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Climate change and community resilience in Samoa

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Being resilient in the face of climate change seems especially important for island societies, which face the effects of rising temperatures, unpredictable rainfall, changing wind patterns and sea level rise. To date, most studies of adaptation and resilience among Pacific island communities have used indicators and methods rooted in Western science and neo-classical economics. These have been criticized as being locally irrelevant and inadequate to appreciate the dynamic nature and social structures of island communities and their capacity to adapt. This paper challenges the paradigm that defines resilience as a return to equilibrium, by using a non-equilibrium, cultural ecological lens. The non-equilibrium view of resilience sees the social systems of island nations as highly dynamic and undergoing persistent adaptation in the face of changing environmental factors. Field-based research undertaken in eight villages in Samoa found that, through constant exposure to environmental change over extended periods of time, communities have become resilient and are in a position to adapt to future changes. In developing future policy in relation to climate change, Pacific island governments need to develop a more nuanced understanding of islanders' perceptions and historical actions in the context of both their physical locations and their dynamic socio-cultural systems.

Keywords: Samoa, climate change, resilience, adaptation, non-equilibrium

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Introduction

The impacts of climate change on Pacific Island countries are already being experienced. At the 2017 United Nations Climate Change Conference ('COP 23') held in Bonn, Germany in November 2017 it was concluded that: 'The Pacific Islands' contribution to greenhouse gases in the atmosphere is negligible, but—like other Small Island Developing States—they suffer disproportionately the effects of global warming, (and) … as a group may be the planet's most vulnerable nations to the effects of climate change, with some facing possible obliteration' (COP, 2017:1). Whilst the nature of the country's topography may mean that Samoa is not affected by climate change as severely as some lower-lying Pacific nations, there is evidence of increasing temperatures, rising sea level, increasing rainfall and persistent dry spells that coincide with El Niño periods. Although the specific rate of current temperature increase is not stated in Samoa's climate change reports, according to the Australian Bureau of Meteorology (ABM) and the Commonwealth Scientific and Industrial Research Organization (CSIRO) (see ABM & CSIRO, 2011: Chapter 12), temperature records from Pacific island observation stations show warming over the past 50 years, with trends mostly between 0.08°C and 0.20°C each decade. The sea level around Samoa has risen by 4 mm since the early 1990s, and water temperatures are increasing by about 0.08°C per decade. La Niña events, however, have

caused wetter and cooler conditions in Samoa, with frequent associated flooding events (ABM & CSIRO, 2011). Between 1969 and 2010 tropical cyclones were most frequent in El Niño years (16 cyclones per season), whilst occurrences in La Niña and neutral years were less frequent (10 cyclones per decade) (ABM & CSIRO, 2011). In terms of local impact, respondents in this survey (detailed below) commented specifically on reef damage and suggested that fisherfolk were on occasions, beginning to fish further out at sea.

The latest climate change projections suggest enhanced risks on several fronts in Samoa. Sea-level around the island group is projected to rise between 5 and 15 cm by 2030 and by 2090 it could be as high as 59 cm (ABM & CSIRO, 2011: Chapter 12). Recent Samoan government reports by the Ministry of Natural Resources and Environment (MNRE) have stated that there has been significant variation in rainfall amounts in the past 20 years (MNRE, 2010). Dry spells that tend to affect the island group during the middle of the year have also become more frequent. Further, acidification of Samoan seas is likely to occur and is likely to cause decreased calcification in coral and other marine resources threatening their future survival and that of fish stocks (Ohde & Hossain, 2004). According to community respondents, sea level rise, combined with human related factors (such as the construction of sea-walls and urban and tourism related facilities), have recently featured in the changing character of coastal processes, mainly through storm surges during cyclones and the more frequent occurrence of king tides which have exacerbated coastal erosion. These events have also increased seawater intrusion into underground water aquifers and coastal springs, as has already been experienced by many coastal communities (MNRE, 2013).

The Samoan Government's National Adaptation Programme of Action (NAPA), launched in 2005, aims 'To achieve a high level of community capacity for adaptation to adverse impacts of climate change' (Government of Samoa, 2005: 16). One of the four objectives of NAPA is 'To increase awareness of climate change impacts and adaptation activities in communities, civil society and government' (Government of Samoa, 2005: 16).

Within the broad framework of Samoa's attempts to strengthen adaptation to the effects of climate change, this research has focused specifically on community adaptation and resilience. The following proposition was formulated at the outset:

> That islanders have for centuries had to cope with difficult and unpredictable environments, during which time individuals and communities have developed a range of coping strategies to strengthen sustainability. Thus, they should be well prepared to deal with current and future effects of climate change.

A number of interrelated questions were used to address this proposition; First, what changes associated with climate change do islanders think are currently taking place, and which of them are likely to occur in the future? Secondly, how have islanders coped with previous disturbances, including those which are climate-related? Thirdly, what strategies are they currently employing? And, fourthly, what do islanders want and need to cope with future global warming? This research sought to deepen understanding of the resilience of island communities, by assessing islanders' knowledge and awareness of climate related changes. Moreover, the study examined survival strategies devised at the individual, family and community levels to reduce, avoid and mitigate current and future climate related risks, and to maximize associated opportunities.

