



Making positive and permanent steps toward reducing the prevalence of non-communicable diseases in the Republic of the Marshall Islands through increased production and consumption of fresh fruits and vegetables

A report for the U.S. Embassy, Majuro, RMI
March 29, 2014



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Majuro, Republic of the Marshall Islands**

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March 29, 2014

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Executive summary

In late 2013, the U.S. Embassy in the Republic of the Marshall Islands (RMI) wanted to know if there was a way to positively, and assertively impact the food system in the RMI in an effort to reduce the incidence of diabetes and other non-communicable disease. Recent comments made at the 6th Asia & Pacific Population Conference in Bangkok in 2013, by Daisy Alik-Momotaro, Permanent Secretary, Ministry of Internal Affairs noted that, “Diabetes-related diseases and cancer are now the leading causes of death [in the RMI]” (http://www.unescapsdd.org/files/documents/APPC6_MS6_MHL.pdf). This is a call to action.

The focal point of this particular project is first to know about the availability and price of locally-grown and imported fresh fruits and vegetables, and then to suggest ways to significantly, if possible, increase the availability of produce at a reasonable price. Ultimately, the long-term goal, and one suggested by medical professionals in the U.S. and the US Department of Agriculture (<http://www.choosemyplate.gov/>), would be that every person in the RMI would be eating at least a half plate of fruits and vegetables at every meal – 7 days a week, 365 days a year.

Numerous interviews were conducted to gather background information on the current import, local production, and local purchases of food in the RMI. Research observations suggest that:

- There are some amount of fruits and vegetables grown locally in the RMI (some sold and an unknown quality grown and used in a subsistence way), but the RMI government does not measure the quantity with any comprehensiveness or preciseness on a national basis.
- There is some interest from importing countries, particularly Kosrae, to sell more fresh produce to the RMI, but farm-gate price and air cargo shipping costs make this produce available only to a small percentage of the population. In addition, Kosrae farmer motivation to produce more and on a regular basis, can be highly variable. Looking to Fiji might be one way to increasing the supply of Pacific-grown fresh foods.
- Uncooked rice imports weigh more than 7 times the weight of imported raw produce and 21 times that weight once the rice is cooked (cooked rice is 3x heavier than raw rice). This has implications for the goal of filling plates half full with fruits and vegetables.
- There appears to be little public awareness of the health impact of personal eating habits and, if market signals are any indication, that the average food buyer does not care much about the nutritional quality of they food they are consuming and feeding their families. It is unclear that even if abundant quantities of healthy food fell from trees (i.e. available at near zero cost), would the average person choose that food over the current rice-centered diet? There appears to be little acknowledgment that personal health (and the health of children under one’s care) is a personal responsibility. In addition, no one has calculated the true medical costs for handling obesity-related issues, but the \$5/visit charge at the national hospital would certainly not cover the actual cost of health care for people suffering from obesity-related maladies. Some entity is subsidizing, to a significant extent, the actual cost of health care for individuals who are not making the best food-related choices.
- RMI government grasp on the issue of obesity, and how food fits into the food production picture, is only now coming into focus, and recent planning documents, for example the

October 2013 RMI Food Security Policy, still indicate a lack of a leadership-held-responsible, impact-measurable, and internally-funded health action plan for the RMI. Food security must be inextricably tied to what it will really take to have a healthy population as well as a thriving economy partially fueled by the production and sale of fresh produce.

- That the future of the health of the current population of the RMI will continue to be impacted by inaction by many parties, including decision-making adults, and that significant and sustained efforts will need to be started now, and maintained forever, to avert the massive tragedy of a large portion of the RMI population dying – early, unpleasantly, and unnecessarily – from obesity-related factors.

These observations indicate the urgency of the issue of obesity related to the access and consumption of a healthy, locally-grown food supply. The task for this project was to suggest ways that some more produce could be made available in the marketplace, perhaps at a lower price than exists today. These ways include, but are not limited to:

- Encourage the review of taxes on food and the suggested imposition of a tax on rice to generate funds that support agriculture production and health information dissemination.
- Hold a casual-dress “speed-dating” 1/2 day meeting to reach out to interested people and organizations who really have a long-term interest in meeting a significant goal for local food production, say “30% of all produce consumed each day by 2017 is grown in the RMI”. One outcome of the meeting would be a tighter web of people who really care to move a healthy and more self-sufficient food agenda forward. Include air cargo and shipping representatives at the meeting.
- Work with leadership of each island to develop a food tree-planting plan for each household that fits into a larger vision of food sustainability/emergency food and beauty for each village. Envision and make the RMI “The Incredible, Edible Islands.”
- Tap the agricultural educators of Israel to teach a large group of RMI citizens how to grow food effectively on nutrient-deficient soils.
- Explore the possibility of bringing in produce from Fiji.
- Initiate an “Ambassador’s Future Leaders Program” to teach skills in leadership, fiscal management, law, project management, food and health, etc. It is critical that a comprehensive skill set will need to be nurtured for the leaders of RMI’s future, especially when Compact support concludes in 2023.
- Meet with the president of United Airlines, or his representative, to seek a significantly lower and stable (indexed to some reasonable metric) fresh produce-only rate for transportation within the Hawaii-RMI-FSM-Guam corridor.

Ideas abound for what could be done to improve the health of citizens in the RMI from the perspective of food production. All that is needed to achieve some level of success is focused leadership, methodical implantation and measurement, modest fiscal resources, an acknowledgement of personal responsibility, and consistent forward movement.

Making positive steps toward reducing the prevalence of non-communicable diseases in the Republic of the Marshall Islands through increased production and consumption of fresh fruits and vegetables

Introduction

The Republic of the Marshall Islands (RMI) lies between Hawaii and Australia in the western Pacific Ocean. There are about 53,000 people living on some of the remotest landmasses in the world (RMI Census, 2011). Majuro Atoll hosts nearly 28,000 people, or 53 percent of those residents. The RMI's 1,156 islands cover about 70 sq. miles of land, most only a few feet above a high tide. Twenty-four of 29 atolls are inhabited (Wikipedia, 2013). Forty percent of the population is below 15 years of age (RMI Census, 2011).

Traditional foods in the RMI were (only) pandanus, breadfruit, coconut, swamp taro, and fish. Compare those five food choices to what is available in the world – http://en.wikipedia.org/wiki/List_of_culinary_vegetables – and it is certainly a very limited range of foods. Soil quality and quantity/depth is highly variable throughout the RMI; but generally insufficient for even medium-scale agriculture as practiced in the U.S. The U.S. military introduced RMI citizens to canned and processed foods – “convenience” foods – in 1944 after they took control of the islands from Japanese forces during WWII; it was that introduction that is having serious consequences 70 years on. Today, at least in Majuro and Ebeye, shoppers have access to many of the foods and consumer products that people in Hawaii and the Mainland U.S. do. This access can be good and/or bad given how shoppers make their overall daily/weekly food purchase choices. It appears that most residents are making poor food choices, however, as indicated by recent health data. In a 2013 speech to the 6th Asia & Pacific Population Conference in Bangkok, Daisy Alik-Momotaro, Permanent Secretary, Ministry of Internal Affairs, stated:

“... a sedentary lifestyle and processed foods have brought about a sharp rise in the levels of adult obesity and non-communicable diseases (NCDs). Diabetes-related diseases and cancer are now the leading causes of death. High population growth and crowded conditions in urban areas have also contributed to the re-emergence and/or rise of certain communicable diseases, such as tuberculosis and leprosy. Other areas of concern include malnutrition in children, immunization coverage, a high teen pregnancy rate, and alarming rates of STIs.”
http://www.unescapsdd.org/files/documents/APPC6_MS6_MHL.pdf

The problem is clear and has been for some time – Marshallese people are now dying because of the types of foods they are eating; not because they don't have any food to eat. Getting tens of thousands of RMI citizens off “bad” foods (less nutrient dense foods and sugar/high fructose corn syrup-sweetened beverages) and (back) onto better foods – fresh fruits and vegetables as a significant part of their daily plate – needs to be part of an aggressive, coordinated, sustained nation-wide effort. This is especially important because the growing consumption of poor quality foods by children is dooming them to a life of sickness and an early grave. A nation can never



A lovely RMI child with both a popsicle and a soft drink. This type of consumption is a relatively frequent sight on Ebeye and Majuro.

Source:
http://www.uoguelph.ca/heportico/past/winter2010/images/winter2010/pardislost_P1010166.jpg

be successful if its children are not healthy throughout their life. In general, caregivers are making poor/uninformed food choices for the children they are raising. The human and financial cost of continuing to do nothing at a national level is significant and will continue to grow as thousands of young children, raised on less nutritious foods, become diabetic adults.

There are a number of entities in the RMI where health or agriculture is part of their mandate. For example, it is a goal of the U.S. Embassy in the RMI is to be engaged in the support of healthy citizens and economic development of the RMI (pers. comm. Jeffry Shelden, U.S. Embassy). Similarly, the RMI's Pacific Islands Forum Millennium Development Goal 1, Eliminate Extreme Poverty and Hunger, covers the health of citizens (<http://www.forumsec.org/resources/uploads/attachments/documents/MDG%20Track%20Rpt%20web%2020122.pdf>, 2012). Therefore, as a concerned and engaged partner, in late 2013, the U.S. Embassy in Majuro contracted for a study of the value chain for produce coming into the RMI from the neighboring island country of Kosrae and for produce being grown in Majuro that is then sold in Majuro and perhaps, Ebeye. They also wanted some potential solutions to food related issues.

