

## **Problems and Prospects for Islands at the Margins: a Case Study of Moturiki Island, Central Fiji**

**Roselyn KUMAR**

**Institute of Applied Sciences, The University of the South Pacific, Suva, Fiji**

### **Abstract**

Outsiders sometimes fail to appreciate the complex geography of the Pacific Islands region when trying to understand the problems associated with global warming and their potential solutions. For this reason this presentation looks at an island on the margins rather than in the centre of a large island group - the Fiji Islands.

Moturiki Island is home to some 800 people living in 10 villages, mostly engaged in subsistence farming and fishing. Increasing population has strained the resource base of the island, and making the population less resilient and more dependent on outside assistance. The physical fabric of the land of Moturiki is being slowly inundated by sea-level rise associated with global warming. Agriculture is being affected by rising temperatures. Decisions about adaptation - both current and proposed - are being driven from the community level and are often inappropriate.

In the foreseeable future it is likely that conditions on Moturiki will become far worse, with large areas of coastal lowland being flooded. Key uncertainties include future precipitation levels and changes in the frequency of typhoons (tropical cyclones). Moturiki is typical of hundreds of smaller, more marginal, inhabited Pacific Islands on which life may be more difficult to sustain in the future because of climate change.

### **1. Introduction**

Many responses to the issue of climate change in the Pacific Islands assume that the region is homogenous. In other words, they assume that all parts of it are equally vulnerable to threats from climate change and that all parts are able to respond equally. This is not true.

The purpose of this paper is to show that there are considerable differences between what I call the “centre” and the “margins” of a country. These differences are normal in any country but are exaggerated in an archipelagic nation - like most of those in the Pacific Islands region. In many Pacific Island groups, the outer islands are more difficult to reach and less ‘developed’ than the larger more central islands. The situation is the same in Japan, with the centre of economic activity perhaps being concentrated on Tokyo-Osaka and the margins being Hokkaido and the Ryukyu Islands. Besides being the centre of economic development, such a centre is normally the place where new ideas develop first. In contrast, the margins are where new ideas take longest to reach, and where traditional ways of life are strongest.

I argue that it is important for anyone trying to help Pacific Island people adapt to climate change to understand the important cultural and geographical differences between the centre and

the margins of an archipelagic Pacific Island nation like Fiji. In Fiji (Fig.1), the centre comprises the area on the south side of the largest island (named Viti Levu) between the two largest cities, Suva and Lautoka. The rest of the country, which comprises 300 islands, 90 of which are inhabited, can be regarded as the margins. It is about one of the islands on the margins - Moturiki Island in central Fiji - that this paper focuses on.



Figure 1. Map of the Fiji Islands showing the centre and the margins, and the location of Moturiki Island.

Since 2000, I have visited Moturiki many times, to undertake research into both climate change issues and geoarchaeology. I am grateful to the people of the island, especially those of Nasauvuki and Uluibau villages, for their assistance and hospitality.

## 2. The geographical context: central Fiji and Moturiki Island

Moturiki Island is part of the central Fiji group, a group of smaller islands lying between Viti Levu (in the west), Vanua Levu (in the north), and the Lau Islands (in the east). The islands are mostly volcanic, being the eroded remains of volcanoes dating from the late Tertiary period about 5-10 million years ago. They form lines which are believed to show that they formed parallel to a former plate boundary (COULSON 1970).

The island of Moturiki is 10.7 square kilometres in area (Fig.2). It rises to about 133 m above sea level and is fault-bounded along its northeast coast. This coast faces Ovalau Island, which is the remains of the centre of the Lovoni Volcano. Moturiki is interpreted as a broken-off piece of the Lovoni Volcano. The general geology of Moturiki is of breccias and pyroclastic flows dipping southwestwards, away from the centre of the Lovoni Volcano. The geological structure of the island is the main control of its landscape.

There is a coastal plain around most of Moturiki, except in the extreme north, where the village of Savuna sits on a hill top. The coastal plain along the northeast coast is narrow and bounded by steep cliffs representing the fault scarp (Fig.3). Around the eastern part of the island



Figure 2. Map of Moturiki Island showing the main villages, the coastal lowlands (light shading), reefs and the offshore islands (including Yanuca).

(Naicabecabe to Daku) there is a coastal plain thought to have formed when sea level fell in the period 4000-1000 years ago (NUNN 2005). Along the other coasts of the island, the coastal plain is quite wide because the rocks beneath are dipping gently seawards. For the same reason, this coast has a broad mangrove fringe.



Figure 3. Photo of the cliffs behind Nasauvuki Village. There is no inland area to which the Nasauvuki community could easily move.

