

Atoll Food Futures

Rapid Assessment of Perceptions Kiritimati Island



Acknowledgements

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This RAP report was written by Chris Jacobson with Sally Asker (InSIGHT Sustainability).

Acronyms and local terminology

ACIAR - Australian Centre for International Agricultural Research

AFF - Atoll Food Futures project

ALD - Agriculture & Livestock Division

DFAT - Department of Foreign Affairs & Trade

FAO - Food and Agriculture Organization

GOK - Government of Kiribati

KUC - Kiribati Urban Church (Kiritimati office)

Toddy - A sweet sap traditionally collected from the coconut palm using traditional knowledge

LMD - Land Management Division on Kiritimati Island

MELAD - Ministry of Environment, Lands and Agriculture Development

MLPID - Ministry of Line & Phoenix Island Development

MOH - Ministry of Health

Mbele - slippery cabbage (nutritious leafy vegetable)

NCD - Non-Communicable Diseases

Salander - Leafy green vegetable

SPC - The Pacific Community

WHO - World Health Organization

WSD - Water and Sanitation Division (under MLPID)

Contents

1. Executive summary	4
2. Background	5
2.1 Climate Change and Kiribati Government Priorities	5
2.2 Kiritimati Island	6
3. The Atoll Food Futures program in Kiribati	7
3.1 Health, Nutrition and Food in Kiribati	7
3.2 The Rapid Assessment of Perceptions	8
4. Summary of findings	9
4.1 Food system context- Assessment of existing factors and perceptions pertaining to the local food system	11
4.1.1 Local community perceptions on food security	11
4.1.2 Availability, affordability, accessibility and acceptability of fruit and vegetables	13
4.1.3 Production motivations and practices	15
4.1.4 Knowledge and training gaps	17
4.1.5 Opportunities for development intervention	19
4.2 Biophysical context- Assessment of biophysical factors conducive for agriculture production	20
4.2.1 Land tenure	21
4.2.2 Geography	22
4.2.3 Water	24
4.2.4 Compost materials	25
4.2.5 Seed and root stock	26
4.2.6 Other resources to support agriculture	26
4.2.7 Opportunities for development intervention	27
4.3 Governance and mobilisation- Factors associated with successful delivery of programs within the local context	28
4.3.1 An island of settlers and population growth – implications	28
4.3.2 Dispersion – implications	29
4.3.3 Churches (8 denominations) and relationship with Council and ALD	29
4.3.4 Opportunities for development intervention	30
4.4 Extension for localised learning	31
4.5 Partnership options – Council, churches, Agriculture and Lands Division (ALD)	31
5. Recommendations	31
5.1 Immediate recommendations	31
5.2 Longer-term recommendations (beyond 12 months)	33
Appendix A: RAP questions and methods	36

1. Executive summary

The purpose of this Rapid Assessment of Perceptions (RAP) is to understand the feasibility of applying the Atoll Food Futures project in Kiritimati Island and to ensure that programming of climate smart agriculture in Kiritimati is grounded in local reality, capacity and evidence.

The links between climate change and food security in Pacific atoll countries have been well documented over the past decades and have exposed various vulnerabilities. The following aspects of vulnerability are particularly relevant to DFAT and Live & Learn's collaboration in Kiribati: over-reliance on food imports, lack of nutritious foods, challenging agricultural conditions, unstable access to water, coastal erosion, sea level rise, saltwater inundation, lack of available land and reduced access to markets.

Climate mitigation and adaptation is a key priority for the Government of Kiribati with a focus on increasing food and water security through integrated and sector specific approaches as well as strengthening the private sector focusing on agricultural and marine products. Kiritimati Island has been identified as a strategic development and population corridor as part of the Kiribati 20 Year Vision and Joint Implementation Plan 2019 – 2028. High dependence on coastal fisheries for subsistence coupled with diminishing stocks of reef fish, harsh agricultural conditions, and relative lack of crop farming with high dependency on imports leads to high levels of vulnerability to food system shocks across the household, national and global levels. A key aspect of climate adaptation and increasing food security is the establishment of a local food production system to complement subsistence fisheries.

The information contained in this report indicates a conducive enabling environment for climate resilient agricultural interventions on Kiritimati. This RAP has identified a series of trends and needs required to support Kiritimati in achieving their development goals through the lens of climate adaptation and food resilience. The macro food security trends perceived to be prevalent in Kiritimati include heavy reliance on imported processed food and low quality imported frozen foods, erratic boat supply of imported foods and limited availability and adequacy of local traditional fruits and crops (both imported from across Kiribati and grown on Kiritimati), lack of local fresh food diversity, high rates of NCDs and gaps in information, knowledge and hardware at the household level for practical climate smart agricultural skills to ensue. Circumstances perceived to be contributing to these trends include preference for processed foods that are quicker and easier to prepare, limited access (as a result of cost, logistical constraints and availability) to local food at markets, high population growth, limited access to clean water, limited access to road transportation (cost prohibitive), infrequent and low volumes of sea transport (boat) and a general lack of widespread knowledge.

It is recommended that immediate short-term actions are implemented as a prerequisite to build a solid foundation (current lacking) required for future scalable uptake of local nutrition sensitive food production, either at a collective commercial level or household subsistence level, supported by a base of climate smart agricultural resources, infrastructure, knowledgeable agriculture staff and local lead farmers. These actions include creation of a central agricultural hub for education and extension, establishment of a facility for key inputs (e.g. compost) and building of agricultural capacity of local staff. In addition, it is recommended that a pilot demonstration site is established, managed by the church but supported by the Agriculture and Lands Division in collaboration with Live & Learn, to embed climate smart agriculture practices across the community. A series of options are presented in detail within this report.

2. Background

2.1 Climate Change and Kiribati Government Priorities

Kiribati is one of the world's most vulnerable countries to the impacts of climate change due to most of its 33 islands sitting less than two meters above sea level. It faces significant risks from climate change, including coastal erosion and increasingly unpredictable rainfall.

The country's ability to respond to climate risks is hampered by its highly vulnerable socio-economic and geographical situation. Low-lying atolls, isolated location, small land area separated by large ocean areas, high population concentration, and the costs of providing basic services make Kiribati vulnerable to external shocks. Sea-level rise and exacerbated natural disasters such as drought and weather fluctuations pose significant and direct additional threats to sectors and resources central to human and national development and the provision of basic human needs. The most significant challenge relates to accessing food and water.

The World Bank climate risk country profile 2021 states that Kiribati faces a potential long-term threat from permanent inundation with numerous studies suggesting many low-lying islands will become uninhabitable within the 21st century. Water supplies depend primarily on rainwater collection and groundwater which is vulnerable to saline contamination. Climate impacts to the agriculture sector include heat stress and damage to water reserves with common mitigation strategies through adjustment in crop variety limited by low fertility soils.

UNDP's Kiribati Climate Security Risk Assessment profile, states that climate change directly threatens vital economic sectors in Kiribati, predominantly fisheries and agriculture. Loss of vital natural resources leads to increased social pressures and tensions that erode cultural norms of cooperation and sharing. Climate induced mobility although an adaptation strategy, increases risks of overcrowding and places pressure on local support structures without lack of proper planning.

In response to the threats posed by climate change, the government of Kiribati released the Kiribati Disaster Risk Management and Climate Change Act 2019. The Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management (KJIP), initiated in 2011 and driven by the Kiribati National Expert Group (KNEG), with representatives from government ministries, private enterprises and non-governmental organisations (NGOs) was revised in 2018 with the technical support from National Adaptation Plan Global Network (NAP GN) and a comprehensive oversight by the Office of Te Beretitenti. The revision was wholly supported with funding from Environment and Climate Change Canada and the U.S. In-Country NAP Support Program. This revision was conducted specifically to deliver on the new Act. The main rationale for developing the KJIP was to support the implementation of holistic approaches on climate actions (i.e., across multiple sectors and with stronger linkages among climate adaptation planning processes at national, sectoral and island levels).

The KJIP recognises that as a result of its inherent characteristics as an atoll nation, a least developed country, and with its fragile economy and environment, Kiribati is extremely vulnerable to climate change and has little capacity to cope with disasters.

The social, economic and environmental ramifications of the observed and projected climatic changes and hazards are multiplied when overlaid with the high levels of vulnerability of people and their environment. According to the Ministry of Finance and Economic Development 2023, Kiribati accessed about USD 170 million from bilateral and multilateral sources for climate change and disaster risk management activities. Investment priorities have been estimated at water and sanitation (40 per cent), followed by energy (19 per cent), transport infrastructure (12 per cent), conservation and

biodiversity (8 per cent), enabling environment (8 per cent), and agriculture and food security (5 per cent). Unlike most other Pacific Island countries, about 82 per cent of the total funding for climate change and disaster risk management accessed by Kiribati was reflected in the national budget, and 18 per cent was off budget. Of the total amount accessed, 25 per cent was from bilateral sources and 75 per cent from multilateral. Most of the accessed funding supported activities on adaptation (53 per cent), followed by mitigation (32 per cent), disaster risk reduction (9 per cent), and disaster risk management (6 per cent) (MFED, 2019).

The KJIP identifies 12 major strategies for implementation to mitigate against climate change. Live & Learn's food resilience initiative delivered under the DFAT supported Atoll Food Futures program aligns directly with 2 of these strategies:

- **Strategy 3:** Strengthening and greening the private sector, including small to medium-sized enterprises, focusing on value-added agricultural and marine products.
- **Strategy 4:** Increasing water and food security with integrated and sector-specific approaches and promoting healthy and resilient ecosystems¹.

2.2 Kiritimati Island

Kiritimati (pronounced 'Christmas') Island comprises over 70% of the total land area of Kiribati and is the largest atoll in the world. It lies 232 km (144 mi) north of the Equator, 2,160 km (1,340 mi) south of Honolulu, and 5,360 km (3,330 mi) from San Francisco. Connected to the Fiji islands once a week via international transit, it is a biodiverse sea bird sanctuary and is earmarked in the Kiribati 20-year Vision (KV20), a long-term blueprint for Kiribati, as a strategic development and population corridor.