Resilience in island communities

The term 'resilience' seems to have entered the climate change literature in the early 2000s and has become the latest 'buzzword' in considering climate change adaptation

strategies. The concept emerged in ecological studies in the 1970s (Holling, 1973; Holling, 1986; Holling *et al*., 1998), and has been further developed in studies exploring the adaptive capacity of societies (Torry, 1979), regional economies (Grabher, 1993; Grabher & Stark, 1997; Gonzalez, 2006; McGlade *et al*., 2006; Jackson, 2009; Bristow, 2010; Pike *et al*., 2010 and Simmie & Martin, 2010), and socio-ecological systems (Berkes & Folke, 1998; Westley 2002; Gunderson & Holling, 2002; Berkes, *et al*., 2003; Holling, 2005 and Folke, 2006). A review of resilience-based studies has revealed a number of inter-connected indicators of resilience among communities, such as greater awareness and sensitivity to changes, mobility, diversification, multiple social and place-based connections and spiritual and mental strength.

There has also been a shift in theoretical understandings of the concept from views of resilience which are based on the achievement of stability, or a state of 'equilibrium' (O'Neill *et al*., 1986; Pimm, 1991; Tilman & Downing, 1994), towards explorations of the dynamic and 'non-equilibrium' nature of systems, and their capacity to endure change and develop new ways of coping. The concept of 'non-equilibrium' refers to an unstable condition or state with complex, highly dynamic and unpredictable variables and appears to be an appropriate descriptor of the adaptation practised by Samoan island communities as this paper will argue.

This theoretical shift towards appreciating the 'non-equilibrium' nature of systems has been slow to develop in literature which considers the resilience of island communities in the face of the likely impacts of climate change. A few studies (Fletcher *et al*., 2013; McMillen *et al*., 2014) have emerged in recent years which have identified the role that resilience plays in islands. But, it seems that in many cases, the indicators and methods used to assess the resilience of island communities are still largely influenced by Western science and neo-classical economics. For example, Briguglio *et al*. (2006; 2009; 2010) proposed a 'resilience index'[1] to assess the adaptive capacity of island nations based on indicators of 'macro-economic stability' and 'market flexibility'. The study concluded that there was a strong correlation between GDP per capita and a country's resilience index, and suggested that advanced economies register higher scores. More recently, the main components of the resilience index have been revised to include aspects such as political governance and institutions, social development and environmental management (Briguglio, 2014).

The lack of community-informed information regarding the resilience of island societies in the context of climate change and the potential western bias of earlier studies motivated the research on which this paper is based, namely to improve current appreciation of 'island adaptability and resilience' on the basis of local community understanding. Three key objectives were identified. Firstly, the study utilized the non-equilibrium definition of resilience to assess the capacity of island communities to adapt to environmental change, including climate-related change. Secondly, this study developed a conceptual framework to assess the resilience of island societies using a cultural ecology lens. Proponents of cultural ecology not only reposition humans into discussions of environmental changes, but apply holistic ideas from ecology and systems theory to understand how humans adapt to their environments (Sauer, 1952; Steward, 1955; Boserup, 1965). Studies by Pacific writers such as Fletcher *et al*. (2013), as well as by McMillen *et al*. (2014) have emphasized the importance of indigenous and local knowledge (ILK) in understanding island resilience and adaptation. These writers highlight the critical need for research which interrogates the interrelated areas of local-scale expertise and observations of change with regard to weather, life-history cycles, ecological processes, customary resource management institutions and practices, and

the role of leaders, social institutions and social networks in the context of change and adaptation. A cultural ecological approach provides a useful way of developing a 'bottom-up' understanding of islands, most of which are not simply 'physical' spaces, but have been 'lived-in' places for more than a millennium. Thirdly, this study identified human derived indicators to assess the resilience of island communities. Departing from previous efforts to determine the resilience of island societies using macro-economic indicators, this research considered human perceptions and local understanding of past, present and future environmental change at the community level, as well as key human survival strategies. In addition, it examined social networks as a 'binding factor', incorporating other diverse strategies, such as diversification, mobility, mental and spiritual strength.

In a similar vein, this study is aligned with the work of authors such as Waddell (1975), Chapman and Prothero (1985), Watson (1985), Hauofa (1993), Comitas (1963), Frucht (1967), Bennell and Oxenham (1983), Baldacchino and Bertram (2009); McMillen *et al.* (2014); and Lilomaiava-Doktor (2015) who challenge the notion of islands as 'small and vulnerable'. Rather, as suggested in the present study, islands need to be regarded as 'lived social spaces' which are both complex and dynamic and places in which community-based approaches have a key role to play in sustainability and resilience thinking.

The study area

Samoa is a small Pacific country with a land area of 2842 km^2, comprising two main islands (Upolu and Savaii) and a number of other smaller islands (Figure 1). At the time of the national census in 2016, the total population was 195 979, with three quarters of these people living on the island of Upolu. More than 70 per cent of the population live in 330 rural villages in Upolu and Savaii (Samoa Bureau of Statistics, 2016). The United Nations Human Development Report in 2016 ranked Samoa as 104th out of 188 listed countries, in the category of 'High Human Development' (UNDP, 2018) (Table 1).

Field-based research was undertaken in eight villages on Samoa's two largest islands, Upolu and Savaii. In the past Samoa has been exposed to the combined effect of volcanic activity, earthquakes and tsunsamis, climate events, colonization and globalization and, like many islands, now faces the challenge of climate change. Most of the country's infrastructure, population and development initiatives are located along or close to the coastline, and its people face similar environmental risks which many other tropical islands experience.

