Pacific Dynamics:
Vol 5 (1) 2021 Journal of Interdisciplinary Research
http://pacificdynamics.nz

ISSN: 2463-641X
DOI: http://dx.doi.org/10.26021/10637

Climate change adaptation programmes on water security in the Pacific: A focus on the Solomon Islands

Noella Dorevella*
The University of the South Pacific

Hilda Waqa Sakiti
The University of the South Pacific

Tammy Tabe
The University of the South Pacific

Abstract

Not all basic water sources are readily available and accessible to most Pacific Island Countries (PICs). The limited drinking water sources such as rainwater, surface water, groundwater, desalinated water and imported water are extremely vulnerable due to the demand of increasing populations for food production, limited financial and technical capacities to manage water resources and natural and anthropogenic disasters.

Unless effective and sustainable Climate Change Adaptation (CCA) measures are implemented, climate change will exacerbate the existing development issues by increasing the intensity and frequency of extreme events such tropical cyclones, drought, heavy rainfall that leads to flooding and damage to water infrastructures. Such events will further increase the cost of ensuring water security in most PICs.

CCA programmes emerged and have been implemented in PICs by international and regional organisations such as the Pacific Islands Climate Change Assistance Programme (PICCAP) since 1997. In the context of the Solomon Islands, the CCA programme on water security is channelled through the National Adaptation Programme of Action (NAPA). Despite such interventions, the relation between the objectives of NAPA and the water sector is not clearly defined. There is no specific aim to operationalise those objectives. Furthermore, since the Solomon Islands is a Least Developed Country (LDC), it is more difficult to implement CCA policies given the country is struggling to address current development issues.

This paper seeks to evaluate CCA programmes on water security in PICs with a focus on the Solomon Islands. Information was gathered through desktop reviews of existing literature.

Keywords: climate change, impacts, adaptation interventions, water security, Solomon Islands.

*__Corresponding author__: Noella Dorevella, The University of the South Pacific, noelladorevella89@gmail.com

Introduction

Climate change has worsened the challenges experienced by Pacific Island Countries (PICs) in achieving the United Nations (UN) water security-related Sustainable Development Goal (SDG) 6: Access to Water and Sanitation for all (Elliot et al. 2017: 9107; Fleming et al. 2019: 332). Climate change affected the water security by intensifying the frequency of precipitation, floods, droughts, and cyclones, causing damage to water infrastructures and multiplying the economic struggles for adaptation (Paeniu et al. 2016: 65). The World Health Organisation (WHO) and the United Nations Children's Fund (UNICEF) indicated a low (48%) coverage level of basic water overall in PICs. Some (33%) PICs still rely on surface water such as streams, rivers and reservoirs (WHO and UNICEF, 2017).

Earlier studies, including those by the Secretariat of the Pacific Community (SPC), attributed the failing status of water security to the demand of an increasing population for food production, limited technical and financial capacities and extraction of natural resources such as logging and mining (SPC, 2012; Paeniu et al. 2015: 15; Anthonj et al. 2019: 2). For example, logging in west Guadalcanal in the Solomon Islands polluted a river that supplies water for cooking, washing and livestock farming for the nearby residences. Chemicals from mining and oil palm plantations in north Guadalcanal also contaminated water sourced from the boreholes and streams (Solomon Islands Government, 2015). Furthermore, lack of technical and financial capacities restricted the people in rural areas to repair, develop and diversify their water resources provided by the government and donors.

Issues with water insecurity are not the same for all PICs. The smaller, low-lying atolls and volcanic islands are often more vulnerable in managing the limited water sources than the larger islands such as Papua New Guinea, Fiji and the Solomon Islands (SPC, 2012). PICs experience unique water security challenges, which are defined by their geographical remoteness, their relatively small size and natural and anthropogenic hazards such as tropical cyclones and urban pollution. For example, Tuvalu, Tonga and Kiribati lack surface water sources (SPREP, 2014; SPC, 2015; Bolton, 2020). The livelihoods of people in and the economies of these small island countries are extremely vulnerable to rainfall variability and drought as they depend more on rainwater harvesting systems.

Some PICs utilise desalination systems; however, these are costly to maintain in the long term (Khalaj-Teimoury, 2018). Limited technical and water governance capacities further challenge PICs to manage limited water resources. Remoteness of the islands and population pressure have constrained the efforts to deliver the water resources in the rural population of the Solomon Islands (Anthonj et al. 2019: 2). The effects of water insecurity on gender-based roles are also uneven between males and females. Women and girls in rural households in PICs bear most household water-dependent tasks such as cooking, laundry and caring for children and the sick, thus they are disproportionately impacted by water insecurity (WHO, 2016; UNICEF, 2020). Yet, integration of the role of women and their knowledge of water collection, storage and water management into water security-related programmes is often overlooked.

The Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) and Pacific regional studies highlighted the effects of climate change on water security through extreme variations in climate parameters such as extreme temperature (high confidence); precipitation (very likely); intense flood (very likely); intrusion of sea level rise (likely); and intense tropical cyclones (likely) (IPCC, 2014; SPREP, 2014; SPC, 2015; Khalaj-Teimoury, 2018).

The AR5 of the IPCC projected with high confidence that changes in these climate parameters would negatively affect the quality and quantity of both surface water and groundwater, exposing risks for human and freshwater ecosystems on a global scale (IPCC, 2014). However, the impacts will vary from one region to another, country to country and even highlands to low-lying islands (Hardwick Jones et al. 2010: 1). According to the Australian Bureau of Meteorology and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the average rainfall is projected to increase in countries such as the Solomon Islands, Cook Islands and Kiribati. Whereas in countries such as Tuvalu, Fiji and Vanuatu, the wet seasons will be accompanied by a decrease in seasonal rainfall (Australian Bureau of Meteorology and CSIRO, 2011; Hadwen et al. 2015: 183).

In the Solomon Islands, although the impacts of climate change on water security have been recognised, achieving long-term water security is difficult at the current rate (4.4% annually) of population growth (Solomon Islands Government, 2020). There are many factors that caused barriers for improving water security, specifically in rural areas. One of the outstanding factors is that people prioritise food, materials for housing and raising funds for their children's school fees, rather than adequate and clean water sources (Solomon Islands Government, 2020). Lack of evidence and data on mortality due to water-related diseases makes it more difficult to change the mind-set of people in rural communities. For instance, people in Savo Island, a volcanic island, use highly sulphur-contaminated water for cooking and cleaning without being affected. Although 49% of the rural population in the Solomon Islands use natural and untreated water sources such as streams and wells for drinking, the lack of substantial evidence on health problems further hinders the achievement of adequate water supplies to the rural communities (Solomon Islands Government, 2015; Anthonj et al. 2019: 2).

The Solomon Islands was also ranked the fourth most vulnerable country in the 2019 World Risk Index (Sanderson and Bruce, 2020). The vulnerability of the Solomon Islands is worsened by its low socioeconomic status that further places the country under the UN list criteria as a Least Developed Country (LDC). Projection for the next fifty years revealed an average direct loss of US$20.5 million annually from disaster risks and the impacts of climate change (Australian Strategic Policy Institute, 2020). Thus, there is a greater need for transformational change that prioritises water security to support and strengthen adaptation programmes on water security interventions.

Recognising the vulnerability of PICs, several CCA interventions have been implemented by international, governmental and non-governmental organisations to address water security issues (Butcher, 2019). With international funding assistance, the Pacific Adaptation to Climate Change Programme (PACC) has implemented several projects across PICs (SPREP, 2014). The interventions on water security by the PACC are initial initiatives to systematically strengthen the capacity to build resilience at the national and community levels. Despite the increasing assistance, there is limited data to support the success of these interventions in addressing the risks and vulnerabilities associated with climate change in the water sector (SPREP, 2010).

