

Perceptions of adaptation, resilience and climate knowledge in the Pacific

Resilience and
climate
knowledge

The cases of Samoa, Fiji and Vanuatu

Rory A. Walshe

*Department of Geography, King's College London, London, UK and
Institute of Risk and Disaster Reduction (IRDR), University College London,
London, UK*

Denis Chang Seng

Intergovernmental Oceanographic Commission, UNESCO, Paris, France

Adam Bumpus

*School of Geography, Faculty of Science, University of Melbourne,
Melbourne, Australia, and*

Joelle Auffray

Apidae Development Innovations Pty Ltd., Melbourne, Australia

303

Received 12 March 2017
Revised 30 June 2017
Accepted 1 August 2017

Abstract

Purpose – While the South Pacific is often cited as highly vulnerable to the impacts of climate change, there is comparatively little known about how different groups perceive climate change. Understanding the gaps and differences between risk and perceived risk is a prerequisite to designing effective and sustainable adaptation strategies.

Design/methodology/approach – This research examined three key groups in Samoa, Fiji and Vanuatu: secondary school teachers, media personnel, and rural subsistence livelihood-based communities that live near or in conservation areas. This study deployed a dual methodology of participatory focus groups, paired with a national mobile phone based survey to gauge perceptions of climate change. This was the first time mobile technology had been used to gather perceptual data regarding the environment in the South Pacific.

Findings – The research findings highlighted a number of important differences and similarities in ways that these groups perceive climate change issues, solutions, personal vulnerability and comprehension of science among other factors.

Practical implications – These differences and similarities are neglected in large-scale top-down climate change adaptation strategies and have key implications for the design of disaster risk reduction and climate change adaptation and therefore sustainable development in the region.



© Rory A. Walshe, Denis Chang Seng, Adam Bumpus and Joelle Auffray. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial & non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at <http://creativecommons.org/licences/by/4.0/legalcode>

International Journal of Climate
Change Strategies and
Management
Vol. 10 No. 2, 2018
pp. 303-322
Emerald Publishing Limited
1756-8692
DOI 10.1108/IJCCSM-03-2017-0060

Originality/value – The research was innovative in terms of its methods, as well as its distillation of the perceptions of climate change from teachers, media and rural communities.

Keywords Perceptions, Climate change, Adaptation, Vanuatu, Samoa, Fiji

Paper type Research paper

1. Introduction

It is widely predicted that the impacts of climate change in the South Pacific will arrive comparatively early and be severely felt (Barnett and Campbell, 2010; Walsh *et al.*, 2012), and climate change and its negative impacts will present major obstacles and challenges to sustainable development in the region (UNOHRLLS, 2009).

It is increasingly appreciated that perceptions of climate change and environmental risk influence the degree and nature of adaptation actions taken at the community level (Adger *et al.*, 2005; Leiserowitz, 2006; Mortreux and Barnett, 2009). Despite this, there is a comparative lack of research and knowledge on how different areas and groups in the South Pacific perceive climate change (Lata and Nunn, 2012). The Human Development Report (United Nations Development Program, 2011), which compiles data for perceptions of the environment, has no figures or indicators for Samoa, Fiji or Vanuatu. Adapting to climate change without considering the knowledge and capacity that exists at the local level is likely to lead to failure and maladaptation (Mercer *et al.*, 2012). Therefore, in order to develop effective adaptation strategies, it is important to understand how different communities and groups in the South Pacific perceive climate change.

This article presents findings from an innovative UNESCO-funded research project (UNESCO, 2014a), conducted between January and September 2013. The project “Sharing Perceptions of Adaptation, Resilience and Climate Knowledge” (SPARCK) used groundbreaking socio-technological methods to survey three key sectors (secondary school teachers, rural communities and media personnel) in Samoa, Fiji and Vanuatu. The authors were directly involved in this research.

This paper contributes to the literature in two principal ways: first, it provides empirical evidence that local perceptions may strongly differ from national recommendations and plans; second, it illustrates an innovative methodology not used before in adaptation planning. As a result, and in the context of the potential climate impacts associated with anthropogenic warming, we contend that to make adaptation planning and implementation effective, local perceptions need to be engaged more thoroughly and that human–technology combined methodologies may provide an efficient and effective approach.

2. Adaptation responses in the pacific

2.1 *Climate impacts and resilience in the Pacific*

Projections and models suggest that in the South Pacific temperature will increase (Ruostenoja *et al.*, 2003), rainfall events will become more intense, but possibly less frequent (Jones *et al.*, 1999), sea levels will rise (Walsh *et al.*, 2012), regional climate systems such as ENSO are likely to change and tropical cyclones are predicted to become more intense but less frequent (IPCC, 2013, p. 126).

As a result, it is often stressed that the small island states of the South Pacific are on the “front lines” of climate change (Barnett and Campbell, 2010; Birkmann *et al.*, 2014; Garschagen *et al.*, 2016; Nurse *et al.*, 2014; UNESCO, 2009). While the gravity of the potential impacts of climate change in the South Pacific is well established, it is necessary to avoid

immediately associating “islandness” with vulnerability and “problematizing” small islands (Kelman and Khan, 2013). While many attributes of small islands present issues of vulnerability [such as isolation, insularity and small population size etc., (Méheux *et al.*, 2007)], there are equally inherent attributes of small islands which present resilience, often emerging from the same characteristics that justify their labelling as vulnerable (such as community cohesion concomitant with isolation and small population; Gaillard, 2007; Kelman *et al.*, 2011).

2.2 Adaptation approaches so far

While investment in climate change adaptation (CCA) in the South Pacific is growing, most projects have focused on raising awareness and engagement at the community and household level with adaptation strategies contained in national adaptation plans (Etkin and Ho, 2007; Lata and Nunn, 2012). Such top-down approaches which aim to bring communities in line with national adaptation plans and communication strategies are often ineffective because communities (both rural and urban) are likely to be unreceptive to information, tools and methods which they perceive as alien, and, consequently, issues persist with ineffective communication (Nunn, 2009; Patt and Schroter, 2008). Instead, communicating information about CCA and best practices should be grounded in local perceptions and the appropriate cultural context (Leiserowitz, 2006; Lindell and Perry, 2003). Therefore, there is a pressing need to understand how various groups and communities in the South Pacific perceive climate change, to develop effective adaptation strategies.

2.3 Role of perceptions in adaptation longevity

Responses to climate change are mediated by how individuals and communities perceive both the challenges and solutions of climate change (Mortreux and Barnett, 2009). The complex and diverse factors which contribute to perceptions include social networks and capital, media influence (Farbotko, 2005), personal experience, worldviews and values (Dessai *et al.*, 2003; McLeman and Smit, 2006). An additional influence on perceptions of climate change is the confidence in the community to successfully adopt adaptation strategies and actions (Barnett and Adger, 2003). Therefore, perceptions are value laden, highly subjective and indivisible from the cultural and social context (Kunreuther and Slovic, 1996). In the Marshall Islands, Rudiak-Gould (2013) demonstrated that climate change is interpreted in a holistic manner where a mixture of beliefs (such as loss of “clan magic” and biblical exegesis) and local knowledge is blended with scientific knowledge within a narrative of the compromise and decay of modernity. Conversely, Lazrus (2009) showed that communities in Tuvalu are energetic and persistent in their response to climate change. However other SIDS communities have demonstrated surprising indifference to harmful climate change impacts (Orłowska, 2016). Similarly, in other SIDS cases, perceptions have demonstrated the potential to act as barrier to adaptation (Betzold, 2015). For example, climate change can be perceived as a distant problem (both in time and space), which may not come to pass (Mataki *et al.*, 2006; Tompkins, 2005).

