Climate and related information for Pacific food systems – preparedness and planning: Expert interview findings

The ANU Institute for Climate, Energy & Disaster Solutions

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sustineo

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Contents

List of acronyms and abbreviations

Acronym	Description
ACPIR	The Australian Centre for Pacific Islands Research
ANU ICEDS	Australian National University's Institute for Climate, Energy & Disaster Solutions
CCICD	The Climate Change and International Cooperation Division
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DFAT	Department of Foreign Affairs and Trade
KII	Key informant interview
KiriCAN	Kiribati Climate Action Network
KSP	Kokosiga Pacific
MAF	Ministry of Agriculture & Fisheries
MELAD	Ministry of Environment Land and Agricultural Development
MoCC	Ministry of Climate Change
PAIS	Pacific Agricultural Information System
PALM	Pacific Australia Labour Mobility
PHAMA Plus	Pacific Horticultural and Agricultural Market Access Plus
PHOAFS	Pacific Heads of Agriculture and Forestry Service
PLS	Pacific Labour Scheme
RSE	Recognised Seasonal Employer
SPC	The Secretariat of the Pacific Community
SPREP	The Secretariat of the Pacific Regional Environment Programme
SROS	The Scientific Research Organisation of Samoa
SWAG	Samoa Women Association of Growers
SWP	Seasonal Worker Programme
WHO	World Health Organization
TAW	Tel-a-Women
VARTC	Vanuatu Agricultural Research and Technical Centre

1. Introduction

1.1. Background and context

Sustineo was engaged by the Australian National University's Institute for Climate, Energy & Disaster Solutions (ANU ICEDS) in March 2022 to undertake a series of expert interviews and associated activities. This research activity is part of a broader Department of Foreign Affairs and Trade (DFAT) funded project, *'Climate and related information for Pacific food systems: Preparedness and planning'*. The project is aimed at supporting the generation of knowledge to assist Pacific stakeholders in understanding likely climate impacts in the region and informing decision-making and planning around future challenges in the agriculture sector. The Secretariat of the Pacific Community (SPC) has requested DFAT for strategic support for Pacific Heads of Agriculture and Forestry Services (PHOAFS) around understanding likely climate impacts in the region and developing tools to help decision making and planning in relation to future challenges and options in the agriculture sector.

The key objective of the overall project is to bolster preparedness for changing climate conditions in the Pacific Islands region and support evidenced-based policy making, specific to sustaining and improving food security. The key output of this project is to develop a Concept Note that can be shared with SPC and PHOAFs for the Pacific Week of Agriculture and Forestry meetings in March 2023. The Concept Note will put forward a preliminary design for a climate adaptation dashboard to be considered for endorsement by PHOAFs.

To achieve the overall objective, the broader project has two main components:

1. A systematic literature review to build an evidence base for the impacts of climate change on Pacific food systems and identify potential climate change adaptation options.
2. A series of expert interviews and data sourcing from relevant experts to address knowledge gaps in climate change impacts around the region as well as at national and sub-national scales.

The primary focus of Sustineo's contribution to the project is the conduct of the second component – a series of expert interviews and data sourcing from relevant experts.

1.2. Purpose and scope

Sustineo's research activity – conducting a series of expert interviews and data sourcing from relevant experts - aimed to identify pre-existing amplifying and/or mitigating factors that influence Pacific food security and are likely to interact with climate change impacts.

The purpose of this research activity is to contribute to the validation of findings from the systematic literature review and to fill knowledge gaps in the context of four Pacific

countries that have been selected for these targeted expert interviews. This report presents the findings from this component of the project.

1.2.1. Target country selection

Findings from the systematic literature review highlighted the need for further country-specific research to enable a greater understanding of adaptation strategies that are highly specific to local contexts. Subsequently, **Fiji, Kiribati, Samoa, and Vanuatu** were selected as the target countries for this study.

Due to the cultural, socio-economic and geographic diversity of the Pacific Island region, the target countries have been selected to represent the diversity of the Pacific across Melanesia, Micronesia and Polynesia. Additionally, for the purposes of developing a potential interactive information tool, there is a greater amount of relevant literature and other information available for these countries relative to other Pacific countries. That said, there were also notable research gaps for these four countries that warranted further investigation via the expert interviews.

1.3. Report structure

The report is structured into seven main chapters.

- **Chapter 1 (Introduction)** — this chapter — has introduced the objectives, scope, and purpose of this study and how it contributes to the broader DFAT funded project.
- **Chapter 2 (Methodology)** provides an overview of the approach and methods used for stakeholder engagement, data collection, and analysis.
- **Chapter 3 (Key findings across the target countries)** presents a synthesis of the key findings across all of the target countries. This includes the key climate related risks and impacts to food systems, amplifiers and mitigators, as well as findings on the importance of context for understanding impacts and risks to food security.
- **Chapters 4-7 (Country-level findings briefs)** presents the findings briefs for each of the target countries.
    - Chapter 4: Fiji findings brief
    - Chapter 5: Kiribati findings brief
    - Chapter 6: Samoa findings brief
    - Chapter 7: Vanuatu findings brief.

2. Methodology

Sustineo employed a qualitative approach to this research activity, centred on stakeholder engagement and validation activities. The methodology was designed to build upon and extend the findings identified through a systematic literature review of the state of research on food system vulnerability to climate change across the South Pacific.[1] A key aspect of the approach was the nuancing of the desk study findings on amplifiers and mitigators in the target countries,[2] through expert interviews and subsequent workshops to validate and test the key findings for each country.

Remote interviews were conducted between September to December 2022. The online validation workshops and interviews took place in January to February 2023.

2.1. Methods

Stakeholder engagement

Sustineo worked closely with SPC to engage the four country governments through established regional diplomatic channels and in accordance with appropriate protocols. This initial government engagement process also provided the opportunity for the country governments to identify relevant country experts to engage for the interview process.

In collaboration with SPC, ANU ICEDS, DFAT and CSIRO the project team identified further experts to engage from across public and private sectors, civil society, the donor community, and academia in each of the target countries.

Key informant interviews

A total of 30 key informant interviews (KIIs) were conducted with experts across the target countries, including some additional regional focused KIIs (see Table 1). The KIIs were conducted remotely via Zoom and Microsoft Teams. The semi-structured KIIs focused on exploring the overlay of projected climate hazards with amplifiers and mitigators, and the severity and sub-national distribution of the resulting risks to food systems (see Annex B for an example interview guide). Interview questions were formulated in collaboration with the project team and were designed to generate data on identified research gaps, such as the social and cultural dimensions of food systems, adaptive capacity, and location-specific vulnerability and resilience factors. Full lists of participants for each

[1] See: Trudinger, H., Crimp, S. & Friedman, R.S. Food systems in the face of climate change: reviewing the state of research in South Pacific Islands. *Reg Environ Change* 23, 45 (2023). https://doi.org/10.1007/s10113-023-02040-3

[2] Amplifiers and mitigators are the non-climatic factors that either increase (amplifiers) or decrease (mitigators) the levels of exposure, sensitivity, or adaptive capacity to climate change hazards. They can occur across the following five areas: biophysical/nature, infrastructure/manufactured, economic/financial, social, and demographic/human. Amplifiers and mitigators are relevant to both the production and off-farm food systems components (Forum for the Future, 2020).

country are provided in the respective country-level findings chapters below (Chapters 4-7).

Table 1: Key informant interviews conducted for each country

Country	Number of experts interviewed
Fiji	7
Kiribati	5
Samoa	6
Vanuatu	6
Regional	6
Total KIIs	**30**

Analysis I

Data from the KIIs were analysed thematically, aligned with the focus on climate exposure, amplifying and mitigating conditions, and ultimately, the geographical distribution and severity of food systems risk for each case study country. A preliminary list of thematic codes was developed for each set of country level data and subsequently used to revisit the detailed interview notes to cross-check for additional information, including illustrative quotations. This analysis formed the basis of a preliminary findings brief for each country which were taken forward to the validation workshops.

Validation workshops

Validation workshops were held for Fiji, Samoa and Vanuatu. For Kiribati, a small validation discussion was held with two civil society participants and another participant provided written feedback on the preliminary findings brief. The workshops were facilitated by Sustineo, with participation from ANU colleagues in the case of Fiji, Samoa and Vanuatu. In addition to the participants in the validation activities for Kiribati, there were a total of 10 participants across the other three country workshops, not including the ANU participants.

The primary objectives of the validation workshops were to validate the interview findings that had been captured in the preliminary findings briefs for each country and to build consensus around the most important impacts and risks to food systems and climate adaptation strategies. Prior to the workshops, participants were sent a copy of the preliminary findings brief to review. The preliminary findings brief served as the basis for the workshops which provided workshop participants an option to clarify and nuance findings, identify any findings that were missing, and, to the extent possible, begin to build

consensus around the most important findings. However, the consensus building activities proved challenging in practice (see sections 2.3 and 3.4 for further details).

An additional objective of the validation workshops was to explore research networks in each target country by asking participants about the evidence that is needed to make good decisions about climate adaptation, who is or needs to be doing this research, and the potential for research collaborations.

2.2. Analysis II

Following the validation workshops, the workshop findings, which had been documented, were used to revise and refine each of the country preliminary findings briefs (see Chapters 4-7 for the final country findings briefs). A further synthesis of the findings was conducted to identify a set of high-level climate impacts, and amplifiers and mitigators across all of the target countries. Key lessons on the importance of understanding context in each of the target countries were also identified through the validation workshop and analysis phase.

2.3. Issues and limitations

There were several issues and limitations for this research activity.

- **Omission of marine based food systems.** It was beyond the scope of this project to consider marine based food systems despite them being an integral part of food security and livelihoods in the Pacific. While we made efforts to identify areas where participants highlighted marine food systems interacting with terrestrial based food systems, further assessment of the impact of climate change on marine based food systems is needed for a more complete picture of food security across the target countries.
- **Challenges with engaging participants remotely.** The remote nature of the recruitment of participants, and subsequent interviews with them, presented a raft of challenges, including non-responsiveness, extensive delays in confirming interviews, and internet connectivity issues. The timing of the interviews also clashed with COP27 meaning that some of the target participants were not available to be interviewed. The sum effect of these challenges is that it was not possible to engage all of the priority participants that had been identified by the project team and senior country government officials. However, referrals from participants that were interviewed ensured that the quotas for each country were achieved and the final samples were broadly representative of government, private sector, donor, civil society and academic expertise. That said, government experts were the most challenging to engage, and, as a result, are somewhat under-represented in the overall sample of participants.
- **Challenges with consensus building and prioritisation.** The consensus building and prioritisation of key climate impacts and risks for food systems, as well as

climate adaptation strategies, as part of the validation workshops was challenging for participants to complete. This activity highlighted the importance of grounding findings in relation to context (detailed further in Section 3.4).

- **High-level engagements only.** This research activity was not able to engage directly with local community members and farmers in the target countries. To the extent possible, we engaged a range of Pacific experts, including some who were farmers themselves or whose organisations work closely with farmers, to share local insights. However, it was beyond the scope of this project to conduct comprehensive community and farmer engagement.
- **Unable to conduct the Kiribati validation workshop.** Scheduling challenges meant that it was not possible for all the Kiribati participants to attend a shared validation workshop on the same date. Consequently, we conducted a small validation discussion with civil society experts and received written feedback on the preliminary findings brief from another academic expert. None of the government stakeholders were available.

3. Key findings across target countries

The following findings were identified as priority climate-related risks and impacts, and amplifiers and mitigators, across all of the target countries.

3.1. Climate-related risks and impacts to food systems across the target countries

The following climate related impacts and risks were identified across all of the target countries as presenting key threats to food security.

Sea-level rise

Sea-level rise is a current and continuing threat to food security across the Pacific, especially for low-lying coastal areas.

- Sea-level rise is forcing relocation from coastal and low-lying areas. This relocation of people and their food environments is challenging and adds pressures to in-land food environments.
- Sea-level rise is also associated with erosion of coastal farming land and increased salinity which negatively affects crops.

Increased intensity of natural hazards and disasters

Natural hazards and disasters such as flooding, droughts and tropical cyclones are increasing in intensity across the Pacific, posing an obvious threat to food security.

- Participants commonly noted that climate change is increasing the intensity of natural hazards and disasters.
- An increasing shift towards cash crops across the Pacific further amplifies farmers' vulnerability to natural disasters.
- Excessive rainfall and flooding were identified by participants to be severely affecting crop productivity and soil erosion. Conversely, drought and increased temperatures also negatively impact crop productivity and yield.

Unpredictable weather patterns

Weather patterns across the target countries are becoming more variable and unpredictable, differing from traditional wet and dry seasons.

- Participants noted that dry season weather patterns have become unpredictable, with both prolonged dry spells and excessive rainfall occurring more frequently.
- The variable nature of fruiting and harvesting seasons are also leading to fluctuations in the availability and price of foods in domestic markets across the target countries.

Pests and diseases

Increased temperatures and humidity are leading to an increase in pests and diseases across the target countries.

3.2. Amplifiers across the target countries

Several key threats were identified across that target countries that amplify the impacts of climate change on food systems.

Unsustainable farming practices

Unsustainable farming practices are amplifying the impacts of climate related risks to food systems. These practices reflect a trend of increasingly market-oriented farming systems. These practices commonly include:

- Large-scale monoculture farming of cash crops which tend to be less resilient to natural hazards and disasters as they lack crop diversity.
- The replacement of traditional crops and plants with introduced species that tend to be more susceptible to natural hazards and disasters.
- Repeated planting of crops on the same land with no fallow (rest) period.
- Intensive use of chemical fertiliser and herbicides.

Reliance on imported foods

Increased consumption of imported food with poor nutritional value has become a significant health concern and is altering patterns of food production across the target countries.

- Several factors are incentivising a shift away from subsistence agriculture to more imported food, including: changes in dietary preferences, the time-consuming tasks of growing and cooking local food, the ease and convenience of store-bought food, widespread access to cash income from remittances, and the perceived risk of natural disasters destroying crops.

Limited knowledge, capacity, and resources

Farmers across the target countries typically have limited knowledge on climate change, and limited capacity and access to resources and technology to help with adaptation. Key challenges affecting food security include:

- A lack of knowledge among farmers and rural communities on how to adapt farming systems in response to climate change.
- Improper infrastructure for storing produce (e.g. not having cooling facilities) and transporting produce (e.g. poor roads damage produce post-harvest).

- Limited capacity and resources to adopt climate smart agriculture technology such as sophisticated irrigation systems and weather forecasting technology.

Reduced supply of labour in the agricultural sector

The movement of labour out of the agricultural sector is a common trend across the target countries, especially among youth.

- This trend is coupled with increasing patterns of urbanisation.
- Loss of labour (primarily youth) to seasonal labour schemes also affects the supply of labour in Pacific nations.[3] It was reported that seasonal labour schemes can create a dependency on remittances and disincentivize agricultural work among those who stay home.

3.3. Mitigators across the target countries

A range of important mitigating factors that increase food security across the target countries were identified.