Key government priorities for Kiritimati include:

- Development of a transshipment hub under the fisheries priority sector.
- Development of sustainable tourism which will in turn support development of other sectors such as agriculture.
- A key targeted area for land reclamation and land use for sustainable development.

As a key target for future development, there will be inevitable strain on resources to provide for the local population and Kiribati as a country in general. There is high dependence on coastal fisheries for subsistence coupled with diminishing stocks of reef fish due to climate change and human related pressures, with productivity projected to decline by 20 per cent by 2050. Harsh agricultural conditions and relative lack of crop farming leads to high dependency on imports and high levels of vulnerability to food system shocks across the household, national and global levels.

A key aspect of climate adaptation and increasing food security is the establishment of a local food production system to complement subsistence fisheries.

Aligning with the national strategy and priorities by the Kiribati government, the Australian High Commission in Kiribati, requested that a scoping study be conducted by Live & Learn Kiribati to assess the feasibility of implementing the Atoll Food Futures program on Kiritimati, with funding provided in 2023.

Additionally, in May 2023, the Honorary Minister for the Line & Phoenix Islands of Kiribati, Mikarite Tamariti, addressed a letter to Live & Learn Kiribati acknowledging the partnership between the government of Kiribati and Live & Learn Kiribati. The letter also expressed the desire by the Ministry of Line & Phoenix Islands that the Atoll Food Futures Program, currently being delivered by Live & Learn Kiribati, be expanded to Kiritimati with their full support.

¹ Government of Kiribati, 2019, Kiribati Joint Implementation Plan 2019-2028.

3. The Atoll Food Futures program in Kiribati

The Atoll Food Futures (AFF) program is funded by DFAT with the aim to adopt climate-smart agriculture technologies in vulnerable populations, to improve food security for populations living with climate change. The program includes four key themes:

1. the use of climate smart technologies for food production
2. consistent supply chains for food production
3. improved diet quality
4. increased consumption of locally grown and traditional foods.

In Kiribati, the program is currently being delivered in South Tarawa, North Tarawa and Abaiang.



3.1 Health, Nutrition and Food in Kiribati

Nationally, Kiribati faces a triple burden of food insecurity, micro-nutrient deficiencies, and over-nutrition. The Line and Phoenix Islands suffer from lower rates of moderate and severe food insecurity in comparison to Kiribati as a whole (19% of all households in the Line and Phoenix Islands have food insecurity compared to 41% nationally)², the presence of copra activities on Kiritimati are linked to the lower levels of food insecurity.

Three out of every four I-Kiribati (Kiribatian people) are at high risk of developing a Non-Communicable Disease (NCD), and NCDs account for as much as 70 per cent of all deaths in the nation³. One of the causes of this crisis is the introduction of highly processed foods, along with low production of local produce and investment of time and skills in agriculture.

² Troubat, N. and Sharp, M.K. 2021. Food consumption in Kiribati. FAO and The Pacific Community, p55.

³ <https://www.ifad.org/> Investing in Rural People 2020 International Fund for Agricultural Development (IFAD).

Salty, oily, and sugary imports have replaced local, natural, and nutritious foods. Anecdotally, NCD rates in Kiritimati appear lower than on Tawara. Due to the remote location, challenging supply chain and biophysical conditions, it has never been easy to grow food in Kiribati, and the expanding supply of industrialised goods only made it easier for the I-Kiribati to turn away from traditional local agriculture.

National obesity prevalence rose from 35% in the year 2000 to 46% in 2016⁴. The Household Income and Expenditure Survey (insert date) found that only 12% of foods are consumed from own household production and of that 12%, fish and brown coconut contribute to 61% of the total dietary energy . Nationally, consumption of fruits and vegetables is highly inadequate, with 130g per day consumed on average, which is far lower than the WHO recommended amount of 400g per day for a healthy diet⁵.

Average ratio of vitamins available for consumption		
	Line & Phoenix Islands	Average Requirements
Vitamin B1	83%	93%
Vitamin B2	77%	87%
Vitamin A	94%	119%
Calcium	39%	40%

The Line and Phoenix islands also has a slightly lower proportion of the population with chronic health issues – 20% in the Line and Phoenix Islands compared to 23% nationally⁶. Despite that fact the Kiritimati is doing better than other parts of Kiribati, there is a long way to go to achieve food security in Kiritimati.

Working to improve these figures is compounded by widely scattered and physically remote villages, limited cash opportunities outside central and local government employment and the small private sector on Kiritimati, irregular shipping and plane access to outer islands and international markets, and poor asset management.

3.2 The Rapid Assessment of Perceptions

A RAP (Rapid Assessment of Perceptions) is a rapid semi-structured research study with communities that draws from participatory rural appraisal methods, and explores community aspirations and perceptions towards an issue, in this context - food security and potential uptake for increased local food production. A RAP includes research into existing human capital strengths and weaknesses, local capabilities, biophysical information and other relevant social, cultural, political, environmental and economic realities relevant to the subject at hand. This report provides an assessment of Kiritimati from a food system, biophysical, governance and mobilisation perspective.

This RAP research was conducted in Kiritimati from 5 July - 12 July 2023.

An expansion of AFF is supported by the Ministry of Line and Phoenix Islands with the RAP data indicating that the AFF program would be a good fit for Kiritimati’s context and would serve to enhance climate resilience. In pursuing climate resilience, AFF will contribute to localised food security and nutrition by building local capacities to shift food consumption away from imported food to fresh local foods.

This RAP provides a series of options and recommendations for applying the DFAT-supported Atoll Food Futures (AFF) program in Kiritimati in a way that enhances the ability of local communities to 10 adapt to climate change by improving food security whilst embedding Gender Equality, Disability and Social Inclusion (GEDSI) through aspects of implementation. *Please refer to Appendix A for detailed information regarding the RAP methodology.*

⁴ 2020 Kiribati Household Income and Expenditure Survey.

⁵ Ibid.

⁶ SPC 2021. Kiribati 2019-2020 Household Income and expenditure survey report. SPC, New Caledonia.

4. Summary of findings

The following points are a summary of the key findings from the RAP on Kiritimati but are elaborated in more detail in the rest of section 4.

Note: that the term “local foods” and “imported foods” throughout this document was utilised loosely by the workshop participants. General interpretation of local foods was defined as agricultural or natural products. Whilst imported foods were defined as packaged, tinned or otherwise processed foods. Findings are based on local perceptions of these foods and not based on the actual nutritional content of the individual items.

1. Around 80% of food on Kiritimati is imported (this does not include produce imported from other parts of Kiribati). The data available from this RAP could not determine what percentage of produce was produced locally just on Kiritimati. Research participants identified positive and negative attributes of local foods and imported foods. The biggest negative of local foods included the time required to grow and cook traditional local foods. Imported foods were identified as highly desirable by children, despite being unhealthy, expensive, often expired, and sometimes in short supply due to shipping constraints.
2. There is insufficient production and availability of local produce on Kiritimati to meet demand. Monthly shipments of produce from outer islands to market shops sell out in 3-5 days.
3. The current cost of eating nutrient dense foods is far higher than the cost of processed or less nutrient dense foods such as rice. Some imported foods are made more accessible via government subsidies. Market prices reflect this with rice costing \$1.1 per kg (with 50% subsidy). Nutrient dense foods like local pumpkin are \$5 per kg and imported frozen vegetables are \$15 per kg.
4. 40% of church goers reported to grow some household produce and workshop participants estimated that 24% of all households sell vegetables, and 2% grow root crops. Further, in new land lease areas (e.g., Tabwakea 2 and 3), the RAP team observed an estimated 10% of households growing vegetables. The potential to harness and build on these producing and market participation rates is promising.
5. Existing household farmers (and non-farmers) are motivated to produce local foods. Farmers shared their perception that (good) health is a key motivator for increased local production followed by income generation as well as the satisfaction of eating their own produce.
6. Household farmers commonly choose to grow papaya, pumpkin and coconut, which can all be easily grown through vegetative propagation; cabbage is also preferred due to the potential for income, despite seed being difficult to find. Root crops such as cassava, sweet potato and taro are also popular due to the ability to store them and their potential for earning income. These traditional foods are favoured, as local people are familiar with cooking them.
7. Even though climate and soil are not ideal, the conditions do exist in Kiritimati for growing a diversity of agriculture species, including traditional as well as new crops (vegetables). The soil conditions and availability of tree and fruit crops, root vegetables and other vegetables in Poland supports this. The identification of breadfruit, taro, coconut, cassava and pumpkin as ‘local crops’, and their alignment with cultural days indicates their acceptance, and these should be part of future food security and nutrition programs. Of note, it is important to prioritise vegetable varieties that are traditionally part of the local diet (i.e. non-traditional vegetables, while accepted, are a novelty to grow but household farmers lack the knowledge and skills on how to grow, prepare and cook them).

8. There is ample brown and green materials available for compost creation on Kiritimati.
9. People in Kiritimati (like others in Kiribati) enjoy and are motivated by competitions.
10. Gardening methods and materials currently include dig-in gardens, raised garden beds, growing in recycled materials (e.g., plastic containers), growing in plastic poly-bags, and growing in partially burnt or decomposing coconut palm logs.
11. Due to limited sources of manure, household farmer growing mediums commonly included biosolids and compost. Biosolids were sludge collected from human wastewater treatment areas. This reflects that there is acceptance in perceptions around using human waste in production, however anecdotal evidence suggested that WHO standards for sludge storage and safety practices were not being followed and current practices therefore pose a human health risk (from pathogens).
12. Around 50% of the population in Kiritimati are in reticulated water supply. Tank size and refill speeds are not enough to support gardening without larger tanks (and climate smart agriculture) and, importantly, suggests low capacity to support predicted population growth and future intensification of local food production?
13. Wells are often brackish and can vary in water quality, with more brackish water on the lagoon side. Households with brackish wells must buy water, but the afforded supply is only enough for cooking, washing and showering. (SPC and UNICEF are focussed on increasing supply and testing).
14. After presentation by the RAP team on the concepts of climate resilient agriculture practices and technologies, community members and government staff expressed a belief that access to this knowledge and technology will increase the availability and affordability of locally grown nutritious local foods in Kiritimati to improve health and long-term wellbeing.
15. Government staff felt that introducing the Atoll Food Futures program could increase local income and boost economic opportunities for communities whilst building climate resilience.
16. Community workshops highlighted that there are some large knowledge gaps identified by existing and future local food growers. These gaps include:
 - lacking knowledge and skills on how to grow from seed and how to sow seed to maximise viability, non-seed propagation techniques, plus transplanting seedlings, seed saving, seed propagation and seed preservation.
 - low knowledge and skills for water-saving planting techniques (e.g. climate smart agriculture, mulching) and irrigation.
 - low knowledge and skills for composting, including compost mixes targeted to different plants, e.g. watermelon.
 - lacking knowledge and skills on how to use liquid fertiliser.
17. Government agricultural staff perceive their own knowledge and skills to be 'low level' for seed saving, climate smart agriculture, pest management, organic fertiliser and pesticide use, as well as business development.
18. Community participants cited their main three sources of local food production information as government agricultural assistant workshops (three times a year), followed by friends and online resources (Facebook and YouTube). Importantly for future project design support and communications, 90% of the entire group of participants at the RAP community workshop reported access to either Facebook or YouTube.
19. There is a strong desire to increase household agricultural knowledge and skills towards improved food security. Selling produce excess to household needs could create livelihood opportunities for people, especially women, and potentially help some households move out of poverty.