It is important to acknowledge that a good deal of aid money has been invested in the RMI for food production related projects over the last 10-15 years. The European Union's support of the Secretariat of the Pacific Community's (SPC) Development of Sustainable Agriculture in the Pacific (DSAP) project and the Republic of China's (Taiwan) Technical Mission at the Laura Farm and other Outer Island research and extension work are just two examples. It is unclear how much measurable and permanent impact these types of projects have had on really changing behaviors and teaching skills that will lead to the sustainable production of food either on Majuro or on the RMI Outer Islands or other atolls. Further evaluation of these investments might be helpful to understanding underlying motivational factors of local farmers so that more efficacious, self-supporting programs could be crafted.

With these many issues in mind, the purpose of the study is to begin to identify the reasons for the relatively high costs of fresh produce – one reason suspected for the lack of consumption. In addition, the project looked at the barriers to increase local and regional production, and to see what actions could be taken (or reinforced) *now* to start seriously and methodically addressing the shortage of sufficient quantities of inexpensive, healthy, locally-grown fruits and vegetables. This report covers reconnaissance work on Kosrae, Ebeye/Kwajalein, and Majuro that took place between Nov 30-Dec 18, 2013. A discussion of the findings follows locational observations. The report finishes with a list of possible action steps that might ignite some critically needed changes in the RMI food system.

Kosrae: Understanding the production and transport of fresh produce to the RMI

Site visit: Nov 30-Dec 6, 2013

Trip findings

The Federated States of Micronesia's Kosrae State lies generally west of the RMI. It is accessible by United Airlines 2-flights/week: Monday and Friday – going east toward Kwajalein and Majuro. Interviews (on-site and over email) regarding the production and sale of fresh fruits and vegetables to the RMI took place with the following individuals:

- Witson Phillip (farmer/consolidator who buys from other growers and ships to the RMI)
- John Martin (farmer)
- David Ittu (farmer)
- Nickson Martin (farmer/consolidator)
- Ruth Berg of L&H (consolidator)
- Representatives of the Kosrae government's Department of Resources & Economic Affairs (DREA) who are consolidators and are the most used "Known/Trusted Shipper" for the nation.
- Dr. Virendra Verma of the College of Micronesia (COM), Land Grant Program, Kosrae Campus

These informants represent the most active players in the Kosrae export food system. The summary box at the right and the Strengths, Weakness, Opportunity, Threat (SWOT) analysis, below, tells a pretty clear story. There is certainly enough land to increase the export of fresh produce to the RMI, given RMI buyer needs and United Airlines cargo space, but produce growers in Kosrae need to make food production a priority in their daily lives. They need to be more professional farmers rather than "yardners". It appears that currently growing and selling export crops is something most growers add to their regular activities to make a little money on the side rather than "having to" make money through agriculture to pay for the basic necessities of life. This distinction is important; many other peoples in the world "need" to sell food they grow to cover their basic needs for food, rent, fuel, children's school fees, etc. With a lack of an urgent/compelling and repeated need for money, it is unclear what will make Kosrae farmers engage in Fiji- or U.S. Mainland-style production; crop after crop, year after year. Farmers don't seem to be motivated by an ever-increasing savings account. Rather, more than once the consultant was told that once paid for the produce, all the revenues (profits?) are quickly spent by the average grower. Thus, when ready to plant again, some farmers typically go back to DREA or the College of Micronesia for "free" supplies or services rather than relying on their own business' savings or farming discipline and planning. This type of "enabling" support system does not build long-term self-reliance or sustainability.

In addition, informants told the consultant that farm-gate prices are set at what the market will bear (in the RMI), rather than a "cost plus" pricing strategy. Typically, larger farmers who

Kosrae summary

Population 6,616 (2010)

Households unknown

Area 42.32 sq miles

F&V production + Abundant land with deep soil. Good agriculture researcher and good seed source. United Airlines could lift over 1,000 lbs/2x week (Mon/Fri) @ \$0.57/lb to Ebeye via Kwaj. and \$0.61/lb to Majuro. Farmers, however, usually ship on Friday because don't work on Sunday. 31,265 lbs valued at \$29,347 shipped to RMI in 2012. No stats available for 2013.

F&V production – Farmers are more like occasional gardeners; not really motivated to grow crops on a consistent basis. In general, farmers don't save money to reinvest in the next crop. Department of Resources & Economic Development (DREA) help to farmers is unclear. Farm gate prices are based on revenue desire, not on actual cost of production.

F&V consumption + Residents eat some traditional crops.

F&V consumption – Not much demand for non-traditional crops. White rice, not a fruit or vegetable, is most likely the most consumed starch.

grow a common crop are “price takers” – taking what the market is willing to pay (assuming it is somewhat above cost of production), but in this case, Kosrae farmers are “price setters” – telling buyers/consumers what they want and some are willing not to make a sale of they don’t get it. There appears to be little negotiation on price. *Or perhaps there does not need to be since the markets in Majuro and Ebeye have enough buyers even at high prices?* While the current pricing maximizes the revenues to farmers, by the time shipping, distribution, and retail mark-ups are added, the price of Kosrae produce in Ebeye and Majuro puts it out of the price range of the average RMI consumer. Thus, if average consumers were, in fact, motivated to buy fresh produce, they could not. Simply, buying Kosrae-grown produce does not meet the needs, or budget, of the average RMI consumer. That said, Kosrae imports will continue to meet the needs of a small minority of expatriates and Marshallese in the RMI who have the economic wherewithal, or make eating fresh produce a high priority in their lives, to buy the Kosrae-grown produce. The following table, based on interviews and observations, summarizes some of the Strengths, Weaknesses, Opportunities and Threats (SWOT) to the Kosrae fruit and vegetable production system as it relates to exports to the RMI.

Figure 1. SWOT analysis based on interviews on Kosrae.

<p>Strengths</p> <ul style="list-style-type: none"> • Good production environment for RMI-demanded crops. Soil is deep, growing areas relatively large by small island standards, and good rain patterns, in general. • High quality science-based production advice from the COM Land Grant program. • One of the best tissue culture labs in the Pacific providing disease-free plants at little or no cost. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Lack of an understanding of future requirements from buyers so production can’t be well planned. • Government paying farmers to grow crops, or providing subsidized inputs, does not help them understand and experience the real cost of production. It distorts business decision-making. • Kosrae has more of an agro-forestry production system rather than large gardens or farms. • Lack of large areas of flat lands for economies of scale and easy plowing. • Generally “farmers” are requiring very high farm gate prices that limit their ability to sell more and perhaps cultivate strong long lasting relationships with buyers. Farmers want as much money as they can get, now. • Lack of a precise understanding of cost of production leads to uninformed decision making. • Lack of decent, sturdy shipping boxes. • Air cargo shipping costs that are relatively high and with some capacity load issues, not normally to Ebeye, but can be some constraint getting produce to Majuro if Ebeye (Kwajalein) takes on unplanned passengers.
<p>Opportunities</p> <ul style="list-style-type: none"> • Probably some potential for growth up to the airfreight capacity of United’s plane and to a volume where RMI demands will equal Kosrae supply. • Cargo “lift” is available on Monday if farmers are willing to harvest on Sunday, or early Monday morning, before shipments need to be at pre-shipping quarantine on time. Sunday is a day of rest or for church, however. • Selling produce to some of the other Federated States of Micronesia. Cannot ship to Guam due to quarantine quality issues in Kosrae. 	<p>Threats</p> <ul style="list-style-type: none"> • The cost of airfreight will continue to climb as fuel prices climb. • Lack of Kosrae production coordination can lead to market flooding – prices plummeting – or farmers just dumping (or feeding it to pigs) good produce (when it might be sold on the local market with some gov’t market promotion). Lack of coordination leads to missed sales targets. • Lack of a long-term view on production/sales. • If airfreight costs out of Honolulu are reduced, less expensive produce from Honolulu could supplant Kosrae produce RMI markets.

Needs of farmers

- One informant mentioned support for farm equipment and/or for field preparation services. More acres could be put into production with the right equipment.
- Sturdy shipping boxes made available to farmers (at cost?) will prevent some of the shipping damage being experienced by some crops.
- Someone having a conversation with the leadership of United Airlines about a better airfreight rate for fresh produce shipped on United's planes.

Disconnects

- Korsae farmers and consolidators say that United Airlines rejects loads "often" due to space constraints. But, United claims it happens about once or twice a year, especially around December when there are a lot of passengers coming back for the holidays.
- Similarly, United claims that Kosrae farmers miss their "hold" levels significantly more often than they, United, reject loads. Some farmers tend to call the airline to "hold" or book a certain amount of weight-space in anticipation of meeting RMI buyer's expectations, but then when the cargo is brought to the plane, the weight can be significantly less than what was booked or no product to ship at all. Thus, other farmers who book later would have been told that there was not enough room in the plane for their produce. As a result of this shortfall, competing farmers lose revenues, as does United. A group conversation needs to take place on this issue to get the misinformation cleared up.
- RMI produce buyers and Kosrae produce providers need to spend some face-to-face time discussing planting plans and market needs. Right now most relationships are cultivated by email or fax alone.

Consultant's observations

Given that the Korsae farmers are more like occasional gardeners, on average, and because their long-term economic needs are not covered by produce sales, there will probably not be major increases in produce supplies to the RMI in the near future. Farming is just not a highly valued profession on Korsae at this time (or perhaps they are just getting started?). On the demand side, there is room for growth in sales even at current prices. However, retail prices of Korsae-grown fruits and vegetables are so high by the time all costs are factored in, that only a small proportion of the population in the RMI will be served.

Ebeye/Kwajalein: Understanding the demand for fresh produce on Ebeye

Site visit: Dec 6-Dec 11, 2013

Trip findings

The tiny island of Ebeye is one of the most densely populated places/islands on earth. It was virtually vacant until the 1950's; being part of an active U.S. military base before that. Fourteen thousand people, more than 41% under 15 years of age, now live on only 90 acres (0.14 sq. miles) of land. Other than a few very small open areas, there are no places for serious soil-grown agriculture on Ebeye (there might be underutilized land on other islands of the Kwajalein atoll, however). In addition, it is doubtful that anyone now living on Ebeye has much familiarity with food production since, as one Majuro informant explained, Marshallese are "gatherers," they don't have a farming past, like for example, Chinese, Japanese or American Amish farmers. Pandanus, breadfruit, coconut, swamp taro, banana, and fish are "gathered"; not actively grown and harvested like leaf lettuce, bok choy, or tomatoes.