Kinship networks and customary practices

Kinship networks and customary practices of sharing food and resources were identified as a key mitigating factor for food security, particularly during times of natural disasters.

- It was commonly said by participants in several of the target countries that "no one goes hungry".
- People share food and planting materials through kinship networks during disaster times.
- However, there is concern that these networks and practices of support are weakening and coming under increasing stress due to the intensifying impacts of climate change.

Traditional knowledge

Traditional knowledge can be a mitigating factor for climate related risks to food systems.

- Examples of traditional knowledge include knowing how to farm local crops, preserve foods without power, and consuming 'disaster foods' such as wild yams and swamp taro.

[3] Seasonal labour schemes provide workers from Pacific Islands and Timor-Leste with temporary working visas for unskilled, low-skilled and semi-skilled positions. Participants commonly referred to the Pacific Australia Labour Mobility (PALM) scheme in Australia (formerly the Seasonal Worker Programme (SWP) and Pacific Labour Scheme (PLS)) and the Recognised Seasonal Employer (RSE) scheme in New Zealand.

- However, there is a general sense from participants that this traditional knowledge is weakening among contemporary farmers, and, in some cases, being lost entirely.

Remittances

Remittances can have a positive impact on food security across the target countries by enabling people to buy food, in addition to producing food, which can be critical during and after natural disaster events.

- However, as previously noted, seasonal worker schemes, which are a key source of remittances across the Pacific, also have negative effects due to reducing the supply of labour in the domestic agriculture sector and increasing a reliance on imported food.

Adoption of sustainable farming practices

There were positive examples of farmers adopting sustainable farming practices across the target countries.

- These sustainable practices were typically characterised by mixed-farming systems with traditional crops.
- However, such examples were reported as an exception to the mainstream trend of large-scale, monoculture and commercial farming practices which are becoming increasingly prevalent in the Pacific.

3.4. The importance of context for understanding impacts and risks to food security

The validation workshops highlighted the importance of understanding context when assessing the importance of different factors affecting climate adaptation and food security across the Pacific. A planned activity for the validation workshop was to build consensus on the ranking of the most important climate-related risks and impacts, amplifiers and mitigators, and climate adaptation strategies. Findings from the workshop highlighted that the consensus building and prioritisation task proved to be very challenging.

Workshop participants highlighted several key considerations that underscore the need to understand these risks and impacts in the context of local environments within the target countries:

- **Defining importance through multiple lenses**. How you define the importance of certain impacts and interventions is highly subjective and influences the prioritisation of factors. For instance, if importance is defined in terms of economic impact, this lends itself to a view that biases the impacts of climate change to cash crops. Conversely, if impacts and risks to health and nutrition are considered

most important, issues like the loss of nutritional diversity in coastal food environments from sea-level rise – which may not be as significant an economic loss compared to damaged cash crops – presents significant threats to the health of affected communities.

- **Perspectives of different stakeholders**. The ranking of impacts and risks to food systems changes relative to the position that different stakeholders occupy both within food systems and in society more broadly. For instance, workshop participants highlighted that the priority risks and impacts for a commercial producer are very different to a subsistence farmer, a government worker or even society at large.
- **Overlapping issues**. The climate related impacts and threats to food security are overlapping and compounding, and as such, are difficult to view in isolation of one another. For instance, the increased intensity of natural hazards and disasters is compounded and influenced by increasingly unpredictable weather patterns. Similarly, unsustainable farming practices affect and are influenced by a greater reliance on imported foods. Consequently, it can be challenging to identify one of these impacts as more of a priority than the other when in reality they are experienced simultaneously.
- **Geographical specificity**. Workshop participants highlighted the challenge inherent in ranking climate risks at the national scale due to important differences in risk across different sub-national geographies and environments. For example, sea level rise and king tides are a more critical risk for low-lying coastal areas than for inland locations, and the leeward and windward side of large islands experience different intensities of rainfall and drought. While the ranking of climate risks to food systems proved challenging at the national scale, it is important to note that the identification of this sort of sub-national variation based on geography is an important objective of this research, and, as such, further details on sub-national variation are provided where possible in the country level findings presented in Chapters 4-7 below.
- **Locally owned climate adaptation**. Taken together, these findings point to the need for any further assessment of priority interventions to be considered in relation to the unique environmental and socio-economic factors of a given context. In a world with limited resources and numerous adaptation needs, some degree of prioritisation is needed to guide effective climate adaptation and to enhance food security across the Pacific. The workshop findings highlighted that initiatives that are perceived to be relevant to the livelihoods of local communities, and are able to foster local buy-in, are far more likely to be successfully implemented. Following this imperative, further prioritisation of climate adaptation strategies should be done in collaboration with farmers and communities where possible.
- **Climate adaptation information tools.** These findings have implications for the design of effective climate adaptation information tools. As noted above, effective

adaptation needs to be centred on the needs and experiences of the communities they seek to support. However, more broadly climate adaptation information for food security may also be achieved on a larger scale through the use of more quantitative methods that reduce some of the subjectivity and relativity inherent in qualitative analysis of these impacts and threats.

4. Fiji findings brief

4.1. Overview of participants

Table 2: Fiji experts engaged via interviews and workshop

Field of expertise	Interview participants	Workshop participants
Government	2	
Private sector	2	1
Academia/research	3	3
Civil society		
Total	**7**	**4**

4.2. Climate impacts and vulnerability

Priority risks for food systems in Fiji

Participants identified a broad range of priority risks which increased food insecurity. Some risks were climate-induced such as sea-level rise, while other risks such as unsustainable farming practices amplified the impacts of climate change on food security.

Ocean acidification

- Ocean acidification is reducing reef fishery stocks which is reducing protein availability for coastal communities and may lead to an increased need for land-based production of protein foods.
- Explaining the link between marine and land-based food systems, one participant noted: “So that's perhaps a massive one [impacts of ocean acidification] that I do eventually think will have to end up linking with land ecosystems because we are hitting a point where we are needing to start to find alternatives. To replace that protein from reef fisheries into something else, and that's likely land-based production, as in chickens, eggs, small ruminants and whatnot.”

Sea-level rise

- Sea-level rise is having pronounced impacts along coastal farming areas.
- Sea-level rise is also associated with increased salinity which negatively affects crops.

Increased intensity of natural hazards

- Participants commonly noted that climate change is increasing the intensity of natural hazards like tropical cyclones, flooding and droughts.
- Perennial crops like kava are particularly vulnerable to these hazards.

Unpredictable weather patterns

- Weather patterns are becoming more variable and unpredictable, differing from traditional wet and dry seasons.
- Rainfall patterns were highlighted by one participant as becoming especially unpredictable.

Pests and diseases

- Increased temperatures and humidity is leading to an increase in pests and diseases.

Geographic factors in Fiji affecting risk distribution

Several geographical factors were identified by participants as affecting the distribution of the priority risks to food systems identified above. In particular:

- Peripheral locations and smaller islands are more vulnerable to the impacts of natural hazards – for example Lau Islands, Lomai Viti, Kadavu, and other small islands on the Eastern side of Fiji – as there are better facilities in the more centrally located areas. Food production systems in these locations tend to be more vulnerable due to issues like distance to markets, soil degradation and saltwater intrusion.
- Low land coastal areas are more affected by sea-level rise.
- There are dry regions (notably the western side of Viti Levu and Labasa on Vanua Levu) and wet regions (notably the eastern side of Viti Levu and Cakaudrove Province). In the wet regions, preventative measures are needed to control the impacts of intense rain and flooding on crops and plants. In contrast, the western part of Fiji, especially Viti Levu, is more exposed to drought.
- The main sugar growing areas of Fiji tend to be worse off due to the unsustainable land management practices being used.
- Taveuni grows most of Fiji's taro and can be vulnerable to cyclones which can wipe out this key cash crop and devastate the local economy.
- Sloping areas are not being managed properly (e.g. no contour planning), which leads to soil degradation.

4.3. Amplifiers

On-farm

Unsustainable farming practices

Participants reported numerous unsustainable farming practices that are amplifying the impacts of climate related risks to food systems. These practices reflect a trend of increasingly market-oriented farming systems, characterised by monoculture cropping

and intensive use of the land. The following unsustainable farming practices, and associated impacts, were identified:

- Large-scale monoculture farming systems tend to be less resilient to natural hazards as they lack diversity. A single natural disaster event can wipe out the whole farm.
- Fijians are moving away from planting traditional indigenous crops and plants. Introduced crops and plants tend to be more susceptible to natural hazards.
- Farmers are clearing forests to plant monoculture crops. The major cash crops associated with having damaging impacts from unsustainable commercial cropping practices include: sugar, ginger, dalo (taro) and most recently kava. In the case of kava, this has led to the spread of the devastating kava dieback (a virus disease).
- Repeated planting of crops on the same land with no fallow (rest) period to enable fertility to be restored to the soil.
- Unsustainable farming systems such as slash and burn agriculture and cutting down trees on slopes which contributes to erosion and vulnerability to floods.
- Intensive use of chemical fertilizer (NPK) and herbicides.
- The planting of crops such as ginger and pineapples up and down sloped land to improve drainage, resulting in erosion and loss of soil fertility.
- Reflecting on the poor farming practices used on sloped land, a participant noted: "if we go up to the Highlands they are planting root crops on very steep slopes without any soil erosion prevention measures."

Land tenure

Insecure land tenure and challenges accessing land were identified as amplifying food insecurity.

- If farmers have insecure tenure, or short-term leases, there are fewer incentives to manage the land sustainably. One participant noted how leasing arrangements incentivise unsustainable exploitation of the land: "Landowners are more conscious of unsustainable practices but people who are leasing land, they need to recover their costs so they are less interested in sustainable farming practices. They know that they won't be on the land for their lifetimes or their children's."
- Customary land can be tied up in long-term leases with commercial farmers, which can create intergenerational tensions within iTaukei landowning groups over access to such land. For example, one participant explained: "so you are a landowner, but you can't plant on your land because your grandfather leased it out".

Sea-level rise and farm relocation

In Fiji, sea-level rise is impacting dietary diversity and the location of farmland.

- Sea-level rise is affecting access to the diversity of available food and nutrients for coastal areas.
- While farmers are relocating their farms further inland, fruits and vegetables typically grown around the house in some coastal communities (for example bele - *Abelmoschus manihot*) are not being relocated.
- A participant highlighted the impact of sea-level rise on dietary diversity among coastal communities:
    - "There has been some thought on relocating people but not necessarily their food environments that were in those village sites. So in a way sea-level rise will have a massive impact, not necessarily on the quantity of food produced, and not on those staple crops, but really on those backyard crops that are sustaining dietary diversity and sustaining a lot of those micronutrients in these settings."

Pests and diseases

- The prevalence of pests and diseases affects crop productivity and can result in loss of large amounts of produce.

Sub-national variation of on-farm amplifiers

Generally, participants tended to highlight that the on-farm amplifiers were applicable to most parts of Fiji. However, some specific sub-national variations were identified:

- Intensification of land use varies between the central islands and the peripheries. Typically, in the central islands greater competition for land results in intensification of land use while in the peripheral islands where there are lower population densities there is some agricultural land that is underutilised and inefficiently used.
- Sugarcane growing areas of Fiji tend to exhibit more severe soil degradation, notably Viti Levu (from Sigatoka in the west to Raki Raki in the northeast) and the northern part of Vanua Levu (Labasa and surrounds).
- On smaller islands like Taveuni and Kadavu, farmers are expanding unsustainable farming practices into forested and mountainous areas. As soil fertility is declining, farmers are moving to hilly environments to grow crops such as taro, which are more susceptible to erosion.

Off-farm

Movement of labour out of the agriculture sector

Some regions of Fiji are experiencing a shortage of agricultural labour, especially where opportunities for work in the tourism sector or on seasonal labour schemes exist. By

contrast, in areas where alternative livelihood opportunities are less prevalent, the inability to transition out of the agriculture sector was perceived as an amplifying factor.

- In some remote locations with a strong tourism sector, youth are moving out of agriculture and into the tourism sector. However, the opportunities for employment in the tourism sector vary substantially throughout Fiji.
- Seasonal labour schemes are reducing the availability of labour in the agriculture sector, especially among male youth.
- In Taveuni, people are not signing up for seasonal labour schemes because they perceive that they can make more money staying at home. However, Taveuni appears to be an exception to the general trend.
- In some locations across Fiji, there are limited livelihood alternatives outside of agriculture and fisheries, meaning that there are few opportunities for mobility out of agriculture into employment that allows for a higher standard of living.

Reliance on imported foods

Participants highlighted a growing trend of reliance on imported and highly processed foods having a significant adverse impact on health across Fiji. Changes in dietary preferences, the risk of natural hazards destroying crops, and the ease and convenience of store-bought food are common incentives driving the shift away from subsistence agriculture to more imported foods. Although, participants commonly highlighted that some purchased food is beneficial to food security.

- Importing food can be an important aspect of food security, especially for outer islands. However, food security could be enhanced overall if communities had better knowledge and education around which domestic crops can be grown to substitute imported food products (e.g. coconut oil can substitute imported cooking oil).
- When demand for local produce is high in international markets like Australia and New Zealand, farmers will sell this produce due to the higher price that they can attract and then purchase cheaper imported food that negatively impacts their health.
- A participant reflected on the important role of both growing traditional foods and buying imported foods to bolster food security: “Reliance on food imports – that’s a reality – we could import a lot less if we could grow some of those crops ourselves, where we have a comparative advantage. Remoteness is obviously an issue – people have been favouring imported foods – they need to go back to their traditional foods – need training, education. This is an example of where remittances are important – for the outer islands – having money is important for food security. But we think there is a much better opportunity to grow domestic foods – if you do it sustainably, there is a comparative advantage.”

Limited knowledge, resources and capacity

Participants commonly identified farmers' limited knowledge on climate smart agriculture, and limited access to resources and infrastructure, as key challenges affecting food security in Fiji.

- There is generally a lack of knowledge among farmers and rural communities on the economic benefits of adopting sustainable cropping and climate resilient practices.
- Improper infrastructure for storing produce (for example not having cooling facilities) affects food security. There are also challenges with insufficient sources of sustainable energy to power cooling facilities across Fiji.
- Farmers typically depend on rainfall variability and do not have irrigation or sophisticated weather forecasting technology. A participant commented on this rudimentary approach to farming: "a lot of the systems that I've studied operate on essentially what I call 'praying for rain', so there's not much input. There's obviously no irrigation, so everything is very dependent on rainfall variability."

Reliance on the tourism industry

- Climate change could negatively impact the tourism industry over the long term due to sea-level rise and other slow onset impacts affecting resorts in coastal locations.

Transportation

- Transporting produce to domestic markets is a challenge, especially from remote locations. Significant amounts of produce can be damaged, with one participant noting: "From the Highlands getting into the markets there can be up to 50 percent post-harvest loss".
- Fuel prices also amplify challenges around transporting produce to markets.

