

Climate change in the Pacific: Tuvalu case-study

I. M. Madaleno

*Department of Natural Sciences, Portuguese Tropical Research Institute,
Lisbon, Portugal*

Abstract

The Tuvalu Group is made of nine small low-lying coral atoll and reef islands, located in the South Pacific, about 1,100 km north of Fiji. With a total area of 26km², it has about 11,000 residents and it is the first nation on Earth to see the rising sun every single day. The people of Tuvalu are mostly of Polynesian origin, their culture and physical type being quite homogeneous. During the month of February 2010, the Portuguese Tropical Research Institute conducted a scientific mission to the atoll of Funafuti, so as to develop an ethno-geographic study. The main objective of the project was to evaluate the Pacific people's awareness to climate change. Results have shown that about two thirds of the remote islanders do not fear the rising sea levels and trust that Divine Providence will bet on their survival. The small population of fishermen and breadfruit, taro, pulaka and coconut subsistence farmers lack economies of scale because of their remoteness yet persevere with a tranquil, slow-paced existence in a vulnerable and isolated environment where they lack resources for adequate development.

Keywords: climate change awareness.

1 Introduction

Tuvalu consists of nine islands located between 4° 36'S and 10° 45'S of the Equator and longitude 176° 8'E and 179° 52'E of Greenwich. From north to south the islands are Nanumea, Nanumanga, Niutao, Nui, Vaitupu, Nukufetau, Funafuti, Nukulaelae and Niulakita [1]. The country lies in the south-east Pacific trade wind belt and even though it is located outside the southern cyclone belt it has suffered over thirty cyclones since the 1940s, the most devastating one being the 1972 cyclone, which provoked one Funafuna construction worker,



interviewed in the atoll of Funafuti, in February 2010, to build an elevated wooden house for his family (see Fig. 1).

Rainfall varies from 2,700 mm per year in the northern islands to 3,500 mm in the southern subgroup, which includes Funafuti, an oceanic atoll covered with sandy and infertile coralline soils. Average temperature lies between 25° and 31°C [2]. The Tuvaluan government plea for international leadership and governmental action against climate change is well-known. Kyoto Protocol agreed on an average of 5.2% reduction of greenhouse gas emissions between 2008 and 2012 based on 1990 emission levels but so far neither this target has been met nor consensus been reached in related forum [3]. Atolls are reefs of corals 3 to 5 metres high that enclose a lagoon. At the current pace of rising sea levels, the island group is expected to disappear, fuelling concerns among Pacific peoples.

2 Methods

As extremes in temperature and rainfall become increasingly noticeable, small pacific countries are compelled to diversify their food systems in order to ensure food and nutritional security [4]. Current project was initiated in Easter Island (Rapa Nui) in 2006, in order to answer these concerns. The objectives were threefold: 1. Recovery of ancestral water and soil management practises; 2. Analysis of traditional therapies using native plant species; 3. Evaluation of pacific people's awareness to climate change. This contribution will focus mainly the last objective [5, 6].

Research used a technique designed to study individuals in their unique settings, commonly called case-study method [7]. The example of Tuvalu can be defined as a geographically delineated community as it is a homogeneous people that inhabit a small Pacific country. Fifty-eight semi-structured interviews included questions about the interrelationships among people in the community, the life of the community and concerns with the physical environment. Following ethnogeographic study tradition, observation techniques, photographic and video records were used to form a comprehensive picture of Tuvaluan culture, education, religion, farming and animal husbandry, food habits, health, water collection, arts and crafts. Literature review and archival documentation were complementary sources of information aimed at substantiating data that couldn't be obtained in the face-to-face interviewing process.

3 Results

Literature on vulnerability to natural hazards has concentrated on availability of and access to resources that people can draw upon to deal more effectively with disaster. Sustainable development discourse is now focusing the regulatory role of the local governments in mitigating and adapting concerned populations and communities to climate change. Discussion contributors such as people's perceptions of risk tend to be ignored [8, 9]. Tuvaluans awareness to climate



change cannot be understood without knowledge of the Pacific island's history and traditions.

3.1 The History of the tiniest nation on Earth

Atoll societies are simple, ruled by chiefs (*aliki*) that are not just rulers but have reciprocal obligations. Communal meetings (*fatele*) are part of a philosophy of gift exchange, starting with open-handed meat consumption, followed by the exhibition of amicably rival dancing groups and the elder's advice in sounding oratory. Legends of the ancient voyagers, religious issues and socio-political problems are often voiced in these assemblies, which in Funafuti are usually organised per island, in their own meeting house (*maneapa*).