Current discussions of climate change in Samoa are predominantly approached from a national perspective and are dominated by the views of government officers, consultancy firms and civil society workers. Romilly *et al.* (2013) stated that the current framework for climate change responses in Samoa also enables the inclusion of local communities, particularly in the design of district and village response plans such as Coastal Infrastructural Management plans (CIM Plans), Disaster Management Plans and Community Livelihood Plans. Romilly however, suggested that many Samoan communities are actually saturated with government consultations (Romilly *et al.*, 2013). A study by Fletcher *et al.* (2013), based on interviews with government workers and experts, stated that traditional coping strategies are consistently being applied as part of response to disasters and climate change in Samoa.

A significant gap in the literature on Samoa is the lack of analysis of community resilience to environmental changes. Kenny (2012) suggests that the predominant

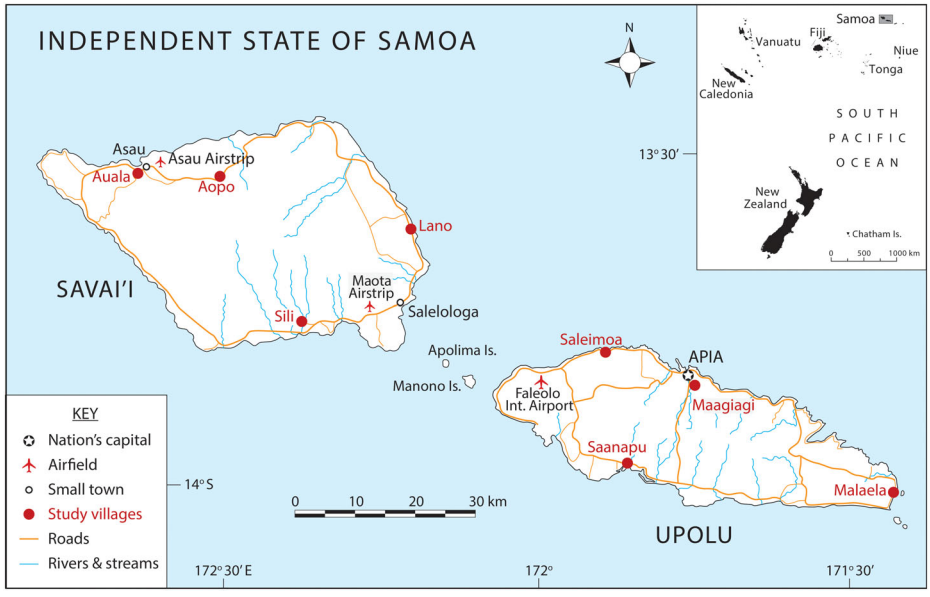

Figure 1. *Study villages in Samoa.*
***Source*: Figure produced by Chris Garden; University of Otago.**

Table 1. Development Indicators for Samoa.

Population	176 710 (2001) 195 979 (2016)
HDI Rank	104/188 'High Human Devpt'
GDP per capita (2016)	US$ 6022
Adult Literacy rate (2016)	99.0%
Expected years of schooling (2016)	12.5 years
Life expectancy at birth (2016)	75.2 years
Infant mortality (per 1000 live births, 2016)	14.8
Under 5 mortality (per 1000 live births, 2016)	17.5
Health expenditure (% of GDP, 2016)	5.6%

Source: UNDP (2018).

focus of climate related activities in Samoa since the 1990s has been on vulnerability assessment, with an implicit assumption that identifying and addressing identified vulnerabilities will lead to increased resilience. For example, a study by Sutherland *et al.* (2005: 14) of the village of Saoluafata on the northern coast of Upolu, concluded that the capacity to respond to climate change was probably insufficient, due to social instability as a result of weakening social networks. Within this context researchers need to acknowledge the key determining role which community-based systems, strategies and values play in shaping local understandings and responses to climate events and change. Traditional forms of social organization remain strong and influence decision-making, indigenous knowledge and evolving forms of localized resilience and

adaptation, justifying the adoption of a non-equilibrium, cultural-ecology approach to this investigation.

Throughout Samoa, the organization and governance of the *aiga* (extended family unit) and the *nuu* (village) is based upon *faamatai*, a cultural framework that ensures participation by all related members. Each Samoan family comprises *matai* (holders of chiefly titles), *tama tane* (sons), *feagaiga* (daughters), *paolo* (in-laws) and children. The *sao* (the main chiefly titleholder) is the head of the *aiga*. In the Samoan context, *pule* (authority) over resources is held in the chiefly title, yet the person who holds that title is only the trustee or caretaker (Aiono Le Tagaloa, 1992; Vaai, 1999). Within each *aiga*, the *matai* in consultation with family members make decisions regarding the collection, allocation and division of resources.

All family members have specific roles and responsibilities, which are carried out daily and especially during traditional activities such as funerals, weddings and bestowal of chiefly titles. The notion of *suli* (heir through blood connection) means that every family member has a right to become a *matai*, upon the agreement of all the other *suli* (Aiono Le Tagaloa, 1992).

The organization and governance of the village mirrors the situation at the extended family level. The village is managed by the *fono* (village council), a decision-making body consisting of *matai*. Access through blood connections to the *matai* ensures that the authority of the village council is neither supreme nor separate. These connections guarantee a voice for opinions through the family member who holds the title when he or she stands to represent her/his family in a village council meeting. All groups play a role in the process of government and in the provision of goods and services (translated from Aiono Le Tagaloa, 1997). According to Meleisea (1987: 18), *faamatai* 'made economic individualism impossible' because the system insists on '… respecting the autonomy of the village and the equality of family members'.