Inconsistent access to international markets

- Fiji has bilateral trade agreements with Australia and New Zealand and can export up to 10 different kinds of fruit. However, farmers in Fiji struggle to consistently produce enough produce that meets international standards.
- A workshop participant noted that fresh produce in Fiji looking different to what is sold in international contexts could reflect a difference from farming practices without the use of pesticides, which can be environmentally beneficial. Conversely, making Fiji produce more successful in international markets can mean more intensive forms of agricultural, which result in negative environmental impacts.

Sub-national variation of off-farm amplifiers

Participants most commonly identified key differences due to remoteness that impact the sub-national variation of off-farm amplifiers, especially for transportation and importing food.

- Participants reported that in some outer islands, careful crop selection based on perishability is important due to the transportation infrastructure and capacity available.
    - For example, kava can be kept for weeks to months so it can be farmed in more remote locations. Whereas fish are a challenge for outer islands due to the immediate transportation needs.
- The remoteness of some villages exacerbates challenges with transportation of produce to markets.
    - Highland areas and remote areas are not ideal for growing large quantities of low value crops due to transportation costs. Instead farmers are better off growing high value crops as they are cheaper to transport.
    - Inter-island shipping is poor among smaller islands.
- In addition to the issue of transportation, some participants identified that access to information is more limited for farmers in remote locations.
- Emerging evidence points to a greater reliance on imported food in urban and central locations than peripheral islands. While imported food is still consumed in peripheral islands, there is less reliance on it for food security.

Impacts of amplifiers on different groups

While on-farm and off-farm amplifiers can impact all segments of Fiji's population, they tend to be worse for women, and people with disabilities.

- There is a distinct gendered dimension to the impacts of dietary changes. For instance, the male head of the household tends to have greater control over income from cash crops like kava. When households shift to greater production of cash crops, women and children can have fewer household crops for domestic consumption, instead becoming more reliant on income from the sale of cash crops to purchase imported and processed foods.
- Selling produce at local markets can be a primary source of income for some women. When increasingly severe weather events adversely impact the production and marketing of these crops it reduces women's access to this crucial source of income.
- Young, able-bodied men, and some women, have greater capacity to farm in more remote or rugged locations while the elderly and people with disabilities are limited to farming in the vicinity of their village. This has implications for relocating farms.

- Men have greater opportunities to access labour markets as they are typically the most mobile demographic.
- ITaukei Fijians and Indo-Fijians typically have different social structures with Indo-Fijians having more individualised, household-based, social units compared to the more communal practices among iTaukei Fijians. This means that decision-making and management of resources is quite different between the iTaukei and Indo-Fijians. There are also important differences between these groups in relation to security of land tenure, with Indo-Fijian farmers more likely to hold short-term leases (as discussed in section 4.3 above).

4.4. Mitigators

Adoption of sustainable farming practices

Participants identified positive examples regarding the mitigating benefits against climate related risks to food systems of more sustainable farming practices. These sustainable farming practices are characterised by mixed-farming systems with local crops. However, such examples were reported as an exception to the mainstream trend of large-scale, monoculture and commercial farming practices, which were perceived to be largely unsustainable.

- Small-scale mixed farming systems tend to be more resilient than large-scale monoculture farming systems, because they are more diverse. So if some crops are affected by climate change related impacts or natural hazards, other crops may be more resilient to these impacts.
- Planting climate resilient varieties of crops that are resistant to diseases and hazards exacerbated by climate change is another key component of sustainable farming practices.
- Some farmers are adapting to the unpredictability of weather patterns and have increased knowledge on disaster preparedness. Some farmers are more accurately timing their plantings so the crops mature before cyclone season, and they are also growing crops on higher ground to avoid flooding. Examples were also given of farmers pruning their kava crops to enable a faster recovery post-disaster.

Kinship networks and customary practices

Kinship networks and associated customary practices such as sharing food and resources were identified as a key mitigating factor for food security, particularly during times of natural disasters and hazards.

- Typically, there is a strong communal spirit and a traditional social system premised on supporting one another. It was commonly said that “no one goes hungry” in Fiji.

- People share planting materials (as well as food) through kinship networks during disaster times. However, one negative affect of this is that it can lead to the transfer of pests and diseases across Fiji.
- There is some evidence that these social networks and relations are weakening.

Traditional knowledge

Traditional knowledge of farming local crops and preserving food can be a mitigating factor to climate related risks to food systems. However, there was a general sense that this knowledge is being lost and weakening.

- Traditional knowledge of how to farm local crops and how they can be grown to be more resilient to hazards helps increase food security.
- Traditional knowledge of how to preserve foods was raised by participants as a mitigating factor against natural hazards and disasters: "they [Fijian farmers] know how to preserve cyclone damaged food for 3-4 weeks. They have ways to preserve food like breadfruit, cassava and taro."
- A key question raised by participants is whether the traditional knowledge that exists can cope with the intensification of hazards due to climate change.
- Having fallow periods where land can rest and rejuvenate is part of traditional farming practices. However, this is increasingly uncommon, especially because of commercial farmers seeking to maximise profits.

Community leadership

- Strong community leadership has led to positive examples of community-driven adaptation. Village chiefs, elders and religious leaders have been instrumental in driving these initiatives.

Remittances

- Remittances can have a positive impact on food security by enabling people to buy food, in addition to producing food, which can be critical during and after disaster events.
- However, seasonal worker schemes, which are a key source of remittances for Fiji, also have negative effects due to reducing the supply of labour in the agriculture sector (described in the Amplifiers section above).
- One participant noted: "[the impact of remittances on food security] is positive – it's about having money in your pocket to buy food as well as producing food. It does provide food security – if you have money you can buy food, including domestic food. Remittances are very important."

COVID-19

- During the COVID-19 pandemic, more Fijians returned to their farms to plant food rather than purchasing imported food. However, this trend is now starting to reverse again with the easing of COVID-19 impacts and restrictions.

Sub-national variation of mitigators

Participants identified some important variations in the sub-national distribution of mitigating factors as follows:

- Kinship networks tend to be stronger in rural areas than urban areas.
- Adoption of sustainable cropping practices has a similarly positive impact across most of Fiji; however, examples of these practices being implemented are sporadic.
- There are examples of the adoption of production systems that are better suited to the local ecosystem in Namosi and Cakaudrove Provinces.
    - These production systems have been adopted by highly informed farmers.
    - There is greater knowledge in Namosi and Cakaudrove Provinces compared to elsewhere due to the greater rollout of awareness programs in these provinces.

Impacts of mitigators on different groups

Generally, mitigating factors were viewed as beneficial for all segments of the population. However, it should be noted that kinship networks, customary practices, and traditional knowledge differ between ITaukei and Indo-Fijians, as one participant explained that resource management and decision-making tends to be less community oriented in Indo-Fijian populations.

4.5. Climate adaptation

Current strategies that are working well

A mix of social factors and technical interventions were reported as being part of current climate adaptation strategies that are working well. These include social factors such as local ownership and involving women, as well as more technical interventions, such as cyclone mitigation containers and the establishment of agricultural training centres.

Community-driven adaptation initiatives

- Communities with strong local leadership can autonomously drive their own adaptation initiatives. Often these initiatives – which include activities such as

planting mangroves, replanting shorelines with coconuts, and relocation to higher ground - are framed around improving livelihoods rather than climate adaptation.
    - Village chiefs, elders and religious leaders have been instrumental in driving these initiatives
    - Initiatives that are perceived to be relevant by community members can be adopted as part of the 'village plan' and subsequently are far more likely to get enacted over the long-term.
- Accordingly, a participant noted: "In the places where I've seen the most long-lasting climate change adaptation initiatives, it's very community driven. The villagers there in those settlements are starting to change and introduce more mangrove conservation and coastal rehabilitation. That's very much community driven. So again, planting mangroves, replanting the shorelines with coconuts and other native trees and sort of relying a bit more on those nature-based solutions for coastal inundation and sea-level rise, rather than just waiting for someone to go and build them a sea wall or something like that."

Cyclone mitigation containers

- Cyclone mitigation containers to store seedlings during a cyclone. After the cyclone, the seedlings can be used to speed up recovery efforts, without relying on government and donors for support.
- A participant highlighted the benefits of cyclone mitigation containers: "When a cyclone comes, everyone is down and out. But if we stock up seedlings it is quicker to replant after a cyclone, instead of farmers waiting around for government support providing seedlings."

Crucial role of women in climate adaptation initiatives

One participant emphasised the critical role that women play in increasing the dissemination and uptake of food security initiatives.

- Experience has shown that the greater involvement of women is likely to result in adoption of sustainable cropping systems which in turn reduces climate risk.
- Women used to play a more central role in traditional agricultural systems, now they contribute labour but are less central. For example, it was shown through the "Tel-a-Women (TAW)" program introduced by PIFON "that by working with women, who predominately cook the food for the family, there was a far greater uptake in the production and consumption of nutritious food. In addition, women tend to have a greater network of friends and neighbours with whom they share information.

Tutu Rural Training Centre

- A good example of the adoption of sustainable agriculture practices can be seen by the Tutu Rural Training Centre based on Taveuni and through Vanua Levu. The centre provides training to young people to equip them to be successful farmers on their own land.
- Workshop participants emphasised the important role that the Tutu Rural Training Centre and other agricultural training centres play, especially for Fijian youth who do not get a tertiary education,

Gaps and limitations in current climate adaptation strategies

Participants provided a broad range of recommendations to improve climate adaptation strategies across all levels of Fiji.

Policy and enabling environment

- Appropriate policy, outreach, farmer training and extension in sustainable agriculture.
    - Government resource constraints mean that outreach initiatives cannot reach all farmers

Coordination and planning

- There is a need for greater context specific planning so that climate adaptation and related policies can be contextualised to specific areas.
- There is a need for greater agricultural diversity across Fiji to improve adaptive capacity to natural disaster events. Disaster events tend to be located in certain parts of Fiji. Therefore, it is important to have a supply of unaffected crops and seedlings in non-disaster affected zones, which can be utilised to improve recovery in affected areas.
- There is a need to address the lack of awareness of the opportunities that climate change offers Fijian farmers if appropriate crops are grown and sustainable cropping systems adopted. Similarly, relocation can be viewed as an opportunity to diversify livelihoods of people who move.

Local ownership

- Climate adaption strategies are often not aligned with community governance structures. Adaptation strategies at the community-level need to involve respected community figures, receive local buy-in and get adopted in ‘village plans’.
    - Workshop participants reiterated that while climate adaptation strategies can originate outside of communities, they need to be communicated in a manner that locals perceive as relevant and actionable.

Greater awareness on traditional crops and resilience crop varieties

- There is a need for further awareness at the household level on the benefits of traditional crops and resilient crop varieties like wild yams, breadfruit and resilient varieties of taro as part of resilience to the effects of climate change.

5. Kiribati findings brief

5.1. Overview of participants

Table 3: Kiribati experts engaged via interviews and group discussion

Field of expertise	Interview participants	Group discussion participants
Government	1	
Private sector		
Academia/research	2	
Civil society	2	2
Total	**5**	**2**

5.2. Climate impacts and vulnerability

Priority risks for food systems in Kiribati[4]

Kiribati faces unique challenges to food security compared to the other target countries (Fiji, Vanuatu, and Samoa). Many of the staple local foods grown across the Pacific region cannot be grown in Kiribati due to the poor soils for agriculture. A range of climate related risks that affect food security were identified by participants.

Sea-level rise and king tides

- Kiribati is especially vulnerable to sea-level rise due to its geography, which consists of low-level atoll islands.
- The erosion of coastal areas from sea-level rise was identified as another significant concern. Participants reported that while coastal erosion is gradual, it is increasing over the long run.
- King tide events pose a significant ongoing threat to farmland and sources of fresh water. Participants reported that crops can be destroyed and supplies of fresh water in wells contaminated by king tides.

Lack of fresh water

- Kiribati's typically thin water table means that supplies of fresh water are limited.
- Increased water salinity was identified as a significant risk for food systems in Vanuatu.

[4] Noting that the scope of food systems examined in the four country case studies is limited to land-based food systems, it is important to note that, in the case of Kiribati, marine-based food systems are a particularly significant component of food security. In this context, one participant noted that ocean acidification is a major threat to food security due to its impact on coral reefs and marine invertebrates.

- A participant reflected on the long-spanning challenge of accessing fresh water in Kiribati: "we have a problem with the water supply. Our water table is quite thin. The increase in salinity of the water system is an issue, not just with climate change but given the nature of our islands it has been a problem for hundreds of years. Droughts are normal, people find it hard to draw fresh water from the water table, we resort to water wells which sometimes may not be safe for drinking."

Intensified hot weather patterns and drought events

- Prolonged dry weather and drought events were identified as another major risk in Kiribati.
- Droughts have significantly impacted soil quality, making it more difficult to grow root crops and vegetables. A participant stated: "we have very shallow sandy soil, and, with long spells of dry weather, it has become very difficult to grow root crops. We mainly grow plants with shallow roots such as watermelon and cucumber, but they are also all affected by the drought."
- Intense heat was identified as becoming more common in Kiribati. A participant shared that hot weather causes discomfort to people and livestock, and could also lead to diminishing crop growth with some local fruit trees such as breadfruit and bananas bearing smaller fruits compared to the past.

Geographic factors in Kiribati affecting risk distribution

The disparate collection of small atoll islands that make up Kiribati face a range of unique geographical factors that affect the distribution of risk to food systems. Furthermore, the geographical make-up of Kiribati means that marine-based sources of food are a critical element of food security.

- The general nature of Kiribati's remote, low-lying, atoll islands makes Kiribati vulnerable to climate change and poses a range of challenges to food security.
- Transporting food to small islands located away from the capital, South Tarawa, is a challenge. One participant explained: "For the islands far away from the capital the imported food has to be transported to them. Their food security is really affected when it comes to transporting food imports from the main island to them. One island, for instance is Kanton, where hardly any boats go to from the main island; sometimes boats only going every 3 to 4 months. So we have to equip that island with food crops. When we have the chance of boats going there, we transport planting material on the boat. But because the island is quite a distance away, and the boat trip takes a long time the planting materials die along the way." The lack of refrigeration facilities also poses a challenge for transporting fresh food between islands when the distances are significant.
- Rainfall distribution is an important factor that determines the extent of food security vulnerability in Kiribati. A participant stated that while it is generally hard

to grow food across most of Kiribati, certain areas are the exception. For example, the northern-located islands get higher rainfall, creating better farming conditions: "Butaritari Island and Makin Island get the highest rainfall compared to the rest of the country. And the residents there can grow a lot of crops that you can't find in other islands such as Tarawa, Nikunau and Arorae. You get the types of cassava and mangoes that don't grow in other parts of Kiribati but only on these islands."
    - In contrast, Banaba Island on the southwestern side of the Gilbert Group is often one of the worst drought-affected areas.
- The southern-located islands tend to be affected worse by drought and dry conditions, while the northern-located islands can experience too much rain at times. The centrally located islands are susceptible to drought and excessive rainfall.
- While king tide events and storm surges are a risk across most of Kiribati, one participant noted that coconut farming and copra production in the Line Island and Phoenix Island groups have been particularly affected by such events.