20. Government based human resources to support growing on Kiritimati are highly limited in their ability to access travel resources to visit the communities they service. The Agriculture and Livestock Division (ALD) Office is a considerable geographic distance from other population centres, and fuel costs are high. There is one vehicle and driver, 1 staff for livestock, 2 nursery staff, and 3 agriculture staff.

4.1 Food system context- Assessment of existing factors and perceptions pertaining to the local food system

4.1.1 LOCAL COMMUNITY PERCEPTIONS ON FOOD SECURITY

During the community workshop, 38 community members (16 women, 22 men) were asked to describe what food security looks like for them at three different scales: family, community and island (see Table 1).

The results captured in Table 1 can be seen as their vision for food security. The vision includes both traditional foods and practices (e.g. tree and root crops, toddy) alongside a strong interest in vegetable growing (perceived as modern because vegetable growing is not a part of local traditional food culture). All participants acknowledged that new skills are needed to support their vision.

Women, men and youth all identified the need for additional training on planting and growing local crops and vegetables in home gardens in order to support improved community nutrition.



Table 1: Community perceptions for improved food security – a vision.

	Family scale vision	Community scale vision	Island scale vision
Women	<ul style="list-style-type: none"> • Growing own food (and therefore) saving money • Have 1 bag of rice for 2 months for security for when cargo boats don't come • Food preservation & planting more food crops 	<ul style="list-style-type: none"> • Encouraging communities to provide seedlings and local food crops and vegetables • (Being able to) cater for big events and fundraising • Establish a canteen and plant more 	<ul style="list-style-type: none"> • Agriculture must sustain the (whole) island • Have arrangements between businesses and shipping companies to avoid food shortages • Create a storage house for food preservation for emergencies
Men	<ul style="list-style-type: none"> • Fishing and toddy (money making) • Save family funds by preserving food • Provide local food crops • Motivate young boys by providing local skills for fishing and cutting toddy • Sustain the traditional way of living 	<ul style="list-style-type: none"> • Planting for food security and fishing • Sharing skills on gardening • Collaborating ideas to sustain culture and improve health to sustain food security 	<ul style="list-style-type: none"> • A design on growing food crops using a quarter acre to include fruit, local and root crops and vegetables • Training on gardening that helps to improve behaviour from not eating healthy food to eating a balanced diet
Youth	<ul style="list-style-type: none"> • Toddy and food preservation – preserve sugar for time of food insecurity and a source of vitamin C 	<ul style="list-style-type: none"> • Train youth to grow food crops, cut toddy and fish 	<ul style="list-style-type: none"> • Training on agriculture production

As a group, community participants identified that healthy food, *'makes people healthy, balanced diet, it makes the body healthy, boosts the immune system; you eat a balanced diet of fresh produce, and you exercise when you garden. All contributes to food security'*. They saw both positive and negative aspects of locally produced and imported produce; albeit community members unanimously identified that local foods are healthier than imported foods (Table 2).

Note: that the term “local foods” and “imported foods” was utilised loosely by the workshop participants. General interpretation of local foods was defined as agricultural or natural products. Whilst imported foods were defined as packaged, tinned or otherwise processed foods. Findings are based on local perceptions of these foods and not based on the actual nutritional content of the individual items.

Table 2: Community perceptions on positive and negative attributes of locally produced and imported foods.

	Locally produced foods Identified mainly as: breadfruit, taro, pumpkin, coconut, cassava, swamp taro	Imported foods Identified mainly as: rice and flour, sugar (subsidised) Tinned fish, imported fruit juice, noodles (not subsidised)
Positive attributes	<ul style="list-style-type: none"> • No cost (home grown) • Healthy, good vitamins and fresh 	<ul style="list-style-type: none"> • Good when tired, easy to cook • Delicious and good taste for the kids – what they want • Usually available
Negative attributes	<ul style="list-style-type: none"> • Not enough of these preferred food(s) • Takes time to plant and harvest • Takes time to cook - takes 1hr • Shortage on island 	<ul style="list-style-type: none"> • Too expensive (non-subsidised items) • Always shortages between boat deliveries • (Imported) foods are often expired • Not balanced diet or fresh

Semi structured interviews with government staff confirmed that the government’s vision for Kiritimati as a development hub and migration corridor. Agriculture is seen as a complementary development pathway for tourism and fisheries. To further support food security on Kiritimati, government participants identified that Fanning and Washington Islands could be used for crop production given their abundant higher quality water supply, with transport to Kiritimati using regular boat services. This includes the production of sweet potato, banana, breadfruit and other root crops. However, regular service to and from Kiritimati from these other islands have not been reliably established as yet.

The importance of a balanced diet and healthy lifestyle was recognised by government staff, including the contribution of a healthy diet to active minds and improved learning outcomes at schools, as well as for civil servants. Related to this, government staff noted that local food safety laws include the need for a healthy balanced diet that applies to vendors, including the school canteen. Government staff activities however are currently focussed on food safety awareness rather than enforcement. Further, the government has planted fruit trees around buildings, and most households come and pick them before the fruit is mature - reflecting both a desire for fruit and shortage of it.

4.1.2 AVAILABILITY, AFFORDABILITY, ACCESSIBILITY AND ACCEPTABILITY OF FRUIT AND VEGETABLES

Community members estimated local foods make up 20% of all food intake and are typically eaten on cultural days. The majority of household diets come from imported foods, which are dependent on shipping. Delays in shipments often means food availability is reduced. In Kiribati, COVID-19 resulted in increased prices that were typically higher for local foods compared to imported foods. Interestingly, the cost increase of local foods did not result in increased home-based vegetable production as a coping strategy⁷. In Kiritimati, anecdotal conversations indicated a switch to fishing for sustenance during this period, including fishing for protected species. It’s useful to note that historically commercial fisheries have fished out tuna and closed local tuna canning operations.

⁷ Internal data of limited size collected in South Tarawa after restrictions eased, April 2022.

In 2021 SPC reported that participation in agriculture in the Line and Phoenix Islands is low – 11% compared to 41% nationally. In the same report no engagement in the production of root crops or sale of root crops was reported. The RAP field data reports 40% of churchgoers grow some kind of produce, 11% of garden competition households sold produce, and workshop participants estimated that 24% of households sell produced vegetables, while 2% grow root crops. In new land lease areas (e.g. Tabwakea 2 and 3), researchers observed an estimated 10% of households growing their own vegetables.

The affordability of fruit and vegetables is lower than less nutrient dense alternatives. The proportion of household expenditure on food is slightly lower in the Line and Phoenix Islands compared to nationally (40% compared to 38%), most likely due to lower median monthly household incomes (\$1015 in the Line and Phoenix Island, compared to \$1248 nationally) (SPC 2021:62). Workshop participants in the RAP reported an average local income of \$65 a month. The government subsidy of 50% on rice, flour and sugar imports means they are about 11 times less expensive as the cheapest local grown vegetable (Table 3).

Table 3: Cost of a serve of different produce items (based on market prices).

Item	Cost of recommended adult daily servings ⁸
Frozen imported mixed vegetables (1kg, \$15)	\$6.75
Fruit – imported oranges (each, \$3)	\$6.00
Mango – seasonal local (each, \$3)	\$6.00
Frozen imported cauliflower (\$1kg, 12)	\$5.40
Onions (1kg, \$10)	\$4.46
Frozen imported french fries (\$1kg, \$8.50)	\$3.83
Pumpkin (4kg, \$25)	\$2.81
Cucumber (300g, \$4)	\$2.67
Rice (in 25kg bag)	\$0.23

Nutrient dense foods regardless of source, locally grown, imported, fresh or frozen is typically more expensive than subsidised staples like rice, flour and sugar.

Access to locally grown produce is very limited, particularly in local marketplaces. RAP researchers visited 3 markets in Banana and 8 markets in Tabwakea. While some had limited fresh food available, others had none.

Accessibility to locally grown produce is largely dependent on knowing local producers to directly purchase produce from or purchasing from shops or stores. A licence is required to sell produce to local stores, which limits the produce available instore to produce imported from international shipping lines, imported from outer islands, or produced by the store owner. Of 11 surveyed stores, only four were selling vegetables, and only two sold local produce (pumpkin, from their gardens). One store owner sold produce from outer islands in the chain when it was in season, but she noted that the boats only arrive every 4-6 weeks, and the produce (root crops, fruit) sold out within one week. This indicates high demand and limited accessibility. Government staff reported that fruit trees planted around buildings are typically harvested at an immature stage. This also demonstrates acceptability and desirability of fruit, yet limited accessibility.

⁸ Six 75g serves of vegetables, two 150g serves of fruit, six 100g serves of cooked rice (200g dry rice) for an adult man, https://www.eatforhealth.gov.au/sites/default/files/files/the_guidelines/n55a_australian_dietary_guidelines_summary_book.pdf

Income from produce sales were highest in Poland and Banana. In Poland, some growers reported making \$60-\$100/week for pumpkin depending on production. Others with diversified income streams from copra and vegetables earned 10 times as much income from copra alone (in areas where it can grow well). However, transport and reliance on buyers coming to Poland affect the ability to sell produce and store mark-ups are up to 50%. In Banana, one grower earned \$300 per week in production, but two other sellers were only making occasional sales, illustrating that income from production can be highly variable.

