Druadrua community	October
Compile a 'Sustainable Island Development Programme'	USP	2010
Develop household rainwater catchment systems	Druadrua community	2009
Drill bore hole in school and Delaivadra	MRD	October–November 2007
Installation of three solar pumps for the three newly drilled bore holes (school, Delaivadra village, and Salevukoso village) as well as two bore hole water tanks for the two villages	USP, Druadrua community, and Department of Energy	November 2007 to April 2008
Trial a compost toilet for the village	Druadrua community	In progress (community and local Peace Corps)

Gathering accurate and relevant information is a key part of adaptive management, and community-based monitoring is one way of informing the local decision-making process. A workshop was conducted for the purpose of educating participants on the importance and process of monitoring. The difference between 'nanuma' (what one assumes) and 'kila' (what one knows) was particularly emphasized. While informal monitoring is part of community daily life, a systematic process of identifying appropriate indicators, measuring, and recording was unfamiliar to participants. As such, the project staff facilitated the development of a community water management monitoring plan that was practical and relevant and that could be modified to suit future community capacities and needs. In its initial stages, the community is monitoring the water use.

Indeed, it is too soon to say whether the project has successfully enabled the community to effectively

manage their water supply. Also, further follow-up visits will be required by the project implementers 3–5 years after the project to sustain the adaptive management momentum. Nevertheless, the above narrative merely suggests that the project has facilitated the establishment of key components required to operationalize adaptive management practices in the Druadrua Island whereby the community owns the decision-making process and participates in its implementation. The ability to access the required human and technological resources and being able to apply new knowledge to solve local problems such as water are features of adaptive capacity to climate change that the Fiji CCA project may have enhanced in the Druadrua community.

Community networks with external actors

Several individuals and organizations visited Druadrua and contributed technical advice and resources

through the Fiji CCA Project. Although a channel of communication already existed between the community and various government organizations, the project may have contributed to enhancing this relationship. For example, the project staff approached a senior MRD officer based in the Suva capital to inform them of the pilot project developments in Druadrua and to enquire about plans to drill bore holes on the island. Through this exchange, the senior officer visited Druadrua and participated in the CAP planning workshop. The senior officer provided further technical advice, informed the community of the MRD's work, and the MRD's role within the Fiji CCA Project.

Apart from organizing a visit by the pilot project donors (AusAID) to Druadrua, project implementers also approached a newly established foundation to request supplementary funding for the island's new water system. A staff member from the water foundation also visited the island and these activities facilitated direct relationship between the community and the donors. Furthermore, the foundation provided funds for more construction supplies.

Several water engineers have been engaged through the Fiji CCA project activities in Druadrua. Two water engineers visited the island to assess the water problem on the island and recommend possible solutions. One of them is currently setting up the new water system on the island. Given his experience in rural water management, he is also mentoring the water committee on managing the community water supply and accessing external resources for this undertaking. Advice on bore holes and pumps was also obtained from a former senior MRD employee who had over 30 years experience with groundwater sourcing. Technical advice from reliable sources is not easily accessible to rural communities such as Druadrua. However, through the project implementing organization's own network, reliable technical advice has reached the community.

Overall, the difficulties experienced by Druadrua in attaining timely and much needed technical assistance to address basic water needs is representative of the structural factors that limit vulnerable communities from successfully adapting to the impacts of climate change. The lack of response from state institutions in providing basic services and the absence of low-cost manual pumps in the domestic market are examples of these structural factors. Nevertheless, the Fiji CCA project has managed to raise awareness of climate change in Druadrua, implement an adaptive approach to water resource management, and expand the networks of people and institutions that the people of Druadrua can utilize to access information and

resources necessary to adapt to climate change. In these key ways, the community-based approach of the CCA Project has increased the capacity of the people in Druadrua to adapt to climate change.

CONCLUSION

The described process and outcomes of the Fiji CCA Project illustrate five key lessons that may be considered for future CBA initiatives. First, CBAs can be very similar to other development projects as they are largely concerned with enhancing the capacity of local communities to manage change. However, the CBA's more distinctive features are its emphasis on raising community awareness on climate change and incorporating future climate risks in planning. As the Fiji CCA Project experience shows strategic planning and adequate resources are required to ensure that the climate change message is not limited to those directly involved in the project.

Second, developing networks and partnerships are critical for accessing information, technological and engineering expertise, and resources necessary for CBA to be beneficial. Given the structural barriers village communities face in accessing resources for adaptation, identifying and developing partnerships with key technological and engineering institutions should be a key function of CBA project implementers.

Third, the Fiji CCA project experience in the Druadrua Island demonstrates that adaptation projects can have both reactionary and anticipatory features. While the first project step (site selection) was based largely on responding to a local problem, enhancing the awareness levels of the community on the greater impact of climate change on other sectors of community life as well as enabling a decision making and planning approach that is able respond to future problems suggests the 'anticipatory' nature of the project. Improving the capacity of people to deal with unforeseen adversity may be the best option as the future cannot be anticipated very well. The outcomes of this project also suggest that given the limited resources available to vulnerable communities, perhaps the best way to initiate adaptation at this level should be by responding to difficulties that communities already face.

Fourth, CBA works efficiently and effectively when the people facilitating it are from the same culture, speak the same language, and understand local customs.

Finally, doing CBA properly takes time and patience.

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