5.3. Amplifiers

On-farm

Poor soil quality

- The poor quality of soil for agricultural production across most of Kiribati's atoll islands severely restricts the diversity of crops that can be grown. Explaining these conditions, one participant noted: "You need to understand the very fragile nature of our land. We are mostly an ocean island. We are more sea than land. There is very limited [food] that we can grow on the land to begin with. What would grow in other parts of the Pacific quite well, we struggle with, you have to use hard labour."
- Participants identified that the soil conditions, which are typically sandy and shallow, mean that very few root crops can be grown. A participant noted that "in addition to poor quality, our soils are very shallow and not able to hold water for successful growing of crops."
    - The main staple crops grown domestically were reported as bananas, breadfruit, and copra.
- The poor soil quality, and subsequent inability to grow a diversity of root crops, means that Kiribati is reliant on food imports to meet the nutritional needs of the country.

Cutting of trees in coastal areas

- The removal of trees, particularly along the coastline, was identified as a significant amplifier of climate risks. Participants noted that farmers cut down trees to clear land for farming.

- A participant explained the poorly planned and unsustainable nature of clearing forested land: “we have no formal planning or strategy regarding what to plant, and where to plant. Kiribati needs a strategy because people continue to plant trees and veggies in vulnerable coastal areas and clearing the land has its bad impact on the environment.”

Poor livestock waste disposal management

- Poor management of waste disposal from livestock poses a significant health risk to food systems.
- Participants noted that livestock waste can quickly contaminate the water supply, given the fragile soils with low-water retainment capacity.

Sub-national variation of on-farm amplifiers

Generally, participants highlighted that the on-farm amplifiers were common across the country.

- One exception is that a greater diversity of crops can be grown on Butaritari Island and Makin Island due to the higher levels of rainfall.
- A participant highlighted the influence that different islands – and their associated climates – can have on the culture and lifestyle of people in Kiribati: “Outer Islands are a bit different and the more southern you get, it gets really dry and much harder to grow food. This influences our lifestyle, because in Kiribati we define the northern people as very relaxed, easy going whereas… the southern people don’t share food. Whatever you grow you keep, you preserve, because it is so hard to grow food there. Their attitudes also tend to be a lot stricter; they are much harder to get along with.”

Off-farm

Dietary changes

- As noted in the on-farm amplifiers, there are limited crops that can be grown in Kiribati. This challenge has resulted in a heavy reliance on imported food, which has created adverse health impacts.
- The convenience of store-bought food is appealing as it is much quicker to prepare than traditional island food. This has intensified the shift towards the increasing reliance on imported food.
- Related to considerations of convenience and accessibility, there is also a change in cultural preference for imported foods.
    - One participant shared an example of visiting a remote village where the villagers served them sugar mixed with water as they perceived it to be more prestigious than the readily available coconut water.

Urbanisation and rapid population growth

- Overcrowding in the urban area of South Tarawa was identified as a major development concern for the country.
- With 90% of Kiribati's population residing in South Tarawa, overcrowding affects land availability and puts pressure on the infrastructure and services needed to cater for the growing population.
- One participant highlighted the challenge of growing food in South Tarawa: "If you live in Betio, which is a heavily urbanised part of the island, people will say 'where do I grow my crops?'".
- Another participant shared an example of government policy increasing food insecurity: the Kiribati government has removed coconut trees along the Tarawa roads in order to make them safer for passers-by or cars. However, this has led to complaints from some locals that their previous source of sweetener – Toddy (*Karewe*) - is no longer available, and they now have to buy sugar.

Lack of proper waste management

- Participants identified that a lack of proper sanitation and waste management facilities is a health issue that is worse in the urban hub of Tarawa.
- One participant noted that the sea is "being used as a toilet". Another stated: "People throw rubbish everywhere: in the sea or burn on the land. This kind of behaviour creates more problems for us. The behaviour of people of taking grass out and burning rubbish behind the house and throwing rubbish in the sea needs to be regulated."

Lack of opportunities and interest in domestic agricultural sector

- Participants noted that youth are becoming less interested in pursuing a livelihood in the agricultural sector.
- Many youths are leaving Kiribati to work on seasonal labour schemes, which reduces the supply of labour for the domestic agricultural sector.

Loss of traditional knowledge

- While traditional knowledge of food preservation and processing is a mitigating factor (detailed below), the loss of this knowledge was also perceived as an amplifier to food insecurity.

Sub-national variation of off-farm amplifiers

The primary variation in off-farm amplifiers identified by participants was around the unique pressures related to overcrowding in the urban centre of the nation's capital, South Tarawa. Another important sub-national variation is remoteness in the context of limited inter-island shipping services.

- The reliance on imported food is intensified in urban areas due to the increased availability of imported and processed foods, and limited availability of land.
- As mentioned in section 1.2 above, the transportation of both imported food and planting material to small islands located away from the capital, South Tarawa, is a challenge.
- Reduced supply of labour due to seasonal labour schemes tends to affect remote islands more than urban areas.

Impacts of amplifiers on different groups

Broadly, the impacts of on-farm and off-farm amplifiers vary across different groups, with women and people with disability typically considered the most vulnerable.

- For example, a participant noted: "There is always the concern about the impact of climate change on women, and also children and the disabled. Not being able to access safe centres or support is a challenge for disabled people. For women it means they have to work harder to get resources like water. On the outer islands they may need to walk long distances to get water. It is typically the women's job to wash and cook, so water is essential."
- During times of food shortages, the impacts at the household-level are also gendered, as one participant explained: "[women] are always the last ones to get their share of the food in the family. Children and elderly first, then men and then women. So women are the most affected when we have difficult times with our food."

5.4. Mitigators

Participants identified a diverse range of mitigating factors against climate-related risks to food systems. Despite these practices being significant, participants typically expressed concern regarding their sustainability and effectiveness against climate change and food insecurity in the future.

Kinship networks and customary practices

- The support that people receive through kinship networks and customary practices of exchange was identified as a crucial mitigating factor against food insecurity. This system of sharing is known as "bubuti" and helps provide a social safety net, especially during natural disasters.
- Despite its importance, participants feared that these customary practices of exchange are coming under pressure, as one noted: "we live in a culture of sharing things together. We share food. But sadly… I don't think people will be able to share. If you have an abundance you will share that, but if you look at your family

and there are 20 people in your home and only six bags of rice, how can you share that with your neighbour? It will be a difficult situation."

Traditional knowledge

- There is some evidence that traditional knowledge of food preservation and processing methods, along with knowledge of traditional foods, plays a role in mitigating against food insecurity. Foods like breadfruit and dry coconut can be stored for long periods.
- In some areas of Kiribati that experience high levels of rainfall, people have designed makeshift ovens to dry food.
- Swamp taro is an important cultural food. While it is often perceived as being hard work and requiring too much water, it is commonly used for traditional social and cultural events.

Remittances

- Remittances, especially from seafarers and people working on seasonal labour schemes, were identified as playing an important role in the country's food security.
- This is mainly through the contribution of remittances to households' capacity to purchase food and tools and equipment for fishing and farming.
- Remittances were also noted as a significant contributor to the increase in living standards, with more families owning vehicles and other purchased household items.

Rainwater harvesting

- Capturing rainwater in cement or plastic water tanks was identified as a common practice to increase the supply of fresh water.
- However, this practice is not always reliable, as it depends on receiving adequate amounts of rain.
- Collecting rainwater in tanks has also been supplemented through well water, as part of a long-time practice for locals.

Sub-national variation of mitigators

Participants identified some important variations in the sub-national distribution of mitigating factors, including in regard to rural and urban differences.

- People in the northern and outer islands of Kiribati tend to invest more in long-term storage of foods like breadfruits and dry coconuts.
- A participant noted that the northern parts of Kiribati, including North Tarawa, have stronger traditional agricultural practices and also relatively stronger traditional social safety nets based on customary practices of sharing food. In

contrast, those in South Tarawa, and especially Betio, tend to be more reliant on imported foods and typically have poorer diets.

5.5. Climate adaptation

Current strategies that are working well

A mix of technological interventions, as well as social and environmental programs and initiatives were identified as part of current strategies that are working well.

Solar water pumps

- Water reticulation projects help to support water supply in most islands in Kiribati. Using solar energy, water pumps are operated to pump up water for storage in tanks.
- Participants noted that these projects, provided via development aid delivered by the government and NGOs, have been working well and provide much needed water for the communities.

Desalination plant

- The Government of Kiribati is in the process of designing a desalination plant due for completion in 2027. Several participants were supportive of this project despite it not being finalised.
- The project was also noted as having limited scope: "Desalination is a way to reduce stress for water. However, this project is only for South Tarawa. How about for the other 30 parts of Kiribati? I don't think the government can provide for everyone."

Climate change awareness programs

- Climate change awareness programs were identified as crucial in ensuring increased knowledge of weather pattern changes and community adaptation strategies.
- Both government and NGO stakeholders collaborate on running awareness trainings on a wide range of topics related to climate adaptation and food security including sustainable use of water, mangrove planting activities, and how to grow food in times of drought.
- Participants stated that communities have experienced unusual changes in weather – especially intense heat and the impact of king tides – but are often not knowledgeable about the science behind the changes. Hence awareness programs help to fill that gap and ensure awareness of adaptation strategies.

Village market days

- Holding market days was identified as an effective strategy to encourage communities to plant more crops and vegetables. The idea of growing new vegetables and holding markets came from development partners, notably Taiwan and China.
- A participant stated: "There seems to be a growth in agricultural activity and a lot of people are beginning to plant more food. We have a market day every month [in Tarawa] and this has prompted the start of little village markets. People are growing lots of produce that they used to think couldn't grow on the islands."
- Participants also reported supportive government initiatives to incentivise production and consumption of local food whereby the Government pays for the freight of produce from their islands to market in Tarawa. This particularly applies to islands in the northern parts of the country, such as Butaritari and Makin, where agricultural production is higher.

Mangrove planting programs

- Planting programs are important initiatives for bolstering adaptation. This especially relates to mangrove planting along the coasts, which participants believed could lessen negative climate impacts and support provision of coastal food.
- While in times of drought it is difficult to promote planting programs on the land as there is not sufficient water, mangrove planting has been a continued focus of many communities.

Food cubes

- An innovative climate smart agricultural practice being used in Kiribati is food cubes. They work by planting food crops in a container with water, and are designed for more efficient use and conservation of water.
- The technology is also called a wicking base system and is suited to the atoll island environment with poor soil and limited land for agriculture.

Promoting organic farming methods

- Organic farming is being promoted and supported by the Ministry of Environment Land and Agricultural Development (MELAD). Part of this involves farmers integrating livestock with crop production; for example: raising pigs in pens near where coconuts are planted. Some organic farming is led by women's groups including growing cabbages for consumption, to sell, and for pig food.
- In addition, MELAD is promoting a dry litter system as a sustainable agricultural production system. The system involves placing dry organic leaves in pens which is then mixed with dry pig waste. The resulting product is used as organic fertiliser for plants and vegetables. MELAD is promoting this system and providing support to interested farmers.

- Participants also highlighted the importance of supporting farmers to establish their own chicken and pig farms and promoting the use of manure from these farms as part of organic farming methods.

Gaps and limitations in current climate adaptation strategies

A diverse range of gaps and limitations were identified in current adaptation strategies. The most commonly raised issue was around the most suitable use of seawalls, for which there were several different views.

Seawalls and coastline protection

The construction of seawalls is a common climate adaptation strategy. However, participants had mixed views on the success of seawalls for preventing coastal erosion and king tides.

- Some participants viewed the seawalls as useful: "My island is a strip of land surrounded by the sea. The seas can be stronger than what we have built on our islands but having the seawalls help". Other participants raised concerns over the longevity of seawalls as an adaptation strategy: "building seawalls is not the answer. There are so many examples of seawalls falling down and the sea water continues to wash away our land."
- Several different types of seawalls exist:
    - Artificial seawalls are made of materials like cement, concrete and stones.
    - Natural seawalls and coastline protection can be constructed by planting mangroves.
    - There is also a traditional coastal protection technique called *wuiwui* – protecting the coastline by putting in posts and sticks and filling them with sand. This is especially in the outer islands where people cannot afford to build artificial seawalls.
    - One participant noted that despite many people in Kiribati wanting cement seawalls, this can exacerbate problems because when the walls break, communities are reliant on imported materials to repair them. However, it is unclear how effective natural seawalls are.

Awareness programs focus mainly on the urban area

- The concentration of training and awareness activities in the urban area was noted to be an important gap in current climate adaptation strategies.
- A participant emphasised the challenge of disseminating services and information to the more remote communities: "We have done a lot with educating communities. They have active programs. UNDP is conducting food security programs on outer islands. The only problem is that the programs are mainly

around the capital, and one wonders how much of the awareness trickles down to the grassroots."

Reviving traditional agricultural knowledge

- The value of traditional knowledge in climate adaptation was significant and highlighted as something that could be revived. This is particularly around food preservation methods.
- A participant stated: "We also need to revive our traditional knowledge and ways of doing things that is good for the environment. For example, instead of constantly harvesting from our coconut and breadfruit trees, we can re-explore traditional ways of storing food in the soil or through boiling and storing so that food will last for two days or even a week.

Creating an enabling policy environment

- Participants underscored the importance of creating an enabling policy environment to promote effective and coordinated approaches to climate adaptation across Kiribati.
- The need for not only relevant policies but implementing them was significant for many participants. One participant shared that Kiribati does not yet have a formal strategy on climate adaptation.
- Another noted: "What should underlie any mitigations and protection against climate change impacting our food system is relevant policy – relevant and effective policies that protect the environment and regulate people's behaviour that is harmful for the environment. Kiribati needs to broaden its policy framework to include the experience of vulnerable people, because they are also impacted by climate change and food system changes. We have some good policies in place but the problem is with enforcement. There is shortage of staff and capacity issues."

Research and data on vulnerable groups

- Participants noted the need to collect data on vulnerable groups in order to inform the provision of services to them.
- Noting that food system risks can impact different groups differently, it was particularly important for those working in communities to have accurate data on vulnerable groups. As one participant stated: "Without specific data, we cannot direct the support for vulnerable people."

Need for atoll food crop varieties from SPC

- The availability of crop varieties that are suited to Kiribati's atoll island conditions was identified as an important concern.

- A participant noted the need for atoll food crop planting materials from SPC: “This is one thing that we would like to have – if they [SPC] can include atoll food crop varieties in their lab, that would be good. If not, it would be good if Kiribati can be provided with a tissue culture lab, that would help sustain us during periods of drought.”
- Participants highlighted the need to get more fruit varieties that are both climate resilient and fast to grow.
- It is also important to consider the desirability of crops. Many crops currently being grown may not be desirable – locals would rather have easily crops that are easily propagated, and newer crops used in other atolls may be suitable for Kiribati.