To get a sense of the demand for fresh produce in Ebeye, the following people were interviewed:

- Scott Paul, manager at Triple J/Payless
- Molly Lin, owner, Lucky Star
- Kilafwakun Sigrah, Kosraean dental technician
- Jessie Liang, owner, BC Retail
- Raphael Maie, manager of the North Loi greenhouse being refurbished by Iroj Mike Kabua
- Kwajalein Diabetes Coalition (KDC)

In short, there is little produce being grown on Ebeye; just a couple of banana and breadfruit trees; certainly not enough to provide 14,000 people with 5 servings of fruits and vegetables a day. There is some fresh, frozen, and/or canned produce in the handful of stores on Ebeye. Pound for pound, however, produce is not nearly as cheap as rice and similar low-nutrient-dense foods and beverages. There is a lot of concrete and some very small open spaces by people's homes on Ebeye. In the absence of rich soil and farmable open spaces on Ebeye, hydroponic systems – such as vertical towers, grow boxes, and grow walls – could provide significant quantities of fresh fruit and vegetables given the interest and discipline to actively grow vegetables and fruits and to protect and maintain production equipment over many years. Technological production options are discussed below. The following SWOT analysis covers some of the attributes observed during the site visit.

Ebeye

Population 14,000 (2013 est)

Households 1,150 (# elec. meters, 2013)

Area 0.14 sq miles

F&V production + Currently no production, but Mike Kabua is rehabilitating a greenhouse on North Loi for hydroponics. Canvasback is supposed to be distributing "grow boxes" in 2014.

F&V production – Little fresh produce grown given population size.

F&V consumption + Some local stores indicate they do sell some fresh produce, but it is unclear what per capita consumption is.

F&V consumption – Given the amount of soft drinks and candy consumed by children and adults on the streets, it would take significant amounts of produce to offset the sugar consumption.

Figure 2. SWOT analysis based on interviews on Ebeye.

<p>Strengths</p> <ul style="list-style-type: none"> • Kwajalein Diabetes Coalition (KDC) is starting to take a leadership role in their community. • It appears that the non-profit, Canvasback Missions, will be providing some “grow boxes” to some families in Ebeye in 2014. • The hydroponic greenhouse in North Loi, if done correctly, might provide some vegetables in 2014 but it is unclear what their business/social goal is and thus what their pricing strategy will be. • Generally a good supply of rainwater is available or can be captured. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Lack of farmable land. • Lack of self-discipline when it comes to what adults and children are eating. • Unclear how much money each family has to spend on food and so the idea of a “food budget” is unknown. Lack of the idea of saving money in the culture is also an issue with long-term sustainability of any family. • U.S. government payments for Kwajalein, that trickle down to families, make life somewhat easy if there are low expectations on living conditions and the types of food that are consumed.
<p>Opportunities</p> <ul style="list-style-type: none"> • The skilled use of traditional in-soil and above ground farming, and hydroponic systems could produce significant amounts of healthy fruits and vegetables. • Compost made/could be made on Kwajalein for soil improvement on islands of the Atoll. 	<p>Threats</p> <ul style="list-style-type: none"> • A forever supply of diabetics if food supplies and food choices do not change. • The junk food easily available over in Kwajalein.

Needs of farmers

- There is no farming on Ebeye and relatively little on the Kwajalein Atoll at the moment. Some of the islands in the atoll do have some subsistence crops, but it is unsure which island will step up to be the “bread basket” of the atoll.
- It is difficult to know what needs might be without gauging how sincere and motivated men and women are for the long-term production of fruits and vegetables. A better question than “what do you want?” to gauge the buy-in is, “what are you willing to invest your time and/or money in?”

Needs of buyers

- The ability to pick up produce on Kwajalein (U.S. military base) later in the evening on Friday or Monday night once the flight has been unloaded. Currently, produce and other commodities brought in on the flight; need to wait, exposed to nature, until the next morning to get transported to Ebeye and then into the chiller/store. This important change would require approval by base leadership.

Consultant’s observations

There are opportunities for both fruit and vegetable production and consumption on the islands of the Kwajalein Atoll. Questions about motivation and who has land and money to invest in fruit and vegetable production remain. Absent a professional farming culture being installed (somehow), the next best opportunity would be in increasing the supply of food plants (traditional and new) that require little maintenance and where the foods can be “gathered,” rather than “farmed,” which is more in line with traditional lifestyles. These could include fruit trees and different types of melons, squash, and pumpkin species.

Majuro: Understanding the demand for, and supply of, fresh produce on Majuro

Site visit: Dec 11-Dec 18, 2013

Trip findings

The population of the RMI was estimated to be 53,000 in 2011 (RMI Census, 2011, page 13). The island of Majuro in the Majuro Atoll is the most populated island in the RMI with over 27,000 inhabitants (RMI Census, 2011, page 14). There are some 3,248 non-native born people living in the RMI; 80 percent living on Majuro (RMI Census, 2011, page 35). This is an important group as they, more than the Marshallese-born population, would be more naturally inclined and possibly more financially able, to buy and eat more types and quantities of fruits and vegetables – they lead the fresh produce buying more often than not according to site interviews. When it comes to food growers, only about 1.2% of the total population said that they are engaged in “agriculture, forestry, or mining” in 2011 (RMI Census, 2011, page 47). This percentage of food growers is in contrast to 15.4% being engaged in “public administration” or government. *Overall, too few people grow food in the RMI relative to the health needs of citizens or the possibilities for some do-it-yourself income from fruit and vegetable sales.*

Majuro Island is the main shopping area of the Atoll with many dozens of tiny mom & pop stores and a half dozen larger full service grocery stores. K&K leads the shopping experience with the largest store and most variety of fresh fruits and vegetables on the island. Relatively high quality and high priced fruits and vegetables (relative to say, a grocery store in California or Costco in Hawaii) is available in Majuro – especially once U.S. Mainland boat shipments arrive. Typically these shipments are on the ocean for 3 weeks with the “fresh” produce having at least another week of time on them since they were harvested. Supplementing U.S. Mainland produce shipments, which accounted for 1,044,591 pounds of produce in 2012, including more stable foods such as potatoes and bulb onions, were imports of about 31,265 pounds of produce (and crabs) from Kosrae in 2012 (Kosrae Export data). The farmers of Laura contributed an additional 105,269 pounds of produce in that same year according to data provided by the Taiwanese Mission in Laura (pers. comm., Andy Chiang, Taiwan Mission). Figure 3 illustrates the pathways for fresh and frozen produce to get to Ebeye and Majuro. The main sources are the U.S. Mainland, then locally grown, then Kosrae respectively by annual weight. Ships from the Mainland bring the bulk of produce and then United Airlines transports some produce from Kosrae, Guam and perhaps, Hawaii, according to RMI Treasury data.

It is important to note that there is a real possibility of Fiji being a new supply opportunity for the RMI. The farmers of Fiji produce a large variety of crops at competitive prices. They often have an oversupply, which can depress farm gate prices. A quote for air cargo from a newer regional carrier, Our Airline, says that for shipments of more than 100 kg, it would be FJD \$5.00 per kg from Nadi to Majuro. On March 3, 2014, \$5.00 Fiji was \$2.66 USD. This would mean about \$1.20/lb to ship (\$2.66 / 2.2 lb/kg) produce from Nadi to Majuro. While higher than the cost of shipping on United Airlines from Kosrae to Majuro, about \$0.61/lb (Figure 3), the original cost of the produce might be cheaper than Kosrae. At the very least, more varieties of produce are found in Fiji, as well as perhaps more a consistent supply.

Majuro

Population 27,797 (2011, updated)
Households 4,092 (2011, updated)
Area 3.75 sq miles