Local spiritual beliefs on SIDS can also influence perceptions of climate change. In Tuvalu, for example, sea level rise has been attributed to scripture, and consequently resulted in inaction (Mortreux and Barnett, 2009; Paton and Fairbairn-Dunlop, 2010) and in the Cook Islands climate impacts are enmeshed with traditional leadership, tourism and emerging Christian eco-theologies (Rubow, 2013).

Neglecting these perceptions, and the disconnect between national (top-down) and community (bottom-up) approaches to CCA in the South Pacific is one reason why the prevailing top-down approach pursued by government has not always been successful in

eliciting appropriate and sustained adaptation (Lata and Nunn, 2012; Nunn, 2010). Indeed, education and adaptation policies that impose Western scientific concepts on rural communities, which lack formal or Western education, have unsurprisingly failed (Berkes and Jolly, 2002; McNamara, 2013), and may also undermine the traditional mechanisms for coping with change (Heyd and Brooks, 2009). Therefore, the plurality of perceptions and approaches within and between social systems needs to be recognised and reconciled to rise to the challenge of adaptation and create locally appropriate responses that are sustainable over time and space (Barnett, 2010).

3. Case studies and methodology

3.1 Case studies: Samoa, Fiji and Vanuatu

This research investigated climate change perceptions in Samoa, Fiji and Vanuatu (Figure 1). The selected countries allowed a broad cross-section of the South Pacific to be examined, with diverse representation from both Melanesia and Polynesia. Our paper does not focus and provide details here concerning the culture or geography of these three countries. Rather, we examine what they have in common, for instance, regarding their exposure to climate change impacts. This includes, for example, less frequent but more severe tropical cyclones in Vanuatu (VMGHD, 2011), coastal erosion and salt-water intrusion in Fiji (Korovulavula, 2016) and increasing temperatures in Samoa (Ministry of Natural Resources and the Environment –MNRE, 2013), as well as a combination of these associated impacts in each country, which interact and cannot be disentangled from other environmental issues. For example, tropical cyclone Pam in Vanuatu recently (March 2015) showed the high damage and losses associated with climatic stressors, underscoring the importance of understanding not only the physical component of climate change impacts but also their social and cultural aspects.

Additionally, these countries were selected because each presented access to participants, including good mobile network coverage for the mobile survey. The diversity within and between countries in the South Pacific means that the results from this research should not be expected to be representative of the South Pacific as a whole.

The main goal of the research was to investigate the perceptions of those groups responsible and empowered for communicating climate change information (Teachers and Media) to a wider group of people, as well as those receiving information and who are exposed to climate change impacts (communities) in Samoa, Fiji and Vanuatu:

3.1.1 Secondary school teachers. The importance of integrating climate change within education, particularly secondary school (ages 12-16 years), to effect behaviour change in line with adaptation is well established (Bangay and Blum, 2010; Wiese, 2012). Several reports stress the need to integrate climate change within the education systems of the South Pacific, with secondary education suggested to have a “trickle up” effect of knowledge transfer from students to parents and the community at-large (Hartmann *et al.*, 2010; UNESCO, 2006; Vize, 2013). However, there is relatively little known about how teachers themselves perceive climate change, and how this subsequently influences education and teaching. Consequently, this research investigated secondary school teachers, who were selected as respondents by snowball sampling in each country with the assistance of local partners and the relevant ministry of education, particularly to generate a diverse sample of ages, gender and subjects taught. Henceforth, this group is referred to as “teachers”.

3.1.2 Media personnel. While a growing body of literature highlights the role of media in communicating climate change (Boykoff and Smith, 2010; Wilson, 2003), there is a dearth of research investigating how the media perceive climate change. The media sector in Samoa, Fiji and Vanuatu is dominated by radio and print media (particularly national newspapers)

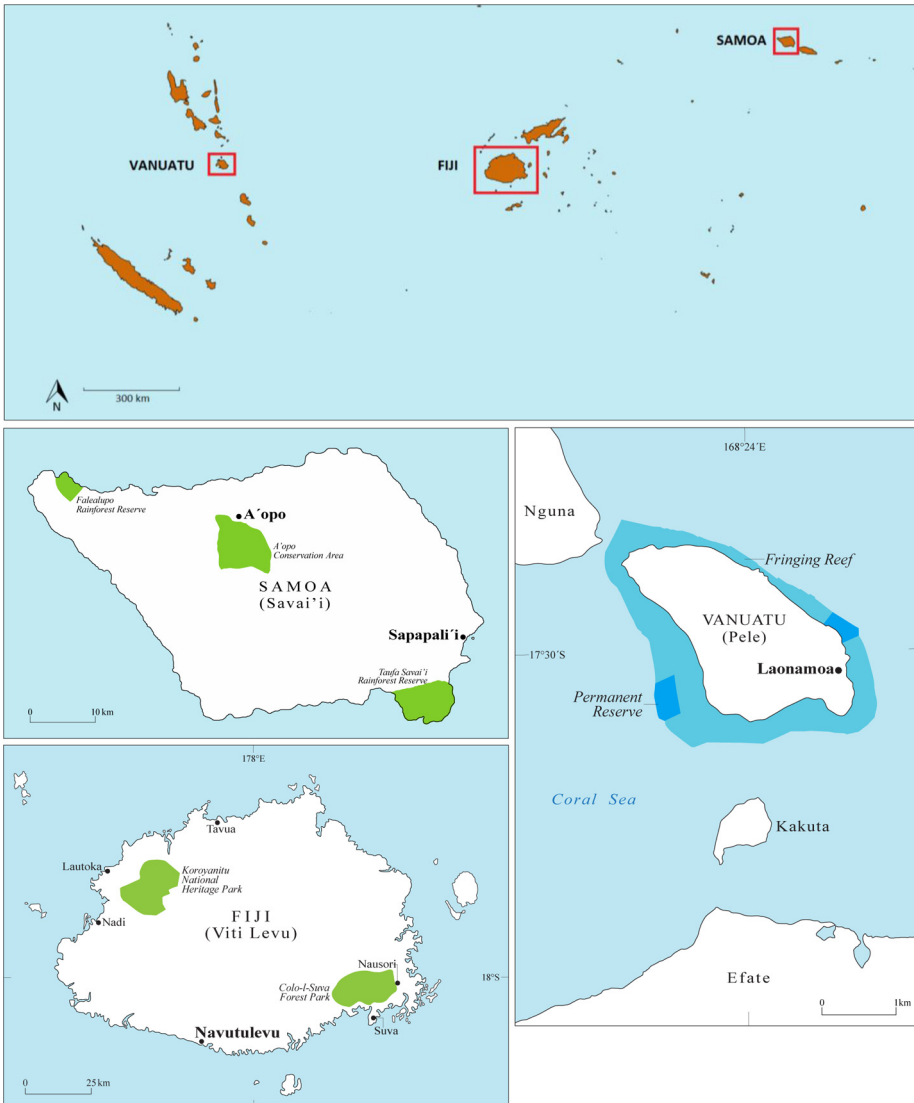


Figure 1.
The case study locations in Samoa, Fiji and Vanuatu

(Papoutsaki and Harris, 2008), with a growing television sector. The isolated, disparate and low income nature of many islands in the South Pacific (particularly Vanuatu and Fiji for this study) has resulted in radio playing a central role in community life; however, increasing development and access has resulted in the emergence of digital media, from television to online news, and an increase in newspaper circulation (Papoutsaki and Harris, 2008). In this context, “media personnel” refers to those employed to create (i.e. the journalists and editors) “traditional” media (radio, newspapers, online news and TV). This

research used snowball sampling of media personnel in the three countries with the assistance of media civil societies as gatekeepers, this includes the *Journalists Association of Samoa (JAWS)* and the Media Association of Vanuatu (MAV), henceforth this group is referred to as “media”. As a function of the comparatively small number of people employed in media in the South Pacific (compared to teachers), these focus groups involved fewer participants (Table I).