Key aspects of Samoan society which are crucial to the assessment of its resilience in the context of this study, include *faamatai* (the chiefly system) and the communal nature of resource ownership which is still prevalent today. More than 80 per cent of Samoa's land is still collectively owned (MNRE, 2013), and every Samoan has access to land, either through their mother or father. In practical terms, access to land and the open sharing of information at the family and village levels have facilitated knowledge exchange, collective understanding and collective action in terms of appreciation of the reality of, and ways in which to respond to, climate events and climate change through collective action based on local culture and the pursuit of a non-equilibrium form of resilience.

Most *aiga* (families) live a semi-subsistent lifestyle, with some members employed in government ministries and private companies, while others are engaged in agriculture, fishing and tourist-related activities. While the contribution of the agricultural sector to the national economy has shrunk from 17 per cent in 1999 to less than 10 per cent in 2010 (Samoa Bureau of Statistics, 2012), it still employs about two-thirds of the national labour force and remains an important source of food and household income (Government of Samoa, 2013). Samoa's farming systems are confined to a few root crops, notably taro, vegetables and fruits that are grown on a small scale, plus coconuts and cacao. Livestock play an important role in Samoan livelihoods, not only commercially, but also for special occasions. 46 per cent of households raise backyard poultry and pigs, and 20 per cent own cattle (Samoa Bureau of Statistics, 2012). Tourism provides direct employment for over 5400 people, representing 10 per cent of the total workforce (Samoa Bureau of Statistics, 2016). There are over 60 small-scale

private and community owned tourist businesses in the country, which provide employment and income-generating activities in the areas of transport, communications, agriculture, fisheries, handicrafts, cultural performance, infrastructure, construction and manufacturing (UNDP & GEF, 2013). For rural communities, tourism has provided valuable job opportunities, especially for young people, encouraging them to stay in their home communities. A notable trend is that tourism businesses such as beach *fale* (houses) have transformed the shorelines of many parts of Upolu and Savaii.

The church plays a key role in Samoan communities and since independence in 1962, the *matai*, church and state have been the three enduring pillars of Samoan society (Thornton *et al.*, 2010). The church is embedded in the *matai* system and is therefore well-positioned to influence all aspects of village life and broader public policy making. Although freedom of religion is enshrined in the constitution, the one village, one church policy has often led to criticisms of the close relationship between the church and state. However, this relationship is a fundamental aspect of Samoan society and is reinforced by the village council (*fono)*, which makes all key decisions in the village. While the role of the church has been criticized, in the context of this study, the church has provided shelter and support in times of crises, it has facilitated the development of social capital and has often introduced relevant external knowledge to communities.

Methodology

As this research dealt with individuals and communities, qualitative methodologies and interpretive frameworks that capture the world as 'we live it', rather than as 'we abstractly theorize them' were adopted, as these are more suitable ways of understanding and appreciating human experiences (Relph, 1981; Tuan, 1975; Allen-Collinson, 2011).

Eight villages were selected for the study—four in Upolu and four in Savaii. Different types of villages—coastal, inland, urban and rural—were considered in the selection of study sites, so that representative data could be obtained from across the country. 165 respondents were surveyed through semi-structured interviews, as part of focus groups, and through the use of participatory techniques (including transect walks and map and photo interpretation). Interviews were audio recorded and notes were also taken. They were of different ages and gender, lived in different parts of the villages, and were engaged in different roles and responsibilities in their families, villages and churches. This was done to enable 'triangulation' of the information, and facilitated cross-checking between different community members. Interviewing government officers, representatives of civil societies and external agencies also contributed to the validation process, as some of these people were involved in community outreach programmes (15 in total). Further, comparing what study participants said against the contents of available government and other documents was another way of ensuring the validity of information. Information was drawn from district CIM plans, Sustainable Village plans, village disaster risk plans and official maps (Romilly *et al.*, 2013). Further secondary information came from climate-related documents produced by regional and international agencies and non-governmental organizations.

Cultural protocols were observed during preparation for the fieldwork, and in carrying out the interviews and focus group meetings. In Samoa there are cultural expectations when meeting with people and gathering information, such as wearing appropriate clothing, the nature of language used, behaviour, and gift-giving. Interviewing people in their homes and taking walks with some of them helped to contextualize what the participants were saying.

Interpretivist processes, such as primary and secondary coding, were used to evaluate the research findings and to appreciate the resilience of the selected island societies from a non-equilibrium perspective. Specifically, secondary coding, which involved the combination of content analysis, deconstructing verbal and non-verbal meanings (as interpreted and noted by the interviewer) and comparative analysis, and interpretation of linguistic nuances, assisted in the development of templates that could be used to examine present human perceptions of current and future climate-related changes and related survival strategies. These same tools were used to develop an assessment framework to determine the significance of risks associated with the various dimensions of climate change.

Key findings of the study

Local awareness of climate change and its implications

The first research question examined was: 'What changes associated with climate change do islanders think are currently taking place, and which of them are likely to occur in the future?' Interviews clearly indicated there was a heightened awareness of various dimensions of climate change across the eight villages. Changes noted included, hotter days and longer dry spells, shorter periods of heavier rainfall, stronger damaging winds and sea level rise. Respondents showed a detailed awareness of climate change, thus confirming that awareness and sensitivity to changes are significant indicators of island knowledge and resilience.