In 2015, after the Paris Agreement on global adaptation, climate change professionals and CCA donors have increased their concern on the effectiveness of CCA programmes. Development of appropriate evaluation frameworks for national and community contexts was highlighted as a major concern. Comprehensive evaluation frameworks for CCA interventions are important to determine whether or not the interventions are effective and also to assess whether the world is doing enough to adapt to climate change (Huq, 2017; Ssekamatte, 2018: 6). According to the International Federation of Red Cross and Red Crescent Societies (IFRC), the success of any adaptation programme must be assessed using the impacts it has on the ground at the community level (IFRC, 2017). The IFRC has stated climate change adaptation programmes could only be successful if the resilience and adaptive capacity improvement outnumbered vulnerable people in targeted communities. This means the percentage of the population with increased adaptive capacity and resilience must be higher when compared to baseline data.

There are some factors that hinder the effectiveness and sustainability of CCA programmes inclusive of water security interventions in PICs. These factors include inadequate understanding of cultural values and community governance structures, limited timeframes of the projects and limited technical and financial capacities (Butcher, 2019). CCA programmes on water security are mostly implemented at a community level where social and economic developments are low. In most rural communities in PICs, the social welfare of the people and land resources are managed through traditional and religious governance systems (Misite'e, 2008; SPC, 2012). An adequate time-frame is required to understand the traditional values and beliefs of how communities adapted to water stress situations in the past and integrated the lessons learnt.

Financial support also needs to be established to fund on-going monitoring and evaluation processes of the projects. Hence, comprehensive evaluation of the CCA programme on water security interventions in the PIC is significant. Such assessments will provide a benchmark for CCA intervention on water security programmes in the future. They also help to measure the progress, effectiveness and sustainability of the water projects.

This paper provides information based on the current literature that would help water practitioners and decision makers to effectively plan, design and implement water security-related adaptation projects. The paper: (1) reviews the current status of water coverage in the Solomon Islands; (2) reviews the water-related impacts of climate change in PICs with a focus on the Solomon Islands; and (3) evaluates the CCA programme on water security in the Solomon Islands.

A review of water coverage in the Solomon Islands

Overview of the Solomon Islands

The Solomon Islands lies south-west of the Pacific Ocean and has a current population of 686,884 (Solomon Islands Government, 2020). The country consists of 1000 islands, including nine major islands that are further categorised as provinces: (1) Choiseul province; (2) Western province; (3) Central province; (4) Guadalcanal province; (5) Rennell and Bellona province; (6) Malaita province; (7) Makira (San Cristobal) province; (8) Ysabel province; and (9) Temotu (Santa Cruz) province (see Figure 1; Foster and Laracy, 2017). The capital, Honiara, is located in the Guadalcanal Province. The Solomon Islands enjoys an equatorial climate with a constant high temperature (~27 ˚C), high humidity (80%) and abundant rainfall of 3000 to 5000 millimetres in a year (Anthonj et al. 2020: 2).

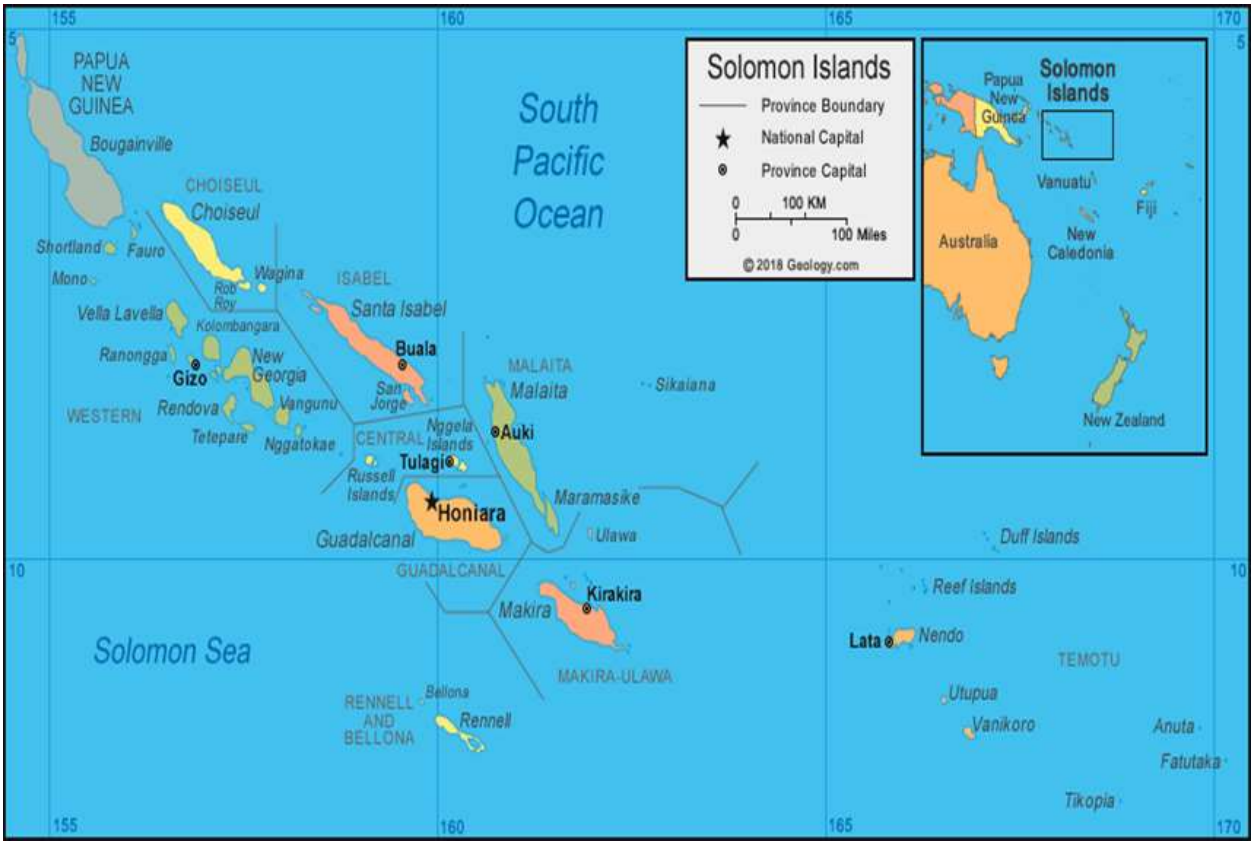

Figure 1 Map of the Solomon Islands. Source :(Geology, 2018)

The Solomon Islands faces socioeconomic issues such as a weak economic base, rapid population growth, poor infrastructures, limited financial capacity and inadequate public administration. These challenges compromised the provision not only of water security services, but also public services for the geographically dispersed population (Fleming et al. 2019: 332). Water security services are unequally distributed between the rural and urban populations with more improved services in Honiara. A recent study indicated that 75% of

the total population lives in rural areas, while the urban population is projected to increase to 40% by 2020 (Fleming et al. 2019: 332). This rapid growth in urban population is attributed to urbanisation as people move into town seeking employment and business opportunities.

Water resources management and development in the Solomon Islands

In the Solomon Islands, assessment and management of the water sector is implemented by the Ministry of Mines, Energy and Rural Electrification (MMERE) and the Ministry of Health and Medical Services. In terms of access to improve water and sanitation services, the Solomon Islands has shown slow progress due to socioeconomic disparities that exist between the rural and urban populations (Fleming et al. 2019: 338; Chan et al. 2020).