3.1.3 Rural communities living in or near conservation areas. There are a number of examples from the South Pacific of traditional communities having heightened awareness of the environment due to their subsistence based livelihoods and culture providing close and intricate links to the environment (Lefale, 2010; Nakashima *et al.*, 2012; Walshe and Nunn, 2012). Communities living in or near defined conservation areas were the final study group, as it is reasonable to suggest that they may have a more intimate understanding of environmental change. These participants will henceforth be referred to as “communities”, with the participating villages selected due to their rural nature, proximity to conservation areas and relative ease of access. The participating members of the communities were selected using snowball sampling with the assistance of a local gatekeeper. Snowball sampling was particularly appropriate to navigate the complicated cultural rituals necessary when conducting research in these areas, to gain access to participants with a diversity of perspectives and to achieve demographic parity (for a similar example, see Altschuler and Brownlee, 2015). Two community focus groups were conducted in Samoa (as opposed to just one in the other countries). This was because one village (Sapapali’i) had already been the subject of a CCA intervention (Secretariat of the Pacific Regional Environment Programme-SPREP, 2009); therefore, the potential influence of this recent project on community responses led to a second community focus group being held in A’opo, which had not been part of a climate change project.

3.2 Mixed methodology approach

To gather the data, UNESCO partnered with the University of Melbourne and Apidae Development Innovations who developed the sociological and technological methodologies. A selected number of well-established techniques known in social science research were adapted to the specific issues in relation to the target groups. This section draws on the

| Groups | Focus group participants | Focus group location | Mobile survey participants |
|----------------|--------------------------|----------------------|----------------------------|
| <i>Samoa</i> | | | |
| Teachers | 33 | Apia | 55 |
| Media | 12 | Apia | 10 |
| Communities | 18/37 | A’opo/Sapapali’i | 45 |
| <i>Fiji</i> | | | |
| Teachers | 11 | Suva | 6 |
| Media | 10 | Suva | 5 |
| Communities | 11 | Navutulevu | 75 |
| <i>Vanuatu</i> | | | |
| Teachers | 28 | Port Vila | 25 |
| Media | 13 | Port Vila | 12 |
| Communities | 26 | Laonamoa | 11 |

Table I.
Participants by
method, country and
group

methodologies outlined in UNESCO (2014a), which includes full listings of questionnaires and focus group guides.

This research undertook two methods, each of which was applied separately to the three sets of participants (teachers, media and communities) in Samoa, Fiji and Vanuatu.

3.2.1 Interactive focus groups. The participants from each group (selected using snowball sampling and guided by in-country assistance) conducted separate focus groups divided into two activities that prompted discussion of climate change, both of the general experiences of climate change and, in the case of teachers and media, from the perspectives of their profession. To minimise the influence of the positionality or “demand characteristics” between the researchers and participants, throughout both activities, it was stressed that this was about personal experiences, and there were no wrong answers. Furthermore, the activities themselves were designed to be participatory, non-leading and, as far as possible, assisted or facilitated by the local contacts in the local language.

3.2.1.1 Activity 1: problems and solutions identification. Focus group participants were first asked to identify what they perceive as the primary problems of, and solutions to, climate change. The activity was slightly tailored to each group, for example teachers were asked what the problems and solutions were in *teaching* about climate change, media were asked with regards to *communicating* climate change, and communities their *personal experience* of climate change issues and solutions. This was an interactive and participatory activity, with the participants writing their answers on post-it notes to encourage open discussion (Plate 1) which prioritised local opinions and experiences.

Next, a facilitator grouped the issues thematically, putting the problems and solutions post-it notes in related clusters (for example those related to changes in the weather). Participants then voted (using coloured stickers) on these clusters for what they, individually, perceived as the biggest solution, the biggest issue and what they wanted to know more about. This whole first stage was transcribed immediately, with translation if necessary, and the resulting clusters of prioritised issues and solutions were photographed (Plate 2).

3.2.1.2 Activity 2: Q-sort. Q-sort is a collective image sorting method of agreement with a statement, which is then used to prompt discussion (Palmer, 1983; Pitt and Sube, 1979). “Q-methods” were designed to be an objective method for the study of subjective values, opinions and meanings, in conjunction with other methods (Robbins and Krueger, 2000). Its



Plate 1.
Problems and
solutions
identification exercise



Plate 2.
Clusters of prioritised
issues and solutions
from focus groups

validity and relevance for gauging community perceptions of the environment on small islands is demonstrated by [Green \(2005\)](#). In this case, the participants were divided into small groups and given a stack of images that visually represented various aspects or elements of what could be perceived as climate change (for example, an image of a cyclone). These included a description written on the back, and additional blank cards could be drawn or written on by participants and added. The participants then placed the images on a grid along a continuum according to agreement with a statement, such as “I teach my students about this climate change issue” (teachers only) ([Plate 3](#)). This was then discussed as a group and transcribed, as well as photographed. This was used to generate discussion, and not to produce quantitative data, as sometimes is the case in Q-sort applications.

These focus groups were informal and semi-structured, conducted with the assistance of three or more facilitators, which allowed for smaller groups in which issues could be followed up on. Such participatory approaches are particularly useful to understand local perspectives ([Chambers and Mayoux, 2003](#)), and have been used effectively in the South Pacific to understand the visualisation of environmental hazards ([Cronin et al., 2004](#)). The resulting discussions were recorded in real time, and, in some cases, were held in the local

**Plate 3.**
Q-sort activity

language and transcribed immediately with the assistance of a translator. The number of participants varied between each of the focus groups (Table I).

3.2.2 Mobile phone based survey. This research used mobile phones to deliver quantitative and qualitative questions regarding climate change perceptions to specific groups in Samoa, Fiji and Vanuatu. Early applications of mobile and ICT-based methods suggest potential for its use in climate change research in the Pacific (Wadley *et al.*, 2014). Such methods should ideally be twinned with participatory methods to ensure that cultural aspects are accounted for, and are particularly suited as a “probe” approach; one that is used as a means of gathering initial data which leads to further investigation, particularly regarding values (Wadley *et al.*, 2014). As far as the authors are aware, this was the first (and so far only) use of such a method for gathering perceptual data in the South Pacific.

Participants self-selected and self-registered for the mobile survey via simple text message (e.g. “text COM to 894”). This self-registration required a targeted promotion strategy pursuing potential participants from the three groups. This included distributing posters and emails with the help of the relevant government ministries, as well as a social media campaign. The participants of the focus groups were also encouraged to publicise the survey as widely as possible with colleagues in their profession. As opposed to the focus groups (with between 9 and 37 participants in each), the mobile survey was open to as many teachers, media personnel and communities in each country as possible.