Situating the respondents' descriptions of climate change within their villages showed marginally different experiences of climate change. Table 2 outlines the various dimensions of climate change that respondents in the eight surveyed villages were experiencing. The villages listed from 1 to 8 in the Table are arranged according to their proximity to the coast with Aopo being the furthest from the coast. Slight increases in air temperature and less predictable wind and rainfall patterns characterize the experiences of respondents living in most of the surveyed villages. However, those living in coastal locations had also noticed a slow rise in sea level. The experiences of respondents in one inland village, Sili, were particularly significant, suggesting that their experience of climate change is mostly characterized by shorter and heavier rainfall periods and damaging winds, rather than increasing temperature. The inland location of Sili in south-eastern Savaii ensures frequent rainfall and a reliable supply of water.

Those living in 'more challenging environments' were rather more aware of particular dimensions of climate change. For example, those respondents living in areas which were more susceptible to coastal and climatic processes referred to more incidences of climate change than those living in inland locations. Residents of Aopo and Auala, located in the drier north-western part of Savaii, and previously exposed to intensive deforestation, cyclone devastation and forest fires, offered more detailed awareness of 'hotter days and longer dry spells'. Those living at Maagiagi (Upolu), whose water resources had been depleted, also stressed the occurrence of hotter days and longer dry spells. Those interviewed at Saanapu and Malaela, both located on the south coast of Upolu and affected by the 2009 tsunami, were slightly more aware of sea level rise than other surveyed communities.

In terms of identifying the risks associated with climate change, respondents living in coastal areas frequently mentioned the possible risk of wave damage to properties. In contrast, those living inland and in the north-western part of Savaii stressed the risk of inadequate water supply. The significance of risks associated with hotter days and

Table 2. Dimensions of climate change experienced by respondents in eight Samoan villages.

Saleimoa	Auala	Lano	Malaela	Saanapu	Maagiagi	Sili	Aopo
Hotter days and longer dry spells	Hotter days and longer dry spells	Hotter days	Hotter days	Hotter days	Hotter days and longer dry spells	Shorter and heavier rainfall	Hotter days and longer dry spells
Shorter and heavier rainfall	Stronger damaging winds	Shorter and heavier rainfall	Stronger damaging winds	Stronger damaging winds	Stronger damaging winds	Stronger damaging winds	Stronger damaging winds
Stronger damaging winds	Sea level rise	Stronger damaging winds	Sea level rise	Sea level rise			
		Sea level rise		Shorter and heavier rainfall			

Source: Table produced by author based on interviews. *Note*: The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2 km from the coast.

longer dry spells, stronger damaging winds, and shorter, but heavier, rainfall episodes was generally perceived as being of 'medium' importance by respondents in the eight surveyed villages. Meanwhile, risks associated with sea level rise were generally perceived as being of 'low' significance, and were understandably mentioned most often by those living on the coast. Residents of Malaela, who were greatly impacted by the September 2009 tsunami, perceived the current risks of sea level rise as rather more significant than respondents from other villages.

Village discussions revealed that most respondents did not simply dwell on the damaging effects of climate related issues, but they also described associated opportunities, such as developing more varied and 'tighter' types of social connections, new food supplies, infrastructural development and, in some cases, issues relating to relocation (see Table 3). For instance, most residents related how surviving during cyclones had in some ways been an enjoyable experience, when they had lived with relatives and shared food. Those who experienced Cyclones Ofa and Val in the 1990s said that this was the first time they had ever seen a helicopter, and they still vividly remembered people receiving food aid and tents. These cyclones also marked the beginning of intensive infrastructural development, such as the building of seawalls and roads which were particularly noticed by respondents living in coastal areas. Observations suggested that exposure to some serious challenges did not make the respondents 'fatalistic' or 'helpless', but gave them a more optimistic outlook on life. This finding supports claims made in several psychological studies, which have highlighted the importance of disturbance, struggle and pain in the development of a person's character and resilience, and that 'adversity and hardship provide motivation and knowledge' for people to move forward (Waller, 2001; Mahoney & Bergman, 2002; Kidd & Shahar, 2008; McElheran, 2011).

Evidence of in-depth awareness and sensitivity to climate change among respondents challenges the conclusions of some studies which suggest that islanders, especially those living in rural communities, have a limited awareness of climate change and do not consider it as a local priority (see, for example, Nunn (2009); Kuruppu and Livermann (2011) and Nunn *et al.* (2013)). In contrast, this study yielded a more detailed understanding of respondents' perceptions of climate change by deploying the concept of resilience from a non-equilibrium perspective and grounding the analysis of results in the places where they were gathered. Respondents seemed to have no difficulty in describing climate change and its implications, and detailed conversations often developed through simply asking them to talk about 'the current *vevela* (heat) in Samoa.'

Awareness of the future dimensions and possible risks of climate change

Respondents demonstrated that their experience of challenges had developed their capacity to imagine future scenarios. 'Heightened sensitivity' and the 'ability to look forward and predict changes' are characteristics of resilient individuals (Pike *et al.*, 2010). By drawing on their experiences, most respondents were able to envisage those dimensions of climate change that they and their communities are likely to experience in the future (see Table 4). With the exception of one village, increasing temperature is perceived by most residents as their greatest future concern. Hotter days were seen as most likely to occur by residents of seven villages, with residents of four villages (Saleimoa, Auala, Maagiagi and Aopo) noting the likelihood of both hotter days and longer dry spells. In contrast, Sili residents perceived shorter and heavier rain storms as the most significant dimension of climate change that they would be likely to

Table 3. Climate related impacts identified by respondents in eight communities in Samoa.

