

Indigenous Knowledge systems' role in addressing sea level rise and dried water source: A Fijian case study

Kolaia Raisele

La Trobe University, Melbourne

Rosiana Lagi

University of the South Pacific

Abstract

Global responses to the climate crisis continue to focus on Western theoretical perspectives and scientific solutions but overshadow community-based responses by indigenous communities. An effective response to the climate crisis in the Pacific Islands needs the Pacific Islanders' own story and their own response systems. This study will explore the role of Indigenous Knowledge Systems (IKS) in addressing sea-level rise (SLR) and dried water sources (DWS) drawing from a case study in Vatutavui village, Fiji. Using the methods of focus group discussion and individual interviews, the study will identify how members of Vatutavui village are responding to SLR and DWS using their Indigenous knowledge and practices. The paper will then weave the findings of this study together with contemporary discourses of social ecological resilience to the climate crisis. We discovered that Indigenous Knowledge System (IKS) continue to cement their significance in Indigenous Fijian villages, and it is a foundational response to the climate crisis. Placing emphasis on IKS in addressing the climate crisis in Vatutavui had positive ecological and social cultural implications.

Keywords: climate change, sea-level rise, dried water sources, indigenous knowledge systems, resilience, social ecological resilience, solesolevaki

Introduction

Indigenous groups across the globe have different worldviews that are based on deep understandings of the natural environment and of people's everyday lives. Over time, the knowledge gained from Indigenous people's day to day activities and phenomenological experiences has given rise to what is termed 'traditional knowledge' (Bruchac, 2014) or, in the context of this paper, 'indigenous knowledge systems' (IKS). IKS refers to the essence of the identities and world views of Indigenous peoples, and it constitutes the collective heritage and patrimony of those peoples. It is preserved in collective memory and Indigenous people's community teachings that emanate from the need to survive (Augustine, 1997). Through IKS, indigenous people are in direct and indirect contact with the environment and its changing climate (Lemi, 2019). From direct contact in terms of detailed knowledge of plants, animals and natural phenomena, to indirect contact such as the indigenous weather forecasting systems. Therefore, as Lemi argued, it is important to incorporate IKS into contemporary Climate Change (CC) adaptation discourses. Indigenous communities, especially climate change frontier communities, have historically lived in areas that have had rapid environmental changes and they have developed a broad-scale adaptation of IKS strategies to these changes.

Over the years, different communities have had different experiences and perceptions of climate change. Indigenous communities have always been at the forefront in having sound knowledge of climate variations and their impacts. Indigenous communities are not only passive observers of climate change, but their daily lives and activities also revolve around the changing climate (Macchi et al., 2008). New climatic conditions prompt Indigenous communities to develop techniques to adapt to these changing conditions. This has resulted in many Indigenous communities holding IKS specifically oriented towards climate change, that is tested by trial-and-error and orally transmitted or shared through practical experiences from one generation to the next (Berkes et. Al., 2000; Xu & Rana 2005, Byg and Salick, 2009). Many Indigenous societies have forecasting techniques for anticipating extreme events such as changes to sky color, changes to winds, fruiting times and bird and animal behavior. These aspects of their knowledge enable communities to prepare for climate change disasters while reducing their vulnerability and increasing their resilience.

As climate change becomes the greatest threat to Pacific Islanders' livelihoods, there is a need to recognize the Indigenous communities' Indigenous Knowledge Systems (IKS) as a whole in addressing ecological and environmental challenges in the Pacific Islands is now more important than ever. IKS of climate change has been tested and proven to be effective over millennia. As such, it is important now, more than ever, for Pacific communities to document and advance their perceptions, experiences and community-driven solutions of climate change and its impacts. It is in this view that this study aims to advance an understanding of Indigenous Fijians' use of IKS in developing and implementing climate change adaptation strategies, specifically on sea-level rise (SLR) and dried water sources (DWS) through a focused case study of Vatutavui village, Fiji. The study will be guided by two research questions; What are the community's perceptions and experiences of climate change? What are the impacts of climate change in Vatutavui and how are members of the community responding to these impacts?

In this study, the term *iTaukei* is used to refer to the Indigenous people of Fiji whose specific population possess a unique knowledge of their environment. Developed from experience gained over the centuries and adapted to the local culture and environment, *iTaukei* IKS is transmitted through oral narratives from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language and agricultural practices including those relating to environmental management.

Literature review

The following literature review will explore Indigenous communities' perceptions and experiences of climate change from a global perspective, Small Islands Developing States' (SIDS) perspective, and Pacific Islands Countries & Territories (PICTs) perspective. At the same time, it will explore how these Indigenous communities are responding to climate change impacts using IKS to foster mitigation and adaptation strategies, and to maintain social-ecologically resilient communities.

Perceptions and experiences of climate change in Indigenous communities

Global level

Different Indigenous communities have different experiences and perceptions of climate change. A study conducted in the Eastern Himalayas showed how two Indigenous communities that have a very strong relationship with their natural surroundings have had to develop adaptation strategies due to climate change effects, such as less snow, shorter winters, and erratic rainfall (Ingty and Bawa, 2012). Normally, the two Indigenous communities of this study, Lachenpas and Dokpas, depend on the changing seasons for livestock grazing, and their livelihoods in general. However, interviews with the people of these two communities indicated that unpredicted climatic conditions such as shorter winters and erratic rainfall have affected their livestock farming and biodiversity (Ingty and Bawa, 2012). The study also revealed that traditional indicators of climate change are being altered, such as delay in the flowering of plants, and the presence of warmer climate species such as mosquitoes. Another study by Singh et al (2010) has also indicated that the warming in the Himalayas has been proven scientifically, and it is warming more than the global average rate.