6. Samoa findings brief

6.1. Overview of participants

Table 4: Samoa experts engaged via interviews and workshop

Field of expertise	Interview participants	Workshop participants
Government	1	1
Private sector	3	2
Academia/research		1
Civil society	1	
Other	1	1
Total	**6**	**5**

6.2. Climate impacts and vulnerability

Priority risks for food systems in Samoa

A range of priority risks were identified by participants which increased food insecurity. Risks were both climate-related and human-induced impacts that are further amplified by climate change.

Increased intensity of weather events and natural hazards

- Excessive rainfall, flooding, and associated soil erosion were identified by participants to be severely affecting crop productivity and causing slow growth rates.
- Conversely, workshop participants reported that drought events are worsening across Samoa.
- Intense cyclones and storm surges were noted by participants as particularly destructive to farming activities, with the coastal areas highly vulnerable.

Unpredictable weather patterns

- Weather patterns are becoming more variable and unpredictable, differing from traditional wet and dry seasons.
- Participants noted that dry season weather patterns have become unpredictable, with both prolonged dry spells and excessive rainfall occurring more frequently. Unusually high daytime temperatures and low night-time temperatures are also becoming more common. Droughts are exacerbating water shortages which are increasingly common, causing significant reduction in agricultural and livestock production.

- Unpredictable weather also affects the production patterns and yields of crops and fruit trees leading to regular shortages of supplies at the local market. One participant noted: "Changing weather patterns affect our crops and therefore our income. For example, we normally expect to harvest our cabbages after three months from the time of planting in January. But that process is taking longer now, and our vegetables don't seem to reach the size we used to have".

Degraded soil and lack of reforestation

- Over-farming of certain areas has led to soil exposure, erosion, and poor soil quality. This is made worse by a lack of reforestation.

Pests and diseases

- Increased temperatures and humidity are leading to an increase in pests and diseases.

Geographic factors in Samoa affecting risk distribution

Participants generally highlighted that intensification of natural hazards and disasters, and increasingly unpredictable weather patterns, affect all of Samoa. However, several geographical factors were identified as affecting the distribution of the priority risks to food systems across Samoa.

- Lowland and coastal areas are more vulnerable to storm surges and sea-level rise. About 70% of the population reside in coastal areas, and, while there is potential to relocate to inland areas, the issue of limited fertile land for agriculture is a significant constraint to food security in these locations.
- There is a 'rain shadow' on the northern side of the two islands, meaning that there is more rainfall in the southern parts of the two islands.

6.3. Amplifiers

On-farm

Unsustainable farming practices

Participants reported several unsustainable farming practices that are increasing the impacts of climate related risks to food systems. These practices reflect a trend of increasingly market-oriented farming systems and lack of knowledge of environmentally friendly farming practices. The following unsustainable farming practices, and associated impacts, were identified:

- Land clearing for commercial and monocrop farming is unsustainable, as the risk of adverse impacts on water catchment areas is often not thought of or managed well. The drive to grow and sell for a profit dominates farmers' approaches and

activities. The pressure of moving to commercial farming and using up more land has resulted in deforestation, soil erosion and loss of biomass.

- The extensive use of pesticides makes it harder for crops to adapt when there are new pests or diseases. Farmers use chemicals because of their convenience but are not effectively managing the risk of chemicals adversely affecting water systems and agricultural production chains.
- Inadequate crop rotation, and not allowing the land to recuperate, means continued reliance on chemicals to drive agricultural production. This undermines the resilience of farming systems. For example, when taro is affected by diseases, farmers tend to use more pesticides, which makes it harder for taro to adapt to new pests and diseases.
- Food safety is an issue of critical concern, particularly in relation to livestock slaughtering practices. Broadly, these are unhygienic, and the risk of producing low quality/contaminated meat is high. Support in building farmers' awareness and capacity in this area is needed.

Land tenure

Insecure land tenure and challenges accessing land were identified as amplifying food insecurity.

- Samoa has a complex land tenure system with 80% of land under customary ownership. Accessing land for agricultural purposes by those who have no family links to land is difficult, and can be a potential source of conflict among families and landowners.

Loss of traditional planting materials and genetic purity

- Participants noted that farmers typically do not maintain traditional planting materials, which can be more disease tolerant, due to a preference for introduced crops and plants for commercial farming purposes. This is leading to the loss of traditional crop varieties that can withstand diseases, as well as fruit trees such as the *niu vai* and *niu afa* (types of coconut trees), that have both traditional/cultural and nutrition value.
- The loss of genetic purity in local crops was identified as a critical concern. This has particularly affected taro, a key crop for both domestic consumption and for export. A participant noted that there are new taro varieties now in Samoa which are not resistant to pests and diseases. These varieties look the same but are genetically different and the local farmers are generally not aware of the differences.

Sub-national variation of on-farm amplifiers

Generally, participants highlighted that the on-farm amplifiers were common across the country.

Off-farm

Reliance on imported foods

- Samoans' increasing consumption of imported food with poor nutritional value has become a significant health concern. Changes in dietary preferences, the time-consuming tasks of growing and cooking local food, the ease and convenience of store-bought food, and widespread access to cash income from remittances are common incentives driving the move away from subsistence agriculture to more imported foods. According to one participant, "reliance on imported food is a risk, because Samoa is one of the countries with the highest NCD [non-communicable diseases] rates. Reliance on imported food is getting worse."
- Social and cultural functions (known as *fa'alavelave*) also encourage spending on imported food items readily available from shops. The ability to buy imported or locally packaged processed food such as corned beef and tinned fish is strongly tied to individual's or a family's financial and social status. Additionally, imported packaged food items are generally considered more convenient than local food, which is time-consuming to prepare.

Movement of labour out of the agriculture sector

- Loss of labour to seasonal labour schemes and trends of urbanisation were raised as key amplifiers, which drain the supply of labour in the agricultural sector. Young men's and women's participation in seasonal labour schemes in Australia and New Zealand is a significant concern for agriculture and other sectors in Samoa. One participant noted: "Seasonal labour mobility will have a bad effect on the whole value chain. Most of the seasonal workers are men who are also needed here to plant and grow our crops. The government will have to work out ways to manage labour shortages in agriculture".
- Another participant had a different perspective on the impact of seasonal labour schemes, noting that despite the schemes, there are still a lot of people left in Samoa. The key issue in terms of the supply of labour in the agricultural sector is that farming is no longer seen as an attractive option.
- There is a trend of increasing urbanisation, with primarily youth moving to Apia, as well as overseas via family migration. Workshop participants highlighted that in many rural settings, it is primarily older adults who farm as youth have left.

Reliance on remittances

- Since Samoans started migrating overseas in the 1950s, remittances have continued to a play a significant role in development across all levels of Samoan society. Reliance on remittances is common, and families see it as an easy way of getting money to spend on buying imported and highly processed food. While some participants saw the value of remittances in subsidising local income, overreliance on remittances was viewed as having a negative impact on locals' diets and consequently health outcomes, as well as disincentivising locals to work in the agriculture sector in Samoa.

Limited knowledge, resources (including technology) and capacity

- Lack of knowledge among farmers on the safe use of chemicals as well as sustainable farming practices, including the value of crop diversity and mixed farming systems, were significant areas of concern raised by participants. New technologies, such as solar dryers, are available but the level of adoption is low. Many farmers still need to learn about the value of new technologies for sustainable agriculture and how to use them. One participant noted that poor management of new technologies stems from a lack of related knowledge in handling and maintenance.

Poor infrastructure for food storage

- Workshop participants highlighted that Samoa generally has poor food storage infrastructure such as cooling facilities which affects the whole supply chain.
- This means that farmers have limited time to sell their food, which affects their ability to focus on food production.

Loss of traditional knowledge

- While traditional knowledge of farming local crops and preserving food is a mitigating factor (detailed below), the loss of this knowledge was also perceived as an amplifier to food insecurity.

Sub-national variation of off-farm amplifiers

Generally, participants highlighted that the off-farm amplifiers were common across the country. The exception was that trend towards increasing urbanisation, particularly movement to Apia, is having a pronounced effect on the local economies and social structures of remote areas.

Impacts of amplifiers on different groups

The impacts of on-farm and off-farm amplifiers tend to be worse for women and people with disabilities.

- Women, men and people with disabilities have differential access to farming opportunities and resources. Agriculture in Samoa has culturally and historically been dominated by abled-bodied men, and those outside of this group are neither expected nor encouraged to engage in the sector. In this manner, societal attitudes shape the exclusion of women and people with disabilities from the agriculture sector. One participant noted: "Women don't have clear access to customary land, and for people with disabilities, it is very hard to build capacity to enter into the agriculture space because the work is physical, and you need the help of others." Limited opportunities for these marginalised groups to engage in farming activities or related capacity building has further impacted their ability to effectively participate in agriculture.
- More men than women and people with disabilities are recruited for seasonal labour schemes. This trend not only reduces the supply of abled-bodied men for domestic agricultural work, but it also leads to a situation where much of the work of agricultural production, particularly small family-based production, is shouldered by women, adding to their already heavy roles in the domestic space.
- A significant positive development for promoting the participation of women and people with disabilities in agriculture is the establishment of an all-women growers' group (SWAG) based in urban Apia. One of its key goals is ensuring inclusive farming practices including potential employment of people with disabilities and women in agricultural projects.

6.4. Mitigators

Adoption of sustainable farming practices

Participants identified mitigating factors associated with the adoption of more sustainable farming practices, including:

- Agroforestry systems that involve not just farming for income but also wider ecosystem benefits. For example, planting Poumuli trees (*Flueggea flexuosa*) around farm areas as a natural boundary marker that protect crops from strong winds and provide wood for building shelters.
- Climate smart agriculture practices like integrated pest management (IPM) that use innovative technologies and techniques. An example is the use of tunnel houses for vegetable and crop production introduced by the Chinese agricultural experts. Tunnel houses are effective for protecting crops, fruits and vegetables by keeping out bugs, insects, and birds associated with pests and diseases. This

replaces the green houses, which are more permanent structures for certain crops.

- Small-scale mixed farming systems are a traditional practice of small semi-subsistence farmers. In these farming systems, there is a diversity in crops ranging from perennial crops such as coconuts to vegetables and root crops such as taro. New additions include cassava and sweet potato, with the former traditionally considered a livestock food in Samoa.
- Promoting the use of sheep helps to keep farming areas free of grown bushes and grass. As a new practice, sheep raising replaces the use of chemical spray to kill weeds and clear the land.

Support of village councils

- Garnering the support of village councils in enforcing regulations on where to plant and what to plant (there were cases of farmers also growing illicit drugs) was noted by some participants as important. One village, Tanugamanono, was provided as an example of how village bylaws have helped to ensure farmers use land designated for farming rather than that earmarked for conservation.

Traditional knowledge

Traditional knowledge of farming local crops and preserving food can be a mitigating factor to climate related risks to food systems.[5] However, there was a general sense that contemporary farmers do not have or practice this knowledge.

- Knowing when to allow the land to rejuvenate is an important traditional farming practice. However, with the growing shift to market-oriented and commercial farming activities this practice is being disincentivised.
- Knowledge of how to preserve foods is important for food security, especially in times of disaster, when there is no electricity available.
- Workshop participants highlighted the potential to boost food security with increased promotion and practice of traditional knowledge due to its compatibility with subsistence farming, which makes up the majority of Samoa's agricultural sector. Loss of traditional knowledge and practices particularly among young farmers is a key concern. Reviving this will take significant effort, and identifying a responsible stakeholder/partner to lead this is currently not clear.

[5] While kinship networks and customary practices were not explicitly mentioned by experts on Samoa, this remains an important aspect of Samoan culture and is likely to be a mitigating factor. See: Lilomaiava-Doktor, Sa'iliemanu. 2020. "Oral Traditions, Cultural Significance of Storytelling, and Samoan Understandings of Place or Fanua." *Native American and Indigenous Studies*, vol. 7, no. 1, pp. 121–151.

Remittances

- Remittances were noted to have both positive and negative impacts: they are a key source of income for purchasing food, but remittances were also noted as encouraging a dependence mindset among locals, disincentivising them from investing time and labour in their own farming. One participant stated: "Remittances are good in one way and bad in another. It is good that our seasonal workers send money home, because that can generate more money for us if it is put into good use. It helps farmers buy equipment and crops they need."

Sub-national variation of mitigators

Participants generally did not report significant sub-national variation of mitigators across Samoa.

Impacts of mitigators on different groups

Generally, mitigating factors were viewed as beneficial for all segments of the population. A few differences demographic variables were highlighted for affecting the distribution of mitigators.

- Workshop participants highlighted that villages that have an active older generation tend to have better levels of traditional knowledge.
- Additionally, access to equipment and capital for farmers differs greatly between commercial farmers, semi-commercial farmers and subsistence farmers and hobbyists.

6.5. Climate adaptation

Current strategies that are working well

A range of government supported climate adaptation and food security initiatives were highlighted as part of strategies that are working well.

Policy environment

- There are a number of policies on the environment, climate change and food systems in Samoa. The key ones are the Samoa Climate Change Policy 2020-2030, the Samoa Food Systems Pathway 2030, and the National Food and Nutrition Policy 2013, all of which highlight the urgency needed to combat climate change impacts on the country's wellbeing. Ministry of Agriculture & Fisheries (MAF) officials refer to these documents as enablers that guide their ministry's mandate in providing technical advice and services to crop, livestock, and fisheries sectors. However, a key challenge is around policy implementation due to lack of resources.

Promotion and development of climate resilient crops

- MAF is working with SPC to identify and support the use of more climate and pest resilient crops such as varieties of taro and coconuts.
- The Scientific Research Organisation of Samoa (SROS) also provides assistance to MAF with plant breeding programs.
    - One participant noted that the new crops have varieties that can withstand specific climatic conditions and could help to ensure food supply during and post-disasters.

Access to equipment and capital

- The introduction of automated credit systems to enhance communication and supplies of materials for farmers has helped to improve the capacity of some farmers. One example is a government e-voucher system supported by the World Bank. This electronic credit system supports communication between farmers and suppliers of farming equipment with information on the quoted prices at each point of the transaction. However, only commercial farmers could access the system when registered with MAF.
- Mobile slaughtering units have also been introduced by the Government, with support from the World Bank, in the last four years as a means to increase farmers' awareness and capacity on food safety. Each unit involves a trained slaughterer, a meat inspector and a driver. The units are currently operated by the MAF with plans for them to be eventually run by private sector operators. The use of the mobile slaughtering units has been particularly important for demonstrating good food safety standards during cultural ceremonies where livestock is often slaughtered.

Gaps and limitations in current climate adaptation strategies

Participants identified a diverse range of gaps and limitations in current adaptation strategies. These gaps and limitations included, but were not limited to, the need for technology adoption and better evaluation and coordination of climate adaptation initiatives and policies.

Further education and awareness on sustainable land use and conservation

- Having a good understanding of the balance between agricultural activities and conservation is important. One participant identified the need to educate local farmers on the types of land that need to be protected and not cleared for farming and livestock use.
- Further education and training on managing the risk of chemicals on crops, the soil and environment is also important.