There is a coral reef fringing most of the Moturiki coast. This reef is widest (as much as 2.5 km) in the south of the island. This reef has attracted people to settle on Moturiki Island since the earliest period of human arrival in Fiji, about 3000 years ago (KUMAR *et al.* 2004).

Some 800 people live on Moturiki today, in ten villages (see Fig.2) including one on smaller nearby Yanuca Island, classified as part of Moturiki for administrative purposes.

With the exception of Savuna Village, all the villages on Moturiki (including Yanuca) are on low-lying flat areas along the islands' coasts. The reasons for this include

- ease of construction and maintenance (shelter) of dwelling houses,
- easy access to flat land for horticulture, and to the ocean for marine foods and other resources, and
- ease of access to other islands and communities.

These coastal flats formed only about 4000 years ago, when they were cut during the high sea level of the middle Holocene period. Holocene sea-level changes on Moturiki and nearby Ovalau Island have been studied in great detail by NUNN (2000a).

Since the middle Holocene, sea level has generally fallen around Moturiki, exposing ancient reef corals in the coastal flats. This sea-level fall created the coastal flats which became overlain with sediments - both from the sea and the land - and developed fertile well-drained soils. These are used widely by the present people of Moturiki for crop growing, especially taro, cassava, yams, and a range of green vegetables. Most of these crops are for on-island consumption.

Root-crop agriculture also dominates the farming in the islands' interiors, where the high-return export crop yaqona (or *kava* - *Piper methysticum*) is grown. Yaqona is the traditional drink of Fiji, and has become an important export crop. The other important use of the islands' interiors is for forestry, with many areas of what used to be grassland (known in Fiji as talasiga) having been planted with exotic pine (*Pinus caribea*) which can be harvested some 20-30 years after planting.

The landscape of Moturiki has changed considerably within the past two hundred years, especially along its coast. Before about AD 1800, as with most parts of the higher islands in the tropical Pacific (NUNN 2000b), most people on Moturiki lived in fortified upland settlements, alert to attack from neighbouring groups. The root of this conflict was competition for a pool of food resources that had been reduced during the AD 1300 Event. A good study of this in Fiji, in the Sigatoka Valley on Viti Levu Island, has just been published (KUMAR *et al.* 2006).

As conflict ended, particularly with the arrival of missionaries, so people moved from uplands to lowlands and the modern villages on Moturiki were established. The British colonial administration that took over in the late 19<sup>th</sup> century laid the foundations of the modern organization of rural Fiji society on islands like Moturiki. Besides requiring people to live along island coasts, many colonial medical officers also encouraged people to chop down the mangrove swamps that fringed these coasts. It was thought that these mangrove swamps were undesirable because they were the breeding grounds of disease-carrying insects, particularly mosquitoes. One result of mangrove clearance was the exposure of island coasts to marine erosion. Shoreline erosion around Moturiki can be attributed to mangrove clearance and 20<sup>th</sup>-century sea-level rise (NUNN 2000c).

Today, almost all exposed coasts on Moturiki are experiencing shoreline erosion. A view of the coast near Daku Village is shown in Figure 4. The response to shoreline erosion has been

generally to build sea walls, which has usually made the problems of coastal sustainability more severe rather than solving them.



Figure 4. Shoreline erosion just north of Daku Village is shown by the fallen and leaning coconut trees.

In the modern villages of Moturiki, there is a mixture of traditional (thatched) houses called *bures* and modern houses of bricks with roofs made from corrugated iron. In all villages, the grandest building is the church (Methodist). The church roof is normally an important catchment for rainwater, being directed into communal tanks. Many individual houses also capture rainwater in this manner. Yet almost all villages on Moturiki depend on well-water for drinking, washing and cooking. Some have cement-lined pools for bathing.

The modern population of Moturiki is dominated, as on many islands on the margins, by older people and their grandchildren. The young adults in particular often live elsewhere, where they can be in cash employment, and send money home to their families on the island. This situation is changeable, depending in particular on

- the wage employment available else (pull factors), particularly seasonal labour during sugar-cane harvesting, and
- the demand and price of cash crops, such as *yaqona*, which can be grown on Moturiki (push factors).

The modern population and age structure of Moturiki influences environmental practices. Many food gardens are overgrown because there is no-one to tend them, especially far away from the villages. Subsistence crops are dominated by cassava, an “easy” crop to grow compared to the more labour-intensive crops like yams and taro. And fishing practices, especially during holiday seasons when large numbers of people living “off the island” return home briefly, are often of the non-sustainable kind - using fish poison (*duva root*), for example.