Studies conducted in Himachal Pradesh India have also shown that rapid change in climatic conditions such as the spike in temperatures during summer, shorter winter periods, and unpredictable rainfalls have affected the livelihoods of farmers in this local area (Asian Development Bank, 2010; Rana et al., 2013). The Indigenous people's perceptions and experiences such as the increase in temperature in summer and winter, insufficient rainfalls, increase in droughts and floods and low crop production corresponded with the state's meteorological record (Rana et al, 2013). A similar study conducted in five rural communities in Ghana concluded that Indigenous farmers are changing their traditional livelihoods due to the impacts of climate change on their crop production (Cobbinah and Kwadwo Anane, 2015). These Indigenous communities can no longer depend on their IKS as it is uncertain whether conditions such as erratic rainfalls and droughts have changed their traditional ways of living (Cobbinah and Kwadwo Anane, 2015). Ethnographic interviews with nine Indigenous communities of Northern Alaska, along with participant observation, have also shown that climate variation in the past few years are not consistent with the normal ranges of variation, as Indigenous communities would expect (Carothers et al, 2014). Therefore, these Indigenous communities perceive climate change as manifested by the inconsistency of changes in the weather and traditional seasons. There is a widespread consensus that climate change is affecting Indigenous communities directly and changing their ways of living, knowing and being.

Most Indigenous communities' perceptions and experiences of climate change are consistent with scientific observations (Singh et al, 2010; Perez et al, 2010; Marengo et al, 2011; Altschuler and Brownlee, 2015), but there are some exceptions. For example, the Quechua farmers of Bolivia believe that climate change is linked directly to human moral and spiritual behavior, and are caused locally (Boillat and Berkes, 2013). The Quechua also interpret climate change as a reaction by natural or spiritual entities, and there are complex factors of causality (Boillat and Berkes, 2013). Some

Indigenous peoples, such as the Quechua acknowledge the uncertainty and unpredictability of the changing climate, and they are not 'helpless' as Western science often suggests. Similarly, a study conducted by Pat and Schroter (2008) report that local farmers in Mozambique attribute climate change impacts to supernatural factors such as their gods and ancestors being unhappy. Therefore, not all perceptions and experiences of climate change in Indigenous communities echo scientific explanations, as some are generated through lived experiences, through analogies between natural phenomena and living beings, and even supernatural factors.

Small Island Developing States (SIDS) level

In addition to the ongoing social and economic challenges that Indigenous communities in Small Island Developing States (SIDS) and Pacific Islands Countries & Territories (PICTs) face, they are increasingly becoming vulnerable to the impacts of climate change (IPCC, 2007; Kelman & West, 2009; Nurse et al., 2014). For most Indigenous communities in SIDS, sea-level rise (SLR) is one of the most devastating effects of climate change (Kelman and West, 2009; Church & White, 2011). These communities are the most vulnerable due to their low-lying coastlines (Taylor et al, 2012; Altschuler and Brownlee, 2015; Nunn and Kumar, 2018; Thomas et al, 2020). Some of the climate change stressors that small islands face include SLR, increased coral bleaching, and impacts on terrestrial biodiversity on islands (Nurse et al., 2014; Bush, 2018). The SLR is one of the widely recognized climate stressors and is linked directly to the continuous emissions of anthropogenic greenhouse gases and global warming (Zickfeld et al, 2017). Walshe and Stancioff (2018) suggest that it is important to consider the perceptions on and experiences of climate change of these islands as they are the first to suffer the adverse effects of climate change and they offer valuable contributions to the understanding of this. This understanding will influence the nature of actions taken at the community level in regards to adaptation, mitigation and resilience (Walshe and Stancioff, 2018).

Added to sea-level rise, Kelman (2018) suggest that communities in SIDS also experience ocean acidification and changes in their ecosystems that will eventually affect their food and water supply. Kelman's work indicated that various climate change narratives of SIDS communities are based on assumptions that are rarely tested. These include the idea of 'forced movement' or 'climate refugees' which are frequent references in some sections of the media and some of the academic literature, but which may be contested (Kelman, 2018). Kelman highlights that movement, whether climate-related or not, has always been part of SIDS people's lives, and has long occurred for many reasons. Instead of being labelled as 'helpless' or 'climate refugees' as a result of climate change, Kelman (2018) argued that communities in SIDS seek to control their fate and will always be able to rely on their IKS while dealing with environmental changes as their ancestors have. In addition, understanding the experiences and perceptions of climate change in SIDS communities will address the growing misattribution of the ways these communities have responded to climate change. For example, the study by Altschuler and Brownlee (2015) conducted in Providence Island, Columbia reported that although most participants have an awareness of climate change causes and impacts that are attributed to their lived experience, some misattribute climate change impacts such as the disposing of garbage and sewage.

Pacific Islands Countries and Territories (PICTs)

In PICTs, studies have also been conducted on Indigenous communities' experiences and perceptions of climate change. For example, Beyerl et al (2018) conducted a survey study in Tuvalu, Samoa and Tonga of perceptions on the impacts of climate change found that "drought, cyclones, flooding, erosion, and associated impacts on health, property, and finances" (Beyerl, 2018: 38) as key impacts that need to be addressed. Respondents from Tonga and Samoa of this study suggested relocation due to flooding and erosion as part of adaptation strategies. Tuvalu respondents, on the other hand, named drought as the main climate stressor that is affecting their daily life the most. Also, the study concluded that some respondents do not feel 'helpless' as some sources have suggested (Farbotko, 2005; 2010; Farbotko and Lazrus, 2012; Shea et al., 2020). Indigenous Pacific Islanders can cope with climate change impacts and have their culture of 'sharing and caring' to foster adaptation strategies.