The story of the Funafuti atoll tells us that the first settler was Telematua, from Samoa, together with a woman, Futi, who stayed for good, giving her name to the island. Once atolls are quite poor, Telematua sailed in search of a land of greater fertility and where freshwater was more plentiful, landing there with his second wife Tupu. The man was forever divided between the two islands of his kingdom – Funafuti and Vaitupu – the first wife and the second, named after the travel motion (*vaai ia Tupu* or to go to see Tupu). Vaitupu is the largest island, about eight hours distant from Funafuti to the north, and it is both a table reef and an oceanic atoll with two lagoons [10]. Interestingly this bias has persisted, the capital city, Vaiaku, was established in Funafuti but any sound investment as the best schools were always settled in Vaitupu.

It is difficult to establish the time of the earliest settlement, archaeological chronology varying from 2000 years ago to the sixteenth century [11]. The earliest European settlers got there in the early 1830s and about twenty years later forced labour trade was already hitting the island group. They enslaved Tuvaluans to work in the Peruvian guano extraction sites. Historical record accounts for a decline on population by 17,000 to 3,000 residents, in a quarter of century. Missionary groups arrived in 1865. The London Missionary Society supplanted both traditional religion and other Christian faiths. Roman Catholic missions began work in 1888 but *Ekalesia Kelisiano o Tuvalu* dominates to our days.

Just before World War I broke out there were 3,300 inhabitants in the then called Ellice Group, and 25,000 in the Gilberts [12]. They were incorporated into the British Gilbert and Ellice Island Protectorate in 1892. The economic significance of the islands was related to copra production [13] and to labour provision (see table 1). Phosphate mines located on Ocean Island (Banaba, in today's Kiribati) and Nauru, absorbed Tuvaluan labourers between 1900 and 1979.

During World War II a USA navy base was established and more than 6000 Americans were based in Funafuti. They outnumbered Tuvaluans and because most local residents were transported to outer islands during the conflict, little remains from this occupation apart from the airfield. Following a 1974 referendum, Ellice Islands voted for separation from the Gilberts and the first October 1978 the group became an independent nation with the designation of Tuvalu. Few subsist of copra exporters these days, island communities are



Table 1: Tuvalu Group Demographic Evolution.

Years	Population
1850	17,000
1875	3,000
1914	3,300
1931	4,074
1947	4,487
1986	8,200
1991*	9,043
2002*	9,561
2005**	10,885

*Total accounted population during the census and not only residents as in previous countings.

** Estimated population.

Sources: Maude [1]; Grattan [12]; Munro [13]; Tuvalu [26]; WHO [19].

migration-oriented, and the state heavily dependent on fishing licences, remittances and imports, in order to meet the most basic needs [14]. With about 11,000 residents, Tuvalu is the tiniest aid dependent country on Earth.

3.2 Nature and nurture and the Tuvaluan resilience

In an island realm there is a higher probability to endemism, in both flora and fauna, although the total number of species inhabiting it is small [15]. In the case of Tuvalu there are about 50 endemic species [16]. Pacific atolls have low agriculture potential. The soil is calcareous and sandy, so porous that any organic materials are quickly leached out, even the rainwater that generously falls. It is important to stress that reef-building corals can flourish only in clear oceanic water at 18° to 23°C, and are inhabited and destroyed by sediment or by freshwater [17].

The most abundant food native species in Tuvalu are Pandanus (*Pandanus odorantissimus* and *tectorius*) and Pulaka (*Cyrtosperma merkusii*) also known as giant Taro. Apart from Pulaka roots, the main staples are coconuts, locally known as Niu (*Cocos nucifera*), bananas or Futi (*Musa spp.*) and breadfruit, Mei for Tuvaluans (*Artocarpus altilis*) that also feed pigs they raise. Fruits of pandanus and breadfruit are eaten raw, either alone or with bonito, flying-fish and kingfish. The preferred drink is sweet toddy, the coconut tree flowers mixed with rainwater captured in cisterns. The inflorescences can be added to the flour into sweet bread, and distilled to produce an alcoholic drink. Fishing and coconut inflorescence collection are male tasks, whilst women prepare the family meal,



and bake the bread usually in outhouse kitchens. After drinking coconut water, that for millennia has offset the scarcity of potable water, Tuvaluans eat the soft meat of the ripe nut, which constitutes an important part of the main meals. Coconut cream (*lolo*) is extracted from chopped pieces of nut meat, using the *tavaga*, and is added to the peeled and washed pulaka corms, a long lasting tradition [18]. The task takes place in the *Fale*, a structure built-up with Pandanus or Fetau wood (*Callophyllum inophyllum*), and it is a male assignment (see Fig. 2).