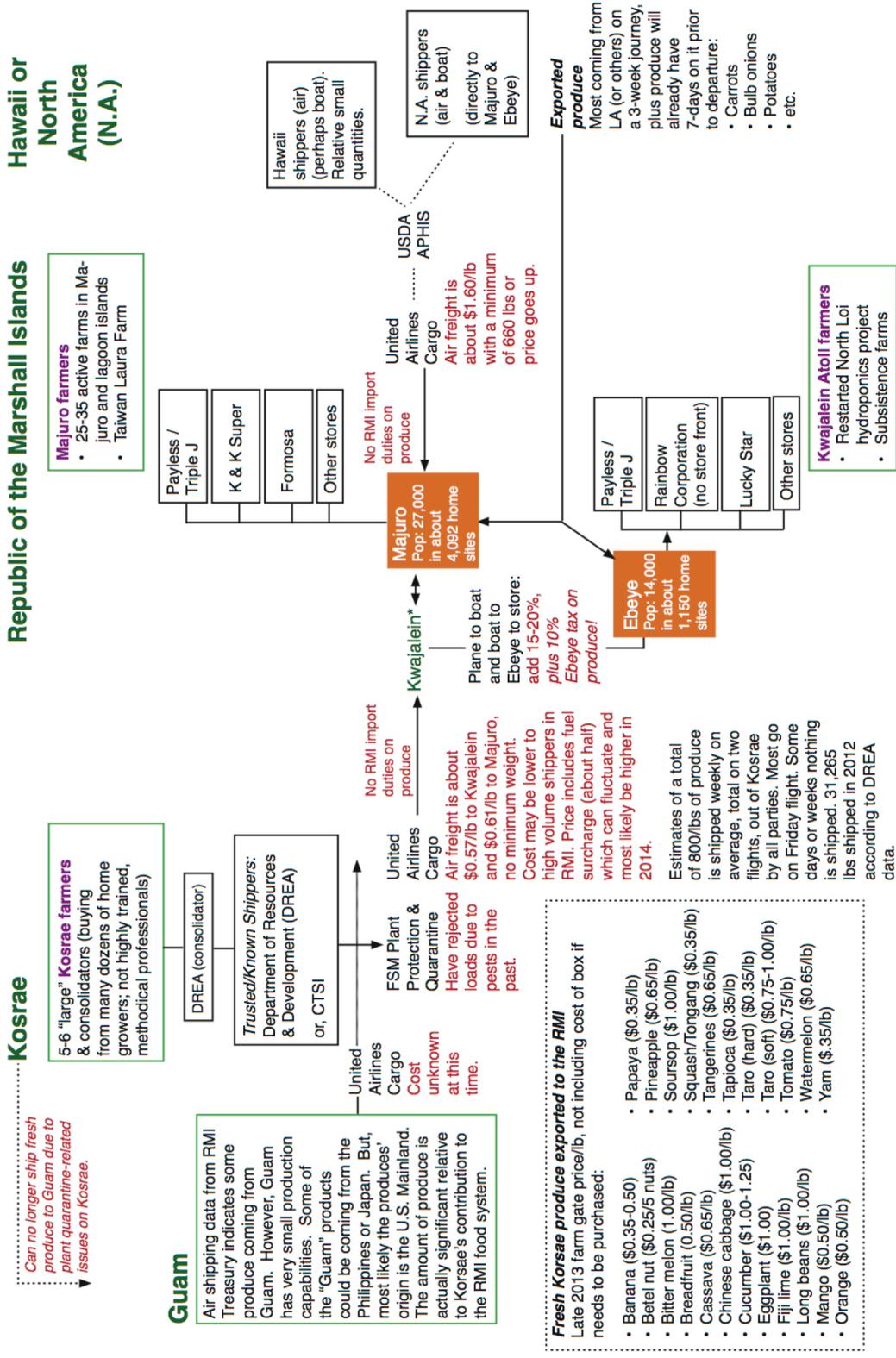
F&V production + About 20-30 Laura area farmers sold 105,269 lbs valued at \$78,518 in 2012. This does not count all farm sales within the atoll.

F&V production – Farmers are more like occasional gardeners; most not really motivated to grow crops on a consistent basis.

F&V consumption + Large retail stores report that locally, regionally, and California agriculture products sell well. Import data reports about 1,044,591 lbs imported in 2012 (not including Kosrae's 31,265 lbs).

F&V consumption – If imports and local Laura production weight is totaled up and divided by the population, 1,149,860/27,797 it yields 43/lbs/yr/person; about 0.82 lb/wk. Of course, this does not include consumption of home-grown produce or frozen or canned produce.

Fresh vegetable & fruit import/production pathways to the Republic of the Marshall Islands (RMI)



* Kwajalein Atoll residents food buying behavior may be significantly influenced by the foods/beverages they are exposed to at stores, restaurants, and vending machines at U.S. military installations on the Atoll.

Figure 3. Pathways of produce to the RMI.

A rough estimate of 1,181,125 total pounds of produce was provided for sale in Majuro in 2012 by the main three sources (RMI import data, Ministry of Finance. Figure does not include subsistence agriculture). Putting that in context, the weight of imported meats was 3,667,163 pounds in that same year (RMI import data, Ministry of Finance). Rice (uncooked) imports were more than 7,212,400 pounds (more than 360,620 bags) in 2013 (RMI import data, Ministry of Finance). It is interesting to note that rice swells to three times its original weight upon cooking – thus about 21,637,200 pounds of rice was made in 2013 – (<http://riceassociation.fivesitestage.co.uk/content/1/20/facts---figures.html>). *This is 18 times more cooked rice than produce every day, week, year!* Given these numbers, the amount of space that rice could (does?) take on a plate dwarfs amount for fruits and vegetables and meat. From this data, per capita *daily* consumption of (purchased) produce, meat, and cooked rice* on the entire Majuro Atoll (total population of 27,797 in 2011) is roughly estimated to be:

- Produce: 0.12 pounds/day (1,181,125 lbs / 27,797 people / 365 days)
- Meat: 0.36 pounds/day (3,667,163 lbs / 27,797 people / 365 days)
- Cooked rice: 2.13 pounds/day (21,637,200 lbs / 27,797 people / 365 days)

* Of course, if some of the foods imported into Majuro were then sold to ships in the area or other non-Majuro atoll residents, per capita consumption estimates could be lower, but these relative numbers are probably good representatives for discussion. This also does not take into account all the bread and flour for bread and potatoes that contributes to the “starch” category of food. Nor does it take into account all the other types of foods that are not defined as fruits and vegetables, meats (protein), and rice.

Clearly rice is important in the meals of RMI residents. In fact, one Majuro informant even mentioned that meals are often described as: “rice *with* XYZ ...” where the XYZ could be red/white meat or fish or something else, but rice is the main part of the dish. This is in contrast to the way many Western or Asian meals are described; rice would be mentioned secondarily. A 20-pound bag of rice can sell for as little as \$10 in the RMI. This means raw rice is \$0.50/lb or when cooked and the weight triples, the cost (not including cooking expenses) is as little at \$0.17/lb. By comparison, see Table 1 for prices of produce in the RMI.

There is no way to estimate the consumption of locally-caught fish or locally gathered bananas, pandanus, coconut, breadfruit, swamp taro, etc. What is also not known is really what the high-, middle-, and less affluent-class Marshallese families actually eat on a regular basis, 2-3 meals a day, 7 days a week. Nonetheless, these per capita figures provide a glimpse at the relative proportions of food on the average plate in the Majuro Atoll and to a lesser extent the other atolls in the RMI (Figure 3). *If health is to be improved in the RMI, the proportion of fruits and vegetables, relative to rice, must be significantly increased.*

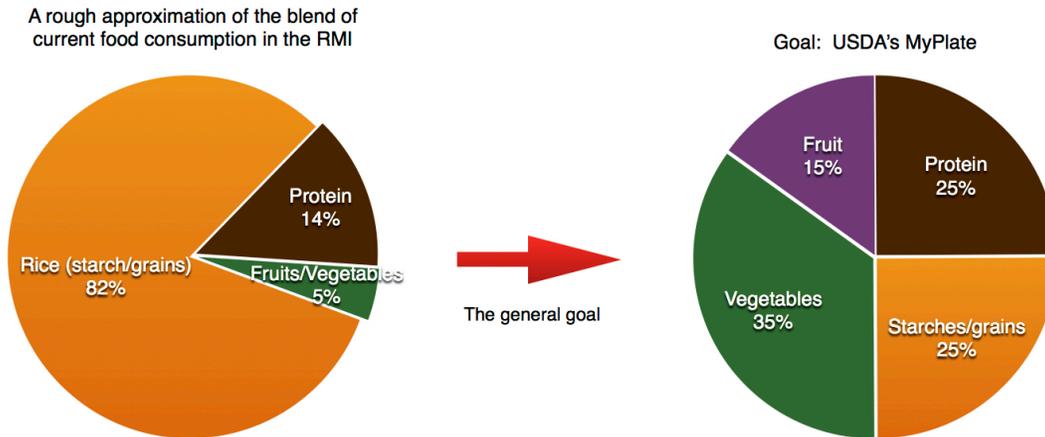


Figure 4. A general presentation of the current mix of food on a plate and the desired goal state: the USDA MyPlate allocation.

In order to begin to find ways to achieve that necessary increase in produce production and sales, the following individuals were interviewed on Majuro:

- Ambassador Thomas H. Armbruster, Norman Barth, Jeffry Shelden, Bart Deemer, Fredrick Nysta, U.S. Embassy, Majuro
- Imam Matiullah Joyia & Falahud Din Shams, Ahmadiyya Muslim Community
- Jerry and Michael Kramer, owner and son, K&K
- Andy Chiang, leader, Taiwan Mission Laura Farm
- Bonnie Taggart, RMI Wellness Center with connections to Canvasback Mission
- Rebecca Lorennij, Secretary, Ministry of Research & Development
- Eli Maravilla and Jojo Catungal, K&K
- Nan McCaffrey, farmer, Kemman Island, Majuro lagoon
- John Mason, manager, Triple J/Payless
- Daniel Price, instructor, Cooperative School
- Roger Muller, student, College of the Marshall Islands
- Fern Lehman, instructor, College of the Marshall Islands
- Biuma Samson, associate director, Land Grant programs at the College of the Marshall Islands

When looking specifically at fresh produce, informants at retail stores said that sales are good and produce waste/spoilage is minimal despite some poor packing of produce coming from Kosrae and the long haul for produce coming from California ports. In fact, they wish they had more fresh produce to sell. Produce supply equals produce demand at a certain, relatively high, price range in Majuro stores. This issue will be explored in more detail below.

What is interesting about the fresh produce situation in Majuro compared to other places in the Pacific such as Samoa and Fiji, is that there is not a significant farmers market with many vendors selling similar produce. Yes, there is a small fledgling market near downtown Majuro, but that one will not have significant impact on produce sales and consumption in Majuro (for a variety of reasons). The lack of a significant daily farmers market is indicative of two major missing factors found in other countries:

- 1) there is not an oversupply of products needing to be sold at what the visible market will bear, and,
- 2) there *is not* the sizable and desperate need by many people to grow and sell anything just to make some money for the costs of daily life (money is obviously being obtained through other avenues, or people are subsisting on very inexpensive foods and what can be gathered).