In Vanuatu, Perumal (2018) conducted qualitative fieldwork on ni-Vanuatu perceptions on climate change and discovered that although there is a wider acknowledgement of the imminent impacts of climate change, relocation due to climate-related events is their last resort. Even if relocation were to occur, internal relocation will be preferable rather than cross-border relocation. This is due to the close connection and support systems that ni-Vanuatu have with their culture and land. For ni-Vanuatu, as for most Pacific Islanders, land has literal and symbolic meanings (Tuwere, 2002) that outsiders may find difficult to understand (Campbell, 2010). To ni-Vanuatu communities, land is inextricably linked to their identity, social networks, connections, and culture (Perumal, 2018; Campbell, 2019). Perkins and Kruse (2018) also found in their study in Yap State, Federated States of Micronesia (FSM), that if residents from outer islands were to relocate to the mainland as a result of climate stressors, they will rely on a traditional support system called the sawei system. The sawei system "is a bicultural system of tribute offerings, gift exchange, and disaster relief" (Hunter-Anderson & Zan, 1996: 1). This system "ensures everyone obtains what they need to survive" (Perkins and Kruse 2018: 73). Therefore, local communities' perceptions are important, not only in guiding actions for adaptation strategies, but also in understanding their perceptions of potential relocation. The 'climate refugee' narrative that has often been argued by some major media outlets (e.g., McNamara and Gibson, 2009; Perumal, 2018), and the association of 'islandness' with vulnerability (Kelman and Khan, 2013; Walshe and Stancioff, 2018) do not always align with communities' own experiences and perceptions. Even if relocation did take place as a result of climate change, it is likely to be a last resort (McNamara and Gibson, 2009; Perumal, 2018). For example, in Vunidogoloa village, Fiji, "relocation was their option of last resort as a means of sustaining livelihoods in the long term" (McNamara and Combes, 2015: 317).

From studies discussed above, it is apparent that Indigenous communities' perceptions and experiences of Climate Change, and their willingness to adapt to climate change, and to mitigate its effects, have contributed to their resilience. It is also noted from these studies that Indigenous communities facing Climate Change impacts continue to survive, adapt, or transform in the face of change. Folke et al. (2016) termed this social-ecological resilience. Adapting to the impacts of natural disasters and climate change will require cross-level interaction and cooperation of different social-ecological systems. A study by Adger et al. (2005), for example, explored two case studies on social-ecological resilience in coastal areas. The first case study was on the 2004 Asian tsunami in South and Southeast Asia coastal areas, and the second one on severe storms and climate change in coastal zones and on small islands. In these coastal areas, the vulnerability was reduced and resilience was enhanced due to adaptive strategies that involved "the mobilization of assets, networks, and social capital both to anticipate and to react to potential disasters" (Adger et al., 2005: 1037). In one of the case studies

in Adger et al., fishing communities on Simeulue Island, west of Sumatra, Indonesia survived the 2004 Asian tsunami due to inherited local knowledge of tsunamis and preparedness for disasters. This positions local knowledge as a primary source of social-ecological resilience in those communities. The second case study by these authors describes how the Cayman Islands community has implemented adaptation strategies for hurricanes as a result of past experiences of such major events that had economic and ecological impacts. These adaptation strategies include transformations in local and community actions, multilevel social networking, and institutional policy interventions that will allow the coastal ecosystem to regenerate after disasters and for individuals and communities to maintain their livelihoods. Thus, both case studies proposed the importance of local peoples' knowledge, sometimes referred to as traditional/indigenous knowledge of resilience to climate disasters.

Indigenous knowledge on climate resilience in the Pacific

Global attention to the role of Indigenous knowledge in climate change adaptation and mitigation has increased recently as such knowledge continues to be recognized in global policy frameworks such as the 2003 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage (UNESCO, 2003). In the Pacific Islands, thirteen of the fourteen Pacific Island states have ratified the Convention as of July 2020. Including these Pacific states, special attention to the inventorying of IKS has been placed on identifying indigenous knowledge “related to natural disasters and the effects of climate change, as well as how these activities can be integrated into reducing disaster risk and adapting actions for climate change” (UNESCO and ICHCAP, 2013: 6). Inventorying of intangible cultural heritage (ICH) is one of the key elements of the 2003 Convention where each State Party shall draw up, in a manner geared to its own situation, one or more inventories of the ICH present in its territory. (UNESCO, 2003). In some Pacific states, inventorying exercises of ICH have shown that some Indigenous ecological knowledge contributes to climate change adaptation and community resilience (UNESCO and ICHCAP, 2013). This can be seen, for example, in the traditional support systems such as the Sawei system of the Federated States of Micronesia (FSM). The Sawei system “is a bicultural system of tribute offerings, gift exchange, and disaster relief” (Hunter-Anderson and Zan, 1996: 1). This system “ensures that everyone obtains what they need to survive” (Perkins and Kruse 2018: 3). This shows that Indigenous ecological knowledge is crucial not only in maintaining cultural identities and ontological security in Indigenous communities, but also in allowing these communities to develop adaptive models to cope with the changing climate (Kim, 2011) and build resilient communities.