Once registered, and depending on the specific group code received with registration, participants were sent 12 text message questions. Aside from a number of key standard questions, each set of questions was tailored to the group (e.g. teachers). Depending on the mobile network, the question messages were either received sequentially via Short Message Service (SMS) or all at once via Unstructured Supplementary Services Data (USSD), to which participants replied via text message. The 12 messages contained concise and carefully worded questions that were sent out in English and in the local language. The survey was then “timed-out” if not completed in a certain time (~2 weeks). Participation was free of charge, and, as an incentive, participants were entered into a draw to win US\$100 in mobile phone credit upon successfully completing the survey.

The first message introduced the survey with a brief explanation that the survey was not a test of knowledge, but instead aimed at gathering opinions. The first three standardised questions were concerned with participant information (gender, age and community district/

teaching subject/media type). This was followed by questions gauging climate change knowledge (e.g. what is the biggest climate change problem?), perceptions of personal risk and vulnerability (e.g. how concerned are you about climate change?) and perceived ability to act (e.g. do you think we can do anything about climate change?). These questions were answered either by replying with a single character linked to multiple-choice options or by replying with a single number on a Likert scale (for example, 1 representing “strongly agree”, 5 as “strongly disagree”, 6 as “don’t know”). The final question was linked to capacity building and asked respondents to type suggestions for what is required to improve capacity (such as in media, “what would be the best thing to help build capacity in the media?”). Once the survey closed, the data were aggregated and results that were clearly erroneous or incomplete were removed. The remaining data sets were verified and validated in an attempt to minimise the impact of demand characteristics by telephoning a number of participants (the square root of N for each separate group in each country; [Table I](#)) and orally asking the survey questions again to confirm authenticity and validate their results.

While every effort was made to reduce biases, it is acknowledged that any interaction between “researchers” and “participants” (either by mobile or focus group) involves a positionality which can influence results; consequently, the analysis of data resulting from these methods should be not be treated as representative beyond this sample but instead should be approached as an insight into perceptions. Moreover, as [Table I](#) shows, the numbers of participants (total $N:443$) for each method, group and location varied considerably. The exact total current number of teachers, media or communities (as defined above) in each country is not available, and as such, it is not possible to provide an indication of statistical representativeness. For example, in 2014, there were 984 secondary school teachers in Samoa ([UNESCO, 2014b](#)) compared to this sample of 88 (33 in focus groups and 55 by mobile survey). However, it is important to point out that not all teachers actually teach climate change. As a result, the data should not be extrapolated or generalised to represent any whole group, demographic or region. Instead it offers a “snap-shot” data set, which can be analysed to derive lessons from these participants, which may be suggestive of larger trends.

4. Results

Given the large amount of quantitative and qualitative data generated by this methodology, the results will be detailed by key findings relevant to the scope of this paper and organised by country and group. Therefore, each section does not necessarily detail all elements of both methods (for full results, see [UNESCO, 2014a](#)).

4.1 Samoa

4.1.1 Teachers. Samoan teachers agreed that climate change was an important issue; however, they also felt constrained by the lack of training, education and resources and, therefore, felt unable to communicate climate change to their pupils effectively. As a result, teachers identified training as a high priority. Specifically, 65 per cent ($N: 36$) of teachers in the mobile survey felt that training and workshops for teachers would be the best solution to enable effective teaching about climate change, and that such workshops or training should be in both Samoan and English, locally contextualized and should involve outdoor experiments and fieldtrips to connect scientific theory with local impacts and realities.

It was also expressed that education in schools needed to be streamlined with broader education initiatives outside of school, within families and communities. The focus groups particularly expressed that students should be engaged at an early age and climate change should be fully integrated into the curriculum of appropriate subjects, with key teaching

points linked to climate change in others subjects. In the mobile survey, when asked which subject climate change should be included in, 41 per cent ($N: 22$) of teachers sampled felt it should be integrated in all subjects, 33 per cent ($N: 18$) felt it should be part of geography, and only 17 per cent ($N: 9$) believed it should be taught in sciences.

The mobile survey also asked whether teaching about climate change was a priority, and 94 per cent of teachers responded “yes, a lot” or “yes, somewhat”. Furthermore, in response to the mobile question “do you feel you understand climate change?”, 85 per cent ($N: 47$) of teachers responded “yes, somewhat” or “yes, a lot”. Similarly, 98 per cent ($N: 54$) also answered “yes” or “yes somewhat” to “are you concerned about climate change”. The Samoan teachers that expressed higher concern in climate change also expressed a desire to deal with or respond to climate change on an individual level, indicated by responses to a question regarding how they dealt with climate change. In an attempt to understand perceptions of the ability to act, the mobile survey asked teachers, “Do you think we can do anything to deal with climate change?” While most teachers responded that something could be done, 7 per cent ($N: 4$) of teachers in Samoa responded that the process of climate change cannot be influenced.

4.1.2 Media. Participants in the media focus group felt there was a tension between their professional role and obligation to inform the public about climate change, and the general disinterest of the public in climate change stories, when compared with other topics. Consequently, just over half of the media respondents (55 per cent/ $N: 6$) of the mobile survey felt that public education and awareness raising would be the best solution for communicating climate change. This also led to the suggestion that a major issue for communicating climate change in Samoa is the inability to connect it to personal interests in a way that resonates with the general public. Consequently, a perceived solution was the communication of climate change stories using local and personal contexts, as opposed to the “dry” negotiations, science and acronyms. Television and radio were perceived as the two primary media for reaching audiences to communicate climate change issues.

4.1.3 Communities. In both communities (Sapapali'i and A'opo), community members perceived that “extreme” meteorological events and changes in weather (such as increasing temperatures) were the largest local climate change issues. Both Samoan communities also attributed various issues and challenges to climate change that were not, in the scientific sense, connected to anthropogenic climate change, such as economic concerns, and the use of chemicals in agriculture. According to the communities, the solution to these issues is the provision of development assistance by external actors, particularly financial aid.

The mobile survey found that two-thirds of community members sampled believe that climate change was either human induced, or partly human induced and partly natural. In terms of importance, climate change was ranked equally with economic and livelihood concerns. The mobile survey also replicated the perceived solution of external financial assistance, in addition to local education and community based initiatives. The results suggest that Samoan communities largely perceive climate change as real and having a tangible local impact. However, there was a broad range of perceived levels of concern and understanding of climate change, and predictably those who saw themselves as personally threatened were more likely to take action (although high perceived threat levels were not a prerequisite for taking action).

4.2 Fiji

4.2.1 Teachers. Fijian teachers identified a lack of local examples with which to demonstrate impacts of climate change or practical applications for classroom lessons as the primary issue with teaching climate change. Consequently, community-based workshops were seen as a solution, not only to locally contextualise lessons about climate change but also because it was highlighted that students did not necessarily “believe” in climate change, and this

disinterest was a barrier to learning. Further, teachers felt that the curriculum did not adequately integrate climate change, and that this should be achieved by including it only in one subject (as opposed to mainstreamed across all subject), and by starting climate change education in primary school.

4.2.2 Media. Fijian media regard the climate change information they receive as too technical and remote, and difficult to translate into Fijian, and as a result, it is rarely translated at all, resulting in a lack of understanding by communities. The media also felt there was an over saturation of both similar and conflicting information from a large number of sources. Media suggested the need for better co-ordination across agencies (including government and NGOs) and media types (radio, print media, television and online) with frequent networking to ensure consistency. The media also proposed connecting the inaccessible technical and global climate change information with local realities and practices by showing local climate change impacts, which would generate content that communities could relate to.