According to the Solomon Islands National Infrastructure Investment Plan, the urban water systems in Honiara and Provincial towns were ineffective to manage and maintain. The ineffectiveness was attributed to poor water infrastructures, limited technical skills, high utility costs and limited water management capacity (Solomon Islands Government, 2016a). These issues have compromised the ability of the water sector to provide adequate and quality water to small and geographically dispersed populations at the provincial level (The World Bank, 2019; WHO and UNICEF, 2020).

The geographically scattered islands with variable sizes and the remoteness of communities in the provincial towns also influence the hydrological characteristics such as accessibility and availability of water sources in the nine provinces (Quigley et al. 2016: 66). For example, higher islands like Guadalcanal province have natural water sources such as sizable rivers and streams, while smaller islands and low-lying atolls like Ontong Java lack natural surface water sources and are heavily dependent upon rainwater catchments and groundwater. In the smaller islands (where groundwater is limited to hand-dug wells), rainfall is varied, causing a shortage of drinkable water within two weeks of the dry period. The country is destined to further exploitation of the water resources with the increasing population growth rate (Solomon Islands Government, 2013; Anthonj et al. 2020: 2).

The assessments on the access to improve basic water services conducted by the Joint Monitoring Programme between WHO and UNICEF noted that at least 75% of the total households in the Solomon Islands had access to basic water services (WHO and UNICEF, 2019). The standard definitions used by WHO and UNICEF for basic drinking water sources and services are outlined in Table 1. Among the 75% of the overall households, 95% of the households in urban areas have better access to basic drinking water services than households in rural areas (55%) (WHO and UNICEF, 2019). The assessment conducted by WHO and UNICEF indicated that 20% of the rural households equally used surface water and other unimproved sources as shown in Figure 2.

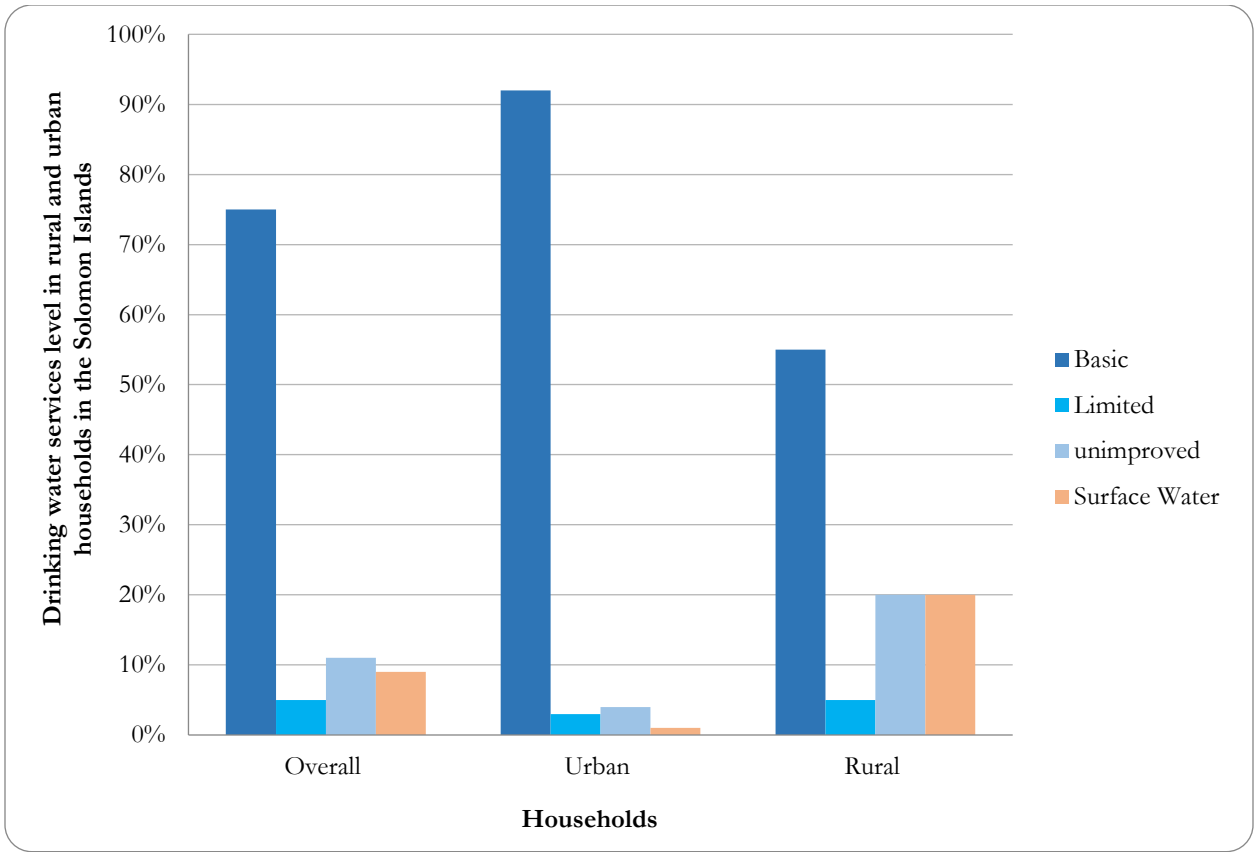

Figure 2 Drinking water service levels in rural and urban households in the Solomon Islands. Source: (WHO and UNICEF, 2019)

Despite an improvement from 2016 where 73% of urban households and 54% of rural households had access to basic drinking water services, the Solomon Islands is still amongst the lowest levels in terms of basic drinking water services across all PICs. Limited access to basic water resources in the Solomon Islands is set to increase with the increasing effects of climate change (Solomon Islands Government, 2016b). Such findings further challenge the vision of the Solomon Islands Government National Water Sanitation and Hygiene (WASH) Policy: "*Every Solomon Islander shall have reasonable access to sustainable, adequate, quality water*" (Direct quote) (Solomon Islands Government, 2014).

Table 1 Definition of drinking water terms used. Source: (WHO and UNICEF, 2019)

	Characteristics of drinking water	Definition
JMP drinking water ladder	**Drinking water services**	the accessibility, availability and quality of the main source used by households for drinking, cooking, personal hygiene and other domestic uses
	Basic services	Drinking water from an improved source, provided collection time is not more than 30 min for a roundtrip including queuing
	Limited service	Drinking water from an improved source for which collection time exceeds 30 minutes for a roundtrip including queuing
	Unimproved service	Drinking water from an unprotected dug well or unprotected spring
	Surface water	Drinking water directly from a river, dam, lake, pond, stream, canal, or irrigation canal.
Drinking Water Sources	**Drinking water sources**	water sources that have the potential to deliver safe water by nature of their design and construction, and Include: piped water, boreholes, or tube wells, protected dug wells, protected springs, rainwater, and packaged or delivered water.
	Public tap or standpipe	Water is a public water point from which people can collect water
	Piped into dwelling	is a piped water supply connected with in-house plumbing to one or more taps (for example in the kitchen or bathroom)
	Piped into compound	Water is a piped water supply connected to a tap in the compound, yard or plot outside the house.
	Rainwater catchment	a system whereby rain is collected or harvested from large surfaces (by roof or ground catchment) and stored in a container, tank, or cistern until used
	Unimproved drinking water sources	Drinking water sources include surface water, unprotected wells and springs, as well as unknown sources

Water-related impacts of climate change in PICs—Solomon Islands

Climate change affects water security in PICs through extreme variations of these climate parameters: (i) increase in rainfall variability; (ii) increase in temperature; (iii) sea level rise; and (iv) increase in intensity and frequency of tropical cyclones (Keener, 2013: 104; SPC, 2015; Iese et al. 2015: 3; Khalaj-Teimoury, 2018). Average rainfall is projected to increase in countries such as the Solomon Islands, Cook Islands and Kiribati. Whereas in countries such as Tuvalu, Fiji and Vanuatu, the wet seasons will be accompanied by a decrease in seasonal rainfall (Australian Bureau of Meteorology and CSIRO, 2014; Hadwen et al. 2015: 189). Changes in rainfall affected seasonal availability and accessibility of water sources. An increase in rainfall also intensifies flooding that may contaminate surface and groundwater and cause damage to water collecting infrastructures (Australian Bureau of Meteorology and CSIRO, 2011). For example, extensive flooding in the Guadalcanal plains in the Solomon Islands in January 2019 was due to two weeks of unrelenting extreme rainfall. The flood had contaminated drinking water and further developed risks of mosquito and water-borne diseases (Stewart, 2019).