In the Pacific context, the focus of resilience studies is on the experiences of Pacific people in terms of the climate crisis and natural disasters. In Pacific communities, resilience is often built on the foundations of existing social structures, communal values and spiritual beliefs. Ratuva (2014) has highlighted five resilient mechanisms for social protection in the Pacific that have enabled Pacific people to create new ways to adapt to the challenges they face. These include kinship, reciprocity, communal obligations, communal labour and land. As Ratuva articulated, kinship in the Pacific Islands continues to offer collective support and response to people's needs whenever there is a crisis. Offering support to fellow kin during and after a crisis is viewed as carrying out people's kinship obligation to the community welfare and spirit (Ratuva, 2014). Ratuva concluded that cultural institutions in the Pacific play very important roles in providing resilience mechanisms for the

communities. Similar to Ratuva's study, the works of McMillen et al. (2014) and Walshe et al. (2018) also proposed traditional knowledge and practices as a major component of Pacific people's livelihoods and have provided further affirmation of the importance of such knowledge and practices for communities' responses to climate change and its challenges. Studies by Fujieda and Kobayashi (2013) and Aquino et al. (2021) on indigenous Fijian knowledge of bure (traditional housing) have also confirmed the important role of Indigenous knowledge in building resilience, and how such Indigenous knowledge-based resilience measures should be incorporated into post-disaster reconstruction frameworks. In the context of the literature surveyed here, it is envisioned that this paper will contribute to understandings of the role of Indigenous knowledge systems, engaging with a case study in Vatutavui village in Fiji, to show how such knowledge in this area can create pathways for Indigenous communities to persist and adapt or transform in the face of climate change impacts

Background

Vatutavui is a coastal village in Tavua District located in the western part of Viti Levu, Fiji with a youthful population of 420. It is surrounded by rocky hills and grassland. The main land use activities include mining, commercial sugarcane cultivation and animal husbandry (goats, cattle and poultry). The villagers' main sources of income are fishing and farming. Vatutavui is located in the leeward side of Viti Levu, and as such is drought prone. One of the main environmental issues experienced in Vatutavui is the drying of its watershed. This is exacerbated by long droughts, unnecessary burning and the slash and burn farming practice implemented by the villagers. The main source of water is from bores and made accessible to the villagers through water tanks. As such, the villagers are dependent on the village water catchment. However, the water catchment is drying, and is mixed with sea water.

To restore the Vatutavui watershed and prevent saltwater intrusion, a group of staff and research students from the University of the South Pacific (USP) carried out a Participatory Action Research (PAR) project in the village, starting in October 2021. Through the PAR, the people of Vatutavui and the USP research group carried out veitalanoa focus group discussions to ascertain the causes of the drying of the watershed and saltwater intrusion, collaboratively create nature-based solutions and, together, implement synchronized traditional and conventional strategies to restore their watershed.

Methodology

This study draws on a qualitative methodology using Participatory Action Research (PAR) to explore Vatutavui villagers' perceptions and experiences of Climate Change in their community, and how they are responding to its impacts using IKS. PAR was adopted as this study was part of a three-year Global Challenges Research Fund -supported research project which aims to support local action on climate change in Fiji through participatory action research. This was facilitated by the University of the South Pacific PAR team.

PAR promotes the full involvement of the participants and the researcher in identifying the research topic of interest, creating relevant intervention(s), implementing the intervention(s) and monitoring, assessing and learning from the PAR to ensure change (Benjamin-Thomas et al., 2018). One of the main aims of adopting PAR in this study is for the Vatutavui community members themselves to define their perceptions and experiences of climate change, to identify and analyze the main impact of climate change affecting their livelihoods, and for community members to propose solutions and

community interventions. As highlighted by MacDonald (2012), PAR empowers community members to actively take part and contribute to research rather than being subjects of research.

Methods

In keeping with the PAR approach, three methods were employed to ensure direct and active collaboration of researchers and Vatutavui village members. These methods also ensured data source triangulation. The three methods were:

- Community Engagement Protocol (CEP)
- Focus group discussions (FGD) or Veitalanoa (in indigenous Fijian context)
- Individual interviews (II)

Community Engagement Protocol (CEP)

This study uses the Community Engagement Protocol (CEP) adapted from the Fijian Vanua Research Framework (FVRF) developed by Nabobo-Baba (2006). The CEP by Nabobo-Baba outlines the indigenous Fijian processes, traditions and protocols that must be followed when conducting research in indigenous Fijian communities. As Vatutavui is a Fijian Indigenous community, it is culturally appropriate to adopt the FVRF CEP so that interpersonal relationships and active collaboration with participants are established. The CEP that was followed for this study included:

- Sevusevu – an indigenous Fijian cultural protocol where the researchers presented a bundle of yaqona to the village chief and elders. This protocol was conducted to traditionally seek approval and blessings for the study to be carried out. This protocol also ensures community members' active participation and ensures the research team pays attention to ethics and reflexivity when accessing the issue and interventions raised.
- iTatau – Similar to the sevusevu, this protocol also involved the presentation of yaqona to the village chief and elders as a means to traditionally acknowledge the work that has been done and to seek their blessings for the safe return of the researchers. However, since this study adopted the PAR as part of the three-year Global Challenges Research Fund-funded research project, this does not mean that the researchers will not return. The PAR research team will continue to actively engage with village members in terms of education and other community interventions related to climate change. In each village visit, both the Sevusevu and iTatau will be followed as these are crucial to the CEP.