	Saleimoa	Auala	Lano	Malaela	Saanapu	Maagiagi	Sili	Aopo
Risks	Damage to Properties	Inadequate Water	Damage to Properties	Damage to Properties	Damage to Properties	Inadequate Water	Damage to Properties	Inadequate Water
	Diminishing marine resources	Damage to Properties	Pests	Diminishing marine resources	Loss of coastal land	Damage to Properties	Pests	Damage to Properties
	Reduced land productivity			Inadequate Water	Reduced land productivity			
	Diseases				Diminishing marine resources			
Opportunities	Access to food and other resources							
	Stronger and diversified networks							
	Improvements in infrastructure							

Source: Table produced by author based on interviews. *Note*: The study sites are organized according to their locations from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2 km from the coast.

experience. More damaging winds were another future concern for people in all eight villages, especially Auala, Malaela, Saanapu, Maagiagi, Sili and Aopo. Shorter and heavier rainfall episodes were also perceived to be a future concern by residents of Saleimoa, Lano and Saanapu. An interesting finding was that rising sea level featured as the least significant concern in five of the eight surveyed villages, with Saanapu residents perceiving this dimension to be less of a concern in the future.

All impacts that participants had already been experiencing were generally perceived as being likely to continue in the future. However, there were some notable differences when respondents' perceptions of the future impacts of climate change were compared with their perceptions of current climate change impacts. Some impacts were perceived to be of more concern in future, while others were perceived to be less significant, suggesting the shifting and complex nature of human perceptions. As shown in Table 5, an inadequate water supply was identified as a new risk in Saleimoa, while reduced productivity of the land was perceived as being a future problem in three villages: Auala, Maagiagi and Aopo. New diseases were seen as a possibility by Saanapu residents, whilst reduced productivity of cultivated land was perceived to be a greater concern in Saleimoa and Saanapu. Diminishing marine resources was thought likely to be less significant by Saleimoa and Malaela residents, whilst damage to properties was of less concern to Saanapu residents.

The holistic, participatory and place-based approach used in this study revealed an impressively good awareness among research participants of the various dimensions of climate change. The most frequently mentioned dimension of climate change was rising temperatures, yet this had not been experienced in the same way in all of the villages. For example, participants in the villages of Auala and Aopo mentioned hotter days and longer dry spells, while those living at Lano mentioned hotter days. Very few residents in Sili talked about the heat, as they were more concerned with inadequate rainfall and water supply. These differences also featured in participants' perceptions of possible future climate change and its impacts. Most participants understood that aspects of climate change which they are currently experiencing are likely to intensify in the future and, for most of them, damage to property and an increasingly inadequate water supply were likely outcomes. At the same time, it was recognized that climate change could bring opportunities, such as better access to food and other resources, and the development of stronger and more diversified social networks.

Social connections and exposure to environmental change have been crucial in the development of such climate change awareness. The village communities possess a great deal of collective experience and knowledge. Multiple and multi-layered connections within families, villages and nationwide create a greater awareness of the dimensions of climate change. Knowledge is shared by means of observing and reporting during daily activities, such as through domestic chores, children's games, at morning and evening prayers, family meetings and cultural activities. The participants also learned about climate change during village- and church-related activities, such as during meetings of the village council, untitled men's groups, or women's committees, inspections of plantations and village surroundings, women's weaving sessions, and various work projects. In addition, the role of the media, especially the main radio station 2AP, has played a significant role in disseminating climate change information. Awareness has also been developed through school curricula together with community programmes by the Ministry of Natural Resources and Environment, Ministry of Women and Social Development and Ministry of Agriculture and Fisheries. All eight villages have endured long-term and often extreme challenges, revealing 'the

Table 4. Dimensions of possible future climate change perceived by respondents in eight Samoan villages.

Saleimoa	Auala	Lano	Malaela	Saanapu	Maagiagi	Sili	Aopo
Hotter days and longer dry spells	Hotter days and longer dry spells	Hotter days	Hotter days	Hotter days	Hotter days and longer dry spells	Shorter and heavier rainfall	Hotter days and longer dry spells
Shorter and heavier rainfall	Stronger damaging winds	Shorter and heavier rainfall	Stronger damaging winds	Stronger damaging winds	Stronger damaging winds	Stronger damaging winds	Stronger damaging winds
Stronger damaging winds	Sea level rise	Stronger damaging winds	Sea level rise	Shorter and heavier rainfall			
Sea level rise		Sea level rise		Sea level rise			

Source: Table produced by author based on interviews. *Note*: The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2 km from the coast.

Table 5. Likely impacts of future climate change as perceived by respondents in eight Samoan villages.

	Saleimoa	Auala	Lano	Malaela	Saanapu	Maagiagi	Sili	Aopo
Risks	Damage to Properties	Inadequate Water	Damage to Properties	Damage to Properties	Reduced productivity of the land↑	Inadequate Water	Damage to Properties	Inadequate Water
	Reduced productivity of the land↑	†Reduced productivity of the land	Pests	Inadequate water↑	Damage to Properties↓	Damage to Properties	Pests	Damage to Properties
	Diminishing marine resources↓	Damage to Properties	Inadequate Water	Diminishing marine resources↓	†Occurrence of new diseases	†Reduced productivity of the land		†Reduced productivity of the land
	†Diseases				Inadequate Water			
	Inadequate Water				Loss of coastal land			
Opportunities	Access to food and other resources Stronger and diversified networks							

Source: Table produced by author based on interviews. *Note*: The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2 km from the coast. (↑) Issues have shifted upwards in ranking because they were more frequently mentioned and emphasized. (↓) Issues shifted downwards in ranking because they were less frequently mentioned and emphasized. (†) A new issue was mentioned.

unpredictable, and sometimes, chaotic nature of the environment' (Holling, 1973). For the majority of those interviewed, the frequent occurrence of damaging winds, notably during Cyclones Ofa and Val in the 1990s, has made individuals and communities more sensitive to various dimensions of climate change.