Thus, even if there was a need for a (non-store) space where budget shoppers to come for low-cost produce, there isn't any low cost produce to be found at this time because there is not an oversupply of locally-grown produce. Consumers with higher incomes appear to have their produce needs sufficiently addressed by local grocery stores, if not, stores would be reporting that they can't sell the produce they are buying from Kosrae, U.S. Mainland, and Laura farmers, and this is not the case according to interviews. The typical driving forces of farmers market are simply not there in Majuro at this time.

The research, extension, education and promotion of agriculture in Majuro appears to be centered out of the Taiwan Mission in Laura, the Land Grant program of the College of the Marshall Islands in Laura, and the Ministry of Research & Development in downtown Majuro. The organization with the most activity in the area of food production appears to be Taiwan Mission that runs a research station and supports (funds) extension activities in the other islands. The Land Grant program has some research going on at their Laura property and has some extension activity, along with student education. The Ministry of Research & Development's role appears to be highly dependent on external funding. So while there is some activity going on in agriculture it does not appear, however, to fit into some sort of comprehensive, measurable national goal.

Figure 5. SWOT based on interviews on Majuro.

<p>Strengths</p> <ul style="list-style-type: none"> • Large population to service. • Generally a good supply of rainwater. • Some land available for food production, including concreted areas. • Labor costs are low with a minimum wage of \$2.00-4.00/hr. • Some residents who know how to grow non-traditional foods on atoll soils, but it is not endemic to the culture. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • The individual or community motivation to open land to food production appears to be lacking, at least not at a near-zero rental cost. Land rents can be as high as \$4,000/ac/yr as set by law. • Government and local leaders don't seem to want to put improved human health through local food production at the top of the political agenda. • Taxes are zero on rice, but there is some tax on junk food, and sugar sweetened beverages. • No national roadmap for food production exists.
<p>Opportunities</p> <ul style="list-style-type: none"> • There are thousands of people who could be taught new ways of cooking foods. • A world of squash/pumpkin/melons, nutrient-rich tropical fruits, new breadfruit varieties, beans, easy-to-grow greens are just waiting to be discovered and grown in the RMI. • New, healthy food products and beverages could be developed. • Fund agriculture expansion and support by a tax on rice, and increase the tax on junk food, and sugar sweetened beverages and designate much of it to agriculture production support and nutrition education. 	<p>Threats</p> <ul style="list-style-type: none"> • A forever supply of diabetics if food supplies and food choices do not change. • Junk food is too easily available in all stores.

Needs of farmers

- The Taiwanese Technical Mission at Laura appears to be the biggest contributor to the development of commercial agriculture in Majuro and some of the Outer Islands. The Ministry of Research & Development provides some service to farmers, but their offerings and support seem to be largely dependent on external aid dollars, which are variable.

Needs of buyers

- It is unclear what more can be done to assist current, motivated, in-it-for-the-long-run farmers than is already being done by the Taiwanese Mission. Perhaps an assessment of what new farmers might be willing to invest to learn about and grow new crops could be undertaken.

Consultant's observations

As has been detailed above, produce supply equals produce demand for a relatively small number of farmers and consumers, respectively. But, it works for these parties. Expansion of production and consumption, to the betterment of human health will take significant effort, an acknowledgment of personal responsibility for food production and healthy decisions, and a consistent source of locally-derived support funds. More on these issues below in the "Ways forward: options for impact" section.

Discussion: what does this all mean for the production and consumption of fresh produce for the people of the RMI?

Summarizing the location reports

The fresh produce supply and demand situation in the RMI is fairly unique in the world. Demand outstrips supply, but the supply side, the farmer side, is not sufficiently motivated to respond to market demand for more produce. There are a number of reasons for this “stuck” market scenario.

Supply

- Traditionally, Marshallese are “gatherers” of food, not “farmers” of food. This means a lack of traditional familiarity and knowledge with what is required for more intensified food production. Traditional crops in the RMI are of the “plant it and forget it” variety (coconuts, breadfruit, pandanus, swamp taro), rather than the “plant it and nurture it each day” type (beans, cucumbers, tomatoes). Thus, it probably makes more sense to focus efforts on “plant it and (somewhat) forget it” plant types – fruit trees, pumpkins, cucumbers, squashes, melons, vine crops (tomatoes, cucumbers), etc, than on small plots of lettuce. Species tolerant to atoll conditions can be found and people can be taught the “mechanics” of how plants work through basic production workshops, group learning and on-site coaching.
- The motivational factors that typically inspire (semi) intensive farming to take place seems to be absent or are not in abundance in the RMI. Money is either not that important or is supplied by other means such as jobs, U.S. government payments, or remittances from family members overseas. The “need” for money typically drives someone(s) into farming or other vocations, but this does not seem to be the case in the RMI. While it can be argued that there are 25-35 farmers in Laura at the current time, a drive though the district shows a great abundance of un-engage land that could be in food production. In fact, west of Long Island there are many acres of land that could be producing food right now. There is unmet demand for produce at good prices, but farmers are not responding because they don’t need to respond – apparently their financial needs are covered in other ways. *What would it take to get those lands producing inexpensive produce that could meet some of the health needs of thousands of people?* This question deserves more exploration by local informants.
- There are supplies available outside of the RMI in Kosrae and other Pacific nations such as Samoa and Fiji. The difficulty is getting transportation of relatively inexpensive produce to the RMI. Nonetheless, if consumers are willing to pay for produce, supplies can be found.

Demand

There is demand for fresh produce in the RMI, but it is not a huge demand (as measured by a consumer base with sufficient resources) at this time. A huge demand would be one that requires enough produce to provide 50% of the food eaten everyday; the USDA MyPlate target. It is simply not there. Specifically, market growth has to contend with Marshallese’:

- Ability (and willingness) to spend money on produce. What is their family unit weekly disposable income (their share of U.S. payments, job income, family remittances)? This information is not known. But one informant stated that he thought there are 2-3 wage earners per family/household.
- The same informant noted that some families’ need to fill up at least 12 bellies, 2-3x/day, 365 days/yr. Can families afford even the cheapest produce when there are many mouths to feed?

- Likes/dislikes for different foods, including ones driven by culture. Introducing new crops is all well and good, but if the local population does not strive to make new foods part of their weekly consumption plan, the new produce is little more than a novelty.

In addition to these observations on produce adoption, there are issues with refrigeration capabilities and cooking knowledge and infrastructure for foods that are not now typically eaten. This is not to say, ‘don’t try new foods,’ but anyone attempting to infuse new produce into the RMI food system needs to make plans to address potential these and other stumbling blocks.

Figure 6 illustrates the issue of supply and demand at the current time. Those who sell produce at a relatively high price and those who want to consume it (and can afford a relatively high price) are in harmony – both getting their collective needs met.

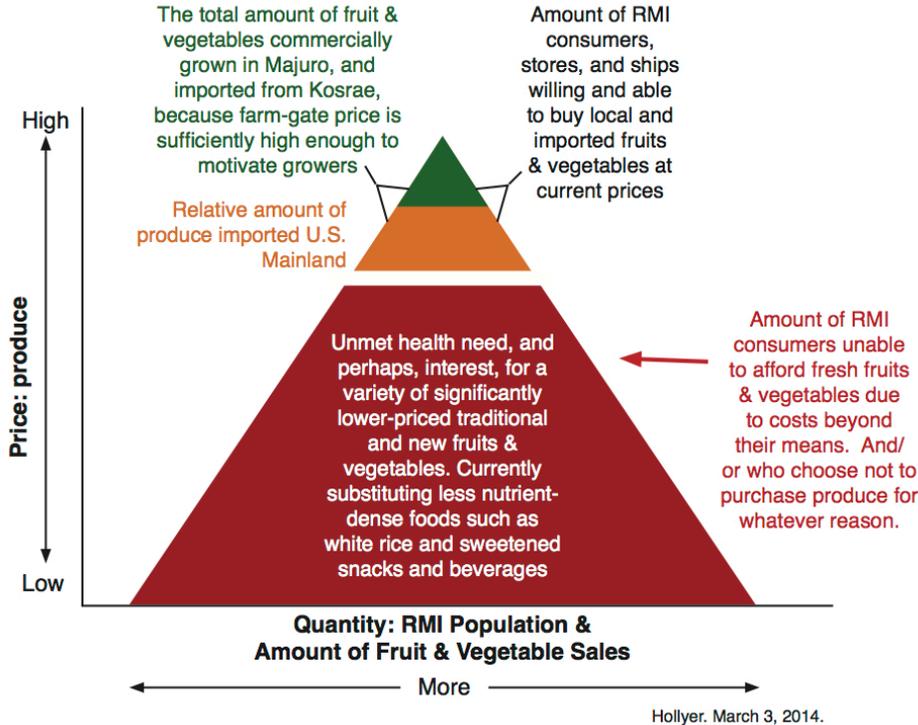


Figure 6. The relative price of locally-grown and imported fruits and vegetables can be a huge factor in the lack of fresh, healthy produce being consumed by a majority of RMI residents. But, price does not tell the whole story. Some other consumers may just not want to eat fruits and vegetables, even if they can afford it. The solution must be both a production one and a health-messaging one.

The price of produce relative to how much disposable income a family or individual has or is willing to invest in produce, and the price of substitutes – rice, for example, will impact purchasing behavior. Table 1 contains prices for Kosrae-grown (yellow shading), Laura-grown (pink shading), and imported produce (no shading). Retail prices reflect farm gate price (price paid to the farmer), plus handling/shipping, plus a retail sales mark-up. Typical mark-up appears to be about 20-30% of the price at the store’s loading dock. These prices are part of the reason that many consumers in the red part of the triangle in Figure 5 are not purchasing fresh produce. Again, some of this non-purchasing behavior is due to price (relative to disposable income), but other reasons will include not liking a product or unfamiliarity with it.

Table 1. Reported range of farm gate prices, per pound, in Kosrae and Laura, RMI.