4.2.3 Communities. The community at Navutulevu perceived that climate change is making them increasingly vulnerable to the impact of tropical cyclones, and the weather patterns they are experiencing are changing and becoming increasingly more variable. As a result, the communities were taking steps such as planting mangroves to strengthen shorelines and protect from storm surges. While the community perceived that humans were causing climate change, they also perceived human capacity on a local scale as a solution to climate change impacts and did not believe that climate change was “out of their hands”. This partly explains why higher levels of concern correlated with taking action on climate change (as opposed to a reaction of despair leading to inaction); however, men were more likely to take action when compared with women, the reasons for this were not clear from the data. Moreover, the men who felt the most threatened by climate change also thought that actions were available to respond to that threat. However, while technology was seen as a potential solution, the community did not feel they had adequate access or understanding to harness technology as a solution. Consequently, further education was also highlighted as a solution.

4.3 Vanuatu

4.3.1 Teachers. The teachers in the focus group in Port Vila viewed that the curriculum was lacking in terms of its coverage of climate change, and this was a major barrier to teaching climate change, as teachers were uncertain where to place materials within the existing subjects, and resources were not allocated. The teachers sampled were particularly interested in the possibility of, and methods for, integrating traditional knowledge and culture with scientific methods and lessons. Like the teachers in Fiji, those in Vanuatu believed that climate change education should start in primary school; however in contrast to Fiji, they believed that climate change lessons should be mainstreamed into all lessons and subjects, and that teachers should play a role in developing these materials via the sharing of best practices.

The mobile survey uncovered a divide between the priority given to teaching climate change, with half saying they only prioritised it “a little” and the other half saying that they prioritised it “somewhat” or “a lot”. Despite this, the majority of teachers sampled felt that they can and must do something about climate change.

4.3.2 Media. The Ni-Vanuatu media perceived themselves as ineffective in communicating climate change; however, they also felt they should take a leading role in raising awareness and believed that as climate change was a relatively new subject, they required training to achieve this. Similar to the other media focus groups, the Ni-Vanuatu media saw a potential solution in making the science and impacts of climate change easier to understand by contextualising and grounding it locally, particularly by using local

examples. Including the media in CCA activities from the offset (as opposed to a media release at the conclusion) was also perceived as a strategy that would help the media report more effectively. The mobile survey demonstrated that the media felt the information provided to them was too technical and frequently inaccessible. This also explains why, in response to a subsequent mobile survey question about whether climate change was understood, half the respondents answered “somewhat” with the other half split between “very little” and “very well”.

4.3.3 Communities. The Vanuatu community focus group was held at Laonamoa village at the heart of the Nguna-Pele marine reserve (see www.marineprotectedarea.com.vu), north of Efate Island. As a result, it is not surprising that the community prioritised the protection of natural resources as a key issue, particularly for food security and livelihoods. The community also repeatedly highlighted the capacity of traditional knowledge as a component of their livelihoods and its application in responding to challenges such as climate change (among others). However, this capacity of traditional knowledge is perceived as being underutilised and neglected by external stakeholders, particularly those who conduct “climate change training”. The community also pointed to the unprecedented nature of changes in the climate and environment as challenging the boundaries of traditional knowledge (for example in regard to seasonal timings of agricultural cycles) and therefore that climate change might potentially erode traditional knowledge. While the mobile survey showed that most community members felt concerned about climate change, it also uncovered a split in priorities, with half the respondents prioritising education and the economy as the most pressing issue. Regardless, the majority of respondents felt threatened by climate change and most also reported already having taken steps to adapt.

As mentioned above, these data can neither be treated as representative of these groups or nations as a whole nor should they be summarised in unity. This sample clearly shows considerable differences in the identification and prioritisation of climate change problems and solutions. For example, 9 per cent ($N: 10$) of mobile survey respondents in Samoa perceived tsunamis as a climate change problem and 6 per cent ($N: 7$) perceived earthquakes as such. In Fiji, the figures were 1 per cent ($N: 1$) and 3 per cent ($N: 2$), respectively. Conversely, in Vanuatu, tsunamis and earthquakes were not seen as climate change problem.

5. Discussion

While there is a general agreement that climate change is a human induced problem and a threat to society, it is clear that there is considerable inter-group and country diversity in perceptions of climate change. This diversity is problematic to integrate into top-down policy-led interventions, particularly those that are multi-national in scale. The diversity of perceptions shows that countries and subdivisions within them should not be viewed collectively or as in unity. The diverse perceptions demonstrated by this research also included a number of conflicting and contradictory perceptions within groups, and complete agreement on any single discussion within the focus groups was rare. This lack of agreement regarding issues and solutions is often smoothed over, as communities are uncritically approached in adaptation programming (Cannon, 2008); consequently, this research suggests that communities should not be portrayed in overly romantic terms which neglect to consider the social divisions within (Forsyth, 2013).

Furthermore, the research has revealed that teachers, media and particularly communities often prioritise other concerns such as poverty, livelihoods and food security, over climate change. This has been remarked upon before in the South Pacific, particularly for subsistence livelihood reliant communities (Iati, 2008; Nunn, 2012). However, this is rarely accounted for in

CCA planning, with programs instead didactically passing down directives and “crowding out” issues which are perceived as greater local concerns (Baldacchino and Kelman, 2014). These divergent priorities illustrate the importance of empowerment, and that for communities in the South Pacific to make informed decisions requires access to appropriate resources (Betzold, 2015). Simply put, CCA should be done *by* communities, not *on* communities (Barnett, 2008, p. 45). It also adds to the assertion that broader climate change thinking fails to acknowledge the diverse experience of climate risks, or the contested nature of many proposed solutions; therefore, discussions about climate action should be based on this diversity of perceived risks and solutions (Forsyth, 2014).

This research also illustrates the artificial nature of the division between DRR and CCA interventions, given that climate change is increasingly being used as a catch all phrase for assigning blame for a range of disasters, including tsunamis (a trend noted by Mercer, 2010; Kelman *et al.*, 2015).

Moreover, the majority of the participants studied in this research agree that something *can* be done at a local scale in response to the impacts of climate change. This capacity to respond and adapt, as well as the historical context of South Pacific island societies successfully overcoming past changes, is neglected in the prevalent discourse about vulnerable islands, in which islanders are passive and “doomed” (Farbotko, 2010). The results of this research suggest that to prepare and implement suitable strategies (either for climate change or other initiatives), the specific socio-cultural context and the key challenges to addressing adaptation and resilience within this context should be further investigated and better understood. Finally, this research offers a number of lessons in terms of its innovative methodology, and particularly, the potential of mobile technology to deliver survey data. There are several clear advantages to this method, given the often disparate and isolated nature of communities in the South Pacific. Fiji for example has over 100 inhabited islands spread over three million square kilometres, and mobile technology has proliferated rapidly and widely in the Pacific (Duffield *et al.*, 2008). While internet-based surveys were considered (and may be more appropriate in the future), the penetration offered by mobile phones is unparalleled, particularly among the older demographic and in more remote areas which might not yet have access to smartphones or internet-enabled devices. There are also clearly limitations and prerequisites necessary to consider with this approach, several of which were demonstrated in this first application. This includes the importance of extensive publicity to ensure adequate participant registration, considering the multiple possible interpretations of such short survey questions between and within groups, the issues with language translations and methodological issues such as the risk of participants contributing random answers or demand characteristics. However, these issues are surmountable with careful analysis and verification of the data and, particularly, when twinned with other methods for means of triangulation. Therefore, this “probe” application suggests that with careful design and support, mobile technology can be used, not only for human-centred climate research in the Pacific region but also to improve the wider efficiency and support of climate change programmes (Wadley *et al.*, 2014).