Assessing levels of resilience

The second composite research question was designed to appreciate levels of resilience in the eight villages: 'How have islanders coped with previous disturbances, including those which were climate-related? What strategies are they currently employing? And, what do islanders want and need to cope with future global warming?' The study found that the majority of participants had coped well with previous challenges and were remarkably 'proactive' in devising coping strategies. Common strategies in all villages included diversification of food and water sources and collection techniques, being geographically mobile, having more than one place of residence, and developing mental and spiritual strength. Using an analytical lense which placed the individual within *faamatai* networks revealed that resilience strategies are mostly developed at the level of the extended family. Village councils and churches have also played a crucial supportive role in the development of these strategies and there was also evidence of government assistance.

There was evidence of mobility in all of the villages, with many people in coastal locations moving inland or out of their village to escape the impact of Cyclones Ofa and Val and the 2009 tsunami. Similar patterns were evident in settlements close to river banks. Those who had faced enduring and/or extreme challenges were more inclined to move, for example, many residents of Saanapu and Malaela shifted to an inland site after the tsunami. Careful consideration of land and water use was evident in all villages, especially those facing longstanding challenging conditions, such as Auala and Aopo, or extreme events in the past few years, as in the case of Maagiagi and Malaela. Those interviewed at Malaela who lost relatives and property during the 2009 tsunami ranked sea level rise lower than those interviewed at the other sites which were not affected by the tsunami. Exposure to an extreme event has caused affected communities to perceive a more gradual sea level rise as being less risky than sudden catastrophic events such as tsunamis.

The government has provided a certain amount of infrastructural support in many of the study sites, notably power and water supplies and improved roads. The government is also assisting communities in the sustainable management of marine and coastal areas, forests and water sources, and in the development of livelihood programmes. In all of the coastal villages, the government has constructed seawalls. Such strategies are helping to build the capacity of individuals and communities to cope with the possible effects of future climate change.

All eight communities had a good vision for the future and demonstrated an ability to cope with new challenges. Respondents frequently commented that there was a need for improvement in processes of consultation and sharing information at the family and village levels, and also between villages, government institutions and external agencies. It was felt that at the extended family level, elderly members of families, parents and holders of chiefly titles must play their roles to ensure that these activities occur. The implementation of evening curfews (for prayers and community discussions), by the village council and untitled men's groups, would allow time for families to share knowledge and foster their connections. One elderly woman commented,

> Every family must ensure they have evening services. This is so important. The first classroom is the home, where there is sharing of family stories, local stories, distribution and sharing of

> food. Whatever food you have share it. If it's bananas that you are having, then share the bananas. Those families should also share. That part of Samoan life is very important- for the continuous connections of families. The Samoan phrase *mativa faafesagai* means facing each other in hardship and poverty. Teach the children the importance of such things- to have heart for their families and their villages (Key Informant 1, pers. comm., 29 September 2014).

Churches and villages have done well in building spaces, such as community *fale* (houses), churches and church halls, for people to meet and strengthen their social connections, share knowledge and develop social memory. Hopefully, these activities will help to prevent the poor decision-making that has caused concerns in some of the villages. These include alienation of lands in Saleimoa, loss of rights to water sources in Maagiagi and logging of native forests at Auala and Aopo. Evidence indicates that reflecting on such experiences has helped people to reconsider their practices and decisions. However, the process must be ongoing to ensure future sustainability, and most importantly that they are shared with younger residents of villages.

Conclusion

Through using a cultural ecology lens and an interpretivist research design, this research has challenged the current paradigm that regards resilience as a return to equilibrium. Authors (e.g. Wilson, 2012) have acknowledged that the development of approaches to examine the resilience of social systems is still at an early stage. This study has shown the value of taking a holistic and longitudinal approach in studying community resilience, revealing historical disturbances that have occurred and also examining changing community structures and processes. In the case of the eight Samoan communities surveyed, it seems that *faamatai* has persisted through changes which have occurred over the past two hundred years. At the same time, changes have occurred whereby *faamatai* in contemporary Samoan society is now characterized by the multi-layered arrangement of extended families, villages and churches, as well as government and external agencies, which has helped facilitate responses to climate events and climate change and strengthened local awareness and the capacity to anticipate and plan for future change. These findings stand in contrast to the market and western science based approaches of other authors (e.g. Briguglio *et al*., 2006; 2009; 2010), through their clear indication of the value of indigenous understandings and responses to climate change and the associated endorsement of a non-equilibrium understanding of resilience.

It is suggested that situating the individual and their perceptions within existing social structures and connections could enable a more nuanced appreciation of their resilience and also the resilience of the places where they reside. With appropriate adaptation and recognition of local protocol, the research approach adopted here could possibly be useful in the assessment of resilience among communities elsewhere.