Increased sea surface temperature contributes to drought and heavy rainfall in equatorial PICs (Murphy et al. 2014: 4018; Fasullo et al. 2018: 9216; Dutheil et al. 2019: 3). For instance, the United Nations Office for Humanitarian Affairs noted the severe drought between 2015 and 2017. This event caused

extremely dry weather that resulted in water scarcity in Tonga and the Western, Eastern and Northern divisions of Fiji. Similarly, for the same period, the drought caused low water levels in Tuvalu, Tokelau, Nauru and Kiribati (OCHA, 2017).

Sea level rise has also impacted the water supply and storage systems in coastal areas in PICs. The rate of sea level rise is highest in the tropical region where thousands of small islands and low-lying coral islands are located (Storlazzi et al. 2018: 3). The AR5 of the IPCC also noted that some PICs would experience four times greater sea level rise than the global average (IPCC, 2013). For instance, between 1994 and 2014, the rate of sea level rise in Tuvalu and Kiribati was recorded at twelve millimetres per year, while the rate in the Solomon Islands was seven millimetres per year for the same period. Furthermore, climate change-induced sea level rise exacerbated the threat of water insecurity in the Ontong Java Atoll, a low-lying atoll in the Solomon Islands (Australian Bureau of Meteorology, 2014).

Future projections for the Solomon Islands noted an increase in extremely high temperature (very high confidence), an increase in an extreme rainfall event that may lead to flooding (high confidence) and an increase in the rate of sea level rise between the range of 45 to 75 centimetres in 2100 (very high confidence) (Solomon Islands Government, 2011; Solomon Islands Government, 2016b). These projections have posed a challenge in achieving the fundamental requirement of SDG 6 (Solomon Times, 2020). Since the Solomon Islands is obligated to meet the target of SDG 6, a holistic approach is required to enable the sustainable management of water resources under extreme climate change scenarios.

Climate change adaptation programmes for water security in the Solomon Islands

Prior to the development of the National Climate Change Policy 2012–2017, the Solomon Islands signed and participated in several international and regional treaties related to climate change. For example, the United Nations Framework Convention on Climate Change (UNFCCC) was ratified in 1994, the country participated in the Pacific Islands Adaptation to Climate Change (PACC) programme in 2000 and submitted its Initial Communication to the UNFCCC in 2004 (Dey, 2016).

Due to its development challenges and weak socioeconomic base, the Solomon Islands is further classified as an LDC. As a requirement of the UNFCCC, LDCs need to develop the National Adaptation Programme of Action (NAPA) as a channel to communicate and disseminate the immediate needs for adaptation to the adverse impacts of climate change (Solomon Islands Government, 2008). The Solomon Islands government developed NAPA after broad consultations in 2008. The water sector is one of the priority sectors that needs immediate attention to address water security issues in the Solomon Islands (Solomon Islands Government, 2008; Solomon Islands Government, 2012).

In response to NAPA, a number of multilateral agencies such as the United Nations Development Programme (UNDP), the Secretariat of the Pacific Regional Environment Programme, the SPC, the World Bank, World Vision and Oxfam have implemented CCA programmes in vulnerable sectors in the Solomon Islands (Butcher, 2019). The Solomon Islands water sector Adaptation Programme (SIWSAP) is one of these interventions that was funded through the Least Developing Countries Fund and implemented by the water resources division of the MMERE with technical support from the UNDP (Solomon Islands Government, 2012; Solomon Islands Government, 2016a). The main objective of the programme is to increase the resilience of water resources to the impacts of climate change to achieve better health, sanitation and quality of life and sustain livelihoods in targeted vulnerable areas (Solomon Islands Government, 2016a).

Apart from the CCA interventions on water security through NAPA, regional initiatives such as PACC also assisted the Solomon Islands. The initial initiatives by PACC are tailored to systematically strengthen the capacity at the national and community levels in PICs (SPREP, 2020). With international funding assistance, PACC also implemented several projects across PICs in response to the impacts of climate change on water security. Table 2 outlines the water security projects implemented by PACC in PICs.

Table 2 Summary of the water security projects implemented in the PICs. Source: (SPC, 2015)

Project	Country/Year	Donor and	Challenges	Lesson learnt

		Implementing Agency		
Water safety and security planning for resilience	Vanuatu and Fiji (2011 - 2015)	UNICEF Government of Australia, Fiji and Vanuatu	Lack of capacity to manage water resources to ensure sustainable operation	Guidance, accountability and community commitment are required to achieve community resilience
PACC: Improving water security and community resilience	Tokelau 2009 - 2014	Government of Australia, SPREP, UNDP	Limited plumbing capacity, climate change perception issues and project's schedule clashes with village events	Culture and gender sensitivities need to be considered
GCCA and PACC: Manufacturing water tanks for water security	Niue 2009 - 2015	European (EU), (GEF) SPREP and SPC and the government of Niue	Issues with the engagement of various stakeholders and vulnerability assessment	Pacific countries can take initiative to combat water security issues through the establishment of operation and maintenance systems.
PACC: Solar water purifier to address water security	Nauru 2009 - 2014	GEF, SPREP, UNDP and the government of Nauru	Land issues, lack of technical support and lack of saltwater reticulation assessment	Strategic level planning in terms of policies, plans and structures development. Project design needs to be community-specific

Although CCA programmes addressing not only water security, but also other vulnerable sectors have increased in PICs, the effectiveness and sustainability of such interventions remains a challenge (SPREP, 2010).

Evaluation on effectiveness of climate change adaptation programmes on water security in PICs

The effectiveness of climate change adaptation interventions has been a global concern, yet limited publications surrounding this topic in the Pacific region currently exist. PICs have been documented for receiving external international assistance to initiate sustainable climate change adaptation initiatives over the years, yet the gap between effective CCA programmes and implementation remains (Barnett and O'Neill, 2010: 211; Xenarios, 2019: 1341). This is due to the assumption that the top-down approaches adopted by developing countries would be effective in mainstreaming climate change adaptation at the community level (Huq et al. 2004: 33). However, the chosen approach failed to obtain the operative and sustainable adaptive methodologies that are feasible in developing countries like most PICs (Lata and Nunn, 2012:180).

Among the limited literature on this topic in PICs, few researchers have taken different approaches in assessing the effectiveness of climate change adaptation programmes, rather than that specific to water security projects. Kuruppu and Liverman (2011) were amongst the few whose research was based on evaluating the effectiveness of a water security programme funded through the LCDF in Kiribati. The study employed semi-structured household surveys that assessed the communities' perception of the process of adaptation concerning adaptive capacity.