Limited adoption of new technologies

- There is a need to share knowledge and awareness on the use and value of climate smart agricultural technologies across Samoa.
- Low adoption of new technologies that help reduce climate risks to food systems was noted as a capacity issue.
    - A participant gave an example of the limited adoption of solar dryers among farmers to help improve the storage of staple crops, vegetables, and fruits. There is a need to share knowledge and awareness on the use and value of solar dryers across the country.

Extension services and information dissemination

- The benefits of agricultural training are not equally accessed by farmers across the country.
    - One participant noted that as an advocate for grassroots and rural community farming, there is a need to ensure key information on new crop varieties, especially those resilient to climate variations, reaches rural farmers.

Coordination of climate adaptation initiatives

- Different implementing partners are working in silos resulting in ineffective efforts on adaptation strategies. Given that stakeholders across multiple sectors are involved in the food system space, it is important that effective communication among implementing agencies is there to help reduce conflicting and duplicating tasks.

Monitoring and evaluation of policy

- Workshop participants noted the need to review and evaluate the implementation of government policy as part of building a body of evidence on what is working well.

7. Vanuatu findings brief

7.1. Overview of participants

Table 5: Vanuatu experts engaged via interviews and workshop

Field of expertise	Interview participants	Workshop participants
Government	2	1
Private sector		
Academia/research	2	
Civil society	1	1
Other	1	1
Total	**6**	**3**

7.2. Climate impacts and vulnerability

Priority risks for food systems in Vanuatu

Participants identified that it is useful to understand climate impacts and risks to food systems through the lens of rapid and slow onset risks and impacts.

Rapid and slow onset risks and impacts

- Increasing intensity of extreme weather events and natural disasters are producing more obvious impacts and risks to food systems from cyclones, droughts, flooding, and ashfall from volcanoes.
- Workshop participants reported this as the most significant climate related risk for food security in Vanuatu.
    - Reflecting on the climate risks to Vanuatu, a participant noted: “Vanuatu is the most disaster vulnerable place in the world”
- Slow onset risks and impacts of climate change are also important and are interacting with and exacerbating existing social, political and economic trends.
    - For example, environmental factors are pushing people to migrate from rural to urban areas, accelerating a trend that has already been occurring in Vanuatu.

Unpredictable weather patterns

Participants noted that weather patterns are becoming more variable and unpredictable, differing from traditional seasons.

- While the focus is often on increased extreme weather events, workshop participants noted that the thermal boundaries of crops are being impacted

through increased temperatures. This means that crops like taro are becoming less tolerant and more stressed from gradual increases in temperature.

- A participant shared an example of the price of island cabbage (*Abelmoschus manihot*) doubling or tripling in price in the Port Vila market because of heavy rainfall events.
- An SPC community vulnerability assessment observed that in the northern province, Torba, fruiting patterns for mangoes and breadfruit have changed dramatically. Another participant noted: "This year there was no cool season when people usually grow greens like broccoli. These aren't the core traditional crops but if this is the issue now then looking into the future it is a major concern especially when it intercepts with geo-political factors that are pushing up costs such as fuel."

Pests and diseases

- Biological pests like the coconut rhinoceros beetle can cause significant disruptions to food systems and impact on traditional diets.

Geographic factors in Vanuatu affecting risk distribution

Participants identified a range of geographic factors affecting the distribution of risk for food systems from climate impacts across Vanuatu.

- The smaller islands, especially in Shefa province, have limited supply of fresh water and shallow soils with low soil fertility.
- Volcanoes are spread throughout Vanuatu, but one participant reported that there is greater risk of volcanic eruptions on Tanna and Ambae Islands.
- Flooding is worse in lowland areas.
- Some parts of Vanuatu have a high concentration of villages along the coast, making these populations more vulnerable to sea-level rise.
- There are some parts of Vanuatu where people do not have areas to relocate to during cyclones. For instance, on the west coast of Santo, during a cyclone people do not have access to interior land to move to due to the region's rugged topography.
- Drought affects all of Vanuatu, with no differentiation at the sub-national level specified by participants.
- The types of pests and diseases varies across Vanuatu based on the staple crops grown in each region. For example, dryland taro is commonly grown in Tanna while breadfruit is a staple food in the Banks Islands – each is affected by different pests and diseases.
- Climatic differences between the northern and southern islands of Vanuatu mean that some vegetables cannot be grown in the north.

7.3. Amplifiers

On-farm

Lack of crop diversity

- Participants noted there is often a lack of diversity in crops that are grown in local gardens.
- Cash crops are commonly sold to buy imported food. For example, farmers are selling kava to buy rice.

Limited knowledge, resources and capacity

A broad range of capacity constraints affecting farmers were raised by participants.

- Farming systems typically do not have irrigation which can amplify the effects of drought.
- There is limited access to farming machinery and equipment.
- Use of poor farming techniques such as slash and burn agriculture which is labour intensive and can lead to pests and diseases.

Access to land and land tenure

Challenges accessing land and with customary land tenure arrangements are resulting in people being unable to access farmland which is disrupting food security.

- This can be exacerbated when there are natural disasters that displace large groups of people.
- Population pressure on land is placing stress on shifting cultivation practices, in particular fallow periods, which have become shortened (one participant said they have been reduced from 5-7 years to 2-3 years).

Low soil fertility

- Small atoll islands typically have poor soils for farming, and over population of large islands means there are not adequate fallow periods to allow soil to rejuvenate, as noted above.

Lack of water supply

- Lack of consistent access to freshwater is a challenge for food production.

Sub-national variation of on-farm amplifiers

Several key sub-national differences affecting the variation of on-farm amplifiers were identified, especially between rural and urban locations (see case study B for further details).

- For many rural villages, gardens are still central to their food security, however some changes are occurring. There is evidence of rural villagers having to relocate food gardens to locations that are cooler and wetter.
- For peri-urban villages, some residents are choosing not to farm at all due to the impacts of natural hazards on gardens.
- Land tenure and access challenges vary substantially across Vanuatu.
    - For example, on Efate there is much greater pressure on land due to in-migration and population growth.
    - The displacement and relocation of people impacted by natural disasters can exacerbate land tenure and access challenges. There are examples of displaced populations being relocated to land that they do not have secure tenure over, land that is exposed to other types of natural hazards, or land that is unsuitable for farming. In recent years, such displacements have occurred on Tanna, Ambae, and Gau in Torba Province.
- Population pressure (which is placing stress on subsistence farming practices) is having more of an impact on the smaller islands compared to the big islands of Santo and Malekula.
- On small atoll islands, people do not have access to wild harvest foods in the forest which are particularly important during disaster events.
- The island of Tanna was singled out by one participant as being particularly important because its rich soils, and skilled farmers supply a lot of food to Port Vila.
    - Volcanic ash falls that affected Tanna in 2021 and early 2022 had an adverse impact on food production on Tanna and hence the supply of fresh food to Port Vila.

Off-farm

<u>Reliance on imported foods</u>

Dietary changes are occurring to meet the needs of modern lifestyles based on participation in the formal economy and in response to the increasing challenges of farming in the context of intensifying natural hazards.

- Farmers are finding that they have less time to farm due to increasing off-farm responsibilities and commitments.
- Increasing demands for cash are incentivising a shift away from subsistence farming.

- The convenience of store-bought food like rice is appealing as it is much quicker to prepare than traditional island food. Rice can also be cheaper than buying local produce and can be stored for longer.
- A participant commented on how store-bought food is perceived to be more compatible with modern lifestyles in Vanuatu: "People are getting full time jobs; they're starting to change their way of life. They have less time to be in their gardens, even less time to prepare food. I mean traditional island food takes quite a long time to prepare and so as women are entering the workforce more so than previously and they have less time to do traditional island food preparation, which is usually left to the women."
- When there is a disaster that affects subsistence farming, remote islands become dependent on imported food.
- Seasonal labour schemes are driving an increasing reliance on imported foods because when young men go overseas, their wives cannot do all the farming so they use income from remittances to purchase imported food.

Price fluctuations

- The reliance on store-bought food has increased people's susceptibility to price volatility after disasters and reduced their nutritional diversity.
- Since the onset of the COVID-19 pandemic, increased prices for fuel and transport have affected supply chains. The increased price of fuel also affects farmers' access to markets.
- There is no government authority that regulates food prices. Further, workshop participants highlighted that a lack of data on production levels of certain crops and market information on pricing further amplifies fluctuations in pricing.

Poor infrastructure and connectivity

Infrastructure for transportation of food between and within islands, as well as infrastructure and facilities for storing and processing food is a key challenge affecting the distribution of food across Vanuatu.

- A participant reflected on how transportation challenges affect the distribution of food: "Shipping is not reliable. We have food growing in places that cannot be accessed".
- Poor transportation between islands means that there can be competition for food and resources, with islands that are more populous getting precedence. Conversely, road connectivity on islands is also a key challenge, as one participant noted: "Bringing food inland from the coast is a challenge".
- A participant shared an example from Tanna, where during a king tide event, the wharf can be completely submerged under water, and consequently food supplies cannot be taken to the market.

- Poor telecommunication infrastructure means that people do not always know when a ship will come past their island.
- Problems with transportation infrastructure are further amplified by the lack of infrastructure for storing (for example not having cooling facilities) and processing food. This means that in times of natural disasters, there are challenges distributing a surplus of food from one island to another as it goes off.

Poor food safety standards

- There is limited capacity to meet food safety standards and production requirements for sale in the domestic market, which can drive further reliance for imported foods.
    - For example, not many local chicken farmers can produce eggs at volume for the market, resulting in the majority of eggs being imported. There have been some quality concerns around these imported eggs.

Limited public awareness campaigns on food and nutritional security

Participants reported the need for more education and awareness around food and nutritional security, including through nuanced public awareness campaigns.

- Public awareness campaigns encouraging people to eat more locally produced food are too basic.
- For example, a participant noted: “It is also public awareness of knowing what's better for your diet, for your own health and I think there is a quite a gap in that awareness. And at the moment it's has been for a few years. It's just been a super basic awareness campaign which just says, you know, ‘kaikai aelan kakai’, which is ‘eat Island food’, as in things that you grow. Don't eat imported food, but I think we're at the stage and in our development where we need to be a bit more nuanced.”

Limited knowledge on climate change and climate smart agriculture

- Many Ni-Vanuatu are not aware of the risks associated with climate change.
- Farmers lack the climate science, knowledge and technology to practice climate resilient farming techniques.

Movement of labour out of the agriculture sector

- Workshop participants reported that seasonal labour schemes are reducing the availability of labour in the agriculture sector, especially among male youth.

Sub-national variation of off-farm amplifiers

The off-farm amplifiers were identified as being applicable to most of Vanuatu. However, some sub-national variations in off-farm amplifiers were identified, especially for rural and remote communities.

- Ni-Vanuatu are increasingly consuming imported food. Currently, this is most prevalent in urban and peri-urban locations as they have greater access to imported food. However, rural populations are increasingly eating more imported foods, especially for convenience items like sugar, instant coffee, and noodles.
    - Workshop participants gave examples of remote islands like Maevo and Futuna, where there is no frequent connectivity, being relatively less reliant on imported foods compared to central islands like Efate and Santo.
- The remoteness of some parts of Vanuatu, such as the west coast of Santo means that they have a lot less access to NGOs, and health and agriculture services.
    - It is hard to get supplies to these more remote locations after disaster events due to the poor infrastructure
- The quality of road infrastructure varies between islands, but is generally poor in most places.
    - Across Vanuatu, 80% of islands have poor feeder road infrastructure.
    - Some islands have no roads at all. Santo, Efate, Malekula have poor roads, while Tanna has better roads relative to the rest of Vanuatu.
    - On the bigger islands, road connectivity is a more critical issue due to the presence of inland communities who need access to coastal areas for inter-island travel and transport.

Impacts of amplifiers on different groups

Vulnerable groups such as women, the elderly and people with disabilities were most commonly identified as being impacted the most by amplifiers.

- The relocation of farming land to more remote areas in response to changing environmental factors means that elderly people, and some people with disabilities, cannot access farmland as easily.
- Remote villagers can suffer from lack of nutritional diversity during times of drought. This can be particularly harmful for vulnerable demographics like young children and pregnant women.
    - One participant noted the risks for young children and pregnant women: “After cyclone Pam when there was the… El Nino drought that lasted quite a long time, there were people in that village that only ate either noni [*Morinda citrifolia*] or bananas for 3, 4, 5 months and that's a long time to have access to only one food product, especially for children in the first 1000 days of life or pregnant women”.

- Women bear the brunt of farming responsibilities, on top of their other duties, when their husbands go on seasonal labour schemes.
- Women are the most affected by poor telecommunication and transportation infrastructure, as women generally go to the market to sell produce.
- Land is typically inherited by a patrilineal system, which makes it challenging for women-headed households to access arable land.
- People with disabilities typically do not participate in farm activities.
- One participant identified that youth are not interested in farming and instead want to go on seasonal worker schemes.

7.4. Mitigators

Kinship networks and customary practices

Kinship networks and customary practices, such as sharing food, are important mitigating factors.

- During the CVOID-19 pandemic, people in Port Vila went back to their home islands. This is an example of family connections to their islands forming a support system during a time of crisis.
- Church groups also form a critical part of people's social networks.
- One participant likened these kinship networks to a form of social security: "In Australia you have social security. We don't have that here in Vanuatu. Our social security has been the family network. That has worked effectively because of the way the culture has been for centuries".

Food distribution system

- Participants noted the importance of formalised food distribution systems for responding to disasters (detailed further in section 7.5 Climate adaptation).

Culture and history of adaptation

Ni-Vanuatu have a long and diverse history of adapting to different disasters and traumatic events.

- One participant reflected: "Traditionally people in the Pacific are quite adaptive and flexible. Over history they have made adaptations. For example, moving gardens is an adaptation. There is innovation and an ability to adapt and be flexible within the culture".

Traditional knowledge

Ni-Vanuatu utilise traditional knowledge on how to preserve food and eat 'disaster foods', which is a crucial mitigator especially during disaster events. While this knowledge is considered important for climate adaptation, it is not widely practiced anymore.

- For instance, some Ni-Vanuatu know how to ferment breadfruit and how to use wild yams, which are not considered tasty but can be an important source of food after disasters.

Imported food

- It is important to note that store-bought food can also be viewed as a mitigator for food security during times of crisis.

Crop selection

- Traditional crops, especially tubers, are in general more resistant to the effects of climate change.
- Growing climate resilient crops.
    - For instance, there is a cassava variety that can be harvested in 3 months instead of the usual 6 months
    - In 2021, the Department of Agriculture & Rural Development launched the "golden yam" which is a mix between a wild yam and commercial one. Vanuatu Agricultural Research and Technical Centre (VARTC) is focusing on developing the golden yam so that it can be a central feature of the Department's response to climate change impacts on food security.