According to community members and site visits, a range of vegetables are produced in the communities (Table 4).

Traditional tree & fruit crops	Root vegetables	Other vegetables
Coconut	Kumara (3 varieties)	Cucumber (3 varieties)
Mango	Cassava	Bok choy and Pak choy
Papaya	Taro (2 varieties)	Cabbage
Breadfruit	English potato	Spinach
Noni	Pumpkin	Broccoli
Banana		Saladeer
Pandanus	Other vegetatively propagated	Tomatoes (poor fruit size)
Dragon fruit	Ginger	Capsicum
Melon (multiple varieties)	Lemon grass	Beans (multiple varieties)
Moca (Amaranth)	Chilli	Corn
Mbele		Lettuce
		Eggplant (multiple varieties)
		Chives

4.1.3 PRODUCTION MOTIVATIONS AND PRACTICES

During the RAP workshop existing growers were asked about their motivations for production. They explored this by placing up to 5 tokens each against a list of motivations. Table 5 summarises their responses and demonstrates that (good) health is a key motivator for local production followed by income (saved) and the satisfaction of eating their own produce. These motivations are reflected in choices of what households grow: papaya, pumpkin and coconut which can all be easily grown through vegetative propagation; cabbage is also preferred due to the potential for income, although seed is difficult to find; root crops such as cassava, sweet potato and taro are also preferred due to the ability to store them and their potential for income earning.

Table 5: Motivating factors for existing growers to produce fruits and vegetables.

Motivation	Proportion of tokens
Good health	23%
Income (the ability to save money from not buying food, especially during times of shortage)	16.5%
Satisfaction of eating own produce	16.5%
Learning	15%
Family food security	15%
Other (ability to cope with periods of food shortage, sharing with family)	10%
Relaxation	4%

Garden visits and discussions with growers identified that vegetative propagation was common and most of these species were grown appropriately (e.g., in areas with shade and appropriate watering). However, species grown from seed showed poor knowledge on appropriate growing practices. Examples included:

- Broccoli in full sun causing heads to get sunburnt and/or rot.
- Leafy greens bolting (i.e., growing too quickly to produce heads) because of growth in full sun.
- Overplanting of leafy greens so that harvest could not be staged to enable consistency in supply.
- Inappropriate choices in varieties, e.g., English cabbages that don't produce good heads.

Household visited (of 21 households in total) practiced seed saving; this was deemed due to limited seed saving knowledge and skills.

Current garden producing methods and materials included dig-in gardens, raised garden beds, growing in recycled materials (e.g., plastic containers), growing in plastic poly-bags, and growing in partially burnt or decomposing coconut palm logs.

Growing mediums commonly sighted in gardening competition household visits included bio-solids and compost. Biosolids were sludge collected from human waste-water treatment areas. The WHO recommends storage of sludge at 20-35 degrees Celsius for at least 1 year and alkaline treatment if moisture levels are low, plus a 1-month period between application and harvest, in addition to safety standards for treatment⁹. These standards are generally not followed in Kiritimati and likely pose human health risk from pathogens (e.g., parasites such as Blastocystis, rotaviruses, E. coli).

Compost methods were applied by a third of growers involved in a gardening competition, including:

- Anerobic compost pits
- Traditional compost layering in dig-in gardens (coconut, brown and green layers sometimes with pig manure)
- Mixed aerobic compost, with green, brown and manure layers, sometimes with collected 'stranded' seaweed¹⁰.

Only two households were observed to be using liquid fertiliser.



⁹ WHO guidelines for the safe use of wastewater, excreta and greywater (2006).

¹⁰ There are no sites with regular seaweed – community members refer to occasional seaweed as 'stranded'.

4.1.4 KNOWLEDGE AND TRAINING GAPS

Community workshop participants were asked to identify their main sources of information for growing produce (Table 6).

Table 6: Local fruit and vegetable production information sources (cited by community members).

Information source	Proportion of tokens
Agriculture assistant	52% (community visit and work experience)
Friends	24% (friends, motivate, share ideas and provide planting materials and elders share ideas and knowledge)
Other (online sources including social media)	12% (Facebook & YouTube)
Training program from NGO or donor	6% (most likely ALD staff)
Visit to demonstration site	3% (from a nursery, KUC, ALD)
Parents or family	3%
Radio	0
Farmer group	0

Although government agriculture assistants were the most common information sources cited, Agriculture only ran three community workshops in the past 12 months (July 2022-2023) and did not provide an option for follow up visits or support. ‘Friends’ were cited as very useful for motivation, sharing and providing planting materials and advice. ‘Other’ sources of information included Facebook and YouTube – while internet access is currently via satellite and is location dependent, 90% of the entire group had accessed Facebook, and 45% had accessed to YouTube. NGO advice was identified as informal advice from Live & learn staff, even though they are not present on the island and this is likely to actually be government staff from Agriculture. The demonstration site mentioned was the Council-run nursery.

Knowledge gaps identified by existing and new local food growers included:

- How to grow from seed and sowing seed to maximise viability, transplanting seedlings, seed saving and seed preservation
- Non-seed propagation
- Water saving planting techniques (e.g. climate smart agriculture, mulching)
- Irrigation
- Composting, including compost mixes targeted to different plants, e.g., watermelon
- Liquid fertiliser use

Government agriculture staff rated their own agricultural knowledge and skills as shown in Table 7.

Table 7. Government agriculture staff perceptions of their own knowledge and skills.

Perceived level	Area of knowledge and skills
High level	Propagation e.g., tree stock
Moderate level	Seed propagation; composting (however, there is no compost shed)
Low level	Organic fertiliser and pesticide; seed saving; climate smart agriculture; pest management; business development

Business development was cited as a responsibility of the Ministry of Commerce, irrespective of agriculture staff training in it. Agricultural staff identified opportunities in beekeeping, given the abundance of wildflowers and the current impacts of wild honey collection on coconut plantations (i.e., uncontrolled fires).

Council nursery staff perceived producers to have good skills in composting and vegetative propagation but lack skills in seed saving and growing vegetables. Conversely, most householders didn't perceive themselves to have good composting skills.

For households currently not producing any local foods, knowledge was identified as a key barrier to uptake. The main barriers to participation were captured in a workshop activity that invited participants to place tokens against various barriers. The more tokens placed the bigger the perceived barrier. Results can be seen in Table 8.

Table 8 Perceived household and community barriers to participation in local food production.

Perceived barrier	Number of tokens (and community explanations)
Cost & availability of tools	27% <ul style="list-style-type: none"> • Tools are expensive • Most households have a shovel but no other tools • Tools are in short supply
Lack of knowledge & skills	21% <ul style="list-style-type: none"> • No perceived knowledge • Don't know how (to produce) • Need training
Lack of money for set up (e.g. shade cloth)	21% <ul style="list-style-type: none"> • Too expensive (to garden/produce) • Not a priority of household budget allocation
Access to quality water	18% <ul style="list-style-type: none"> • Need water tanks • No water
Access to manure or compost materials	18% <ul style="list-style-type: none"> • Need training on making compost • No manure • Need to improve compost production
Planting materials	9% Not enough seed (supply or affordability)
Time	6% <ul style="list-style-type: none"> • Busy with work • No one in the house interested in gardening
Land access	0
Lack of interest	0
Other (e.g., crabs)	0

Table 8 above confirms that low participation rates are not through lack of interest but through a perceived lack of most things needed to make it happen - tools, knowledge and skills, set up support, and access to quality water, compost know-how and planting materials.

Government education staff acknowledged they have a gardening syllabus that covers primary and secondary students. However, teachers are yet to be trained. Government staff felt that written (book) resources are needed, as teachers don't yet use computers or their phones for learning or accessing information. However, this last point is contrary to community workshop participant feedback and is likely to be redundant when cable internet is fully functioning after October 2023. School representatives voiced that they want garden projects for the health of the kids, but they lack funds needed, and currently teachers are using their own money to supply tools and seeds.

Kiritimati Household Gardening Competition

For the last three years, a garden growing and beautification competition has been organised by the Minister's office in the lead up for Independence Day or World Food Day. It involves the provision of seed and three inspections at three-week intervals. In 2023, 18 households took part (3 per key area), with prizes for the top 5 households, based on criteria for production, beautification, and toilet sanitation. This event is an example of culturally appropriate ways to support and motivate home gardening. Although training was not provided, it could be added to a plan to improve technical aspects relating to gardening practices.

Interestingly, of the households who took part in 2023:

- about 1/3 have livestock (pigs) or access to manure
- about 1/3 had a hose
- there was limited mulching (mulching by only about 1/4 of households)
- about 1/3 were making compost (about 60% using human waste - unclear how safe this is)
- most used coconut husk as compost material.

4.1.5 OPPORTUNITIES FOR DEVELOPMENT INTERVENTION

1. Health appears to be a significant motivator for households for growing local foods. A vision for decreased reliance on imported foods is evident and could be leveraged for improved food and nutritional security.
2. Improved tree crop and vegetable production could improve diet diversity and quality.
3. Increased supply and preservation of local foods will likely enhance their availability, affordability, and consumption.
4. Preservation of traditional crops could be a pathway to improve food security and counter reliance on imported foods, especially as families prepare for shipment delays, and have memory of events such as COVID-19 pandemic. Support for preservation training and storage is likely needed.
5. The existing diversity of tree and fruit crops, root vegetables and other vegetables suggest favourable climate and soil conditions exist on Kiritimati suitable for growing a diversity of agriculture species, including traditional and new crops. The identification of breadfruit, taro, coconut, cassava and pumpkin as 'local crops' and their alignment with cultural days indicates the acceptance, and these should be part of food security programs moving forward.