6. Conclusion

Regardless of the mitigation actions that result from the 2015 UNFCCC policy processes and the Paris Agreement, significant and sustained adaptation will be required in the South Pacific. To design effective adaptation strategies, it has been repeatedly demonstrated that the perceptions of the communities at risk must be considered, otherwise adaptation is likely to fail. This study shows empirical evidence that there is a dissonance in the diverse way teachers, the media and communities perceive and relate to climate change in the South

Pacific. This encompasses issues, solutions, personal vulnerability and comprehension of science among other factors (UNESCO, 2014a). However, there is also common ground in perceptions that climate change is due to human activities and is already having tangible effects. The groups studied largely perceive that something can be done about climate change, and perhaps most importantly, the majority also felt that actions, lessons and communication about climate change and adaptation should be locally grounded and contextualised, including the use of traditional knowledge where possible.

These findings, particularly the diversity of perceptions, are at odds with the prevalent top-down adaptation approaches and education policies, which do not adequately account for these differences and similarities. Regional education programs have been adopted which directly recommend empowering communities in the South Pacific by the use of locally relevant and culturally appropriate climate change education (UNESCO, 2006) and, more recently, the importance of integrating climate change into the curriculum for both DRR and CCA (SPC, 2012). However, there remains a considerable gap between these statements and their actual implementation (Walid, 2017). At the heart of these issues is the struggle to reconcile the mass produced and “one-size-fits-all” adaptation strategies, with the diverse, local and cultural understanding and experience of climate change (Glantz, 1988; Hulme, 2016). Therefore, further research should be aimed at better understanding the influence of culture and cultural practices on these perceptions.

The mixed methodology approach deployed by this research combined technological innovation (particularly the application of mobile technology) with human/social approaches to provide empirical evidence of local perceptions. This also suggests its potential as an efficient and effective approach to design and support adaptation strategies.

7. Acknowledgements

The authors wish to thank Sue Vize, Kevin Petrini, Anne Meldau, Leauga Tamasoalii Saivaise, Tapu Tuailmafu, Cathy Nunn, Christopher Bartlett, Filomena Nelson, Ali Hobbs and Carol Young. Institutions which provided support included: In Samoa, the Ministry of Education, Sports and Culture (MESC), the Global Climate Change Alliance (GCCA) of the University of the South Pacific (USP) and the Journalists Association of Samoa (JAWS). In Fiji, the Department of Environment, the Ministry of Education, Natural Heritage, Culture and Arts, the Ministry of Information and National Archives and Vodafone Fiji. In Vanuatu, the Ministry of Education, Vanuatu National Advisory Board on Climate Change and Disaster Risk Reduction, the Vanuatu Cultural Centre and the Media Association of Vanuatu (MAV). Thanks are also owed to all colleagues at UNESCO Apia Office for the Pacific States, and Apidae Development Innovations Pty Ltd. The national maps for this publication were kindly produced and provided by the University of Melbourne cartographer. Finally to all the participants, vinaka vaka levu, tank yu tumas and fa’afetai tele lava.

Research funding: The funding for this project was provided by the United Nations Educational Scientific and Cultural Organisation (UNESCO).

References

- Adger, W.N., Arnell, N.W. and Tompkins, E.L. (2005), “Successful adaptation to climate change across scales”, *Global Environmental Change*, Vol. 15 No. 2, pp. 77-86.
- Altschuler, B. and Brownlee, M. (2015), “Perceptions of climate change on the Island of Providencia”, *Local Environment*, Vol. 21 No. 5, pp. 615-635.
- Baldacchino, G. and Kelman, I. (2014), “Critiquing the pursuit of Island sustainability”, *Shima*, Vol. 8 No. 2, pp. 1-21.

- Bangay, C. and Blum, N. (2010), "Education responses to climate change and quality: two parts of the same agenda?", *International Journal of Educational Development*, Vol. 30 No. 4, pp. 359-368.
- Barnett, J. (2008), "The effect of aid on capacity to adapt to climate change: insights from Niue", *Political Science*, Vol. 60 No. 1, pp. 31-45.
- Barnett, J. (2010), "Adapting to climate change: three key challenges for research and policy-an editorial essay", *Wiley Interdisciplinary Reviews: Climate Change*, Vol. 1 No. 3, pp. 314-317.
- Barnett, J. and Adger, W.N. (2003), "Climate dangers and atoll countries", *Climatic Change, Kluwer Academic Publishers*, Vol. 61 No. 3, pp. 321-337.
- Barnett, J. and Campbell, J. (2010), *Climate Change and Small Island States: Power, Knowledge, and the South Pacific*, Earthscan, London.
- Berkes, F. and Jolly, D. (2002), "Adapting to climate change: social-ecological resilience in a Canadian western arctic community", *Conservation Ecology*, Vol. 5 No. 2, p. 18.
- Betzold, C. (2015), "Adapting to climate change in small Island developing states", *Climatic Change*, Vol. 133 No. 3, pp. 481-489.
- Birkmann, J., Garschagen, M., Mucke, P. and Schauder, A. (2014), *World Risk Report 2014*, UNU-EHS (Ed.), Bonn.
- Boykoff, M.T. and Smith, J. (2010), "Media presentations of climate change", in Lever-Tracy, Constance (Ed.), *Routledge Handbook of Climate Change and Society*, Routledge International Handbooks, Abingdon, pp. 210-218.
- Cannon, T. (2008), "Reducing people's vulnerability to natural hazards: communities and resilience", Wider Research Paper, p. 19.
- Chambers, R. and Mayoux, L. (2003), "Reversing the paradigm: quantification and participatory methods", EDIAIS Conference on New Directions in Impact Assessment for Development: Methods and Practice, *Manchester*, pp. 1-24.
- Cronin, S.J., Gaylord, D.R., Charley, D., Alloway, B.V., Wallez, S. and Esau, J.W. (2004), "Participatory methods of incorporating scientific with traditional knowledge for volcanic hazard management on Ambae Island, Vanuatu", *Bulletin of Volcanology*, Vol. 66 No. 7, pp. 652-668.
- Dessai, S., Adger, W.N., Hulme, M., Koehler, J., Turnpenny, J., Warren, R. and Köhler, J. (2003), "Defining and experiencing dangerous climate change defining and experiencing dangerous climate change", *Climatic Change*, Vol. 64 Nos 1/2, pp. 11-25.
- Duffield, D.L., Watson, A.H.A. and Hayes, D.M. (2008), "Media and communication capacities in the Pacific region", *Ejournalist*, Vol. 8 No. 1, pp. 20-34.
- Etkin, D. and Ho, E. (2007), "Climate change: perceptions and discourses of risk", *Journal of Risk Research*, Vol. 10 No. 5, pp. 623-641.
- Farbotko, C. (2005), "Tuvalu and climate change: constructions of environmental displacement in the Sydney morning Herald", *Geografiska Annaler: Series B, Human Geography*, Vol. 87 No. 4, pp. 279-293.
- Farbotko, C. (2010), "Wishful sinking: disappearing Islands, climate refugees and cosmopolitan experimentation", *Asia Pacific Viewpoint*, Vol. 51 No. 1, pp. 47-60.
- Forsyth, T. (2013), "Community-based adaptation: a review of past and future challenges", *Wiley Interdisciplinary Reviews: Climate Change*, Vol. 4 No. 5, pp. 439-446.
- Forsyth, T. (2014), "Climate justice is not just ice", *Geoforum, Elsevier Ltd*, Vol. 54, pp. 230-232.
- Gaillard, J. (2007), "Resilience of traditional societies in facing natural hazards", *Disaster Prevention and Management: An International Journal*, Vol. 16 No. 4, pp. 522-544.
- Garschagen, M., Hagenlocher, M., Comes, M. and Dubbert, M. (2016), *World Risk Report 2016*, UNU-EHS, Bonn.