Sub-national variation of mitigators

Participants identified some important variations in the sub-national distribution of mitigating factors, including in regard to rural and urban differences.

- Remoteness can be both a mitigating factor and an amplifier. In some instances, villagers living in remote villages are not as integrated into the cash economy as urban residents, and actually have a more diverse diet due to growing a greater variety of local crops than urban residents who rely on a limited range of imported food. However, during periods of drought, rural villagers can suffer from a lack of nutritional diversity.
- Kinship networks and customary practices of sharing food and resources are generally present across all parts of Vanuatu but vary in strength between different groups and tribes.
    - One case study suggests that kinship networks and customary practices of sharing are stronger in rural villagers compared to in urban areas.

- The strength of cultural and traditional knowledge varies between islands due to different histories and experiences of traumatic events.
    - For example, Erromango is unique in that the island experienced 92% depopulation as consequence of contact and colonisation, which led to "a lot of cultural erosion and loss of culture".
    - Traditional knowledge of food preservation and disaster foods tends to be stronger in more remote islands.
- A small-scale vetiver grass program on Aneityum has shown success in reducing soil run-off and soil erosion.[6]

Impacts of mitigators on different groups

Generally, mitigating factors were viewed as benefitting all segments of the population.

7.5. Climate adaptation

Current strategies that are working well

Participants primarily highlighted government initiatives as current climate adaptation strategies that are working well in Vanuatu.

Government-driven adaptation initiatives

- The Government provides a suite of climate resilient initiatives, including initiatives aimed at improving agricultural water and soil, and planting of grasses to help mitigate the impacts of sea-level rise and coastal erosion.

National disaster responses

- Government agencies have been establishing 'food banks' and 'food baskets' where food crops are produced to help with the supply and distribution of food and seeds after disaster events.
- The National Disaster Management Office food cluster system distributes food after disaster events. While there can be inequities in distribution between islands, it is broadly seen as a critical safety net during times of disasters.
- During the COVID-19 pandemic, the Government of Vanuatu mandated that no external food relief would be sourced internationally to mitigate the risk of COVID-19 transmission. The Government has since kept this policy - that all food relief will be sourced domestically - for future (non-COVID-19 related) disasters.
    - After Cyclone Harold, the Department of Agriculture & Rural Development has been developing food baskets, which are two-hectare blocks of land across the islands, in partnership with farmers. These food baskets include

[6] Vetiver is a type of grass with deep roots and tall stems that can be used to help prevent erosion.

multiplication plots of root crops to ensure that both food and planting materials are available during disasters.

Breeding climate resilient crops

- Workshop participants reported that research in Santo is looking at breeding of climate resilient varieties of root crops and nutritional content.
    - There is potential to include these climate resilient varieties as part of food banks and baskets.

Community-driven adaptation initiatives

- There are already examples of communities relocating their gardens further in-land and to higher ground.

Gaps and limitations in current climate adaptation strategies

Participants provided a mix of high-level, broad, recommendations, as well as more targeted suggestions to improve climate adaptation strategies across Vanuatu. A strong focus of these is centred on the need for greater policy, planning and coordination.

Context specific planning

- There is a need for greater context-specific planning so that climate adaptation and related policies can be contextualised to local social factors and not just the scientific effects of climate change.
    - One participant explained: "I think one of the gaps is that they [climate adaptation strategies] really need to be context specific. We're talking about small communities… It's a very different way of life. And so to adapt to climate change that needs to be done at a local level and really listening to what is happening and people's lives and taking into account not just the very kind of scientific effects of climate change… but also all these other social factors."
    - In addition to the social factors, there is a need for better land use planning around the suitability of crops for different ecological conditions across Vanuatu.

Lack of data on food security

- There is a lack of data on the status of food insecurity across Vanuatu. Workshop participants noted the absence of good baseline information to compare against, the lack of regular collection and dissemination of information.
- This means that decisions on food security and climate adaptation are often based on incomplete assumptions. This can be particularly challenging to inform responses in times of natural disasters.

- Further efforts are also required around effective analysis and utilisation of data for planning

Coordination of climate adaptation strategies

- Poor coordination of climate adaptation initiatives, and limited consideration of their ongoing sustainability affects the long-term success of climate adaptation strategies.
    - One participant highlighted: "[There is] no coordination among government or among donors. So if government is not having good coordination, others don't have it either. So there are lots of good projects existing but no sustainability. Effectively a lot of policies are aspirational. Donors are going straight to provinces and do projects here and there, but sustainability is questionable."

Enabling environment for knowledge dissemination and exchange

- An enabling environment is needed to facilitate the exchange of traditional knowledge and to resource climate adaptation initiatives.
    - In some cases, people have traditional knowledge, but they don't want to share it without being paid.
    - There is a role for both government and private sector to fund adaptation initiatives
    - Reflecting on the need for an effective enabling environment, one participant noted: "there's an assumption that communities will just do things regardless, the question is always, 'but what's the role of government?' Does government create a policy enabling environment? Does it provide resources?... it's a much deeper question, even with climate change tools and all of that, you know you can have all these interactive tools that tell people, 'OK, it's a La Nina year, you might not want to be planting crops that don't do well in wet conditions or you might want to rethink your crops for this year'. But a lot of people are going to be like, 'well, then, are you going to subsidise our seeds?'... so it's really starting to think about, well, how does that interface between what government can do and what and when we say to community. Remembering there is a private sector element to it in that for some it's their business.
- Workshop participants highlighted the need for greater two-way exchange of knowledge on climate smart agriculture between government and farmers. Government could improve their dissemination of information to farmers, as well as tracking the climate change impacts that farmers experience across the archipelago.

Policies and planning around land governance

Policy and strategies around land tenure are required, especially in the context of climate change, as well as increasing urban migration and development.

- As one participant noted: "The [land] tenure security issue is really important to highlight. Even if you have tenure security as a customary owner, if your coastal zone is shrinking and you can't move, basically what you have tenure over becomes more sea than land. You know, how do you handle that shift?... As well as of course, people who are completely displaced and need to find safe places to settle with security. I feel this is in the 'too hard basket' for a lot of policy makers".
- Planning around land zoning for agricultural zones and residential zones is also an increasingly important issue for food security. People want to live around urban hubs, however, a lot of areas being developed for residential purposes are also on prime agricultural land.

Establishment of seedbanks

- Establishment of more seedbanks that can be accessed during times of disasters.
    - There is a national policy to ensure that seeds are available across all islands. It is important to have a constant supply of seeds to be duplicated across all islands so that when one island is affected by disasters, seeds and food (coconut, breadfruit, bananas) can be distributed.
    - This would also help reduce the reliance on rice.

Inclusive policy and planning

- Marginalised groups such as people with disabilities and women are not factored into policy making in Vanuatu.

Annex A: Additional resources, initiatives, and literature in the target countries

Experts engaged as part of the KII process highlighted and shared a range of relevant resources, initiatives, and literature in each of the target countries which are listed below.

Fiji

Relevant initiatives

Participants shared a range of relevant initiatives to research on climate impacts on food security, detailed below:

Examples of sustainable cropping systems in Fiji

- Tutu Rural Training Centre and its catchment area on Taveuni and through Vanua Levu. Click here.
- Prakash's "food forest on degraded sugar land outside Lautoka, Viti Levu. Click here and here for videos.

Example of the benefits of involving women to enhance the adoption of sustainable agricultural practices

- The experience of "the Tel-a-Women (TAW)" introduced by PIFON in Fiji. See the Moko Productions video here introducing the TAW program.

Research investigating the impacts of climate change on root crops

- Australia Pacific Climate Partnership and Phama Plus project in Fiji, Samoa and Tonga (Reference provided below)

Online information tools

- Pacific Agricultural Information System (PAIS) https://thepais.net/pais/home/home.aspx

Relevant literature

- Andrew McGregor has been developing training modules on sustainable agriculture for Pacific farmers (with strong focus on Fiji) which are available here (https://pacificfarmers.com/key-resources/publications/)
- D. Medina Hidalgo, P.D. Nunn, H. Beazley, S. Burkhart, J. Rantes. (2022) Adaptation, sustainable food systems and healthy diets: an analysis of climate policy integration in Fiji and Vanuatu. *Climate Policy* 22:9-10, pages 1130-1145.
- Isoa Korovulavula, Patrick D. Nunn, Roselyn Kumar & Teddy Fong (2020) Peripherality as key to understanding opportunities and needs for effective and

sustainable climatechange adaptation: a case study from Viti Levu Island, Fiji, *Climate and Development*, 12:10, 888-898, DOI: 10.1080/17565529.2019.1701972

- APCP and PHAMA Plus (2020) Managing the Impacts of Climate Change on Root Crop Production and Value Chains in Fiji. Johnson, J.E., Nauluvula, P., Siakimotu, T.S. and Tuivuniwai, N. (Authors), Pacific Horticulture and Agriculture Market Access (PHAMA) Plus Program and the Australia Pacific Climate Partnership, Suva, Fiji.

Kiribati

Relevant literature

- Cauchi, J.P., Moncada, S., Bambrick, H. and Correa-Velez, I., 2021. Coping with environmental hazards and shocks in Kiribati: Experiences of climate change by atoll communities in the Equatorial Pacific. *Environmental Development*, *37*, p.100549. https://doi.org/10.1016/j.envdev.2020.100549
- Cauchi, J.P., Bambrick, H., Correa-Velez, I. and Moncada, S., 2021. 'White flour, white sugar, white rice, white salt': Barriers to achieving food and nutrition security in Kiribati. *Food Policy*, *101*, p.102075. https://doi.org/10.1016/j.foodpol.2021.102075
- Cauchi, J.P., Bambrick, H., Moncada, S. *et al.* Nutritional diversity and community perceptions of health and importance of foods in Kiribati: a case study. *Food Sec.* **13**, 351–367 (2021). https://doi.org/10.1007/s12571-020-01128-6

Samoa

Relevant literature

- National Food and Nutrition Policy 2013. Available at: https://extranet.who.int/nutrition/gina/sites/default/filesstore/Final%20Food%20and%20Nutrition%20Policy%202013.pdf
  This policy guides and supports actions through key points of the entire food and nutrition system from production to consumption and preventative health actions. The policy is administered by MAF with implementing partners across government, NGOs and local communities. Samoa Climate Change Policy 2020-2030. Available at: https://www.mnre.gov.ws/wp-content/uploads/2021/03/Samoa-Climate-Change-Policy-2020-2030.pdf
  This policy guides and supports coordination of national and sub-national actions aimed at addressing climate change impact and building resilience in Samoa.

- Samoa Food Systems Pathway 2030. Available at: https://summitdialogues.org/wp-content/uploads/2021/12/Samoa-Food-Systems-Pathway-2030-Official-version.pdf
  The Samoan government's new Samoa Food Systems Pathway 2030, launched in 2021, guides the training activities that the MAF provides for farmers. It covers a broad range of activities focused on sustainable food systems including production, processing and consumption

Vanuatu

Relevant initiatives

Government policy on food security

- Government has developed a food systems secretariat which will develop a committee to implement their Gudfala Kaekae Policy. This is a multi-sector initiative designed to improve food and nutritional security.

Example of a Government and Green Climate Fund adaptation initiative

- The Vanuatu Community-based Climate Resilience Project (VCCRP) is a $32.7m Green Climate Fund initiative managed by Save the Children and the Vanuatu Ministry of Climate Change (MoCC). This multi-component initiative will run from 2022 through 2028 and is designed to increase community resilience to climate variability and change in Vanuatu.

Example of a climate information tool

- The Van-KIRAP project is focused on communicating climate information services via a portal.[7]

[7] "The Green Climate Fund Van-KIRAP Project in Vanuatu is delivering climate science to support decision makers and communities in Vanuatu to prepare for and adapt to climate variability and change. This project is led by SPREP (Secretariat of the Pacific Regional Environmental Program) in partnership with VMGD (Vanuatu Meteorology & Geo-hazards Department) and delivery partners including CSIRO, BOM (Bureau of Meteorology) and APCC (APEC Climate Centre). He development of the Van KIRAP portal is a key activity as part of the CSIRO scope of work and is being undertaken by Frontier SI as part of a consortium of delivery partners with complementary expertise." (see https://frontiersi.com.au/van-kirap/)

Annex B: Semi-structured key informant interview guide

An example of the semi-structured KII guide used for participants with expertise on Fiji is provided below.

7.5.1. Introduction:

- *Researchers introduce the project and the ethics requirements*

7.5.2. Background and context: Previous research findings, concepts and definitions

- *Key concepts and definitions that will be referred to in the interview are explained to the participant*

World Bank Climate Risk Country Profile – Key messages

- Long-term warming is expected to be below the global average in Fiji, ranging between 0.6°C and 2.6°C by the 2090s when compared with the 1986–2005 baseline. The range of possible temperature rises highlights the significant differences between 21st century emissions pathways, while uncertainty remains high.
- Fiji has a high degree of vulnerability to climate extremes such as drought and extreme rainfall and any increases in the frequency and intensity of such events could represent a major threat to livelihoods, infrastructure, and human wellbeing.
- Considerable uncertainty surrounds projections of future precipitation trends and extreme climate events; further research is required to constrain the wide range of current estimates.
- The frequency of tropical cyclones affecting Fiji is projected to decrease, though the magnitude of the decrease remains uncertain and the intensity (wind speed) of cyclones may increase.
- Sea-level rise will have a range of impacts on Fiji's islands, including potential inundation, coastal erosion, and saline intrusion, the risks of storm surges and king tides may also be exacerbated.
- Fiji has significant assets and infrastructure with high exposure to climate-related damage.
- Degradation of key natural resources is inevitable, coral reefs and associated fisheries are under significant threat, with declines in soil and water quality are likely.
- The various projected impacts of climate change are likely to affect Fiji's poor, marginalized, and remote communities most significantly.

Concepts and definitions

Food systems: A food system is composed of the elements (including environment, people, inputs, processes, infrastructure, institutions), activities, and outcomes that relate to food (including production, processing, distribution, preparation, and consumption), which involve both socioeconomic, political, cultural and environmental dimensions (Ericksen, 2008; Robins et al., 2020). The primary role of a food system is to achieve food and nutritional security without compromising the ability to achieve this goal in the future.

On-farm production: "On-farm" activities are a key part of the broader food system and include subsistence and commercial agriculture, livestock, coastal and inland fisheries and other mixed systems.

Off-farm activities: "Off-farm" activities are a key part of the broader food system and include processing, transport, access to markets, infrastructure, storage and labour. The food environment, such as availability, affordability, preferences, and food safety, also affects the consumption aspect of food systems.

Amplifiers and mitigators: Amplifiers and mitigators are the non-climatic factors that affect the levels of exposure, sensitivity, or adaptive capacity to climate change hazards. They can occur across the following five areas: biophysical/nature, infrastructure/manufactured, economic/financial, social, and demographic/human. Amplifiers and mitigators are relevant to both the production and off-farm food systems

components (Forum for the Future, 2020).