6. Local market days could improve local produce accessibility, as could co-ordinated transport of produce from Poland.
7. Demonstrations of cooking methods of new non-root stock vegetable varieties could reduce negative perceptions of local foods compared to imported foods.
8. Compost 'recipes' for local conditions could be made and demonstrated, e.g., watermelon.
9. Community scale training is needed in a full range of gardening methods (composting; seed sowing, growing, saving; fertiliser and pest control; water efficient production). This is especially important for non-root stock vegetables that represent a shift in food culture and the evidence of a lack of skilled production for these.
10. Local Council and agriculture department training is needed on seed saving and improved compost production to address knowledge gaps and food safety for planting materials.
11. Climate smart water saving planting techniques (e.g., mulching) could be introduced.
12. Hardcopy and online resources potentially supported by short videos of Agriculture extension officers or lead farmers on climate smart agriculture to support growers, including e.g. a series of single page worksheets with a complimentary short video.
13. Expand the Council nursery site into a demonstration site to showcase compost, fertiliser, sowing seed and proper transplantation, target compost or fertiliser, liquid fertiliser, seed saving and seed preservation, propagation, crop management, irrigation and water management.

4.2 Biophysical context- Assessment of biophysical factors conducive for agriculture production.

Kiritimati Island is one of three inhabited islands in the Line Islands group of Kiribati. It is the world's largest low-lying atoll and is the largest island in the Line Island chain, with an approximate land area of 321 square kilometres¹¹.

The island is in the shape of a key, with a lagoon opening to the west. The area around the lagoon includes four key settlement areas – London and Tabwakea to the north, Banana to the west, and Poland to the south of the lagoon. The southern part of the island is a reserve designated as 'Cook Islet Closed Area' in 1975. The reserve is an IUCN category 1a Nature Reserve with endangered species including the Phoenix Petrel and Polynesian Storm Petrel.

Unlike some other parts of Kiribati, Kiritimati's settled areas are 11m at the highest point and elevated higher than predicted sea level rise of 0.75m by 2100¹². Kiritimati is therefore an important future major hub and development base for the Kiribati Government.

¹¹ Anderson, A., Wallin, P., Martinsson-Wallin, H., Frankhauser, B and Hope, G., 2000. The Journal of the Polynesian Society 109(3) 273-293.

¹² <https://thecommonwealth.org/news/climate-risk-assessment-kiribati-finds-significant-ecological-and-financial-risk>.

4.2.1 LAND TENURE

The whole of Kiritimati Island is government land. With increasing population growth, the government opened perpetual leases in 2017 of quarter acre blocks for 100 years for \$1000. As part of this initiative, nearly 2,000 new land leases were released. These blocks were an expansion of existing settlements, especially in Tabwakea with many occupied by new island residents – particularly people relocating from the highly population-dense urban areas of the island nation’s capital, South Tarawa. Of note, there are no native inhabitants on Kiritimati, with everyone voluntarily settling on Kiritimati from somewhere else in the island group. Additional new blocks of land are released from time to time. The combination of new lease occupation (particularly by new island residents) with natural population growth will result in increasing demand and stress on the island’s freshwater resources¹³.



Inspection of new land lease areas (Tabwakea 2 and 3)

The RAP team visited two lease areas, Tabwakea 2 and 3. Government leases are by lottery for quarter acre blocks. All those who apply obtain one (i.e. no waiting list) but only married couples and single women can apply. Leases are \$37 per month until \$1,000 has been paid; business leases are \$360 per year. Conditions include that leaseholders must clear the land, put in a well and a toilet (\$1,500) and a building (\$500 for 40sqm thatch, or \$25-35k for 60sqm concrete -which is by permit only)¹⁴. Leases do not give leaseholders any right to sell the land.

Most houses in the area are made of tin and wire materials and some have a thatch roof. Residents are predominantly low income (e.g., welfare is at \$50 per adult per month and average income was cited by RAP participants to be around \$65 per month). While there appears to be lots of evidence of copra processing, only around 10% of households in the area have a vegetable garden, depending on location – closer to lagoon or closer to the coast affects the number of coconut and shade trees that will grow well, as well as quality of water access. The RAP site visits found that compost materials are available in both lease sites, but more availability is seen on the lagoon site (although the wells are more brackish).

¹³ Ibid SPC Draft Report.

¹⁴ Ibid SPC Draft Report.

4.2.2 GEOGRAPHY

During the RAP a series of site visits were made. Table 9 captures the geographic observations:

Table 9: RAP site visit observations around Kiritimati.

Area	Observations
General observations:	<ul style="list-style-type: none"> • Heavily vegetated, coconut, palms, figs, pandanus, breadfruit and other tree crops. • Abundant green and brown compost materials, occasional seaweed, fish waste available from fishing boats and stranded seaweed.
East of Banana Point 1	<ul style="list-style-type: none"> • Dry area with coconut and salt bush, heavy ground cover • Could be good for goats • Plenty of wildflowers for honey. • Coconuts are now too dry; in the past they were healthier.
East of Banana Point 2 (At turn off to cross bottom of lagoon, NEP outpost)	<ul style="list-style-type: none"> • The road to the SE is closed when birds are breeding. This outpost is for wildlife staff. (Historically there was over-harvesting of bird eggs.). • Wildlife staff also stop illegal harvesting of milkfish from within the reserve (the area south of the road across the bottom of the reserve).
East of Banana Point 3 (road towards SE point)	<ul style="list-style-type: none"> • There are sand dunes to the eastern coastline, which includes a high point for the island above sea level. • The area has shallow soils, and largely consists of saltbush and tumbleweed, with large pieces of coral evident. • Grassed areas in some places. • Coconuts appear planted in rows but are dry and dying. • Suspect brackish water here and impacts of drought. • No sign of guano deposits that could be used for compost, despite large number of sea birds. • Rye grass and colts foot present – these are pasture grasses that would have been introduced. • Lots of birds present and sighted a wild cat.

<p>Banana Point 4 – area across south of lagoon, with ponds to south and north of road</p>	<ul style="list-style-type: none"> • Brackish water but not as salty as the sea • Vegetation is sparse (in places looks like a moonscape). • Milkfish ponds, coral rimmed. • To south is not fishable, to north is fishable • Low lying and sand on exposed coral. • Fire (near American air strip) has caused significant damage to coconut plantations. The fire was to drive native bees from hives so people could collect honey (however there is no bee keeping equipment). • Driving west there are more and more coconuts.
<p>Paris Point 5</p>	<ul style="list-style-type: none"> • A tourism destination with beautiful picnic areas (with toilet), long beach, and areas for collecting pipis. • Vegetation is pandanus and coconut with sea neptune, saltbush scrub and very dry soil.
<p>Poland Point 6</p>	<ul style="list-style-type: none"> • Lush green area with a range of trees; coconut trees, pandanus, breadfruit, papaya and fig. Solid ground cover. • Estimated soil depth probably 6m, topsoil depth is around 20cm (brown materials decomposing). • Plenty of shade in the area. • Sufficient good quality water. • Abundantly grown amaranth and koura (lucern type NFC cover crop). • Copra area on government land and many gardens present; \$4/kg dry, \$2/kg wet – starting to harvest younger coconuts to ensure supply, as fire has damaged many. • Population around 300, 40-50 households. • Two or three large trucks with KUC.

Household Farmers in Poland

Near Poland the RAP team met with two home-based farmers and witnessed the following growing well: pandanus, coconut, breadfruit, papaya, pumpkin, noni. Both farmers were challenged by not knowing how to grow from seed.

Household Farmer 1 (male)

Farmer 1 has a 20-30sqm pumpkin garden plus trees. He sells pumpkin to London occasionally for \$20 each for a 3-5kg pumpkin. The pumpkin at the shop costs \$30 (\$10 mark up). Farmer 1's income per week from copra is around \$200 (he sells copra to Kiritimati Coconut Ltd and receives \$4 per kg), and about \$20 income from vegetable sales. Anecdotally Farmer 1 is getting fewer coconut fruits compared to in the past. Anecdotally there can be lots of money in harvesting coconuts – as households can make more money than a government staff if they work hard and have transport.

Household Farmer 2 (female)

Farmer 2 has a 40-50sqm garden. She grows a nitrogen-fixing hedgerow crop around her garden and in the paddock that is also used for a traditional compost mix (coconut logs, layers of brown and green from nitrogen fixing crops). Farmer 2 can earn \$60-\$100 a week growing vegetables depending on production (she sells pumpkins for \$20 each). However, she reported only making \$200 in the past 3 months as production has been lower because the climate has been drier. She thinks half of the (Poland) houses have a garden her size, and half would be smaller – she reports almost all households have a garden because they have access to good water in Poland.

4.2.3 WATER

The Kiritimati Water and Sanitation Division (WSD) sits under the Ministry of Line and Phoenix Islands Development (MLPID) and manages the island's four main reticulated water supply systems, along with six water trucks and sanitation services. In a May 2022 SPC Report, SPC described how WSD are challenged with 'operating and maintaining dated and often dilapidated water infrastructure with little institutional capacity and resources whilst attempting to satisfy growing consumer demand for potable water from the four limited and vulnerable groundwater lenses (Decca, Four Wells, Banana and New Zealand Airfield)' ¹⁵. This was evidenced by some well equipment not working at the time of the RAP site visits (in July 2023). Each lens supplies water to different villages:

- The Decca lens supplies London, South Tabwakea and Tennessee villages.
- The Four Wells lens supplies part of Tabwakea village.
- The Banana lens supplies part of Banana village and most of Main Camp village.
- The New Zealand Airfield lens supplies Poland village.

Water access on Kiritimati is both reticulated and via the wells. The main source of freshwater on Kiritimati is from the above-mentioned groundwater lens formed by rainfall percolating through the highly permeable soils. As a result of the low and variable rainfall, there is very limited dependence on rainwater. SPC is currently still working to further understand the water lens and freshwater availability. Each lens has a maximum estimated sustainable pumping rate derived from groundwater assessments and calculations, and therefore a limited population can be sustainably served by local groundwater alone¹⁶.

¹⁵ SPC, May 2022, Safe and Sustainable Drinking Water for Kiritimati Island Baseline Report pp4-5.

¹⁶ Ibid (p.5).

Around 50% of the population in Kiritimati are in reticulated water supply. Tanks are around 500L, and the refill speed is enough for 2 fills per day per household. This is not enough to support gardening without larger tanks and importantly, suggests low capacity to support predicted population growth.