Figure 1: Elevated wooden house with cistern – Funafuti atoll, Tuvalu.

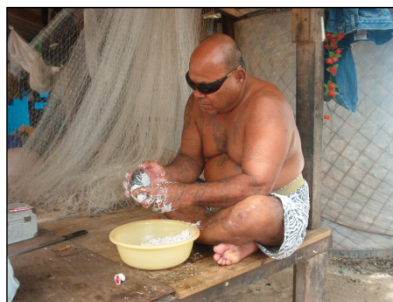


Figure 2: Elevated wooden structure or *Fale* where Tuvaluans extract coconut *lolo*, using the *tavaga* – Funafuti atoll, Tuvalu.

Pulaka roots are preferred to taro (*Colocasia esculenta*) because the last is a water demanding crop, which is impossible to grow on atolls, where irrigation is not recommended, as said. The giant pulaka is grown in dug pits down to the muddy horizon, because rainwater accumulates at a depth of a few metres. Vegetable waste, such as breadfruit leaves and coconut leftovers built-up the much necessary compost to cultivate this dry crop. Breadfruit, pandanus and fetau provide timber for building houses or canoes, and coconut palms covered the house roofs in ancient times. Modernity brought alien and imported building materials as well as canned fish, meat and packed rice, which became vital part of the Tuvaluan diet.

Milk is scarcely consumed, and animal husbandry is reduced to pigs and poultry. Vitamins ingested are Passion-fruit or Passinifuluti (*Passiflora edulis*), Kalampola (*Averrhoa carambola*), Guava or Kuava in Tuvaluan idiom (*Psidium guajava*), Citrus fruits, such as Laimi (*Citrus aurantiifolia*), Mango, called Mangko (*Mangifera indica*), Papaya or Olesi (*Carica papaya*), Soursop, known as Saosopu (*Annona muricata*), and Noni, pronounced Nono in Tuvalu (*Morinda citrifolia*). Nono leaf is smashed with coconut oil and applied to the skin as anti-septic for inadequate garbage disposal favours dermatological problems among Tuvaluans, because they walk barefoot or wearing slippers. In fact, according to the World Health Organisation, septic sores rank second in the communicable

diseases treated in Funafuti hospital, after respiratory infections [19]. In case of fever and respiratory ailments the ancestral prescription is to wash, peel and squeeze pandanus roots and give the resulting juice as medicine, an internal application particularly recommended to children.

Lifestyle diseases such as diabetes and hypertension are common, mainly due to the excessive consumption of imported canned food, salty and sweet goods. This is principally acute in the atoll of Funafuti, where 42% of the island inhabitants live, whilst residents from outer islands develop more traditional livelihoods and are more reliant on ancestral healing practises. It was evident in the discourse of the interviewed persons, which included migrants from Nanumea (7), Vaitupu (5), Niutao (4), and from other origins with smaller representation. The sample has shown they had different approaches to food preparation and dissimilar eating habits. They also were keen to rely on natural remedies for sickness mitigation as related to born residents in Funafuti.

Common to all informants was the faith in God, the proud they were of their culture, the co-operative manner they conducted their existences within the community. Communal organisations and religious associations, respective meetings and ceremonies, were vital part of their routine, even with youngsters. Tuvaluans constitute a close-knit community where each family has its place and role to perform to the benefit of all, as I also found to be the case with Easter Island. Modernity brought some differences in lifestyle and communal duties though, for instance the ancestral duties of the family are not obligatorily passed from father to son, as in old times, for education in local schools and at the university are prioritised within the group and by the government of the islands, so as to prepare them better for future challenges.

This adaptation process is part of Tuvaluan resilience, made of brave sailors men and fishermen, as much as good dancers, experienced tree climbers, skilled artisans, expected to perform better in new professions. As defined by the United Nations International Strategy for Disaster Reduction “*Resilience is the capacity of a (...) community (...) potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain a certain level of functioning* [20]”. Adapt to change in a way you might be capable of enduring as a well-born and raised Tuvaluan is the Polynesian mode to show their uniqueness, their singularity.