Kuruppu and Liverman (2011) argued that the CCA programme at the community level needed to consider community cognition and culture during the phases of the programme. Their findings indicated that cultural beliefs and experiences of past water insecurity issues had limited the understanding of the local community to realise the effects of climate change on water resources. As a result, belief-efficacy has delayed the expected outcomes of formal adaptation interventions. The authors recommended a need to assess local

knowledge about climate change and water management, which might be useful in the effective implementation of interventions in the context of water security (Kuruppu, 2009). Similar findings are also established by Lata and Nunn (2012: 183) in their study on barriers to climate change adaptation in the Rewa Delta, Fiji. Hence, to achieve an effective and sustainable adaptation, misperception between risks and perceived risks needs to be specifically addressed in the targeted communities (Nunn and Kumar, 2018: 249).

Effectiveness of water security programmes in the Solomon Islands

In the Solomon Islands, independent evaluations have been conducted on different perspectives about the water sector, rather than of climate change adaptation programmes. The focus of evaluating the water sector is to measure the progress of the country towards the Millennium Development Goals and SDG 6 (Solomon Islands Government, 2016c). One of these evaluation assessments was funded by the Australian Agency for International Development in 2016. The project analysed the Solomon Water Development Plan 2013–2015, particularly for urban water services in Honiara to determine the progress of the water sector.

The main findings revealed that even though comprehensive policy documents such as the Rural Water and Sanitation Hygiene (RWASH) Policy (2014), the RWASH Strategic Plan (2015– 2020), and the Solomon Water Development Plan (2013–15) have been developed, there still exists a lack of commitment by the national government towards financing, and the effective implementation of these policies and strategies was highlighted as an issue (Solomon Islands Government, 2016c). The assessment reports also acknowledged the vulnerability of the water sector due to the impacts of climate change and the need to include proactive mechanisms in climate change adaptation plans.

An independent assessment was also conducted by UNICEF to evaluate the extent of their effort with WASH in the Solomon Islands (UNICEF, 2017). The findings of the UNICEF report noted that the degree at which the project addressed the specific water and sanitation needs remains low in rural communities, schools and clinics. This is because the project had a minimal understanding of how the community perceived their urgent needs. The evaluation report further recommended on-going monitoring on access to water supplies, sanitation coverage, climate change indicators and an evaluation system (UNICEF, 2017). Besides this, due to little improvements with WASH outputs, UNICEF conducted another follow-up assessment on capacity building to strengthen the overall capacity of RWASH in 2018 (UNICEF, 2018).

An independent body of the UNDP had also evaluated the Mid Term Report to assess the progress towards the objectives of SIWSAP and to identify potential design problems as well as lessons learnt about the project design, implementation and management (UNDP, 2017). The progress of the project was measured according to the result framework indicators outlined in the Global Environment Facility tracking tools. The UNDP evaluated the SIWSAP according to the four outcomes outlined in the project report (UNDP, 2017).

A summary of the evaluation rating is outlined in Table 3. The findings indicated that the effectiveness and sustainability of the project are challenged due to limited project timeframes, limited technical capacities and limited understanding of the cultural contexts of the recipient communities. Based on these findings, the report concluded that it was unlikely that the expected outcomes would be achieved at the end of the project period in 2018 (UNDP, 2017).

Table 3 Evaluation of the SIWSAP overall performance. Source: (UNDP, 2017)

Outcome/Measure	Rating	Description of achievement
Outcome 1: formulating, integrating and mainstreaming Water Sector - Climate Change Adaptation Response (WS - CCAR) plans	Moderately satisfactory	Although the WS-CCAR plans are formulated, adaptation planning is not per the Integrated Water Resources Management (IWRM). Pending water resources assessment also caused the failure to address the underpinned hydrological aspects.
Outcome 2: increase the reliability and quality of water supply in the targeted area	Moderately satisfactory	The reliability and quality of the water supply have been increased, however, more effort is required to design and deliver water adaptation services to

		communities effectively.
Outcome 3: Cost-effective and adaptive intervention and technology transfer	Moderately unsatisfactory	The project is unprepared in terms of technological capacity to install the desalination units and ultrafiltration unit
Outcome 4: Improving governance and knowledge management for climate change adaptation at the local level	Moderately unsatisfactory	Rescheduling of procurement due to lack of technical advisory capacities
Sustainability	Moderately likely	The quick-fix interventions have built trust and social cohesion between the implementers and the local communities.

Capacity building is an important transformational approach that assists vulnerable communities and organisations to acquire knowledge and skills that would assist them to adapt to social changes, including climate change (Dervitsiotis, 2006; Brinkerhoff and Morgan, 2010: 3). Limited capacities in this paper refer to the partial ability to install and operate technical water infrastructures such as desalination and ultrafiltration units. The sustainability of SIWSAP was also affected by inadequacy of specialised skills in hydrological assessment, water resources assessment, monitoring and management of water security initiatives (UNDP, 2017). Technical capacity building for CCA programmes at community levels was often compromised by the limited timeframe of the project.

In the Solomon Islands, the CCA programmes are implemented over a period of less than five years with individual pilot projects being implemented as part of the large programmes. Unfortunately, there is still inadequate literature on the experience of the communities that are involved in these CCA programmes. A relationship between a short-term donor programme and recipient is expressed as a weak and low-trust relationship (Butcher, 2019). A community-based adaptation project requires a strong relationship as it involves elements of complexity relating to landownership and community traditional governance systems.

Building a strong relationship with the recipient community can also provide a useful entry point for harnessing the specialised knowledge held by men and women in developing strategies for adapting to climate change (Lane and McNaught, 2009). With the short timeframe, it is difficult to invest in building strong relationships and understanding of the community governance structure. Short-term contracts also come with a lot of conditions attached when compared to grants (Morris, 2000; Ha'apio, 2019). For instance, one of the conditions is that the contracted individual or organisation has to fulfil a particular deliverable of the project before certain percentages of charges are paid. Hence, implementers focused more on delivering the expected outputs within the limited time and space rather than exploring culturally appropriate and equitable approaches that influence sustainable outcomes (Butcher, 2019).

According to information outlined in Table 2, challenges that affect the effectiveness and sustainability of SIWSAP are viewed as project-based or implementation challenges, rather than the complex social and cultural factors in the location where the project was implemented. Although Traditional Ecological Knowledge is acknowledged as one of the solutions for adaptation, CCA programmes in the Solomon Islands are culturally deficient (Valencia, 2010; Weir et al. 2017: 1026). There is a greater need to discover local practices that are more appropriate in the local context that may contribute to long-term sustainability.

Way forward

It is highly recommended that effective institutional arrangements and an enabling environment need to be established. In this case, the enabling environment embraces proper policies and networking approaches, while an institutional arrangement entails coordinated mechanisms and government-led agencies and strategies to tackle water security issues. These arrangements have an impact on inputs, outcomes and outputs of project implementation required for adaptation. Such actions are crucial to ensure issues with water security are addressed through political, social and economic systems (Allouche, 2011: 4: Gibson, 2017: 8; McLeod et al. 2019).

Traditional governance systems and their gender limitations also contribute to ineffectiveness of climate change adaptation programmes at the community level in PICs. In the context of the Solomon Islands, indigenous Solomon Islanders in a group such as tribal communities have their own customary jurisdictions of traditional governance. Although there is no legal recognition of the power and functions of traditional leaders, they maintain peaceful co-existence in a community through performing their own dispute resolution method (Walenenea, 2019).