Wells are often brackish and can vary in water quality. Generally, on the lagoon side it's more brackish and on the ocean side of road it's fresh. It's currently good luck if you apply for a lease and get good quality well water. Households on the brackish side must buy water however it's only enough for cooking, washing and showering. A second project with SPC and UNICEF is focussed on increasing supply and testing.

In May 2022 SPC found that there is sufficient infrastructure in place (groundwater infiltration galleries, pumps, pipelines, distribution networks, etc.) to only meet the demand of up to 3,080 people (only 42% of the 2020 census population) at 100 litres per person per day (L/p/d), or up to 5,140 people (70% of the 2020 census population) at 60 L/p/d¹⁷.

The Honourable Minister (HM) MLPID has stated the intention to implement a policy to manage and limit population growth, motivated in part by limited water availability and associated infrastructure and service delivery capacity.

Despite this, SPC found that groundwater is likely the most cost effective and reliable water supply source. Alternatives such as desalination will need to come into play as part of long-term water security plans once the sustainable groundwater abstraction rates are fully utilised.

A major challenge lies in being able to dedicate financial resources effectively and efficiently to sustainably satisfy the projected growth in reticulated water demand on Kiritimati. The challenge increases with the release of new land leases. SPC have calculated the cumulative low-end freshwater lens carrying capacity as 21,720 persons @ 60 L/p/d which is sufficient to meet the 2045 projected island-wide population. However, the water isn't where the majority of people are, and as such, the geographical distance between freshwater lenses and demand centres are a major issue¹⁸.

Choice of crop variety produced will be an important consideration with the constraints imposed by available water.

4.2.4 COMPOST MATERIALS

Currently there is very limited composting occurring on Kiritimati, with the methods observed including:

- anerobic compost pits
- traditional compost layering in dig-in gardens (coconut, brown and green layers sometimes with pig manure)
- mixed aerobic compost, with green, brown and manure layers, sometimes with collected 'stranded' seaweed.

The site visits and interviews found ample resources for compost. The prominence of stranded seaweed and very few livestock will require different compost recipes, including the safe use of human biosolids. However, the safety protocols in using these will need to be addressed. There is potential for the use of local fish in compost recipes.

Currently there is no public compost facility on Kiritimati. As a foundation activity, it would be strategic to build one up at the Council nursery (given its preferred location) to support demonstration gardening sites and other households who self-propel into action.

¹⁷ Ibid (p.6).

¹⁸ Ibid (p.19).

4.2.5 SEED AND ROOT STOCK

Kiritimati has limited seed stock and currently there are no stakeholders who practice seed saving. There is a small ALD-run nursery as well as a KUC nursery but both have very limited seed. Seedlings and coconut plantings are sold through the ALD nursery. Anecdotally ALD staff cited that 'Hop Ty' branded seed often has low germination rates and Taiwanese seed is thought to be better. ALD staff relayed that the best results from seed are gained from growing sugar baby cabbage, cucumber and pepper.

There is sufficient root stock available on outer islands that gets brought into Kiritimati by boat, and growing from root stock is well-understood and therefore preferred by farmers.

4.2.6 OTHER RESOURCES TO SUPPORT AGRICULTURE

Government based human resources to support growing are limited. The Agriculture and Livestock Division (ALD) Office (in Banana) is quite a distance from population centres, has a damaged roof, no tables or chairs, and no electricity. There is one vehicle and driver, 1 staff member for livestock, 2 nursery staff, and 3 agriculture staff. The ALD nursery is small and partly operational compared to the one supported by the Council in Tabwakea. The agricultural extension officer ratio in Kiritimati is 1/3,500 (one of the lowest in the Pacific).

SPC introduced dryland wicking beds as a concept and design for ALD staff in Quarter 3, 2022, but the ALD is yet to set up a physical demonstration. During interviews it was evident the cost of wicking beds is a concern (this concern needs to be examined further).

According to ALD staff land crabs are very difficult to manage on Kiritimati, often causing destruction to planted crops and seedling. There are a variety of methods currently used to manage them, tin walls, wire mesh and cement blocks to create a barrier and reduce access to crops.

Last year, the ALD team conducted 3 community trainings in Banana but did not do any follow up visits due to travel budget constraints. The trainings included composting, seed sowing and harvesting. Their focus was on the garden beautification competition where the prizes consist of water pumps and gardening tools.

ALD primarily help individuals and households who ask for help. Discussions with ALD staff supported the findings of the community workshop where community interest in gardening was found to be high. However, households lack resources (e.g. transport and seed) and funds (e.g. for fuel) to progress. One government staff member noted trust issues being common within the wider community and explained that people generally keep information to themselves. However, they share more openly in church groups.

There are no registered agriculture co-operatives. The small cost may be a limitation to people becoming registered.

Agriculture staff advised that for food security households need:

- more seed (Taiwanese varieties are preferred)
- training on growing, planting and preserving
- increased climate adapted root crops including kumara, cassava, pandanus, taro (Colocassia) and local fig
- a designated compost facility
- training in bee keeping and resources for it (as there are plenty of wildflowers and wild bees, but honey collection includes the burning of coconut trees)
- manure for compost. Livestock are limited on the island. ALD uses pig manure for compost, but the stock runs out quickly – there is not enough to be shared. It was noted that chickens could help with manure, but they require imported feed to lay, and there is no importer of feed.

Government interviews established that other outer islands have good water, and materials suitable for growing root crops including taro and kumara, banana, breadfruit and vegetable crops. It is planned that these will be grown and brought in from the islands to the north-west of Kiritimati.

To improve connectivity and access between islands, a new boat for transport from outer islands is projected to start in October 2023. However, an interviewed government staff member expected interruptions to the service and supplies due to potential breakdowns, and consequent difficulty in fixing parts. Despite these concerns, plans are for the boat to run a service every 2 or 3 weeks.

4.2.7 OPPORTUNITIES FOR DEVELOPMENT INTERVENTION

1. Set up a designated compost shed near the KUC nursery. The project would need to identify if it is best to do this with ALD staff or at the KUC nursery, to support demonstration gardening sites and other households who self-propel into action. This facility could be used for a nursery demonstration garden, for education and in the longer term to sell surplus to the community.
2. Utilise agriculture extension staff to support households in seed planting training and growing advice and provide community-wide education on the long-term importance of diversity of produce.
3. For short-term production, focus should be on increasing production of climate adapted traditional root crops including kumara, cassava, pandanus, taro (colocassia) and local fig, as these are socially accepted, desired and have the highest knowledge and skills to grow and use successfully.
4. Develop community educative sources to support household gardening knowledge and skills. Resources could be provided in hard and soft copy and supported by social media (e.g. Facebook ‘lives’) particularly to target young people’s participation.
5. Market and value chain interventions such as support KUC to facilitate transport of produce from Poland (with the most productive conditions) to sell surplus at markets 45 minutes away. This could be done either through subsidies or by facilitating agreements between sellers and groups of producers.
6. Poland may be a good location for a dig-in garden demonstration site for growing produce. The demonstration site could serve to train locals on growing from seed and seed saving, as well as set up a secure seed storage area to store and catalogue all seed varieties as the diversity expands on the island. The KUC nursery site could also serve as a strategic demonstration site.

7. Short term investment of resources in ‘lead farmer’ household demonstration sites could be worthwhile, to build the profile of producing and inspire others to start producing. Culturally, people living on Kiritimati are motivated by competitions (such as the garden competition), so building competition into a local AFF project could be beneficial.
8. In the long-term (3 plus year transition) strive to create conditions and household capacity for crop production. Crop selection is critical and should be fulfill a variety of factors, adaptability to local growing condition, palatability for local consumption and nutritionally diverse.
9. An assessment into the viability of beekeeping may be useful alongside training in bee keeping and resources required for it. There are currently plenty of wildflowers and wild bees.

4.3 Governance and mobilisation- Factors associated with successful delivery of programs within the local context

4.3.1 AN ISLAND OF SETTLERS AND POPULATION GROWTH - IMPLICATIONS

Due to high voluntary resettlement rates the government of Kiritimati has experienced the fastest population growth in Kiribati. The government has had to carefully manage rapid population growth, not least to ensure that population health is factored into economic growth.

Table 10 Population growth in Kiritimati (source: census data).

Year	Total population of Kiritimati (census data)	Notes
1985	1,737	
1995	3,225	
2000	3,431	
2005	5,115	2000-2005 8.3% population increase
2010	5,586	
2015	6,456	Population by village data commenced in 2015
2020	7,369	Population by village: <ul style="list-style-type: none"> • 48% in Tabwakea (fastest village growth rate) • 27% in London & Tennessee combined • 20% in NW villages including Banana, Maincamp & Bamboo • 5% in SW including Poland
2045	Projected to be 14,560	

The 2045 projected population data (by natural growth rate and full lease occupancy) is around twice the 2020 population.

In 2007-2009 the ADB assisted the government in formulating planning and policy mechanisms through a technical assistance (TA) program entitled Integrated Land and Population Development Program on Kiritimati Island. The TA included detailed planning for land use management, a population policy, a coordinated land development program and plans for infrastructure expansion (basic water, sanitation and power) with the goal of environmentally sustainable and properly planned settlements. The TA was supported by another ADB TA entitled Preparing the Outer Island Growth Centres Project. Both projects sought to support Kiritimati in its pursuit to become a growth centre.

Prior to colonisation Kiritimati was considered 'empty' – of both people and trees. It now has 4 settlement areas – London, Tabwakea, Banana and Poland, with a total population of approximately 7,380. The latest population density is relatively low at around 16.6 people per square kilometre¹⁹, but the population is concentrated in the 4 settlement areas as per the table above. Households average 6 people per household²⁰. Kiritimati is predominantly settled on the north coast running NW- SE. Most of the population is provided with worker transport, as it's a long way between locations. In recent years the Tabwakea population has grown from 3 to 6 villages, with more land releases expected from government. Despite good planning some people who have voluntarily migrated to Kiritimati have ended up as squatters without adequate access to water and sanitation.