This study suggests that rethinking resilience from a non-equilibrium and cultural ecological lens could provide a more accurate portrayal of contemporary island societies and how they are enduring challenges and anticipating future climate change. Several themes have emerged from this research which should be considered in future investigations into adaptation and resilience in the face of the effects of climate change. First, island societies must be considered as complex and dynamic entities as other studies which have focused on macro-economic scenarios and/or development strategies have often failed to appreciate the community resilience that this study has revealed. Secondly, certain characteristics of islands, such as their small size, isolation, and frequent

exposure to environmental challenges could actually enable islanders to be both more resilient and adaptable, as challenges also bring opportunities for societies to develop preparedness and reorganize. Thirdly, social indicators of resilience must be used to determine and assess the buffering capacities of islands, namely connections, mental and spiritual strength, awareness and sensitivity, diversification and mobility. Fourthly, a deeper understanding of island resilience is facilitated by following a holistic, participatory and place-based approach which recognizes the interplay of a wide range of social indicators in particular situations, and how these support the development of adaptive behaviour and resilience.

In the context of Samoa, this is the first study that has attempted to understand community resilience and adaptation in the face of the possible future effects of climate change. In looking to possible future development strategies, a number of recommendations have emerged from the research. First, individuals and communities need to continue to be proactive in family, village and church activities. Active participation in family and community debate, information sharing and decision-making is important in coping with challenging situations.

Secondly, village councils, government representatives and church leaders need to develop local knowledge and strengthen connections in anticipation of future change. It is important to share knowledge of the history and environment of their village and the changes that have been experienced. Churches have been proactive in implementing 'sharing sessions' and 'knowledge building' exercises during Sunday youth nights and Sunday school activities. Village strategy documents now exist and inform government development plans, notably the CIM Plans, Village Sustainable Plans and Disaster Management Plans. Council members and government representatives must ensure that all village residents are aware of the importance of these documents, understand their content and take part in reviewing the documents. Thirdly, village councils and local churches must strengthen their connections with government and other external agencies, because these agents have the funding capacity and expertise that could help support local development initiatives. Finally, governments, established scientific wisdom and external funding agencies need to develop a more nuanced understanding of local communities and their key concerns and priorities. In developing sustainable and appropriate strategies for coping with the effects of climate change, it is vital that governments consider the knowledge and experiences of local residents and communities. Evidence shows that recent government engagements with village councils have often been limited by funding and the application of top-down processes (Latai, 2008). In order to tap into the rich and diverse knowledge of communities, and to ensure the relevance and sustainability of government climate change strategies, governments must continue to strengthen connections with local communities, in particular, village leaders such as council members, leaders of women's committees, untitled men's groups and pastors. Assistance that specifically targets the development of livelihoods was commended by residents, and the study recommends that this should be continued as part of future climate change adaptation projects, for example, with the provision of farming equipment, vegetable seedlings and other edible crops. The Ministry of Agriculture, Forestry and Fisheries has provided seedlings for reforestation, and sponsored the Agriculture and Fisheries Show, which has been well received by participants. Governments need to carefully reconsider its expenditure in relation to climate change adaptation, with perhaps less spending directed towards building seawalls and coastal roads. More support should be given to other climate change adaptation initiatives such as village, church and family activities which strengthen social networks and build social memory.

Climate change is undoubtedly a significant challenge for communities in Samoa and many other Pacific island countries, but its dimensions and impacts are not new to island communities. In Samoa, ways of 'being' resilient in the face of such challenges are inherent in *faamatai* and the structures of extended families, village and church groups, as well as in their external connections with government and external agencies. The crown of thorns starfish, *alamea* paradoxically symbolizes disturbances and the necessity of seeking solutions 'within'[2]. If it is to formulate appropriate interventions for climate change, the Samoan and other governments and aid agencies must develop a more nuanced understanding of local knowledge by strengthening connections with village councils, local churches and extended families. By tapping into these local reserves of knowledge, and tightening partnerships with village councils, churches and extended families, government agencies should not only develop sustainable solutions to climate change, but also empower local leaders and residents as they face both current and future challenges. At the same time, it is important that village councils and churches continue to work together with governments. The Samoan concepts of *soalaupule* (consensus or consultative decision making) and *autasi* (consensus agreement), which are central to *faamatai* decisions, insist on the 'inclusion' of everyone and 'assurance that all parties are satisfied'. These could well serve as guiding principles for the development of increased resilience through stronger connections between people.

Over many generations the sustainability of Samoan society has depended on the persistence and development of strong bonds and reciprocal flows of environmental and other important information between individuals, communities, the church and government agencies. If these links are compromised—for example, by an accelerating pace of urbanization through internal and external migration—the adaptive web of consultation and support, known as *faamatai*, could be irreparably damaged. Such a process would inevitably detach Samoans from the traditional mores and structures of their home villages, lessen their resilience, and possibly pose even greater risks to the nation than the direct and indirect effects of climate change in the remaining decades of the 21st century. Understanding community perspectives and adaptive strategies relating to climate change should be a vital process in ensuring sustainable futures for all Pacific island countries and beyond.

Endnotes

1 The Mauritius Strategy (United Nations, 2005), called for international support to build resilience in SIDS. Such an exercise was carried out by the Commonwealth Secretariat in collaboration with the Islands and Small States Institute of the University of Malta, culminating with the publication of Briguglio *et al.*, 2006.

2 The Samoan phrase *E fofo a alamea*, which means 'the crown of thorns starfish cures itself,' directs those who inadvertently step on the starfish to turn it over and step on its underside and let the *alamea* (crown of thorns starfish) suck the poison out.

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