### 3. The future of Moturiki

It is expected that this century, the temperatures in the tropical Pacific (and everywhere else

in the world) will increase by 1.4-5.8°C (1990-2100), which will certainly influence subsistence dwellers throughout the region. Higher temperatures may restrict the types of crops able to be grown. Higher temperatures are also likely to cause coral bleaching, which will have dire consequences for the production of marine foods.

Sea level is also expected to rise 9-88 cm (1990-2100) which will see the problems associated with 20<sup>th</sup>-century sea-level rise get worse. Sea-level rise will cause flooding and shoreline erosion, perhaps forcing coastal villages to relocate inland. Sea-level rise will also cause salinization of lowland groundwater, causing problems for crop growing in lowland areas.

There will also be changes in the society of Moturiki - and many other islands on the margins in the Pacific. Population growth is currently quite fast, most families having 3-5 children. This will cause increased demands on the environment, although this may be offset by rural depopulation. There are concerns among the older people that such changes will lead to a loss of cultural identity.

This section discusses the future of Moturiki in more detail in three sectors. The first is agriculture, then water, and then coasts.

#### *The future of agriculture on Moturiki*

Most crops grown on Moturiki today are for subsistence, that is for on-island consumption. While many of these crops are grown close to the villages, some are grown inland, mostly because the complicated system of land ownership on Moturiki requires it. Many extended family groups (*mataqali*) own land that is a considerable distance from their homes. Other family groups have to lease land.

Some varieties of taro, particularly the swamp taro (known as *via*), are tolerant of saline groundwater and grow well even in lowland areas where groundwater is salty. But most subsistence crops are not, and large areas inland of some villages (like Naniubasaga, Uluibau and Wawa) have been cleared for such agriculture. This trend is likely to continue, as coastal lowland areas become less suited to growing crops. It is likely that areas increasingly higher up the valleys (where these exist) will be cropped, but this is not an easy option for some villages (like Naicabecabe, Nasauvuki and Navuti - see Fig.3) where there are no areas suitable inland.

Fortunately Moturiki is not too large, so that crops can be grown at considerable distances from villages and brought back daily for consumption in those villages. But the case of subsistence agriculture in modern Moturiki is likely to disappear in the future.

The nature of the crops will also change, and the Fiji Government has been working on developing new strains of (salt-tolerant) crops that its people can grow in more saline groundwaters. Some of the taro so developed is being grown just south of Nasesara Village.

New cash crops have occasionally been introduced to Moturiki, but none have been very successful. The longest-term cash crop is coconuts, the copra from which is bought by the government's National Marketing Authority. But this is a labour-intensive and low-return crop, so not very popular, although many uninhabited coastal flats on Moturiki are covered with coconut forest.

Sea-based crops like beche-de-mer (sea slug) and seaweed have been farmed commercially

but the difficulties of sustaining the supply of these has reduced its commercial success. Trochus shells are occasionally collected and sold to the button factory in Suva.

Much of the future of Moturiki's agriculture depends on how rainfall will change in the future. If there is more rain, that will present problems for inland agriculture, much of which is on steep slopes. If there is less rain, as there probably will be, then water-management practices will have to be improved on Moturiki. The island is already sensitive to drought.

#### *Future water supply and water management on Moturiki*

Like many islands on the margins, most communities on Moturiki do not manage their water supplies in ways that are sustainable in the short term. Many roof catchment systems are falling apart or have been dismantled. Many pipes are leaking. Many rainwater tanks, particularly the communal ones, are likewise leaking or polluted. And, in response to this, many families who can afford it have purchased their own rainwater-collection tanks, thereby excluding themselves from the communal system.

The problem is the cost of installing and maintaining the rainwater-collection infrastructure. On islands like Moturiki that are on the margins, there is little cash. This is not a criticism. Normally there is little need for cash and, when that need arises, then the cash can be earned. But pipes and cement for rainwater tanks are costly, and most communities look to government for financial aid. The government's dilemma is that they do not have enough money for every village in need, so inevitably some villages are "left out" - usually the villages on the margins.

Water management needs to be improved on Moturiki in the future, whether rainfall becomes more or less. Reservoirs could be established, boreholes could be dug, but people also need to be more aware of the need to conserve the water they have, whether that water is used for agriculture or directly by people.

#### *The future of Moturiki's coasts*

The coasts of Moturiki are where most of its people live at present, and where most economic activity (agriculture) and infrastructure (villages, schools, nursing station) is located. As sea level rises, so life will become more difficult along low-lying coastal flats,

Many communities have responded to the problem of shoreline (coastal) erosion by building sea walls. This was done as community initiatives, with little professional input from government, and has generally been unsuccessful. The sea wall at Nasauvuki is a typical vertical impermeable sea wall (Fig.5), which sea water at high tide goes under and around, and often over. It has caused scouring of the area offshore for more than 200 m, reducing its ecological productivity. As seen in Figure 5, the house nearest the sea has raised its entrance to prevent flooding at high tide.