4 Discussion

Sea-level variation in the South Pacific Ocean is difficult to assess. Average sea surface in the Western Pacific is about 40 cm higher than the corresponding surface in the Eastern Pacific because of the wind stress of the easterly Trade Winds. (...) During the El Niño-Southern Oscillation (ENSO) events, however, the differential is lost [21]. According to interviews conducted in February 2010, in the atoll of Funafuti, to a meteorologist and to the responsible director of the Tuvaluan Weather Service, data collected has shown that since 1993 the sea level has augmented 5.3 mm per year. This adds to the mentioned differential and points to non-synoptic causes. There are increased impacts on the low



islands of the Pacific that cannot be disregarded, challenging science to isolate atmosphere dynamics and ocean currents from human-induced disturbances.

The people of Tuvalu I've interviewed in the atoll of Funafuti were not interested in the scientific debate. Apart from the awareness day, which takes place during the high tides, they got so used to the caprices of the ocean, to the strong Westerlies, to the heavy rainfall, to the occasional hurricanes, that the fact they observe the sea to behave strangely is just a slight detail in their lives. For generations they got used to live in the isolation of their tiny atolls. Europeans, Asians, whoever comes by is welcome. They know they won't take long to depart. Tuvaluans are fearless people.

However, fearless is not synonym to unawareness, even less of lack of interest for their islands, for their physical environments (see table 2). Tuvaluans are engaged in fighting in the international arena for their identity and for their right to exist in remote Pacific atolls, against all odds.

Table 2: Sample of the beliefs in the future of Tuvalu Islands.

Indicators	N° of Interviews	% Interviews
Belief in the disappearance of the islands	20	34,4
Disbelief on the islands' disappearance	34	58,6
No opinion	4	6,9
TOTAL	58	99,9

Source: Author Interviews, 2010.

Tuvalu case-study contrasts with Hitchings research conducted in the United Kingdom, among eleven respondents working in the financial heart of London, in 2007. They were cocooned indoors during the week, spending long hours sitting at their desks within offices that are commonly pumped full of conditioned air. They often never needed to descend to the lobby as others came and catered to their needs in food and laundry. They hurried from the car or the tube to the foyer, limiting outdoor time to a minimum so as to enjoy thermal comfort as much as possible. Because this European study group from a developed country is used to live in sanitised environments, they declared to hardly notice the changing seasons and weather patterns [22]. Results have shown there was also indifference to the challenges posed by wider climatic warming.

Of course no one in Tuvalu expects to change developed countries people's habits, even less condemn high-rise office buildings in the financial capitals of the world. Their expectation is that science and new technologies might be used to solve the global warming problem. But they hope that we lose the enduring ethnocentric perspective we have been using when we study them and let them be, too. That is why, according to Nhamo *"Developing countries have formed strong coalitions to ensure that their voices are heard as they are also the most vulnerable to climate variability and change"* [23]. As to Tuvalu, *"since the*



early 1990s, Pacific developing member countries have articulated their priorities for addressing climate change at a regional level through the Pacific Plan for Strengthening Regional Coordination and Integration and the Pacific Islands Framework for Action on Climate Change 2006–2015” [24].

It is an increasingly difficult task as Manzo argues for both the messages of the iconography and the political discourse of climate change are contradictory [25]. In fact, just before, during and after the Copenhagen Conference (2009) the previously dominant danger and vulnerability signifiers have been replaced by doubt and criticism against the Intergovernmental Panel on Climate Change (IPCC). The controversy only augmented by September 2010 when Arctic Sea resources exploitation, opened by the melting ice caps, was discussed among interested players. Faith in Science was terminated? Or was it the faith in Politics that ravaged us all? Definitely distrust was established.

5 Conclusions

Discussion on the issue of climate change presented here reflects extreme positions that so far have made consensus improbable. Why change the comfort of air-conditioned houses and offices, the use of automotive means of transportation, when they were so hardly obtained through years of research, of human and financial resources investment, of technological advance, for the survival of remote islanders, who are aid-dependent?