Women, girls and youths play a significant role in managing natural resources, food and water as well as nurturing children. However, women and girls are often marginalised during the consultative engagement phase of CCA programmes. Even in a family, community and throughout the national and governmental levels, women and youths are often excluded from decision-making processes (Asian Development Bank, 2015).

Colonial administrations and early development models create barriers for women in decision-making processes in the Solomon Islands. Male dominance in decision making greatly influences land and property rights in both patrilineal and matrilineal inheritance systems (McDiarmid and Walker, 2019). Males still have a final say in decision-making processes regarding land development or any interventions. Similar practices occur in Vanuatu where men make the bulk of decisions on resource allocation for climate change-related disasters, while women are only responsible for food preparation (Lane and McNaught, 2009: 89).

The impacts of climate change will affect women and girls who are marginalised from accessing better education, political involvement, mental health services and the labour market (Gero et al. 2018: 79; Winterford et al. 2018: 32). Most (73%) men still perceived gender-based violence was acceptable (Hermkens, 2013). Attitudes of men towards women are embedded in a culture that promotes men as leaders (McKinnon et al. 2016: 3). In the Solomon Islands, gender equality in terms of participation in CCA programmes is only recognised in theory, and the inclusive engagement of women, girls and people with special needs at both national and community levels remains poor (Butcher, 2019).

Inclusive engagement of women in CCA interventions on water security will add value to the effectiveness and sustainability of the CCA programme because of their social roles in managing household water (Charan et al. 2017: 113; Gero et al. 2018: 79; Winterford et al. 2018: 32). For instance, in rural communities in PICs, it is the daily routine of a woman to collect and store sufficient drinking water for the family (Ajani et al. 2013: 26). Thus, comprehensive gender analysis for access and control on water resources management at household and community levels needs to be conducted to integrate the knowledge and experience of women in water CCA programmes on water security interventions in the Solomon Islands.

Conclusion

Research on the effectiveness of climate change adaptation efforts is critical if researchers and policymakers are to prioritise best policies that accomplish adaptation goals. CCA programmes in PICs, specifically in the Solomon Islands, are so focused on delivering expected outputs that there is little time and space allowed for exploration of power relations, cultural worldviews and experiences. Programmes are often heavily influenced by those funding them, rather than communities, provincial governments or even national governments, who are meant to be the recipients. This greatly impacts the associated relationships. Even though those promoting CCA programmes are aware of this, it continues to occur. Hence, intended recipients see CCA programmes as having largely self-governing agency, often impenetrable to outside influence.

Acknowledgements

The authors acknowledge the support provided by the University of the South Pacific Research Office.

References

Ajani, E. N., E. A. Onwubuya, and R. N. Mgbenka. 2013. "Approaches to Economic Empowerment of Rural Women for Climate Change Mitigation and Adaptation: Implications for Policy". *Journal of Agricultural Extension*, 17(1): 23–34.

Allouche, Jeremy. 2011. "The sustainability and resilience of global water and food systems: Political analysis of the interplay between security, resource scarcity, political systems and global trade". *Food Policy*, 36: S3–S8.

Anthonj, C., Wren Tracy, Lisa Fleming, Katherina F. Shields, Waqairapoa M. Tikoisuva, Emma R. Kelly, Mamita Bora Thakkar, Ryan Cronk, Marc Overmars, and Jamie Bartram. 2020. "Geographical inequalities in drinking water in the Solomon Islands". *Science of the Total Environment*, 712: 1–14.

Asian Development Bank. 2015. "Women and Business in the Pacific". ADB. Accessed October 25. https://www.adb.org/sites/default/files/publication/445821/women-business-pacific.pdf .

Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation. 2014. "Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports 2014". Australian Government. Accessed October 20. https://www.pacificclimatechangescience.org/publications/reports/climate-variability-extremes-and-change-in-the-western-tropical-pacific-2014/.

Australian Bureau of Meteorology and CSIRO. 2011. "Climate Change in the Pacific: Scientific Assessment and New Research." Australian Government. Accessed Oct 24. https://www.pacificclimatechangescience.org/wp-content/uploads/2013/08/Climate-Change-in-the-Pacific.-Scientific-Assessment-and-New-Research-Volume-1.-Regional-Overview.pdf

Australian Strategic Policy Institute. 2020. *A Pacific Disaster Prevention Review, Australian Strategic Policy Institute:* https://books.google.com.sb/books/about/A_Pacific_Disaster_Prevention_Review.html?id=US2nzQEACAAJ&redir_esc=y

Barnett, Jon and Saffron O'neill. 2010. "Maladaptation." *Global Environmental Change,* 20**:** 211-213.

Bolton, Annette, Kamal Khatri, Matthew Ashworth, S'Akolo Fa'u, S. Ki Folau Fusi, Judy Williamson, and Reynold Ofanoa. "Strengthening Adaptation Planning and Action to Climate-Related Health Impacts in Pacific Islands Countries: Tonga." Global Journal of Health Science 12, no. 3 (2020): 1–55.

Brinkerhoff, W. Derrick and Peter J. Morgan 2010. "Capacity and capacity development: Coping with complexity. *"Public Administration and Development: The International Journal of Management Research and Practice,* 30**:** 2–10.

Butcher, Scott 2019. Climate change adaptation programs in the Solomon Islands: a study of perceptions and relationships. Master thesis, University of Canterbury.

Chan, T, M. C Macdonald, A. Kearton, M. Elliott, K. F. Shields, B. Powell, J. K. Bartram and W. L. Hadwen. 2020. "Climate adaptation for rural water and sanitation systems in the Solomon Islands: A community scale systems model for decision support." *Science of The Total Environment,* 714**:** 136681.

Charan, Drishna, Manpreet Kaur, and Priyatma Singh. 2016. "Indigenous Fijian women's role in disaster risk management and climate change adaptation." *Pacific Asia Inquiry*, *7*(1):106–122.

Dervitsiotis, Kostas N. 2006. "Building trust for excellence in performance and adaptation to change." *Total Quality Management and Business Excellence,* 17**:** 795–810.

Dey, M. Mohan, Kamal Gosh, Rowena Valmonte-Santos, Mark W. Rosegrant and Oai L. Chen. 2016. "Economic impact of climate change and climate change adaptation strategies for fisheries sector in Solomon Islands: Implication for food security." *Marine Policy,* 67:171–178.

Dutheil, Cyril, Margot Bador, Matthieu Lengaigne, Jérôme Lefèvre, N. C. Jourdain, Jérôme Vialard, Swen Jullien, Alexandre Peltier, and Christophe Menkès. 2019. "Impact of surface temperature biases on climate change projections of the South Pacific Convergence Zone." *Climate Dynamics*, *53*(5-6):3197–3219.

Elliott, Mark, Morgan C. MacDonald, Terence Chan, Annika Kearton, Katherine F. Shields, J. K. Bartram, and W. L. Hadwen.. 2017. "Multiple household water sources and their use in remote communities with evidence from Pacific Island countries." *Water Resources Research*, 53(11):9106–9117.

Fasullo, J. T., B. L. Otto-Bliesner, and S. Stevenson 2018. "ENSO's Changing Influence on Temperature, Precipitation, and Wildfire in a Warming Climate." *Geophysical Research Letters,* 45:9216–9225.

Fleming, Lisa, Carmen Anthonj, M. B. Thakkar, W. M. Tikoisuva, Musa Manga, Guy Howard, K. F. Shields, Emma Kelly, Marc Overmars, and Jamie Bartram. 2019. "Urban and rural sanitation in the Solomon Islands: How resilient are these to extreme weather events?" *Science of The Total Environment,* 683**:** 331–340.