Kiritimati has been identified as a second development hub (to join Tarawa) for Kiribati, with an industry of state-owned copra (which accounts for around two thirds of export revenue), fishing (including aquarium fish and seaweed for export) and a small amount of fishing (bone fishing catch and release) and surf tourism. Kiribati's principal trading partner is Australia.

The government sees fishing tourism as a key development pathway and noted that hotels will need to support this with fresh fruit and vegetables for guests. As such, the government sees potential for local farmers and households to supply the tourism sector with fresh fruit and vegetables.

4.3.2 DISPERSION - IMPLICATIONS

The distance between villages in Kiritimati presents many challenges for the movement of people and resources, including agricultural extension activities and movement of produce. For example, the ALD in Banana is 25 minutes away from the nearest major village of Tabwakea, 45 minutes from London and 1 hour from Poland. The distance from Poland to Tabwakea is 1 hour 15 minutes. ALD staff are restricted by operational costs including transport costs. Any project design will need to be strategic about the location of focus and how to manage (and fund) travel logistics.

4.3.3 CHURCHES (8 DENOMINATIONS) AND RELATIONSHIP WITH COUNCIL AND ALD

During the RAP the team visited the church near London for a semi-structured meeting and individual survey. Around 50 people, equal female/male participants, attended to share their food security perceptions and discuss how churches could support project implementation.

During the meeting RAP researchers were interested to find out what food security means to participants to ensure community ownership of project.

¹⁹ SPC, May 2022, Safe and Sustainable Drinking Water for Kiritimati Island Baseline Report.

²⁰ Kiribati 2019–2020 HIES report.

Church members held a strong interest in growing fresh food for good health and a balanced diet. About 40% of participations are currently household growers. During the meeting the pastor asked household farmers to share materials and skills with those who are not yet growing and suggested they should partner with each other to check on their gardens.

The church community suggested churches are a strong mechanism for community gardening, given that all residents are from different places, and without the church structure there is little trust between strangers on the atoll.

Church leaders stressed the importance of growing traditional crops – todody, taro, cassava, leaves like Mbele and Moca, and fruit (papaya, coconut, etc). Alongside this was the importance of youth engagement, highlighted by the pastor’s instruction to youth, ‘you youth need to spend less time on Facebook!’. The research team recognise that Facebook could in fact be a very useful tool to engage youth in gardening.

In further discussions it became apparent that an Atoll Food Futures Project in Kiritimati could leverage on existing structures within the community including using farmer-to-farmer sharing via churches, supported with broader training via ALD and competition-based engagement (competitions are popular in Kiribati) via Council and the Ministry of Line and Phoenix Islands.

4.3.4 OPPORTUNITIES FOR DEVELOPMENT INTERVENTION

1. Population densities will need to be carefully managed to ensure safe water and sanitation for good health outcomes and to ensure enough water for gardens.
2. The government sees future potential for agricultural production on communal church land to complement household farmers who produce a surplus to supply the growing tourism sector with fresh fruit and vegetables. There is also an opportunity to increase local commercial crop production to supply the expanding villages.
3. For fruit and vegetables, the government believe the Fanning and Washington Islands could be used for crop production to supply Kiritimati – including kumara, banana, breadfruit and other root crops. Fanning and Washington are both believed to have good water supply. However a reliable regular form of transport between the islands and Kiritimati is yet to be established.
4. In the short term it will be important to build a base of strong agricultural skills and demonstration gardens to showcase what can be grown and how, in order to support growing at scale in the longer term (either at household subsistence level and/or through communal commercial gardens).
5. Church members feel churches are a strong mechanism for communal gardening, given their existing structure, established communication channels and imbedded trust networks. Pastors appear to support the idea of communal gardens.
6. Both household and/or communal gardening could be well supported with broader training via ALD and competition-based engagement via Council and the Ministry of Line and Phoenix Islands.
7. Designated resources to assist with managing ALD travel logistics would be beneficial to the project.
8. A lead gardener model could be useful to champion a shift toward household gardening. Lead gardeners should be identified across different age brackets of women, men, girls and boys, so all community segments can identify with a leader. Social media can be used to engage youth in garden production.

4.4 Extension for localised learning

ALD would be well placed to offer agricultural extension support for any of the above options and would likely benefit from a resource staff member to be consistently on the ground in Kiritimati dedicated to the project and localised learning. Lead farmers could also be incentivised to provide basic technical support to nearby householders or church groups.

4.5 Partnership options – Council, churches, Agriculture and Lands Division (ALD)

Options for partnering could include both KUC and ALD but will need to be put to the Minister (Line and Phoenix) for consideration.

5. Recommendations

The information contained in this report indicates a conducive enabling environment for climate resilient agricultural interventions on Kiritimati.

1. A country highly vulnerable to climate change and a need for climate adaptation solutions.
2. National government priorities focused on development of Kiritimati.
3. National and local government support for climate and food resilience interventions.
4. A need for increased supplies nutritionally diverse foods.
5. A community receptive to novel climate smart agricultural practices.
6. A bio-physical environment capable of supporting expansion of agricultural activity through either large-scale production or at the household level.

According to RAP staff and research participants, the following design recommendations are strategic and necessary for increasing local crop (fruit and vegetable) production, increasing uptake of climate-smart technologies, and decreasing reliance on imported foods in Kiritimati. These recommendations specifically target climate change adaptation increasing food resilience and reducing vulnerability.

Investing in the foundations needed to facilitate local crop production will also enable the delivery of programs associated with improved nutrition and behaviour change for diversifying diets.

5.1 Immediate recommendations

The following short-term (up to 12 months) priorities are recommended as a minimum to build a solid foundation for future scalable uptake of local food production, either at a collective commercial level or household subsistence level, supported by a base of climate smart agricultural resources and infrastructure and knowledgeable agriculture staff and local lead farmers.

- 1. Improve the Council nursery to make it a central hub for agricultural extension education and resources** – including demonstration of climate smart agriculture (e.g. dry wicking garden beds and keyhole gardens), seed sowing, seed saving, food preservation, compost training, and water saving shade practices. Further, seek to demonstrate innovative context-specific ways of growing food at the nursery such as using vertical gardens to raise gardens off the ground and away from crabs. Unlike the ALD nursery (in Banana), the Council nursery is well-located (next to leased land on the northern side of Tabwakea) where growing populations reside.
- 2. Set up a designated compost facility near the Council nursery.** The purpose of the facility would be as a teaching and learning site with compost output primarily used for the nursery demonstration garden, and in the longer term to sell surplus to support increased community production. The project would need to identify if it is best to locate this facility with ALD staff and/or at the Council nursery.
- 3. Build knowledge and skill capacity of government staff** (local Council staff and some agriculture staff) across agricultural topics, including organic fertiliser and pesticide, seed saving, climate smart agriculture, compost, pest management and business development. This could potentially draw on atoll-to-atoll skills from Live & Learn based in South Tarawa, and/or utilise highly skilled local experts.
- 4. Strengthen the project demonstration site set-up, consider providing support for 1 staff member** on a 12-month position with a view for extension. The need for this dedicated resource would be to provide ongoing on-the-ground support for the project on Kiritimati.
- 5. Provide logistical and operational support to ALD to engage with the community.** The ALD office is located in Banana and given long road distances they require transport support to be able to conduct site visits. Lack of transport is currently a major challenge.

In addition, we recommend one of the following pilots to be implemented to commence the dissemination of climate smart agriculture practices within the community:

Option 1. 10-acre, church-led communal food security production area with climate resilient agriculture demonstration producing nutritionally diverse crops.

Government has indicated the possibility of designating a 10-acre area for food production purposes. Each of the 8 churches on Kiritimati could be offered 1 acre for production using their existing highly functional structures and working groups for communal farming groups.

The focus in the short term for each church group would be on:

- completing a design plan for their 1 acre.
- building up compost production for use on their 1 acre.
- producing existing traditional crops (e.g. sweet potato, toddy, taro, cassava and leafy greens like mbele and moca, and fruit like papaya and coconut) within their 1 acre.

The project would need to offer transport to the 10-acre area for churches to overcome the challenges posed by distance in Kiritimati. This could be a strategic option given that the planting plans are ready to use and the churches are easy to mobilise. ALD could conduct training via the church groups. The first year's produce could be distributed to those who engage, and subsequent years' production as food security when cargo is delayed and/or for commercial output and/or community events.

Option 2. Lead farmer training for household subsistence farmers located around the Council nursery.

The embedding and uptake of new technology typically take 2-3 years, but it may be possible to use existing growers to establish some demonstration growing groups around the nursery in the short term. This could include a ‘training of trainers’ (TOT) productive farmer via farmer-to-farmer approach to motivate other households to commence production. As such:

- Providing knowledge on how to plan annual planting to provide diverse and nutrition foods supporting diversification of diets and provide basic nutrition and cooking support.
- Existing productive farmers’ gardens could be learning sites with seed saving areas, shade house nursery and water tanks.
- Materials and water tanks could be dispersed on a needs basis (i.e. lagoon vs non-lagoon side of main road), tools and shade materials, liquid fertiliser.
- Each lead farmer would demonstrate use of household compost pits (Fakapopo style without sewerage sludge) and raised garden beds (coconut log or tin edge).
- ALD would provide TOT for lead farmers and attend sessions.
- KUC & ALD could distribute initial seed and seedlings, root and tree stock, garden plans and compost (including collection of fish waste).

An important driver and community entry point for the project would be to seek to engage ‘early adopters’ to speed up the behaviour change process by harnessing the willingness of existing 2023 garden competition households located in/near the KUC nursery to demonstrate increased local crop production and decreased reliance on imported foods.

The project could try to use the lead farmers to be the champions of changing existing social norms e.g. through strongly snowballing early success stories through social media tools.

Option 3. Seek to boost household garden production near Poland and link to markets.