Focus group discussions (FGD) or Veitalanoa (in Indigenous Fijian context)

Participants were grouped according to their gender and age, then were provided with the research questions to guide their discussion. They were given thirty minutes to discuss each question and present their discussion to the whole group. Culturally, this is an acceptable way of exchanging views as participants are able to validate each other's information as well as learn from each other. In addition, it gives confidence for each member of the group to share and validate their opinion first among their peers and the same gender before sharing it to the whole group. Participants for FGD include:

- Ten men (Age 35+)
- Twenty women (Age 35+)
- Twenty youth (male & female; Age 15 – 35)

Individual interviews

For a deeper understanding of the points discussed in the FGD and for data triangulation, key members of each group (men, women, and youth) were selected for an interview with a researcher on the same research questions after the FGD. The individual interviews were carried out in the vernacular, and video recorded for documentation purposes. In some cases, the interviewees would speak in their dialect as such, and translators from members of the community were requested to assist with verbatim transcription.

Data from FGD and individual interviews were documented using a voice recorder and video camera. These raw data were then transcribed verbatim and translated to English. These transcribed data were then coded and analyzed separately.

Findings

Combining the two methods of focus group discussion (FGD) and individual interviews allowed data source triangulation for the study. Data source triangulation is a type of triangulation in qualitative research that “involves the collection of data from different types of people, including individuals, groups, families, and communities, to gain multiple perspectives and validation of data” (Carter et al., 2014: 545). Focus group discussions enable participants to share various perspectives on a given topic (Morgan, 1996), whereas individual interviews allow the researcher to explore a particular theme in-depth (Fontana and Frey, 2000). Adopting two methods, FGD and individual interviews also allows data validity. Guion et al. (2011) highlight that when “conclusions from each method are the same, then validity is established” (Guion et al., 2011: 2). Findings from FGD and individual interviews were at first coded and analyzed separately, and then similarities and differences were identified and synthesized.

Perceptions and experiences of climate change from focus group discussions (FGD)

Participants of this PAR project are iTaukei (indigenous Fijians), thus FGD’s questions were first translated into the iTaukei language and distributed to the three focus groups. The raw findings gathered from the focus group discussions were later analyzed in the process of initial coding whereby keywords or phrases were tabled and translated into English. This is presented in Table 1 below, which presents the findings from the FGD:

Table 1. Initial coding – data extract from focus group discussions

Question	Group 1: Men	Group 2: Women	Group 3: Youth
What is your understanding of climate change?	- Hot weather due to excessive deforestation. - sea-level rise - climate change cannot be predicted thus	- climate change is weather changes that have not been experienced before. For example, sea-level rise and increase in earth’s surface temperature.	climate change is: - sea-level rise - increase in temperature - prolonged period of drought - fewer fish caught and

	affecting the health of people.		- less rainfall
From your understanding, what causes climate change?	<ul style="list-style-type: none"> - people are no longer practicing subsistence farming, but are buying canned-food from shops. - Humans cause climate change due to burning hills and farmlands. - Resources that were abundant before are no longer now (on sea & land). 	<ul style="list-style-type: none"> - Maybe it is God's will - Earth's atmosphere is filled with GHGs from large factories thus trapping more heat which leads to the melting of ice and rise in sea level. - cutting down mangroves. 	<ul style="list-style-type: none"> - GHGs from factories and industries - Excessive amount of GHGs in earth's atmosphere which has depleted the ozone layer and allowed harmful rays into earth's atmosphere. - Deforestation and burning of trees. - polluting ocean and water sources.
What are some of the impacts of climate change on your community?	<ul style="list-style-type: none"> - Salt water intrusion into farm and water sources due to sea-level rise. - surroundings are polluted - Current weather changes do not coincide with the traditional farming seasons. - Traditional practices of farming and respect are slowly fading away. 	<ul style="list-style-type: none"> - The rise in sea level has claimed parts of the community boundary. - Fish and crabs that were once abundant before are no longer. - it impacts culture and traditional way of life as current community elders can no longer predict weather changes using traditional weather indicators. The traditional ecological knowledge of the community is affected. - Climate change has affected food supply for community households. The shortage of food due to climate change impacts on farming and fishing practices have resulted in social issues such as domestic violence. 	<ul style="list-style-type: none"> - Longer period of drought has resulted in hardened-soils thus impacting the farming practices and food supply of the community. - There is less forest surrounding the community compared to previous times. - soil erosion - dried water sources to prolong droughts. <p>At sea:</p> <ul style="list-style-type: none"> - Decrease in the number and sizes of fish being caught. - Fish and sea creatures that were once within the community's atoll and lagoon are no longer seen. - oil spill from engine boats and container ships - Traditional cultural practices are slowly fading.
What can be done to address climate change or address its impacts?	<ul style="list-style-type: none"> - Plant mangroves - The use of boreholes to address water issues in the community. - Revitalize subsistence farming and reduce buying and consuming canned food. 	<ul style="list-style-type: none"> - Plant more mangroves. <p>Recommendation to COP26:</p> <ul style="list-style-type: none"> - All countries should be given X number of trees to plant. If a country does not meet this number, they should pay a certain 	<ul style="list-style-type: none"> - Plant more mangroves - Plant more trees <p>Recommendations to Cop 26:</p> <ul style="list-style-type: none"> - reduce the manufacture of motor vehicles. - Reduce the number of factories and industries.