- Glantz, M.H. (1988), *An Essay on the Interactions Between Climate and Society*, National Center for Atmospheric Research, CO.
- Green, R. (2005), "Community perceptions of environmental and social change and tourism development on the Island of Koh Samui, Thailand", *Journal of Environmental Psychology*, Vol. 25 No. 1, pp. 37-56.
- Hartmann, H., Sabass, H., Tagivakadini, S. and Ries, F. (2010), *Climate Change Education in the Pacific Island States*, SPC-GIZ, Suva.
- Heyd, T. and Brooks, N. (2009), "Exploring cultural dimensions of adaptation to climate change", in Adger, W.N., Lorenzoni, I. and O'Brien, K.L. (Eds), *Adapting to Climate Change: Thresholds, Values, Governance*, 1st ed., University Press, Cambridge, Cambridge, MA, pp. 269-282.
- Hulme, M. (2016), *Weathered Cultures of Climate*, SAGE Publications, London.
- Iati, I. (2008), "The potential of civil society in climate change adaptation strategies", *Political Science*, Vol. 60 No. 1, pp. 19-30.
- IPCC (2013), *Climate Change 2013: The Physical Science Basis: Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Stocker, T.F., Qin, D., Plattner, G.-K., Tignor, M., Allen, S.K., Boschung, J., Nauels, A., Xia, Y., Bex, V. and Midgley, P.M. (Eds), Cambridge University Press, Cambridge, MA.
- Jones, R., Hennessy, K. and Page, C. (1999), *An Analysis of the Effects of Kyoto Protocol on Pacific Island Countries, Part 2: Regional Climate Change Scenarios and Risk Assessment Methods*, 1st ed., SPREP, Apia.
- Kelman, I. and Khan, S. (2013), "Progressive climate change and disasters: Island perspectives", *Natural Hazards*, Vol. 69 No. 1, pp. 1131-1136.
- Kelman, I., Gaillard, J.C. and Mercer, J. (2015), "Climate change's role in disaster risk reduction's future: beyond vulnerability and resilience", *International Journal of Disaster Risk Science*, Vol. 6 No. 1, pp. 21-27.
- Kelman, I., Lewis, J., Gaillard, J.C. and Mercer, J. (2011), "Participatory action research for dealing with disasters on Islands", *Island Studies Journal*, Vol. 6 No. 1, pp. 59-86.
- Korovulavula, I. (2016) "Climate change impacts in Ra and Kadavu provinces", *SPC Pacific Community Report*, available at: www.spc.int/wp-content/uploads/2016/12/Climate-change-impacts-Ra-Kadavu-Provinces-Fiji.pdf
- Kunreuther, H. and Slovic, P. (1996), "Science, values, and risk", *The Annals of the American Academy of Political and Social Science*, Vol. 545 No. 1, pp. 116-125.
- Lata, S. and Nunn, P. (2012), "Misperceptions of climate-change risk as barriers to climate-change adaptation: a case study from the Rewa Delta, Fiji", *Climatic Change*, Vol. 110 Nos 1/2, pp. 169-186.
- Lefale, P.F. (2010), "Ua 'afa le Aso stormy weather today: traditional ecological knowledge of weather and climate: the Samoa experience", *Climatic Change*, Vol. 100 No. 2, pp. 317-335.
- Leiserowitz, A. (2006), "Climate change risk perception and policy preferences: the role of affect, imagery, and values", *Climatic Change*, Vol. 77 Nos 1/2, pp. 45-72.
- Lindell, M. and Perry, R. (2003), *Communicating Environmental Risk in Multiethnic Communities*, 1st ed., Sage, London.
- McLeman, R. and Smit, B. (2006), "Migration as an adaptation to climate change", *Climatic Change*, Vol. 76 Nos 1/2, pp. 31-53.
- Mcnamara, K.E. (2013), "Taking stock of community-based climate-change adaptation projects in the Pacific", *Asia Pacific Viewpoint*, Vol. 54 No. 3, pp. 398-405.
- Mataki, M., Koshy, K. and Nair, V. (2006), "Implementing climate change adaptation in the Pacific Islands: adapting to present climate variability and extreme weather events in Navua (Fiji)", *AIACC Working Assessments of Impacts and Adaptations to Climate Change*, No. 34.

- Méheux, K., Dominey-Howes, D. and Lloyd, K. (2007), "Natural hazard impacts in small Island developing states: a review of current knowledge and future research needs", *Natural Hazards*, Vol. 40 No. 2, pp. 429-446.
- Mercer, J. (2010), "Disaster risk reduction or climate change adaptation: are we reinventing the wheel?", *Journal of International Development*, Vol. 22 No. 2, pp. 247-264.
- Mercer, J., Kelman, I., Alfthan, B. and Kurvits, T. (2012), "Ecosystem-based adaptation to climate change in Caribbean small Island developing states: integrating local and external knowledge", *Sustainability*, Vol. 4 No. 8, pp. 1908-1932.
- Ministry of Natural Resources and the Environment –MNRE (2013), "Current and future climate of Samoa: the Pacific Climate Change Science Program", available at: www.pacificclimatechangescience.org/wp-content/uploads/2013/06/3_PCCSP_Samoa_8pp.pdf (accessed 5 May 2017).
- Mortreux, C. and Barnett, J. (2009), "Climate change, migration and adaptation in Funafuti, Tuvalu", *Global Environmental Change*, Vol. 19 No. 1, pp. 105-112.
- Nakashima, D., Galloway, M., Thulstrup, H., Castilho, R. and Rubis, J. (2012), *Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation*, UNESCO, Jakarta.
- Nunn, P.D. (2009), *Understanding Environmental Decision Making in the Rural Pacific Islands*, Suva.
- Nunn, P.D. (2010), "Bridging the gulf between science and society: imperatives for minimizing societal disruption from climate change in the Pacific", *Adaptation and Mitigation Strategies for Climate Change*, Springer Japan, Tokyo, pp. 233-248.
- Nunn, P.D. (2012), "Climate change and Pacific Island countries, report background papers series 2012/07", *United Nations Development Programme*, Asia Pacific Regional Centre, Suva.
- Nurse, L.A., Mclean, R.F., Agard, J., Briguglio, L.P., Duvat-Magnan, V., Pelesikoti, N., Tompkins, E. and Webb, A. (2014), "Small Islands, Part B: regional aspects", *Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.
- Orłowska, J. (2016), "Living on the sinking Islands", Social Aspects of Climate Change on Example of Maldives, PhD thesis, Institute of Philosophy and Sociology Polish Academy of Sciences, Warsaw.
- Palmer, J.F. (1983), "Assessment of Coastal Wetlands in Dennis, Massachusetts", in Osmun, A. (Ed.), *The Future of Wetlands, Assessing Visual-Cultural Values*, Allanheld Osmun, Totowa, NJ.
- Papoutsaki, E. and Harris, U.S. (2008), *South Pacific Islands Communication: Regional Perspectives*, University of the South Pacific Press, Suva.
- Paton, K. and Fairbairn-Dunlop, P. (2010), "Listening to local voices: Tuvaluans respond to climate change", *Local Environment*, Vol. 15 No. 7, pp. 687-698.
- Patt, A. and Schroter, D. (2008), "Perception of climate risk in Mozambique: implication for the success of adaptation", *Global Environmental Change*, Vol. 18 No. 1, pp. 458-467.
- Pitt, D.G. and Sube, E.H. (1979), "The Q-sort method: use in landscape assessment research and landscape planning", *Proceedings of National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource*, Vol. 1, pp. 227-234.
- Robbins, P. and Krueger, R. (2000), "Beyond bias? The promise and limits of Q method in human geography", *Professional Geographer*, Vol. 52 No. 4, pp. 636-648.
- Rubow, C. (2013), "Enacting cyclones: the mixed response to climate change in the Cook Islands", in Hastrup, K. and Skrydstrup, M. (Eds), *The Social Life of Climate Change Models*, 1st ed., Vol. 8, Routledge, Routledge Studies in Anthropology, Abingdon, pp. 57-76.
- Rudiak-Gould, P. (2013), *Climate Change and Tradition in a Small Island State: The Rising Tide*, Routledge, Abingdon.
- Ruosteenoja, K., Carter, T.R. and Tuomenvirta, H. (2003), "Future climate in world regions: intercomparison of model based projections for the new IPCC emissions scenarios", *The Finnish Environment*, Vol. 1 No. 644, p. 81.