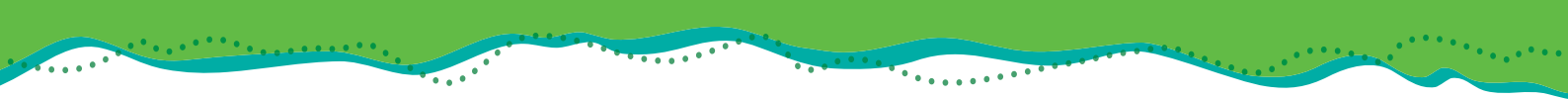
Given that Poland provides the best growing conditions on Kiritimati, there is an option to focus on boosting household production in Poland as a key agricultural site. Strategically this would be focused on growing nutritionally diverse but locally acceptable crops. The project could support households to acquire permits to sell surplus produce and coordinate transport to take surplus produce to markets (e.g., in the north). For this to be viable, transport would either need to be subsidised (by Council) and/or agreements set-up with sellers to bring produce across the island to make the supply chain favourable for all.

5.2 Longer-term recommendations (beyond 12 months)

1. **Live & Learn to develop hardcopy and online resources to support household gardeners in the shorter and longer term.** These ‘home growing guides’ could be supported by short YouTube and/or Facebook videos of lead farmers and/or agriculture extension officers presenting on topics of climate smart agriculture to support growers, including e.g. a series of single page grower guides each with a complimentary short video on 1. garden planning, 2. compost recipes (that use lower levels of manure), 3. growing from seed, 4. seed saving, and 5. mulching. The focus for these should be on traditional crops for the shorter term (as changing diets radically to include new vegetables is a much longer-term process). Kiribati government environmental health fact sheets together with SPC and ACIAR fact sheets could be drawn upon for this²¹. The resources could also use lessons learnt and be augmented by existing resources from Live & Learn’s work in South Tawara and on other atolls.

²¹ ACIAR Improving soil health, agricultural productivity and food security on atolls: SMCN2014/089 Fact Sheets.

2. **When fast internet arrives on Kiritimati (expected imminently), the agriculture extension team on Kiritimati could decrease some travel to individual households by running a weekly online 'Ag Q&A' through social media (e.g., Facebook live) or another culturally popular platform.** The Live & Learn team in South Tarawa could also assist remotely on a given day/time of the week.
3. **Seek to embed a competition at the heart of the project.** The RAP found that culturally people are motivated by competitions and suggest the project should seek to harness this. Competition place getters could be celebrated on social media to showcase desirable production behaviours to shift social norms toward wide scale growing.
4. **Work with agriculture staff for technical support as well as the strategic dispersion of climate smart tools and technologies to motivated lead farmers and/or church groups.** These tools and technologies can be used as incentives for engagement and successful participation in the project.
5. **Establish a Kiritimati Atoll Food Futures program advisory group led by government, potentially including KUC, ALD, church leaders, the Mayor's Office, SPC, lead farmers, and other stakeholders** to strategically discuss and support how the project runs. In the absence of a Live & Learn office in Kiritimati, this group could provide local guidance to the project and coordinate efforts. The advisory group could also assist in identifying challenges and celebrate successes.
6. Live & Learn Kiribati to connect to and **work with regional organisations (SPC), national government, Kiritimati Urban Council, and civil society organisations creating change toward climate adaptation and/or food security,** for greater Kiritimati project effectiveness and coordination where efforts are complimentary nationally and regionally.
7. **Scale production at the household subsistence and/or communal level. There is long term potential for uptake of innovative technologies to scale-up production, as well as grow a wider variety of nutritious crops.** Utilising the strengths of existing groups, particularly within the eight established churches, could result in scalable agricultural products for improved nutrition by branching out into 'new' vegetable varieties. It will take time for local acceptance and cooking skills to embrace newer varieties. Surplus production could be sold commercially at markets.
8. **Nearby Fanning and Washington Islands could be used for commercial crop production given their comparably more abundant higher fresh quality water supply than Kiritimati, and produce could be transported to Kiritimati using newly proposed boat services.** Government participants identified this potential opportunity. It was perceived by government staff as an ideal site for the production of sweet potato, banana, breadfruit, cassava, taro and other root crops (as well as fruit). The government expects the arrival of a new boat to service the outer islands by early 2024. This option has not been scoped and it's possible that transport costs may be prohibitive, and water availability on the islands would need to be confirmed.
9. **Community-wide training is needed in a diverse range of gardening methods** including composting; seed sowing, growing, saving; fertiliser and pest control; and water efficient production. This is especially important for non-root stock vegetables that represent a shift in food culture and the lack of skilled production for these. Increasing access to this knowledge, skills and solutions with ongoing access to support is paramount to long-term success. These trainings could be conducted at the demonstration nursery site and be supported by ICT, e.g., Facebook and YouTube videos. Local identities could feature in these. Following trainings, seeds and seedlings could be provided as incentive to start or grow household gardens.
10. **Coordinated local market days could improve local produce accessibility, as could co-ordinated transport (e.g., for transporting produce from Poland to other villages in Kiritimati).** Gaining access for products into new markets will lessen reliance on monthly food shipments for households who don't produce their own crops.

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11. **Provide demonstrations of their cooking methods to reduce negative perceptions of new non-root stock vegetables that are introduced to gardens.** Cooking demonstrations could be recorded on social media (for viewing at any time).
 12. **Preservation of traditional crops could be a pathway to counter reliance on imported processed foods,** especially as families prepare for shipment delays, and have memory of events such as the COVID-19 pandemic. Support for preservation training and storage is needed.
 13. **Mainstream gender inclusive food security planning and management** as part of broader climate change adaptation activities with inclusive decision-making systems. The project could seek to work with female growers as 50% of lead farmers.

Appendix A: RAP questions and methods

The RAP is an investigative social research method developed by Live & Learn Environmental Education to gauge community aspirations and perceptions toward sustainable development issues, to enhance localisation, collaboration and sustainability of development activities that follow. At its core, the RAP methodology acknowledges the intimate relationship that exists between people and the environment.

For project design to be effective, involving the community during the design phase is highly beneficial, not only for identifying where and how support can best be provided, but by engendering trust and ownership from the outset through genuine community engagement. The findings of the RAP are intended to inform a viable and effective community engagement plan and project design. These two documents will be developed using, among other things, the RAP findings.

A RAP is defined by Live & Learn as:

A semi-structured process of learning with and from communities about their aspirations and perceptions toward access and power structures, existing human capital strengths and weaknesses, local capabilities, and other relevant social, cultural, political, environmental and economic information to the subject being explored.

RAP methods

The RAP data collection approach is highly participatory and uses a mix of qualitative and quantitative research methods to facilitate the exploration of relationships and interactions around climate resilient food security topics and gendered perceptions.

Ethical practices are followed in conducting a RAP. This includes the practice of obtaining informed consent from all research participants and ensuring all research participants remain anonymous in notetaking and reporting. Key principles to ensure ethical research practice include:

- respect for cultural values and choice of individuals
- mindfulness of the benefit of the research for those that participate in it
- fairness in participation and distribution of benefits
- integrity of research through capacity and skills development.

Kiritimati RAP

This RAP research was conducted in Kiritimati from 5 July to 12 July 2023.

The RAP proved to be a highly useful approach to gaining insights into the perceptions and aspirations of communities in Kiribati toward food security. The approach engendered levels of trust, and led to participation and engagement in the form of critical reflection.

The RAP approach proved important for:

- Design that is evidence-based and grounded in community and individuals' reality
- Building a foundation of inclusion, which acts to remove the 'them and us' or 'give and take' mentality commonly associated with community-based aid provision
- Managing project expectations in a partnership approach with the Ministry for Line and Phoenix Islands
- Avoiding tokenistic consultation 'after the fact' on a finished design
- ensuring the integrity of engendering community ownership of the project from the outset
- Alignment with DFAT development priorities in the Pacific around climate change, GEDSI and localisation.

Research questions

Accordingly, this RAP captures gendered community perceptions toward issues linked to climate resilience, GEDSI and food security. It strives to gauge where strengths and opportunities exist to support socially and culturally appropriate channels for change. During the RAP, participants explored different aspects of the climate resilient food production systems in their personal past, present and future contexts.

The following overarching research questions guided the RAP:

1. What are stakeholder perceptions around responsibilities, priorities and pertinent issues relating to Kiritimati climate resilience and food security?
2. What perceptions exist on knowledge, skills and training needs for local, climate resilient food production, nutrition and food safety in Kiritimati?
3. What current programs and activities and ideas exist in climate resilient food security and production in Kiritimati?

A brief description of the research schedule of the RAP is below.

Meetings with government staff

These included staff from relevant ministries – Minister's Office, Education, Environmental Health, Urban Council and Agriculture and Lands Division (ALD), as identified by the Minister's Office, as well as the Uniting Church.

A 6-hour community workshop

The workshop was facilitated with 38 representatives (22 men and 16 women) including vegetable producers, church leaders (representing two of eight denominations), the mayor's office, Council ward representatives, Ministry of Internal Affairs representatives, Agriculture and Land Division representatives and other community participants. Participants were identified in conjunction with Agriculture staff and the Minister's office.

The workshop looked at community perceptions of food security, nutrition as well as their motivations and challenges for local food production, and production knowledge and skills.

20 producer visits & semi structured interviews

Producer visits were primarily conducted with households engaged in the Ministry of Interior Garden 'Farming' competition (in London, Tabwakea and Banana) and households with discernible extensive gardens in Poland. Within these household semi structured interviews, information was gathered on:

- Compost materials in use
- Planting lists and materials in use (including seed saving)
- Planting materials
- Water availability and quality
- Tools used and needed
- Extent of sales from gardens.

Geographic site visits

Site visits included exploring the key settlement areas and surrounds to assess:

- Access to water and depth of water (evidenced by water tanks and or wells)
- Village location and estimates of density
- Topsoil depth and quality (if any)
- Access to compost materials (brown and green materials, livestock, guano and seaweed)
- Visual estimates of the numbers of households with gardens producing vegetables and or tree and root crops
- Road and transport accessibility, quality and distance to urban 'hubs' (i.e., with stores)
- New lease (land) inspections
- Other observable features, e.g., crabs, plantations, nesting birds.

Church visit

A church visit (50 people, equal female/male participants) served to validate food security perceptions and discuss how churches could support project implementation.

11 market store surveys

The team surveyed 11 stores across Banana and Tabwakea to understand:

- Vegetable availability and cost
- Suppliers' availability of produce and demand including restaurant and hotel supply
- Cost comparison of fresh and frozen vegetables with other produce, e.g., rice, tinned fish
- Market customer discussions