	<ul style="list-style-type: none"> - There needs to be a greenhouse for the community for plant seedlings. - Reduce GHGs emissions and incorporate the use of solar energy in large factories. - Incorporate issues of climate change and how to reduce GHGs emission into schools' curriculum. - Attend church and follow the will of the word of God. 	amount of money as punishment.	
What do you propose could be another way of addressing the climate change issue you have highlighted in (3) above? Why?	<ul style="list-style-type: none"> - Communal labor - Reforestation - Re-planting mangroves as wave breakers 	<ul style="list-style-type: none"> - Reforestation - Avoid unnecessary deforestation. - Avoid burning farmlands 	<ul style="list-style-type: none"> - Reforestation - Build seawalls - Replanting of mangroves

Perceptions and experiences of climate change from individual interviews

Findings from individual interviews were also transcribed verbatim and coded initially according to the research questions. Table 2 below outlines the initial coded data of individual interviews:

Table 2. Initial coding – data extracted from individual interviews

Leading Interview question	Village headman	Village nurse	Youth representative
Perceptions of climate change	- long periods of drought and sea-level rise as seawater inundated the village during high/king tides	- dried water sources, saltwater intrusion into the village	sea level rise, fewer fish on fishing grounds, poor water supply, frequent burning of farmlands and forest areas, water pollution, loss of cultural values known to the community.
Causes of climate change	Burning of farmlands, deforestation of mangroves	- burning farmlands, cutting down mangroves.	- GHGs from industries, oil spillage from ships, deforestation of native forest.
Impacts of climate change in the community	Seawater has claimed parts of the village,	Prolonged droughts, seafood sources are not abundant like before,	Food sources on land and sea are becoming difficult to gather (fish,

		seawater flows directly into the village during king tides.	seafood), dried-up farmlands, water-cuts from prolonged droughts.
Interventions to address climate change impacts.	Individuals drive on self-awareness, community engagement, trust, cooperation (<i>solesolevaki</i>) to plant more mangroves.	Involvement of all community members (<i>solesolevaki</i>). Collaboration with outside organizations to assist with awareness and supply of seedlings for reforestation.	Challenges off climate change are taken lightly. This can be addressed through frequent visits and more awareness. Community empowerment from local elders and leaders on the need for continuous community engagement (<i>solesolevaki</i>) on replanting mangroves (as a seawall) and native plants.

The two tables above have shown that the interactive process of data analysis through coding is a meticulous exercise. It requires careful observations and note-taking during focus group discussions and analyzing audio and video recordings of these focus group discussions.

Based on the focus group discussions and individual interviews, it is apparent that the community's perception and understanding of climate change and its associated issues are restricted to their personal experiences. This is illustrated in Tables 1 and 2 presented above. Notably, the youth focus group exhibited a more comprehensive understanding of the causes of climate change, possibly due to their exposure to education on this topic during their secondary school years (Years 9 to 13)

In one of the focus group discussions, a representative of the men's group highlights that his perceptions and understanding of climate change and its related issues are solely based on his daily experiences.

“Na draki veisau, o au na noqu kila madaga, o au kila tuga na ka ga au sotava tu. Na ka ga au sotava tu ena veisiga au sa nanuma tu ga ni sa okoya ga oya na draki veisau. Vabibi o keitou na yasayasa vaRa, na ka ga keitou dau kila tuga mai, ni ono ga na vula dau tau kina na uca, ono na vula dau tarai keimami na mamaca. Veiveisau ga oya keimami kila. Ni sa yaco na veivakararamataki, au raica kina ni levu tale na ka e tu tale. E rabailevu kina na noqu kila me baleta na draki veisau.” (Climate change, to my understanding, is based on what I experience. What I experience every day in regard to climate, is climate change to me. Especially for us in Western Fiji, what we have always understood is that the first six months are rainy period, and the next six months are dry months. Now that we have been made aware of climate change and its related issues through this PAR, I have come to understand that climate change is complex. It has widened my understanding of climate change). **(Vatutavui village headman, personal communication, December 11, 2021).**

Discussion

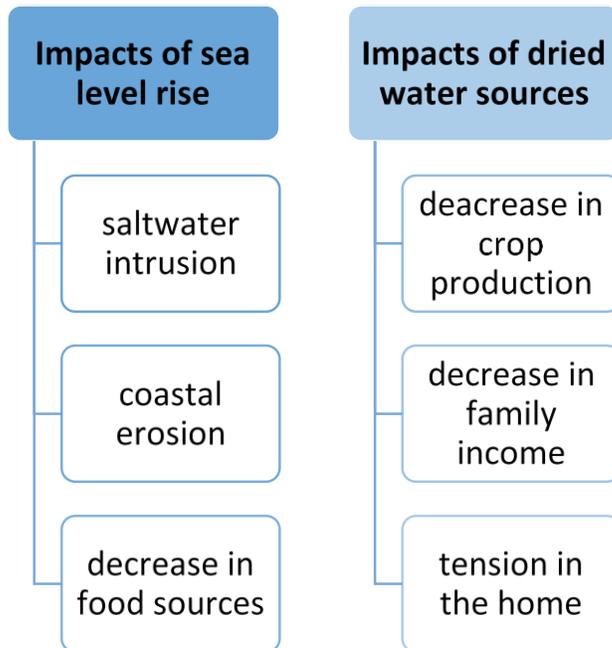


Diagram 1. Summary of discussion

The impacts of climate change that the Vatutavui community faces include rises in sea level, dried water sources due to prolonged droughts, and saltwater intrusion on community's food and water sources. These were voiced out during FGD, and individual interviews as shown in Tables 1 and 2. As articulated by one of the focus groups, sources of food and income from the sea are also on the decline.