Sophie, Foster and Hugh Laracy. 2020. "Solomon Islands." Encyclopædia Britannica. Accessed October 25. https://www.britannica.com/place/Solomon-Islands

Gero, Anna, Keren Winterford, Tamara Megaw, Emmanuella Kauhue, and T. Tangi . 2018. "Beyond a token effort: Gender transformative climate change action in the Pacific." *Development Bulletin*.

Gheuens, Jana, Nidhi Nagabhatla, and E. D. P. Perera.. 2019. "Disaster-risk, water security challenges and strategies in Small Island Developing States (SIDS)." *Water,* 11(4):637.

Gilson, Julie 2017. "The security of water in Asia and the Pacific." *Critical Studies on Security*, *5*(3):253–269.

Ha'apio, Micheal. 2019. Analysing adaptive strategies to cope with extreme environmental events and impacts of climate change in the pacific: case studies in the Solomon Islands. PhD thesis. The University of the South Pacific

Hadwen, W. L., Bronwyn Powell, M. C. MacDonald, Mark Elliott, Terence Chan, Wolfgang Gernjak, and W. G. L Aalbersberg. 2015. "Putting WASH in the water cycle: climate change, water resources and the future of water, sanitation and hygiene challenges in Pacific Island Countries." *Journal of Water, Sanitation and Hygiene for Development,* 5**:** 183–191.

Hardwick Jones, Rhys, Seth Westra, and Ashish Sharma.. 2010. "Observed relationships between extreme sub-daily precipitation, surface temperature, and relative humidity." *Geophysical Research Letters,* 37.

Huq, Saleemul, Hannah Reid, Mama Konate, Atiq Rahman, Youba Sokona, and Florence Crick. 2004. "Mainstreaming adaptation to climate change in least developed countries (LDCs)." *Climate Policy,* 4**:** 25–43.

Iese, V., L. Paeniu, S. I. Pouvalu, A. Tuisavusavu, S. Bosenaqali, M. Wairiu, and A. Devi.2015. "Food security: Best practices from the Pacific." *Pacific Centre for Environment and Sustainable Development (PaCE-SD). The University of the South Pacific, Suva, Fiji.*

IFRC. 2017. "Framework for Climate Change Action towards 2020." Geneva. Accessed October 24. http://www.climatecentre.org/downloads/files/CLIMATE%20FRAMEWORK%20FULL.pdf

IPCC. 2013. "Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.*"* Cambridge, United Kingdom and New York.

IPCC. 2014. "Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change." Geneva, Switzerland.

Keener, Victoria. 2013. "Climate change and pacific islands: indicators and impacts: report for the 2012 Pacific Islands regional climate assessment." Island press.

Khalaj-Teimoury, Masoud 2018. *Environmental Impacts on Guam's Water Security and Sustainable Management of the Resource.* 10787879 Ph.D., University of Alaska Fairbanks.

Kuruppu, Natasha. 2009. Adapting water resources to climate change in Kiribati: the importance of cultural values and meanings. *Environmental Science and Policy,* 12**:** 799–809.

Kuruppu, Natasha, and Diana Liverman. 2011. Mental preparation for climate adaptation: The role of cognition and culture in enhancing adaptive capacity of water management in Kiribati. *Global Environmental Change,* 21**:** 657–669.

Kuruppu, Natasha, and Reenate Willie. 2015. Barriers to reducing climate enhanced disaster risks in Least Developed Country-Small Islands through anticipatory adaptation. *Weather and Climate Extremes,* 7**:** 72–83.

Lane, Ruth, and Rebecca McNaught. 2009. Building gendered approaches to adaptation in the Pacific. *Gender and Development,* 17**:** 67–80.

Lata, Shalini, and Patrick Nunn. 2012. Misperceptions of climate-change risk as barriers to climate-change adaptation: a case study from the Rewa Delta, Fiji. *Climatic Change,* 110**:** 169–186.

Mataki, MelchioR. 2013. Solomon Islands-National Report for Third International Conference.

Mataki, Melchior, Kanayathu Koshy, and Veena Nair. 2006. Implementing climate change adaptation in the pacific islands: adapting to present climate variability and extreme weather events in navua (Fiji). *Assessments of Impacts and Adaptations to Climate Change (AIACC), Florida, USA*.

Stella, Mulder. 2019. "WAVE: Women and political leadership in Solomon Islands-literature review." Solomon Islands. Accessed October 23. https://iwda.org.au/assets/files/Women-and-Political-Leadership-Literature-Review-Solomon-Island_publicPDF3_3_2020.pdf

Mcleod, Elizabeth, Mae Bruton-Adams, Johannes Förster, Chiara Franco, Graham Gaines, Berna Gorong, Robyn James, Gabriel Posing-Kulwaum, Magdalene Tara, and Elizabeth Terk. 2019. "Lessons from the Pacific Islands–Adapting to climate change by supporting social and ecological resilience." *Frontiers in Marine Science*.

Murphy, F. F., S. B. Power, and Simon McGree. 2014. The varied impacts of El Niño–Southern Oscillation on Pacific island climates. *Journal of Climate,* 27**:** 4015–4036.

Nunn, Patrick, William Aalbersberg, Shalini Lata, and Marion Gwilliam. 2014. Beyond the core: community governance for climate-change adaptation in peripheral parts of Pacific Island Countries. *Regional Environmental Change,* 14**:** 221–235.

Nunn, Patrick, and Roselyn Kumar. 2018. Understanding climate-human interactions in Small Island Developing States (SIDS). *International Journal of Climate Change Strategies and Management,* 10.

OCHA 2017. "Pacific: Drought - 2015-2017." Geneva, Switzerland: UN Office for the Coordination of Humanitarian Affairs.

Paeniu, Luke, Viliamu Iese, Helene Jacot des Combes, Antoine De Ramon N'Yeurt, Isoa T. Korovulavula, Aliti Koroi, P. Sharma, N. Hobgood, K. L. Chung, and Ashmita Devi. 2015. "Coastal protection: Best practices from the Pacific." *The University of the South Pacific, Suva, Fiji*.

PACCSAP 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific 2014. Pacific Climate Change portal

Quigley, Nicholas, Sara G. Beavis, and Ian White. 2016. Rainwater harvesting augmentation of domestic water supply in Honiara, Solomon Islands. *Australasian Journal of Water Resources,* 20**:** 65–77.

Sanderson, David, and Laura Bruce, eds. 2020. *Urbanisation at Risk in the Pacific and Asia: Disasters, Climate Change and Resilience in the Built Environment*. Routledge: https://www.taylorfrancis.com/books/e/9780429290176/chapters/10.4324/9780429290176–2

Schipper, E. Lisa. 2006. Conceptual history of adaptation in the UNFCCC process. *Review of European Community and International Environmental Law,* 15**:** 82–92.

Secretariat of the Pacific Regional Environmental Programme 2010. Pacific Adaptation to Climate Change. Apia.Samoa

Solomon Islands Government. 2020. "*Demographic Statistics."* Honiara, Accessed October 20. https://www.statistics.gov.sb/statistics/demographic-statistics.