One of the most vulnerable villages is Naicabecabe (Fig.6) which, being the lowest-lying on Moturiki, is regularly flooded at high tide. Life in Naicabecabe become very difficult at such times, but the people own no land on Moturiki so cannot easily locate themselves.

One very important cultural site is at Naitabale in the south of Moturiki. It is one of the ear-

liest-known human settlements in Fiji, dating from more than 3000 years ago (KUMAR *et al.* 2004), and was the place from which a complete Lapita-era skeleton was recovered. The person in question died about 800 BC (KATAYAMA *et al.* 2003). This site is also threatened by sea-level rise. This emphasizes the point that sea-level rise threatens not only modern livelihoods, but also cultural heritage.



Figure 5. The sea wall at Nasauvuki.



Figure 6. The front of Naicabecabe Village, the lowest-lying village on Moturiki.

In the future, if sea level rises as the IPCC predict, it is likely that some villages on Moturiki (Naicabecabe, Navuti, Yanuca) will be abandoned. The question of where the affected people will move is unresolved. Other villages may be able to continue living in their present locations if appropriate coastal conservation is carried out. Such villages include Nasauvuki and Uluibau, where mangrove replanting along the shoreline needs to be carried out.

#### 4. Barriers to problem solving, opportunities for problem solving

There are barriers to problem solving on Moturiki. The main one is that community leaders - traditional chiefs, village headmen (*turaga ni koro*), and religious leaders (*vakatawa*) - do not



have the appropriate information to make informed decisions about environmental management. They need to know about appropriate coastal protection (mangroves rather than sea walls), they need to know about water conservation, and about likely future climate changes, so that they can plan effectively for the future of Moturiki.

The other major barrier to problem solving is resources, particularly financial resources. Perhaps a combination of government assistance and local contributions could provide sufficient money to buy the basic materials for constructing better rainwater-collection infrastructure, for example, but it is not all about the money.

Many of the problems of present and future environmental management on Moturiki - and many other islands on the margins - could be solved by “appropriate empowerment” of community-level decision makers. By giving such people, the information they need to make informed decisions is to empower them to make such decisions. The hierarchical nature of many traditional Pacific Island societies - like that on Moturiki - is appropriate to such empowerment.

Other opportunities include income-generating activities, ranging from tourism to mariculture (seaweed farming), and the improvement of village-level infrastructure (electrification, for example) to encourage more young adults to stay on the island.

## 5. Conclusion: sustaining People-Nature Interactions on Moturiki

Present people-nature interactions on Moturiki are not sustainable. The first challenge is to make them sustainable. The second challenge is to prepare for future changes, resulting from 21<sup>st</sup>-century climate change. The solution lies in empowering the community leaders of Moturiki to make appropriate choices about the future management of the islands’ environment and its natural and cultural resources.

## References

- COULSON, F.I.E. 1976. Geology of the Lomaiviti and Moala Island groups. Fiji Mineral Resources Department, Bulletin 2.
- KATAYAMA, K., NUNN, P.D., KUMAR, R., MATARARABA, S. and ODA, H. 2003. Reconstruction of a Lapita lady skeleton unearthed from the Moturiki Island, Fiji (Preliminary Report). *Anthropological Science*, 111: 404-405.
- KUMAR, R., NUNN, P.D., FIELD, J.E. and DE BIRAN, A. 2006. Human responses to climate change around AD 1300: a case study of the Sigatoka Valley, Viti Levu Island, Fiji. *Quaternary International*, in press.
- KUMAR, R., NUNN, P.D., KATAYAMA, K., ODA, H., MATARARABA, S. and OSBORNE, T. 2004. The earliest-known humans in Fiji and their pottery: the first dates from the 2002 excavations at Naitabale (Naturuku), Moturiki Island. *South Pacific Journal of Natural Science*, 22: 15-21.
- NUNN, P.D. 2000a. Significance of emerged Holocene corals around Ovalau and Moturiki islands, Fiji, southwest Pacific. *Marine Geology*, 163: 345-351.
- NUNN, P.D. 2000b. Environmental catastrophe in the Pacific Islands about AD 1300.

Geoarchaeology, 15: 715-740.

NUNN, P.D. 2000c. Coastal changes over the past two hundred years around Ovalau and Moturiki Islands, Fiji: implications for coastal-zone management. *Australian Geographer*, 31: 21-39.