“Na vanua e sega ni dau yacova mai na waitui mai na gauna iliu, gauna qo sa yacova mai. Kina iyaubula, na qari kei na ika ena baravi qo, sa sega ni vaka eliu, ka sa yali yani vakamalua.” (Sea level has risen to a level that we did not see happening in the past. This is a result of climate change in our village and we have witnessed this happening to our beloved village. With regards to marine life, crabs and fish that used to be seen in our shores are slowly declining in numbers). **(Vatutavui men's group representative, personal communication, December 11, 2021)**

As Vatutavui is a coastal village with a sea level of about two metres high, the village is exposed to flooding during king tides and saltwater intrusion. As such, parts of the village along the coast have eroded and food sources have been affected. Consequently, affecting the diet and health of the people of Vatutavui. In addition, the number and sizes of fish and marine resources have decreased as the sea is contaminated with waste from land. Consequently, the people of Vatutavui have to go further out to sea and spend more time trying to collect sea resources for sale and for family consumption.

It was noted from the participant responses that climate change has social and cultural impacts on communities. As the source of food and income has been reduced drastically, this has created tensions in the homes, causing conflicts and violence. According to the participants, the cultural values of

respect and sharing have been lost as there are not enough food resources to share. As noted by one of the focus groups, climate change impacts have resulted in tension within the family.

“So na qase, era sa sega ni kidava rawa tiko eso na vakatakilakila ni dua na draki e vakarau yaco mai. Na vakatakilakila ni dau yaco mai, eda na kila sa varau tau na uca, sa voleka na cagilaba. Sa levu ga noda varorogo na retio, veika dau tukuni na walesi eda sa qai kila tu ni sa voleka na uca, cagilaba. Sa da sega ni kidava rawa tiko ni sa voleka na cagilaba se na uca. Kena karua, na vakarau ni rawaka ena loma ni vuvale me baleta na veika e laukana tiko ena loma ni matavuvale esa sega ni veiraurau ena loma ni matavuvale ka vakavuna tiko na tiko yavavala.” (Today the elders in our village cannot predict the weather like our ancestors. Some indicators can tell us whether it is about to rain, or a cyclone is coming. At present, most of the time we rely on the radio for weather bulletins. Firstly, we are not able to realize the weather indicators around us that imply there is a cyclone coming or there is going to be rain. Secondly, the sources of food for the family are not enough to feed all members. Most of the time, there are family tensions as there are not enough resources to meet the needs in the family. **(Vatutavui men’s group representative, personal communication, Dec 11, 2021)**

As is evident from the above discussion, family tension arises when there is a scarcity of resources to sustain the household. In Vatutavui village, extended periods of drought and depleted water sources have impeded the cultivation of root crops. Even when such crops are planted, they yield subpar returns owing to arid soil conditions. Consequently, households that depend on agriculture as their primary source of income are compelled to seek alternative means of subsistence, which do not necessarily offer a dependable stream of income. Similarly, income streams stemming from marine activities are also dwindling. These factors exacerbate family tension as expounded upon earlier.

In addition, climate change has affected the traditional weather interpretation by the community. Elders of the village in the past were able to interpret weather indicators, which allowed preparation, whether it be for a cyclone or heavy rain. At present, the unpredictable changes in weather have resulted in the loss of knowledge of traditional weather interpretations.

Indigenous Knowledge Systems’ Response to SLR & DWS



The Vatutavui's Indigenous Knowledge and Skills are readily available and have been effective over the years. As such, to address the impacts of climate change on their vanua, they resorted to the use of the remaining traditional practices that they can remember, weaving them together with conventional practices where relevant. Some of the traditional practices and conventional ones that were used are as follows:

i. Vanua Sauvi restriction of the use of marine area

In 2019, certain designated zones within the Vatutavui iqoliqoli (a traditional customary fishing area) were subjected to a temporary closure lasting one year. This measure aimed to enable the restoration of marine resources. Subsequently, a traditional ceremony was conducted to disseminate information about the imposed taboo to all community members. There are penalties for those that break such taboo. Usually, any penalty was decided by the Chief. However, the vanua also has its own way of punishing the perpetrators. According to one of the elders, baskets of fish were harvested from the restricted area when the restriction was lifted a year later. These would then be shared among community households as well as being sold to meet the financial needs of the community.

ii. Solesolevaki – communal organised activities

Another cultural practice that was implemented by the people of Vatutavui was solesolevaki of reforestation. This social practice has always been part of Indigenous Fijians' ways of living and being. It has been the center of development in Fijian communities in the past and present (Raisele, 2021). This is the cultural practice of engaging in activities communally or as a group. In doing so, the group hopes to achieve more work. Solesolevaki involves prior planning and continuous collective work so that the group's goals are achieved. In this study, the participants' aims were to replant mangroves along shorelines and restore watersheds through reforestation of hills and farmlands. As such, the community organised themselves into their mataqali clans and replanted native fruit trees and mangroves. This communal approach to reforestation was conducted fortnightly from August 2021 to July 2022. Six months after the first plants were cultivated, trees have grown up to a metre and a half, the water sources are slowly recovering and coastlines are rehabilitating, thus preventing sea water intrusion.