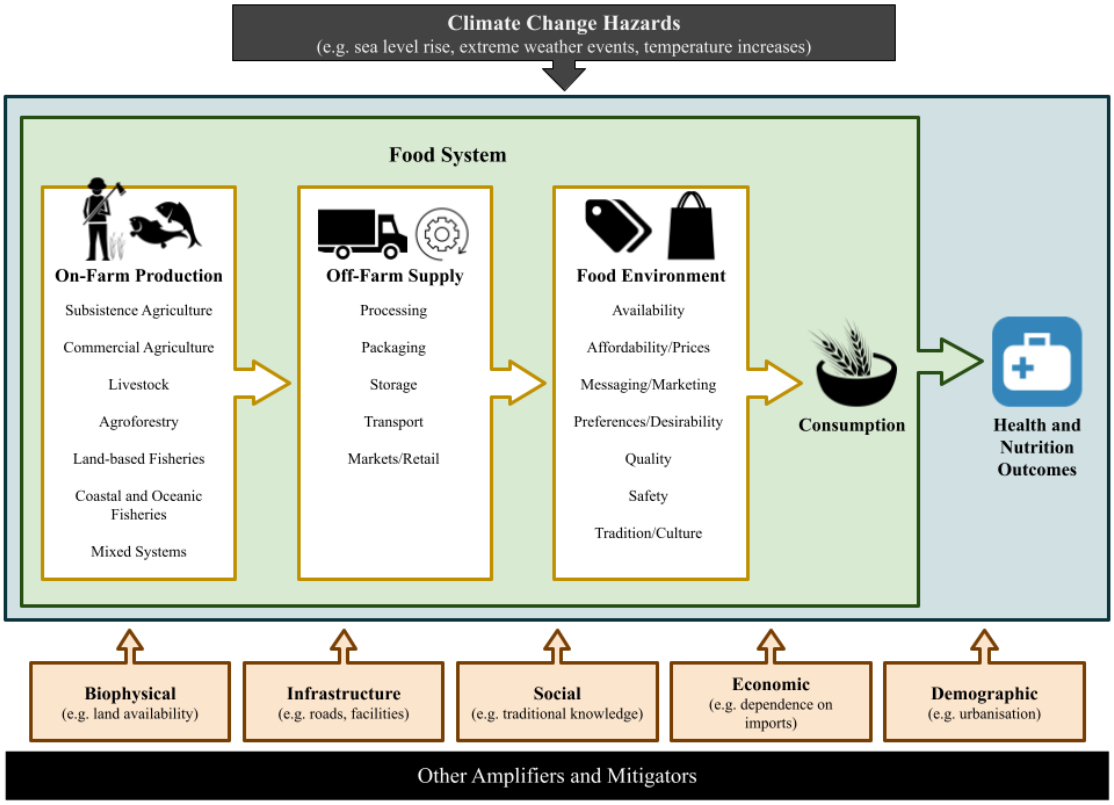


Figure 1: Conceptual figure of food systems components, climate change hazards, and potential amplifiers and mitigators of climate change impacts on the system. Based on (Turner et al., 2018; Mbow et al., 2019)

7.5.3. Participant Background and Experience

First, we are going to ask a few background questions about your work and your organisation.

1. Could you please tell us a little bit about the role of your organisation?
2. What is the role that that you fill in your organisation?
3. What is the role and function of your organisation in relation to climate change adaptation/food systems in the Pacific Islands region?
4. What country/region does your organisation focus on?

7.5.4. Climate impacts and vulnerability

5. In your view, what are the greatest climate related risks for food systems in Fiji?
    - How do these risks affect food supply chains in Fiji?
    - Are there any geographic factors that make these climate related risks better or worse in different parts of Fiji?

- Can you prioritise what you think are the three greatest risks from what you have just mentioned?

7.5.5. Amplifiers and mitigators

On-farm amplifiers

6. What are the most important on-farm factors that make these climate risks worse (*amplifiers*) in Fiji?

Potential prompts:

On-farm amplifiers may include things like –

- Biophyiscal amplifiers e.g. Remote atolls, limited arable land, pollution
- Infrastructure e.g. poor access to basic infrastructure, limited transportation
- Social e.g. change in community decision making practices, land rights issues
- Demographic e.g. urbanisation, outmigration of youth
- Economic e.g. reliance on natural resources for subsistence/income, shift to cash crops

7. Do you think that these on-farm factors that make climate risks worse (*amplifiers*) vary across Fiji?
   - How do they vary?
   - Are any of these factors relevant to the broader Pacific? (i.e. multiple Pacific countries)
8. Do you think that these on-farm factors that make climate risks worse (*amplifiers*) have different impacts on particular groups? e.g. men, women, youth, people with disabilities

Off-farm amplifiers

9. What are the most important off-farm factors that make these climate risks worse (*amplifiers*) in Fiji?

Off-farm amplifiers may include things like -

- Biophyiscal amplifiers e.g. remoteness, risk of non-climate natural disasters
- Infrastructure e.g. Limited technical capacity, unable to refrigerate food
- Social e.g. Post-colonial social change altered dietary habits, loss of traditional knowledge and social structures
- Demographic e.g. Urbanisation, population growth
- Economic e.g. Reliance on food imports, reliance on foreign aid
- Enabling environment (policy, trade, regulatory environment)

10. Do you think that these off-farm factors that make climate risks worse (*amplifiers*) vary across Fiji?
    - How do they vary?
    - Are any of these factors relevant to the broader Pacific? (i.e. multiple Pacific countries)
11. Do you think that these off-farm factors that make climate risks worse (*amplifiers*) have different impacts on particular groups? e.g. men, women, youth, people with disabilities

Mitigators

12. What are the most important factors that reduce these climate risks (*mitigators*) in Fiji?

Potential prompts:

Mitigators may include things like –

- Customary exchange networks
- Traditional production practices and history of local adaptation
- Remittances
- Enabling environment (policy, trade, regulatory environment)

13. Do you think that these factors that reduce these climate risks (*mitigators*) vary across Fiji?
    - How do they vary?
    - Are any of these factors relevant to the broader Pacific? (i.e. multiple Pacific countries)
14. Do you think that these factors that reduce these climate risks (*mitigators*) have different impacts on particular groups? e.g. men, women, youth, people with disabilities
15. Taking into account these factors that we have discussed that make climate impacts better or worse, does this change how you prioritise the greatest climate related risks for food systems in Fiji that you mentioned before?

7.5.6. Climate adaptation

16. What adaptation strategies have you seen work well in Fiji?
17. What do you think is missing from current adaptation strategies in Fiji?
18. Do different groups have more or less capacity to adapt to climate impacts? e.g. men, women, youth, people with disabilities
    - How can adaptive strategies better help marginalised groups to adapt to climate impacts?
19. What are some key considerations for implementing effective adaptation strategies over the following time frames?

- Short term (e.g. less than 2 years)
- Medium term (e.g. 2-10 years)
- Long term (e.g. more than 10 years)

7.5.7. Information and stakeholders

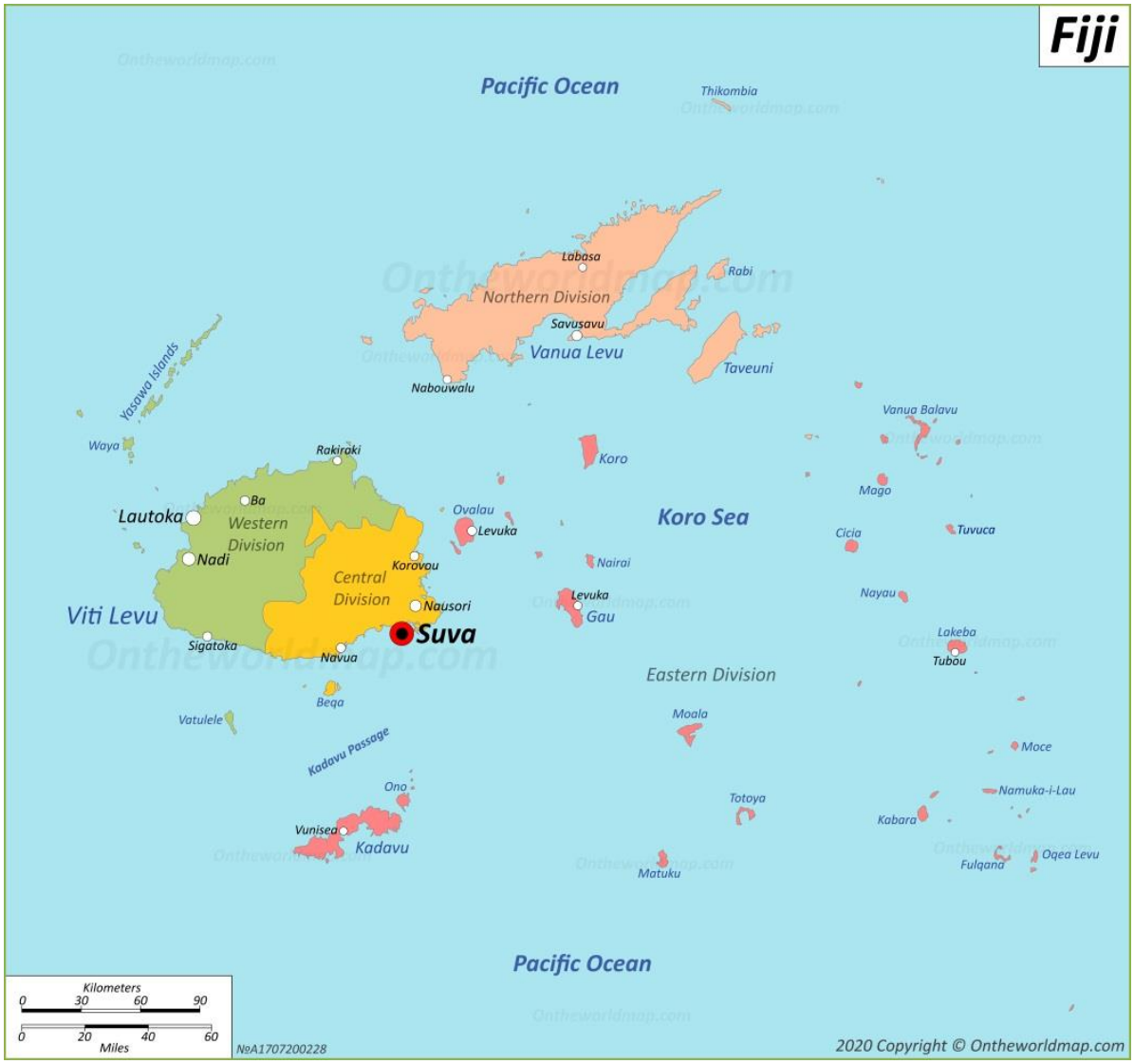
20. Are there gaps in the mainstream understanding of climate change impacts on food systems in Fiji?
    - Do you have any resources/literature, including grey literature, that you could share on this?
21. Are there other organisations or individuals working on the issues of climate adaptation and food systems in the Pacific Islands region that you would recommend us engaging with?

7.5.8. Conclusion

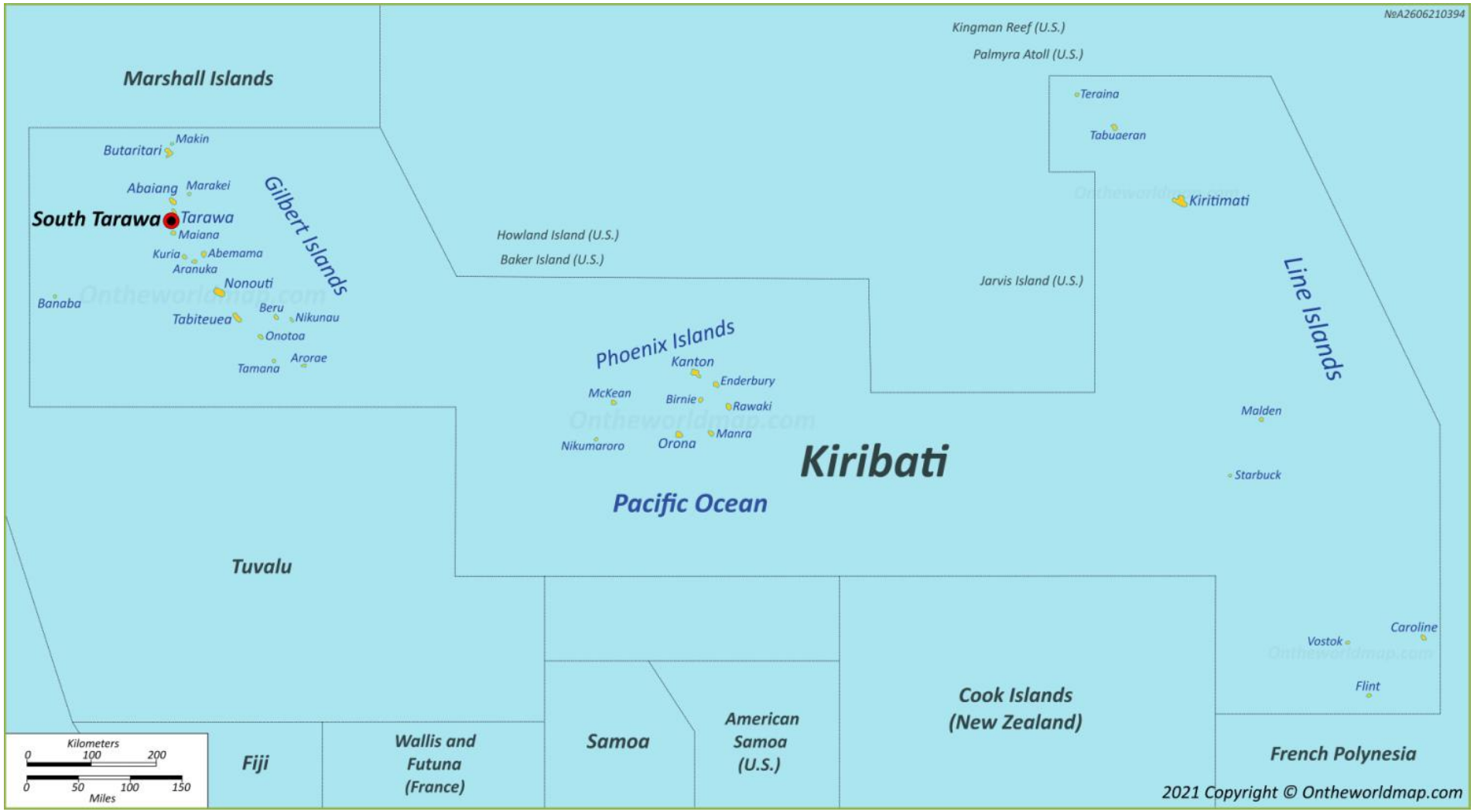
22. Is there anything further that you would like to add that we have not already discussed?

Annex C: Reference maps of the target countries

Reference map of Fiji



Reference map of Kiribati



Reference map of Samoa

Reference map of Vanuatu