Produce item	Kosrae farm gate price	Ebeye retail store	Laura area farm gate price	Majuro Retail store 1	Majuro Retail store 2	Majuro Retail store 3
Apple, Fuji						\$1.95
Avocado				\$4.59		
Banana, eating	\$0.62-0.75	\$1.95				
Banana, cooking	\$0.50-0.65	\$1.95				
Banana, cooking, Manila	\$0.65	\$1.89				
Banana, heart	\$1.00					
Beans, long	\$1.00	\$2.75	\$1.60			
Betel nut	0.25/5 nuts					
Bitter melon	\$1.00	\$2.50				
Breadfruit	\$0.50-0.65	\$1.90				
Bok choy, baby				\$3.29		
Bok choy, large				\$2.19		\$2.95
Broccoli				\$3.49		\$2.50
Cabbage, Chinese	\$1.00-1.50	\$2.14				
Cabbage, undescribed	\$1.00-1.50	\$2.65				
Cabbage, green, head				\$1.59		\$1.35
Cabbage, Napa				\$2.79		\$1.95
Cabbage, red				\$1.79		
Cantaloupe				\$2.59		
Carrot, baby, peeled				\$2.09		
Carrot, jumbo/large						\$1.35
Cassava	\$0.65-0.75	\$1.95			\$2.99	
Cauliflower				\$2.99		
Coconut, eating, copra		\$1.34				
Corn, sweet		\$2.51	\$1.35			
Cucumber	\$1.00-1.25	\$2.85	\$2.00	\$2.99	\$3.99	
Daikon (white radish)						\$1.95
Eggplant	\$1.00-1.75	\$2.85	\$1.65			
Garlic						\$2.95
Ginger root				\$2.89		\$2.35
Gourd, bottle			\$1.35			
Gourd, white (AKA Winter melon)		\$3.43				
Grapefruit				\$1.59		
Guava	\$1.00					
Kangkong						
Kiwi				\$2.29		
Leek				\$2.89		\$2.45
Lettuce, unknown variety	\$1.50					
Lettuce, iceberg				\$2.79		\$2.49
Lettuce, leaf				\$2.69		
Lettuce, Romaine				\$2.49		\$2.49
Lime, Fiji, green	\$1.00-2.00	\$4.15				
Mango	\$0.50	\$5.36				
Mangrove crab	\$4.00	\$7.00			\$7.88	
Melon, Honeydew				\$2.59		
Mushroom, Portobello				\$18.64		
Okra		\$3.19				

Onion, blub						
Onion, green				\$2.99		\$3.95
Orange, sweet	\$0.50-65	\$1.74-2.89				\$0.96
Papaya, Hawaiian				\$3.99		
Papaya, local			\$1.00	\$0.70		
Papaya, Kosrae	\$0.35-0.75	\$1.95	\$1.00	\$0.70		
Pak choy			\$1.35			
Peas, snow				\$6.99		\$3.75
Pepper, bell, unknown color			\$2.00			
Pepper, bell, green		\$7.13		2.49		
Pepper, bell, red				\$3.39		
Pepper, bell, yellow				\$4.99		
Pepper, Chili, Anaheim				\$4.99		
Pepper, Chili, Kosrae		\$12.00				
Pepper, Jalapeno				\$3.49		
Pineapple	\$0.65			\$1.99		
Potato, small						\$2.49
Pumpkin		\$2.51				
Radish			\$1.35			
Soursop	\$1.00					
Spinach, water			\$2.00			
Squash/Tongang	\$0.35	\$2.25	\$1.35			
Sugar cane		\$1.04				
Sweet potato, leaves			\$2.00			
Sweet potato, tuber, Kosrae	\$1.25	\$2.25				
Sweet potato, tuber				\$1.29		
Tangerine	\$0.65-0.85	\$3.20			\$3.49	
Tapioca	\$0.35	\$1.50				
Taro, hard	\$0.35-0.65	\$2.89				
Taro, leaf	\$1.50	\$2.45				
Taro, soft	\$0.75-1.00	\$3.20			\$3.28	
Tomato, undescribed			\$1.50			\$1.95
Tomato, undescribed, Kosrae	\$0.75	\$4.20				
Tomato, layer				\$2.29		
Tomato, Roma				\$2.49		
Watermelon	\$0.65-1.25	\$3.83				
Watermelon, seedless				\$1.49		
Yam, Kosrean	\$0.35-1.15	\$3.83				

Notes: retail products could be from Kosrae, Laura, or U.S. Mainland.

Yellow shading indicates Kosrae products as indicated by data source or labeling.

Pink indicates Laura-grown products as indicated by data source or labeling.

Ways forward: options for impact

As is true for many people and countries around the world, the purchasing and consumption of unhealthy food is contributing to unhealthy citizens. It is the case in the RMI where the leading cause of death is now diabetes related issues. The RMI is at a crossroads with the health of its citizens. There are a variety of options for chipping away at this issue, most notably for the citizenry of the RMI to take full responsibility for their own health. This factor is hard to influence, but it must be addressed. Table 2 provides options for the U.S. Embassy to consider when deciding how it might be part of the solution to growing obesity in the RMI. Some of these ideas come from informants, other consultant reports, and still others come from this projects consultant. Ideas are parsed by the potential level of engagement, a relative estimate of the cost of the investment (cash costs), and the project idea.

Table 2. List of potential projects that can have an impact on the food system in the RMI.

Project type	Investment (L/M/H)	Project
Advisor	L	<input type="checkbox"/> Support the removal of the 10% local Ebeye tax on produce.
Advisor	L	<input type="checkbox"/> Support a \$0.25 / bag tax on rice. More than 360,620 bags of rice were imported to Majuro in 2013 and a small tax would generate more than \$90,155 that could internally fund both agriculture and some health-related efforts. The impact on store sales and consumers would be negligible.
Advisor	L	<input type="checkbox"/> Encourage the government to use data, like is used in this report, to come out with an annual “Food and Agriculture Report” in February each year. Report to include food and drink imports by sources, at all atolls, commercial sales of produce from Laura, and consumer price surveys done by Price Monitoring Unit of Internal Affairs. Some discussion of current subsistence food production should also be included. A February reporting time frame will give ample time for the import summaries to be completed. This report can be both a steering device and a tool by which change is measured and course corrections made. Should be part of a formal food production strategic plan.
Advisor	L	<input type="checkbox"/> Encourage the government to review its tax levels on sugar-sweetened beverages, candy, snack foods and other foods that contribute to obesity. Additional tax revenue could go to agriculture and human health related efforts.
Catalyst	L	<input type="checkbox"/> Host a series of comfortable “Ambassador’s Conversations” with RMI residents, especially those who have returned from overseas, about how they see their participation in the evolution of the RMI. Champion good food with an annual U.S. Ambassador’s Award program for impact on the food system.
Catalyst	L	<input type="checkbox"/> Hold a casual-dress “speed-dating” 1/2 day meeting to reach out to interested people and organizations who really have a long-term interest in meeting a significant goal for local food production, say 30% of all produce consumed each day by 2017 is grown in the RMI. One outcome of the meeting would be a tighter web of people who really care to move a healthy and more self-sufficient food agenda forward. Include air cargo and shipping representatives.
Catalyst	L	<input type="checkbox"/> Encourage the development of a Farmers market/Night market , with careful rules, to inspire entrepreneurs to grow and make good food and sell them to locals and visitors. Work with the CMI to innovate new foods.
Catalyst	L	<input type="checkbox"/> Encourage the ex-patriots in the RMI to take part in a local food cooking/tasting contest - it is possible that ideas from another country, might rub off in the RMI. It is important to find ways to introduce RMI citizens to new foods, new spices, and healthy ways of preparing unknown vegetables and fruits.

Driver	L	<input type="checkbox"/> Focus (refocus) some U.S. Compact funds on agriculture projects and specific nutrition-related health programs and install a simple on-line progress reporting system for project-based work. Require progress reports every 2 weeks. Use a detailed planning structure as defined in the Summary section of this document.
Driver	M	<input type="checkbox"/> Sponsor high quality educational food/health seminars for the employees of businesses and agencies that have significant numbers of employees. Messages need to be infused in many locations within society to create a tipping point.
Driver	L	<input type="checkbox"/> Work with church leaders, specifically, to get them to understand their role in encouraging the local production and consumption of healthy food. Have them encourage young people to be part of the local food movement. Have them turn their unused property to food production.
Driver	M-H	<input type="checkbox"/> Work with leadership of each island to develop a food tree-planting plan for each household that fits into a larger vision of food sustainability/emergency food and beauty for each village. Envision and make the RMI “The Incredible, Edible Islands”. An additional benefit of Green Streets would be travel ways for pedestrians and shaded places for children to be more active. Work with the Land Grant tissue culture program in Kosrae, the Secretariat of the Pacific Community (Fiji), the National Tropical Botanical Garden (on Kauai, Hawaii), and the Fairchild Tropical Botanical Garden (FL) to acquire the needed food trees. Trees to include new varieties of traditional trees, and citrus, avocado, mango, persimmon, tropical apricot, etc.
Driver	M	<input type="checkbox"/> Support “urban agriculture” as is now being done worldwide. “Re-imagine Majuro/Ebeye!” There is every reason to green the concreted portion of Majuro with edible trees and controlled/protected-environment production systems in vacant lots and on roof-tops. Look for individuals/families who are innovators/early adopters and work on a “make-over” to show people what an edible-landscape could look like. Where there is open land or space, there should be food production.
Driver	L-M	<input type="checkbox"/> Initiate an Ambassador’s Future Leaders Program to teach skills in leadership, fiscal management, law, project management, food and health, etc.
Supporter	L	<input type="checkbox"/> Meet with the president of United Airlines , or his representative, to seek a significantly lower and stable (indexed to some reasonable metric) fresh produce-only rate for transportation within the Hawaii-RMI-FSM-Guam corridor. When Continental had the route, there was a lower fresh produce rate.
Supporter	L	<input type="checkbox"/> Encourage Marshall Islands Air to set up a weekly produce route to Fiji . Fiji farmers will be more consistent than Kosrae growers as their innate profit motivation is different.
Supporter	L	<input type="checkbox"/> Purchase a “sandwich board” sign for the small farmers market so that vendors can place it on the street median and tell drive-by customers what they are selling and what is the price.
Supporter	M	<input type="checkbox"/> Support a significant, but compact controlled/protected-environment demonstration project in the middle of the CMI campus. (See examples of technology options below). Make the art and science of food production the center of attention at that campus. Also support any school campus that shows the interest and capability to maintain a smaller system, using it for children’s’ educational purposes primarily. Send children home with a plant-in-a-bag that they can nurture.
Supporter	L	<input type="checkbox"/> Encourage the government to rent, at a zero-price for the first 5 years productive government land/space to non-locals , who have the capability and desire to farm either in the soil or in a controlled/protected-environments. Current maximum allowed rent is \$4,000/ac/yr.
Supporter	L	<input type="checkbox"/> Support the development and use of school lessons (curriculum) to help children become more aware of their unique island surroundings and the importance of local food production and consumption. Tie it to a goal (see “speed dating” item above for a possible goal). Create take home messages that encourage parents to feed their children healthily and within their budget. NOTE: Others have done this work and it may need some help to re-energize.
Supporter	L-M	<input type="checkbox"/> Financially support exploratory food processing work on locally produced pasta products (like ramen) made from significant amounts of breadfruit and pandanus flour. Support the exploration of good foods such as Kimchi that enhance <i>Lactobacillus acidophilus</i> cultures in consumers. <i>Lactobacillus acidophilus</i> can aid in proper food digestion.