In addition, the community-proposed intervention of afforestation through solesolevaki also yielded positive outcomes for the sociocultural development of Vatutavui village. This is due to the social practice of solesolevaki that allows community members to come together and contribute to the socially inclusive development of the village. From the USP PAR observations, some impacts of solesolevaki on the inclusive social development of Vatutavui village included:

1. Community engagement and trust
2. Social cohesion and inclusion
3. Cooperation

iii. Lotu or Spirituality

Traditionally, Indigenous Fijians worshipped ancestral gods to seek prosperity in their vanua. Since the introduction of Christianity in the 1830s, the majority of the Fijians worship the Christian God. As such, in Vatutavui, to seek prosperity and protection, the people would conduct evening worship and talanoa about the causes of sea level rise and ways in which they can mitigate it. These sessions have proven successful as the villagers are more aware of climate change and its impacts on sea level. More so, the community's perception of climate change has transformed as they have taken more

responsibility for ensuring that they mitigate sea level rises by replanting fruit trees and mangroves along the coast, and they have stopped the use of slash and burn farming, and also the use of dynamite for catching fish.

iv. Traditional farming practice

The people of Vatutavui rely on food crops as a staple. To ensure the retention of high nutrition in food crops, the elders in the community taught the young men and women of Vatutavui how to grow sweet potatoes using a traditional approach. Sweet potato is a salt tolerant crop that takes less than three months to mature for harvest. It is usually planted as a kakana ni cagi laba (food for during and after a cyclone). To preserve the nutrients in the soil and sweet potato, the elders placed a mixture of charcoal on the sweet potato mound.

From the discussion above, it is clear that Vatutavui village members are drawing from their Indigenous knowledge to address the impacts of climate change. The community has positioned their IKS as their primary source of social ecological resilience. In doing so, Vatutavui community continues to maintain its cultural identity and ensure ontological security. Ontological security in this context refers to the sense of material (space, resource, livelihood, health, safety), social (community, kinship, leadership, reciprocity) and cultural (place, identity) security (Campbell, 2010). Therefore, drawing from their IKS to adapt and mitigate climate change impacts, Vatutavui village is not only demonstrating social-ecological resilience, but also valuing and preserving its community's ontologies in the process. Participants in this study have demonstrated that the USP PAR research has brought community members together and has ensured the validation of their local knowledge and maintenance of their ontology through knowledge transmission. This knowledge transmission took place during focus group discussions and the communal practice of solesolevaki.

Therefore, the implications of this study are wide ranging. Not only do they show the ecological implications of IKS, but they also demonstrate the social and cultural significance of the need for climate change researchers, conservation agencies, climate change department in governments, and tertiary institutions to continuously engage Indigenous communities in climate change research. Achieving a sustainable future entails a delicate balance between ecological, social, and economic aspects, which IKS addresses comprehensively. Indeed, IKS lies at the very core of sustainable living within Indigenous communities. Thus, it is imperative that we integrate and recognize the value of IKS in all our efforts towards a sustainable future.

Conclusions

Perceptions of climate change issues in Vatutavui village are limited to community members' personal experiences. The results of the study discussed in this paper have demonstrated that daily experiences of weather changes such as sea level rises, prolonged droughts and dried water sources have been attributed to community activities such as burning of farmlands, deforestation and also to the extent that some participants considered maybe it is God's will. It was only after community climate change education from the USP PAR team that community members understood the complexity of climate change and its impacts. This paper has also suggested that impacts of climate change in Vatutavui village are not only limited to the environment. Participants have demonstrated that lack of resources for their livelihoods due to climate change impacts have social implications, such as tensions in the family. There are also not enough resources to meet the daily needs of a family.

Nonetheless, there is room for some optimism in Vatutavui. In their focus group discussions and individual interviews, Vatutavui villagers have demonstrated Indigenous resilient practices that have allowed them to address impacts of SLR and DWS. These include the maintenance of social and cultural practices such as solesolevaki, tabu ni qoliqoli, traditional farming practices and lotu (spirituality). These Indigenous responses to climate change impacts have also strengthened social-ecological resilience in Vatutavui. It emerged from the results of the study discussed here, that not only do these Indigenous responses contribute to ecological resilience, they are also socially desirable. Through the social practice of solesolevaki (communal organized activities), while Vatutavui villagers replanted mangroves and native plants as a community, there was an increase in social inclusion and cohesion during the process. Community members were able to gather and be active, contributing members of their village, a process that further strengthened their human and social capital.

From this study, it is recommended that there should be more research conducted on climate change and Indigenous knowledge in Fijian local communities and throughout the Pacific. This would cement the active role that IKS has in maintaining resilient communities in the face of climate change and strengthen the revitalization process of certain aspects of IKS that may have been displaced. It was also revealed from this study that, although Indigenous communities may lack the understanding of the complexity of climate change and its related issues, these communities continue to demonstrate social-ecological resilience that is rooted in their Indigenous knowledge systems. Indigenous knowledge systems in communities such as Vatutavui have proved to contribute to innovative thinking and actions for desirable transformations for all social-ecological systems. Actions undertaken to address SLR and DWS in Vatutavui have demonstrated social and ecological stewardship, which creates desirable outcomes in their ecology and their social lives.

Acknowledgement

We wish to acknowledge the Vanua o Vatutavui for sharing their stories with us and allowing us to be their voice.

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Authors' biographies

Kolaia Raisele is a PhD candidate at La Trobe University, Melbourne Campus, Australia. His research interests are on youth leadership and civic engagement in the Pacific, inclusive social development, intangible cultural heritage and sustainable development, indigenous knowledge and climate change, and ethnographic research.

Dr Rosiana Lagi is a teacher by profession, currently a Senior Lecturer in Education at the Education Discipline at the University of the South Pacific, Suva Fiji. She is a researcher with interest in Climate Change, Indigenous Knowledge Systems, human development, literacy and quality education. Her PhD in Education focused on the topic Na Bu: an exploratory study of Indigenous Knowledge of Climate Change and Education in Ovalau Fiji at the University of the South Pacific (USP) in 2015.