Whilst the focus are peoples and contrasting cultures and not the ability to continue developing a wide range of livelihood options, at the same pace forever, without depleting non-renewable natural resources, there will never be an agreement as to the fact that there is (really) climate change in the Pacific, even less action and modification of lifestyles. The message from Tuvalu is: “*You believe in nothing anymore. But we believe in God. So we expect a miracle...*”

References

- [1] Maude, H.E. Post-Spanish Discoveries in the Central Pacific. *Journal of the Polynesian Society*, **70**, pp. 67-111, 1961.
- [2] Lane, J. *State of the Environment Report 1993*. United Nations Development Programme, Apia (Samoa), 1993.
- [3] Nhamo, G. Co-Leadership in Climate Change: An Agenda to 2013 and Beyond. *Politikon*, **36(3)**, pp. 463-480, 2010.
- [4] Taylor, M., Jaenicke, H., Skelton, P. and Mathur, P.N. Regional Consultation on Crops for the future: towards food, nutritional, economic and environmental security in the Pacific. APAARI, Nadi (Fiji), 2009.
- [5] Madaleno, I. M. Water History in Easter Island and extreme northern Chile. *5th Water History Association Conference*. Tampere: University of Tampere (Finland), Tampere, pp. 1-9 (CD-ROM), 2007.
- [6] Madaleno, I. M. Sustainable Livelihood Examples from Water Deficient Easter Island and the Lower Amazon River Floodplains. *Deutscher*



- Tropentag 2007*, University of Kassel-Witzenhausen and University of Göttingen, Witzenhausen, 2007. <http://www.tropentag.de/2007/abstracts/full/135.pdf>
- [7] Berg, B.L. *Qualitative Research Methods for the Social Sciences*. Pearson, New York, 2006.
 - [8] López-Marrero, T. An Integrative Approach to Study and Promote Natural Hazards Adaptative Capacity: A case-study of two flood-prone communities in Puerto Rico. *The Geographical Journal*, **176** (2), pp. 150-163, 2010.
 - [9] Nolon, J.R. Climate Change and Sustainable Development: The Quest for Green Communities (Part I). *Planning and Environmental Law*, **61** (10), pp. 3-10, 2010.
 - [10] Roberts, R.G. Te Atu Tuvalu, a short story of the Ellice Islands. *Journal of the Polynesian Society*, **67** (204), pp. 394-423, 1958.
 - [11] Kennedy, D.G. Field Notes on the culture of Vaitupu. *Polynesian Society Memoir*, **9**, pp. 1-4, 1931.
 - [12] Grattan, C.H. *The Southwest Pacific since 1900*. The University of Michigan, New York, 1963.
 - [13] Munro, D. and Besnier, N. Plantations in the Atolls: the case of Nukulaelae. Moore, C., Leckie, J. and Munro, D. (eds.) *Labour in the South Pacific*. James Cook University of North Queensland, Townsville, pp. 178-180, 1990.
 - [14] Munro, D. Migration and Shift to Dependence in Tuvalu. Connell, J. (ed.) *Migration and Development in the South Pacific*. National Centre for Development Studies, Canberra, pp. 30-40, 1988.
 - [15] Darwin, C. *The Origin of Species by Means of Natural Selection*. Barnes and Noble Classics, New York, 2004 (first edited in 1859).
 - [16] Seluka, S., Panapa, T. Maluofenua, S. Samisoni, L. and Tebano, T. *A Preliminary Listing of Tuvalu Plants, Fishes, Birds and Insects*. University of the South Pacific, Tarawa (Kiribati), 1998.
 - [17] Spate, O.H.K. *Paradise Found and Lost*. Routledge, London, 1988.
 - [18] Koch, G. *The Material Culture of Tuvalu*. University of the South Pacific, Suva, 1961.
 - [19] WHO. *Western Pacific Country Health Information Profiles*. World Health Organisation, Manila, pp. 454-464, 2008.
 - [20] U.N. International Strategy for Disaster Reduction. Basic Terms of Disaster Risk Reduction. Online (<http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm>).
 - [21] Spencer, T., Geodynamics, Ocean Dynamics and Island Geomorphology in the Pacific Plate. Alexandre, J. Dapper, M. de and Symoens, J.-J. (eds) *Climatic Change and Geomorphology in Tropical Environments*, pp. 49-99, 1994.
 - [22] Hitchings, R. Seasonal Climate Change and the Indoor City Worker. *Transactions of the Institute of British Geographers*, **35** (2), pp. 282-298, 2010.



- [23] Nhamo, G. Co-Leadership in Climate Change: An Agenda to 2013 and Beyond. *Politikon*, **36(3)**, pp. 467, 2010.
- [24] *ADB's Pacific Approach 2010-2014*. Asian Development Bank, Mandaluyong City, 2009, pp. 9.
- [25] Manzo, K. Imaging vulnerability: the iconography of climate change. *Area*, **42 (1)**, pp. 96-107, 2010.
- [26] Tuvalu. Government of Tuvalu Demographic Profile 1991-2002. Secretariat of the Pacific Community, Noumea, 2002.