- Secretariat of the Pacific Community (SPC) (2012), *Pacific Platform for Disaster Risk Management*, SPC, Suva.
- Secretariat of the Pacific Regional Environment Programme-SPREP (2009), “Pacific adaptation to climate change: Solomon Islands”, *Report of In-Country Consultations*, pp. 1-37.
- Tompkins, E.L. (2005), “Planning for climate change in small Islands: insights from national hurricane preparedness in the Cayman Islands”, *Global Environmental Change*, Vol. 15 No. 2, pp. 139-149.
- UNESCO (2006), “Pacific education for sustainable development framework”, Endorsed by the Pacific Ministers of Education, 27 September, Nadi.
- UNESCO (2009), *Climate Frontlines*, UNESCO, Paris.
- UNESCO (2014a), *Understanding Community Perceptions about Climate Change in the Pacific*, UNESCO, Apia.
- UNESCO (2014b), “Institute for statistics (UIS) national education data”, available at: www.epdc.org/country/samoa/search?school_level=82-53-59-113-50-48-118122&indicators=718&year_from=2010&year_to=2017 (accessed 14 April 2017).
- United Nations Development Program (2011), *Human Development Report 2011. Sustainability and Equity: A Better Future for All*, UNDP.
- UNOHRLLS (2009), *The Impact of Climate Change on the Development Prospects of the Least Developed and Small Island Developing States*, 1st ed., UN-OHRLLS, Geneva.
- Vanuatu Meteorology and Geo-hazard Department (VMGHD) (2011), “Current and future climate of Vanuatu: the Pacific climate change science program”, available at: www.pacificclimatechangescience.org/wp-content/uploads/2013/06/15_PCCSP_Vanuatu_8pp.pdf (accessed 5 May 2017).
- Vize, S. (2013), “Using education to bring climate change adaptation to Pacific communities”, *Journal of Education for Sustainable Development*, Vol. 6 No. 2, pp. 219-235.
- Wadley, G., Bumpus, A. and Green, R. (2014), “Citizen involvement in the design of technology for climate change adaptation projects in the Pacific”, *Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures the Future of Design - OzCHI '14*, ACM Press, New York, NY, pp. 180-183.
- Walid, M. (2017), “Towards a mega-Pacific Islands education curriculum for climate adaptation blending traditional knowledge in modern curriculum”, in Filho, W.L. (Ed.), *Climate Change Adaptation in Pacific Countries*, 1st ed., Springer International, London, pp. 271-285.
- Walsh, K.J.E., McInnes, K.L. and McBride, J.L. (2012), “Climate change impacts on tropical cyclones and extreme sea levels in the South Pacific – a regional assessment”, *Global and Planetary Change, Elsevier B.V.*, Vols 80/81, pp. 149-164.
- Walshe, R.A. and Nunn, P.D. (2012), “Integration of indigenous knowledge and disaster risk reduction: a case study from Baie Martelli, Pentecost Island, Vanuatu”, *International Journal of Disaster Risk Science*, Vol. 3 No. 4, pp. 185-194.
- Wiese, V. (2012), “Education and climate change: living and learning in interesting times”, *Journal of Peace Education*, Vol. 9 No. 2, pp. 321-323.

Further reading

- Farbotko, C. and Lazrus, H. (2012), “The first climate refugees? Contesting global narratives of climate change in Tuvalu”, *Global Environmental Change*, Vol. 22 No. 2, pp. 382-390.
- Nunn, P.D., Runman, J., Falanruw, M. and Kumar, R. (2016), “Culturally grounded responses to coastal change on Islands in the federated states of Micronesia, Northwest Pacific ocean”, *Regional Environmental Change*, Vol. 1 No. 13, pp. 428-439.

About the authors

Rory A. Walshe is a PhD Student at King's College London, Department of Geography and the University College London (UCL) Institute of Risk and Disaster Reduction (IRDR). His research interest is community resilience and vulnerability on small island developing states. This particularly includes the integration of local knowledge and culture within disaster risk reduction and climate change adaptation. His current research investigates contemporary and historical responses and perceptions of tropical cyclones in the Indian Ocean. Rory A. Walshe is the corresponding author and can be contacted at: rory.walshe@kcl.ac.uk

Denis Chang Seng currently works at the Intergovernmental Oceanographic Commission (IOC) of UNESCO. He is a Programme Specialist working jointly in the Tsunami Unit and the Ocean Observation and Services Section. In the tsunami unit, he is the Technical Secretary for the IOCs Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and connected seas (*ICG/NEAMTWS*). Previously, Denis was a UNESCO's Natural Science Programme Specialist for the Pacific Island States. He also worked at the United Nations – Institute for Environment and Human Security (UNU-EHS) in Bonn, Germany.

Adam Bumpus, BSc MA DPhil, is a Senior Lecturer in Environment, Innovation and Development, Faculty of Science, University of Melbourne, Australia. His work focuses on the business and policy pathways to a low carbon future including clean energy entrepreneurship, how mobile technologies can make local development more effective and how local sustainability innovations can become successful in the global economy.

Joelle Auffray is the Co-Founder and Director of Apidae Development Innovations Pty Ltd, a strategic communications and creative agency for sustainable development. Since 2012, Joelle has led climate change and sustainable development projects throughout the Asia-Pacific region, working with organisations such as UNESCO, UNDP, UNISDR, SPREP, SPC, ITTO, GGGI and the World Bank. Her expertise in community engagement, knowledge sharing, research and reporting and communicating program impact on sustainable development outcomes, has supported the work of intergovernmental organizations, government, donors and the private sector. She holds a master's degree in Global Media Communication at the University of Melbourne.