Supporter	M	<input type="checkbox"/> Support the make-over of prepared foods in the RMI . Teach how to make more nutritious, produce-heavy bentos (take away meals), catered meals, meals in restaurants, as well as home meals.
Supporter	L-M	<input type="checkbox"/> Pay part of a 3-4 day visit (depends on United schedule) to Kosrae and Majuro for Kosrae farmers/consolidators and Majuro and Ebeye fresh produce buyers . Many business relationships have only been formed by fax and more time is needed to firm up shaky business ties and for both sides of the supply and demand equation to understand each others' needs.
Supporter	L	<input type="checkbox"/> Mark the road - every mile - from one end of the island to the other to indicate a measured distance. About 2,000 steps are in a mile and it is recommended that each person walk 10,000 steps a day.
Visionary	L	<input type="checkbox"/> Work with the administration of Kwajalein island to transition their rather unhealthy offerings in restaurants, the mini-store, and vending machines. Their bottom line focus on profits is partially responsible for Ebeye citizens' buying behaviors and thus their health and the health of their children.
Visionary	M	<input type="checkbox"/> Find leaders, families, villages, churches, organizations, women's groups, or islands where there is significant and proven interest in producing fresh produce at a low price (Revenues, for example, only 10-20% greater than actual Costs) for consumers, and in exchange, funds from the RMI government (part of the SSB tax) and U.S. Embassy, sends interested parties off to Israel for 2-months of rigorous hands-on training. Up to a dozen RMI citizens can learn desert and controlled/protected-environment food production from some of the most resilient farmers in the world.
Visionary	L	<input type="checkbox"/> Encourage the introduction and use of protein- and fiber-rich beans to take up some of the space rice takes on the plate.
Visionary	L	<input type="checkbox"/> Encourage bringing Hawaiian canoe paddling to the RMI as an activity for youth and adults that will burn off calories.
Visionary	L	<input type="checkbox"/> Encourage composting in every home - when people sweep up leaves, they should go to an area to build soil, not put in a trashcan or burned. Investigate the possibility of getting compost from Kwajalein for Ebeye residents' gardens/farms.

This shopping list of ideas gives a range of action levels. The international community contributes to agriculture through different venues but many are direct production projects. In many cases, what is needed is leadership or co-leadership to get ideas off the ground, moving at an *urgent* pace, and maintained until completion. Embassy leadership, intentional messaging, connecting projects and results to Compact funding, can all help orient the RMI in a direction that is beneficial for the long-term health and prosperity of its citizens.

One of the most immediate options for getting more food in the ground is not to put it in the ground (soil) at all, especially if land is scarce (Table 4). There is a greenhouse renovation project going in North Loi in the Kwajalein atoll that demonstrates this idea (Figure 7). The concept of "controlled environment" agriculture reduces some of the needs of in-ground food production, including the need for land with soil and good soil at that. Growing space can go vertical, like on a wall or trellis, so that a farm/garden footprint could be smaller because of a 3-dimensional production environment. Growing media can be in a pot or bag (small or long). Pests can often be better managed in off-the-ground production environments, than in-ground ones, if best practices are employed at the start of the operation. Whether the production media is non-soil, compost or other solid media, or liquid-based like a hydroponic system, a good understanding of the 'mechanics' of plant production should be learned and practiced. This is where a connection to innovative Israeli food producers could supercharge larger-scale food production efforts in the RMI.

One thing is for certain, however, is that there needs to be an understanding of the amount of land/space required to grow X amount of produce for X amount of people for X amount of meals for X amount of days. This detail should be part of a national strategic plan for local food

production. Table 3, from the Johnny's Seeds website (<http://www.johnnyseeds.com>), provides a starting point for any estimation and planning activity. Certainly, the land conditions in the RMI are not optimal, but real progress can be made if someone in the RMI will take a long-term leadership role.



Figure 7. A greenhouse, located on North Loi in the Kwajalein Atoll, is being updated.

Table 3. Johnny's Seeds estimate of how much space is required to grow an estimated amount of produce (see red boxes).

Direct Seeded Vegetable Crops

Vegetable	Average Seeds Needed Per:			Average Yield Per:	
	100' Row	Weight:	Seeds: (M=1,000)	100'	Acres
Beans, bush	800	85 lbs.	125M	80 lbs.	4,000 lbs.
Beans, pole	400	49 lbs.	43.5M	150 lbs.	4,000 lbs.
Beans, lima	400	145 lbs.	58M	12 lbs.	2,500 lbs.
Beans, shell					
American & Italian	700	150 lbs.	120-128M	8 lbs.	1,800 lbs.
French	700	65 lbs.	117M	8 lbs.	3,480 lbs.
Beans, soy	800	80 lbs.	144M	20 lbs. fresh, 12 lbs. dry	3,480 lbs.
Beets	1,500	9 lbs.	315M	40 lbs. greens, 100 lbs. roots	14,000 lbs.
Broccoli	170	1/2-3/4 lbs.	50M	75 lbs.	10,500 lbs.
Brussels sprouts	200	5 oz.	35M	60 lbs.	16,000 lbs.
Burdock	1/2 oz. or 800 seeds	6 lbs.	183M	60 lbs.	13,000 lbs.
Cabbage	300	5 1/4 oz.	37M	150 lbs.; 60 heads	31,500 lbs.
Cabbage, Chinese	300	7 oz.	66M	60 heads	35,000 lbs.
Carrot	3,000	2 1/2 lbs.	720M	100 lbs.	30,000 lbs.
Cauliflower	200	4 oz.	32M	90 lbs.; 60 heads	12,000 lbs.
Corn, sweet	200	11 1/2 lbs.	29M	8 dozen ears	1,200 dozen
Corn, ornamental	6 oz. or 400 seeds	25-35 lbs.		20 lbs. fresh, 12 lbs. dry	2,900 lbs.
Cucumber	600	2 1/2 lbs.	42.5M	120 lbs.	17,500 lbs.
Endive	600	10 oz.	190M	80 heads	13,500 lbs.
Greens, Mustard	1,500	1 1/3 lbs.	250M	100 lbs.	29,000 lbs.
Kale/Collards	450	1 lb.	112M	75 lbs.	16,275
Kohlrabi	1,500	4 1/4 lbs.	436M	50 lbs.	14,500 lbs.
Leeks	600	11 oz.	105M	150 stalks	32,550 stalks
Lettuce (full size heads, precision seeded)	400 seeds	5 1/2 oz.	7 1/4 oz. or 174M	50 lbs.; 100 heads	27,000 lbs.
Melons	200	13 oz.	15M	100 Fruits	15,000 lbs.
Onions, bulbing	2,000	5 1/2 lbs.	577.5M	100 lbs.	38,500 lbs.
Onions, bunching	5,000	7 1/2 lbs.	1,500M	100 lbs.	29,000 lbs.
Parsnips	1/2 oz. or 1,400 seeds	5 1/2 lbs.	539M	75 lbs.	12,600 lbs.
Peas, fresh	1.3 lbs. or 2,600 seeds	270 lbs.	540M	20 lbs.	4,000 lbs.
Pumpkin	135	3 1/2 lbs.	10M	300 lbs.	40,000 lbs.
Radish, small	3,580	25 lbs.	1,000M	100 bunches	7,500 lbs.
Radish, Daikon	600	7 lbs.	175M	200 roots	39,000 lbs.
Rutabaga	600 seeds	15 1/2 oz.	150M	150 lbs.	40,000 lbs.
Salsify	2,000 seeds	13 lbs.	437M	60 lbs.	17,400 lbs.
Spinach, full size	1/2 oz. or 1,000 seeds	8 1/4 lbs.	290M	40 lbs.	12,500 lbs.
Squash, Summer					
Zucchini	300	7 1/4 lbs.	22M	200 lbs.	30,000 lbs.
Yellow Summer	300	5 lbs.	22.5M	200 lbs.	30,000 lbs.
Patty Pan/Scallop	300	4 1/2 lbs.	21.5M	200 lbs.	30,000 lbs.
Squash, Winter	200	2-8 1/2 lbs.	15M	200 lbs.	40,000 lbs.
Turnip	3,500 seeds	5 3/4 lbs.	702M -1.230M	100 lbs. greens; 50 lbs. roots	40,000 lbs.
Watermelon	200	1 1/2 lbs.	15M	70 fruits	18,000 lbs.