Solomon Times. 2020. "Access to Clean Drinking Water and Sanitation Lacking in Rural Areas." Accessed October 20. https://www.solomontimes.com/news/eu-supporting-efforts-to-improve-access-to-water-sanitation-and-hygiene-in-solomon-islands/10083

Solomon Islands Government. 2016. "Climate Adaptation in the water sector in Solomon Islands." Novus Ltd. Accessed October 20. http://www.mecdm.gov.sb/projects/donor-funded/115-solomon-islands-water-sector-adaptation-project-siwsap.html

Solomon Islands Government. 2016a. "About the Solomon Islands Water Sector Adaptation Project." Honiara. Accessed October 20. http://www.siwsap.org.sb/about-us.html

Solomon Islands Government 2016b. "National Development Strategy." Honiara. Accessed October 20. https://www.mpgis.gov.sb/about-us/resources/plans-policies/81-national-development-strategy-2016-35/file.html

Solomon Islands Government. 2016c. "Solomon Islands WASH Sector Analysis." Honiara.
Accessed October 2020.
https://sirwash.weebly.com/uploads/4/2/7/6/42764129/solomon_islands_wash_sector_analysis_-_final_05092016.pdf

Solomon Islands Government. 2015. "Water, sanitation and hygiene: A socio-cultural survey of communities of Guadalcanal and Savo Island." Honiara. Accessed October 28.

https://sirwash.weebly.com/uploads/4/2/7/6/42764129/2015_red_cross_sociocultural_survey_-_narrative.pdf

Solomon Islands Government. 2014. "The Solomon Islands Rural Water Supply, Sanitation and Hygiene Policy." Honiara. Accessed October 20. https://sirwash.weebly.com/uploads/4/2/7/6/42764129/rwash_policy_-_final.pdf

Solomon Islands Government. 2013. "Solomon Islands National Water and Sanitation Sector Plan." Honiara. Accessed October 20. https://www.pacificclimatechange.net/document/solomon-islands-national-water-and-sanitation-sector-plan

Solomon Islands Government. 2012. "Solomon Islands National Climate Change Policy: 2012 – 2017." Honiara. Accessed October 20. https://www.adaptation-undp.org/resources/naps-least-developed-countries-ldcs/solomon-islands%E2%80%99-national-climate-change-policy-2012

Solomon Islands Government. 2011. "Current and Future Climate of the Solomon Islands. Pacific." Climate Change Portal (PCCP). Accessed October 20. https://www.pacificclimatechangescience.org/wpcontent/uploads/2013/06/13_PCCSP_Solomon_Islands_8pp.pdf

Solomon Islands Government. 2008. "Solomon Islands National Adaptation Program of Action." Honiara. Accessed October 20. http://www.adaptation-undp.org/resources/assessments-and-background-documents/solomon-islands-national-adaptation-programme-action.

SPC. 2015. "Compendium of Case Studies on Climate and Disaster Resilient Development in the Pacific." Suva. Accessed October 20. http://gsd.spc.int/frdp/assets/case_studies_pacific.pdf.

SPC. 2012. "Freshwater Under Threat Pacific Islands: vulnerability assessment of Freshwater Resources to Environmental Change." Suva, Fiji Islands: Accessed October. 18. https://reliefweb.int/sites/reliefweb.int/files/resources/Freshwater_Under_Threat-Pacific_Islands.pdf

SPREP. 2020. "Pacific Adaptation to Climate Change (PACC) Programme" PACC Portal. Accessed October 23. https://www.sprep.org/pacc

SPREP. 2014. Vulnerability and adaptation (V&A) assessment for Ontong Java Atoll, Solomon Islands. Apia, Samoa.

SPREP. 2012. Pacific Environment and Climate Outlook. SPREP Library. Accessed October 23. https://www.sprep.org/attachments/Publications/PECCO_lr.pdf

SPREP. 2010. Pacific Adaptation to Climate Change: Kingdom of Tonga. SPREP Library. Accessed October 24. https://www.sprep.org/attachments/Climate_Change/PACC_Report_of_in-country_consultations_Tonga.pdf

Ssekamatte, David. 2018. The role of monitoring and evaluation in climate change mitigation and adaptation interventions in developing countries. African Evaluation Journal, 6: 1–9.

Stewart, Indira. 2019. Climate Change Hits Home as Solomon Islands Flood again. *Radio New Zealand (RNZ).*

Storlazzi C. D, S. B. Gingerich, A. van Dongeren, O. M. Cheriton, P. W. Swarzenski, E. Quataert, C. L. Voss, D. W. Field, H. Annamalai, G. A. Piniak, R. McCall. 2018. Most atolls will be uninhabitable by the mid-21st century because of sea-level rise exacerbating wave-driven flooding. *Science Advances,* 4:9741.

The World Bank. 2019. "Urban Water Supply and Sanitation Sector Project." World Bank Group. Accessed October 25. http://documents1.worldbank.org/curated/en/448081556809858039/pdf/Solomon-Islands-Urban-Water-Supply-and-Sanitation-Sector-Project.pdf

UNDP. 2017. "Midterm Review Report, 2017: Solomon Islands Water Sector Adaptation Project (SIWSAP.". Solomon Islands. Accessed October 20. https://erc.undp.org/evaluation/evaluations/detail/9217

UNICEF. 2017. Final Evaluation Improving WASH in Solomon Islands (IWASH-SI) Project. UNICEF. Accessed October20. https://www.unicef.org/evaldatabase/index_102655.html

UNICEF. 2018. WASH Sector Capacity Assessment Solomon Islands Solomon Islands

Valencia, Richard. (2010). Dismantling contemporary deficit thinking: educational thought and practice. New York: Routledge.

Weir, Tony, Liz Dovey, and Dan Orcherton, 2017. "Social and cultural issues raised by climate change in Pacific Island countries: an overview." *Regional Environmental Change*, *17*(4):1017–1028.

Winterford, Keren, Tamara Megaw, J. Chong, and A. Gero. 2018. "Gender Transformative Climate Change Action in the Pacific." Prepared for Plan International Australia by the Institute for Sustainable Futures, University of Technology Sydney.

WHO and UNICEF. 2019. "Progress on household drinking water, sanitation and hygiene 2000-2017: Special focus on inequalities." UNICEF. Accessed October 25. https://www.unicef.org/reports/progress-on-drinking-water-sanitation-and-hygiene-2019

WHO and UNICEF. 2017. A Snapshot of Water and Sanitation in the Pacific 2017 Regional Analysis of UNICEF Programme Countries Pacific Region: Pacific Community. Accessed October 25. https://www.unicef.org/EAPRO_Pacific_Snapshot_Final_2017_27_10_2017.pdf

Xenarios, Stefanos, Abror Gafurov, Dietrich Schmidt-Vogt, Jenniver Sehring, Sujata Manandhar, Chris Hergarten, Jyldyz Shigaeva, and Marc Foggin. 2019. "Climate change and adaptation of mountain societies in Central Asia: uncertainties, knowledge gaps, and data constraints." *Regional Environmental Change*, *19*(5): 1339–1352.

Authors' biographies

Noella Dorevella is completing a Master's degree at The University of the South Pacific (USP). Her Masters Research thesis is looking at "Evaluating the effectiveness of climate change adaptation interventions on water security on the Solomon Islands.

Dr. Hilda Waqa-Sakiti has over fifteen years' experience in the field of Conservation, Biodiversity and Environmental Management. Her research focuses on Nature-based solutions (NBS) towards adapting and mitigating climate change. She is currently a lecturer at the Pacific Centre for Environment and Sustainable Development (PaCE-SD), University of the South Pacific.

Tammy Tabe is a social anthropologist who has worked widely in the Pacific Islands region, specifically in the Solomon Islands, Fiji, Tuvalu and Kiribati. She currently works as a Lecturer at the University of the South Pacific with research interests on ecosystem-based adaptation, gender inequality, Pacific Islands epistemologies, historical relocations, identity, diaspora, and climate change migration and displacement.