Transplanted Vegetable Crops

Vegetable	Plants to expect from:		Days from setting plants to mature crops	Average Yield per 100'
	PKT	1 Oz.		
Beets	175	1,100	35-45	40 lb. greens; 100 lb. roots
Broccoli	75	4,800	45-70	75 lbs.
Brussels Sprouts	75	5,000	100-110	60 lbs.
Cabbage	75	4,500	50-150	150 lbs.; 60 heads
Cauliflower	75	5,600	45-80	90 lbs.; 60 heads
Celeriac	120	37,500	100-120	60 lbs.
Celery	120	37,500	75-90	100 heads
Eggplant	15	3,500	50-75	75 lbs.
Kale	70	5,000	40-50	75 lbs.
Kohlrabi	60	4,000	30-40	50 lbs.
Leeks	140	6,000	75-100	150 stalks
Lettuce	400	20,000	35-65	100 heads; 50 lbs.
Melons	25	800	70-85	100 fruits
Onions, Bulbing	150	4,000	75-100	100 lbs.
Pepper	20	3,000	50-70	50 lbs.
Tomato	30	7,400	50-85	150 lbs.
Watermelon	20	400	70-85	70 fruits

Feet of Row Per Acre (1 acre=43,560 square feet)

Single Rows Distance Apart	Number of Row Feet/Acre	Rows/Bed on beds spaced 6 ft. on cntr.	Number of Row Feet/Acre
12"	43,560	1 row	7,260
16"	32,670	2 rows	14,520
18"	29,040	3 rows	21,780
20"	26,136	4 rows	29,040
24"	21,780	5 rows	36,300
28"	18,668	6 rows	43,560
30"	17,424		
32"	16,335		
36"	14,520		
40"	13,068		
42"	12,445		
48"	10,890		
60"	8,712		
72"	7,260		

Number of seeds to plant/acre: Find your row spacing on the chart. Multiply the corresponding row feet per acre figure by the number of seeds (plants) you plan to sow per foot to arrive at the number of seeds you will need per acre. Example: You plan to sow 20 seeds per foot on rows 24" apart; 20 x 21,780=435,600 seeds/acre.

Table 4. Types of technologies for “controlled environment” agriculture.



Ulithi: Landing boats left behind after WWII become ideal container gardens. As global warming threatens the fresh water lenses of low-lying atolls, islanders are building cement tanks similar to these landing boats to plant taro.



GardenSoxx can be filled with compost and placed on any surface: parking lots, roof tops, poor soils, etc., to create a soil-free production environment.

Anything can be used to hold media to grow food. But, soil should not be used, best to fill with leaves and food discards and let it compost to create a “clean” media.



Commercial container farming is easy with the right media and drip irrigation.



Shadehouse/greenhouse growing can be a way to keep the production environment clean, but moving water (and fertilizer) requires electrical pumps.



Growing vertical can be done simply, but requires that fertilizers and water be pumped to the top of the system where it will trickle down among plants. <http://vertigo.com/>



With these state-of-the-art Tower Gardens, up to 8 feet of crops – more than 28 plants - can be grown in a few square feet. <http://futuregrowing.com/>



Growing on the outside walls of buildings and houses can provide food with little soil. <http://livewall.com>



GardenSoxx, filled with (light weight) compost, can be used to grow foods on roofs. <http://farmroof.com/>

In summary

As is true for many people and countries around the world, the purchasing and consumption of unhealthy food is contributing to unhealthy citizens. It is the case in the RMI where the leading cause of death is now diabetes according to Daisy Alik-Momotaro, Permanent Secretary, Ministry of Internal Affairs. The RMI government needs to focus and be focused on the health of its citizens to avert major and costly health outcomes; it can't wait until after the Compact payments end. A good place to start is by orienting agriculture and affiliated efforts toward getting more fresh produce into the hands, and mouths, of RMI citizens. A well-defined and measurable plan needs to be put into place and supported in large part by local funds; it's important that the country have a financial "skin in the game". The plan, hosted and maintained on the internet for clarity and transparency purposes, should provide very precise details on:

Goals (Focusing on increases and decreases)

Priority ranking (H/M/L)

Objectives (with timelines (starting and end dates) and measureable targets)

Names of responsible individuals and parties

Action steps (with step-by-step detail, including success factor measurement)

Obstacles that might be encountered

Contingency plans for addressing those obstacles

Resource needs (and source of where those resources/funds might come from)

Key success factors defined

Methodology and plan for measuring the success factors

Value or impact of action if success is attained

Lessons learned

This report presented a substantial amount of information from research and interviews. One striking data point indicated that perhaps 18 times more (cooked) white rice than produce (by relative weight) is consumed every day in the RMI. Ultimately, meals must be re-formulated to contain more fruits and vegetables if health conditions are to improve for the long run. More than 20 ideas for improvement of the situation have been provided. The action level by the U.S. Embassy and the cost for each project varies. Some projects can have a bigger impact than others, but it is clear that some steps must be taken now and someone needs to take a leadership position that will point the people of the RMI to a most health-filled future. Projects can be as simple as a national fruit tree- and melon/squash/pumpkin planting- effort. Technology can be introduced with shade-houses and growing towers. Learning from Israeli farmers, who grow successfully in desert environments, could accelerate the pace of local food production. It makes the most sense for both the international community and the RMI community to lead and work collaboratively for a better future for all residents of the RMI. There is no time to waste.

References and additional material

This list contains citations for documents referenced above plus some documents that might be of value to the reader.

Alik-Momotaro, Daisy. 2013. Republic of the Marshall Islands' Statement on the 6th Asia & Pacific Population Conference September 16th – 20th 2013, Bangkok, Thailand. <http://countryoffice.unfpa.org/pacific/drive/FINALRMISStatement.pdf>. 5 pages.

Asian Development Bank. 2005. Commercialization of Agriculture in the Maldives. 179 pages.

Brown, Sidney Park. Alternative Vegetable Gardening. University of Florida. http://grec.ifas.ufl.edu/pcc/Teaching_Garden/Alt_Veg_Garden_Info.pdf. 4 pages.

Economic Policy, Planning, and Statistics Office. 2012. Republic of the Marshall Islands - 2011 Census of Population and Housing. 547 pages.

European Community. 2008. Marshall Islands, Country Strategy Paper and National Indicative Program. http://ec.europa.eu/development/icenter/repository/scanned_mh_csp10_en.pdf. 63 pages.

Federal Regional Council. 2013. Grants to the Outer Pacific FY 2012. <http://www.doi.gov/oia/reports/outer-pacific-grants.cfm>. 63 pages.

Gabel, Kim. Vegetable Gardening in the Florida Keys. University of Florida. http://monroe.ifas.ufl.edu/pdf/Hort/Vegetable_Gardening_in_the_Florida_Keys.pdf. 2 pages.

Ichihō, Henry M., MD, MPH; Johannes Seremai AS; Richard Trinidad MD; Irene Paul BA; Justina Langidrik MPH; and Nia Aitaoto MPH, MS. 2013. An Assessment of Non-Communicable Diseases, Diabetes, and Related Risk Factors in the Republic of the Marshall Islands, Kwajelein Atoll, Ebeye Island: A Systems Perspective. *Hawai'i Journal of Medicine & Public Health*, May 2013, Vol 72, No 5, Supplement 1. 10 pages.

Israel Export & International Cooperation Institute. 2013. Israel's Agriculture. http://www.moag.gov.il/agri/files/Israel's_Agriculture_Booklet.pdf. 58 pages.

King, Lisa. 2005. Skills-based trainings to increase income generation and enhance life skills on the RMI outer atolls. Asian Development Bank. 85 pages.

Leban, Tommy. 2013. ROC-Taiwan Sponsored Mili Atoll Agriculture Project. 8 pages.

Malik, Nasir S.A. 2013. Agriculture Report – Kosrae / Majuro. 15 pages.

- Pacific Islands Forum Secretariat. 2012. Millennium Goals MDG Tracking Report – Republic of the Marshall Islands.
<http://www.forumsec.org/resources/uploads/attachments/documents/MDG%20Track%20Rpt%20web%2020122.pdf>. 212 pages.
- Pardossi A., Carmassi G., Diara C., Incrocci L., Maggini R., Massa D. 2011. Fertigation and Substrate Management in Closed Soilless Culture. Dipartimento di Biologia delle Piante Agrarie, Università di Pisa, Pisa. http://www.wageningenur.nl/upload_mm/8/c/0/aa4b4486-a9db-429f-8b03-f19d4cec3ee6_Fertigation%20and%20Substrate%20Management%20in%20Closed%20Soilless%20Culture.pdf. 63 pages.
- Rogers, Steve. 2008. Food Security and Sustainable Livelihoods in the Pacific Island Countries: Development Partners Mapping Study. Food and Agriculture Organization of the United Nations. 252 pages.
- Secretariat of the Pacific Community. 2007. Republic of The Marshall Islands and Secretariat of The Pacific Community - Joint Country Strategy.
<http://www.spc.int/sppu/images/stories/rmi%20final%202008-2010%20jcs.pdf> . 25 pages.
- Secretariat of the Pacific Community. 2010. NCD Statistics for the Pacific Islands Countries and Territories. 29 pages.
- Stone, Earl, Leo Migvar and William Robison. 2000. Growing Plants on Atoll Soils. University of California Lawrence Livermore National Laboratory. <https://e-reports-ext.llnl.gov/pdf/237536.pdf>. 32 pages.