

Community Involvement in Grenada: Aquaponics and Biocultural Sustainability

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Abstract

Adverse conditions to coral reefs are shown to reduce fish habitats, negatively affecting the culture of an island community that depends on coastal resources as a daily food resource. People sustain or harm their local environment by practices embedded in their culture. Focus on environmental sustainability or economic opportunity alone misses the human component that is in relationship with nature in specific practice. The acknowledgment of community ownership is examined in the context of project development, community response over time, and the effect of, and local perception of, power loss and marginalized voice, which through their own use of inter-community voice can affect the project's future. This four year research project examines the integration of cultural sustainability practices during the launch of an ecologically sustainable small-scale aquaponics program designed as a vehicle to bridge the scientific community and the local grassroots community in efforts to reduce coral reef degradation and build food security resiliency.

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Section 1: INTRODUCTION

A few years ago, I was the lucky recipient of an invitation to be part of a group that would evaluate a philanthropic endeavor to build private schools, medical centers, and women's shelters in several Central American countries. It would shape my life profoundly; I was able to witness the processes of successful social development. One day, I found myself standing alongside an algae-covered, modest sized manmade pond in a remote village in Guatemala. One man, a local missionary, stood near it, singularly contemplating its potential. His goal was simple; try to tap into the food demands of a tourist market and thereby create a modest income to supplement the economic and nutritional needs of his community. With poor soils, little available labor, intense heat, no government assistance, and minimal resources, there remained one tool left – to turn to nature for a solution. It was called aquaponics. It required a little know-how about ecology, science and nature, but was inexpensive to begin using local resources. It was about growing your own food organically, and becoming self-sustaining.

Turning to simple, personal sized solutions for larger food security issues tends to be contrary to how industry and governments around the globe have responded since the Industrial Age to the current condition of meeting the food needs for an increasing global market. The established methods have taxed our natural resources and depleted others to states of degradation or extinction. Today, access to small islands previously thought too remote are being targeted as resources to tap for other burgeoning societies consuming staggering sums of food resources. Fisheries around the world are harvesting further out to

sea, both legally and illegally, to meet the demands. At the grassroots level, people continue basic food resourcing by fishing from shore, a practice that meets every day nutritional needs in the Caribbean, using large nets rather than an individual fishing line.

My current project and the subject of this study are located in the island state of Grenada, in the Caribbean Lesser Antilles. Grenada has beneficial near shore coral reefs representing a biodiverse habitat to thousands of living species. Coral reefs reduce carbon dioxide in the ocean, which is critical in maintaining shoreline health. Additionally, coral reefs prevent shoreline erosion by buffering waves during tropical storms. For Grenadians, coral reefs are a part of the ecology which has fostered a tradition of shoreline food sourcing. The procurement of this natural resource has been a part of the social, economic and food culture for everyday people. Yet marine biologists the world over are concluding that coral reefs are facing alarming taxation and that urgent action must be taken to conserve and protect them (Mora 2008, Paddock 2009, Anderson et al 2012).

Marine Protected Areas (MPAs)¹ are a relatively new concept for Grenadians. Located at Molinière-Beauséjour, Flamingo and Dragon bays along the eastern coast, human activity is restricted by the government in order to protect marine ecosystems. In a discussion with Dr. Steven Nimrod, native Grenadian and Marine Biologist at local St. George University explained why one will customarily see Grenadians enjoying the beach from its shallowest points only. Nimrod explained that local folk stories couple respect for the sea along with reinforced beliefs of dangers lurking within which deter the vast majority from learning to swim. Traditional education has only recently begun at primary

¹ Marine Protected Areas are protected coastal and coral reef zones that incorporate principles of adaptive and ecosystem management, protection and restoration. There are over 100,000 global designations, representing a significant investment in conserving biodiversity.

school levels to expose youths to snorkeling, otherwise generally viewed as a costly pleasure activity designated for wealthy tourists, out of the reach of the average Grenadian. As a result, most Grenadians do not have a visual and active understanding of what the MPA seeks to protect. Knowledge about what may negatively affect it is not a common concern; fish have always been perceived as an endless resource. Recognizing a lack of knowledge about shoreline ecology, the local MPA seeks to dispel local misconceptions that hinder exposure to the value reefs contribute to Grenada's overall ecology, economy, and food security (Nimrod 2016).

In Rio de Janeiro in 1992, The United Nations Conference on Environmental and Development (UNCED) challenged Caribbean leaders to participate in pledging to conserve biodiversity and to protect their coral reefs (GCRMN 2008). Three significant conferences followed: in 1994 The UN Conference on the Sustainable Development of Small Island Developing States; the 2002 World Summit on Sustainable Development Conference; and the 2008 International Coral Reef Initiative. The resulting outcome produced conservation efforts launched and ratified at the Convention of Biological Diversity, resulting in international pledges to conserve coral reefs and significantly reduce the rate of global biodiversity loss by 2010. For Grenada in particular, their government announced to complete a plan by 2020 that would protect 25% of its land and sea areas. The remaining major challenge is the continuance of funding to strengthen the management of Marine Protected Areas to promote sustainable tourism efforts, and to protect shoreline food resources.

While governments of small island states tackle the complexities of global environmental policy, there is a call for assistance from the international community for a

bottom-up approach by the peoples who live near and depend upon coral reefs. The aim is to eliminate destructive fishing practices and reduce human-generated pollution of the reefs (Millennium Project 2000) (CARICOM 2002) (Grenada National Protected Areas System Capacity Development Plan 2007).

Wisconsin Lutheran College (WLC), Milwaukee, has been conducting marine coastal research along the western coast of Grenada for the past ten years (Anderson et al 2012). Their data supported global scientific community reports (Paddack 2009) confirming stresses upon coral reef habitats. At WLC in 2011, as a student of both anthropology and science I began to ask myself about how connections were being made between the scientific research community and the local, grassroots community about threats to an environment that affected local cultural food traditions. Were the average persons aware that coral reef damage was reducing the reef's ability to support local fish populations? Did people know what caused these changes? Were any of their shoreline fishing traditions adversely affecting the marine ecology? Were livelihoods facing compromise? How were governing agencies communicating these concerns?

In May, 2012, while still an undergraduate student under the auspices of Dr. Robert Anderson, WLC, I designed a feasibility study in St. George, Grenada, to examine if the introduction of *small-scale* aquaponics could be a vehicle to inform the local community about coral reef ecology and how its preservation affects their future economic and cultural capital resources. When I began this endeavor, though I had an interest in coastal marine health, I was substantially driven by my concern that its degradation could adversely affect the culture of a community that depends upon coastal resources for daily food harvests. This concern evolved into a desire to ensure that citizens become more direct contributors

toward their cultural sustainability by having an active part in understanding the forces that affect it, and to become active participants in developing solutions to ensure their own resiliency. I chose to advocate for aquaponics because it is a cost-effective, sustainable method of agriculture that combines the raising of fish along with the raising of vegetable plants in water (hydroponics) and can adapt well in climates and landscapes that Grenada possesses. These two food methods work in a symbiotic relationship where the waste of fish feeds the plants whose roots then purify the water in a re-circulating, closed aquatic system.



Figure 1 Example of one method of closed aquaponic system growing lettuce

When implemented even in small scale, aquaponics becomes a food mill that offers an interesting variety of potential; first to raise healthy, organic food for the individual or market; second to potentially mitigate overfishing stresses; and third to become the vehicle which informs resident populations of the value in preserving their finite natural marine resources to ensure food security. Further, learning aquaponics concepts provides new

training, exploration of entrepreneurial opportunities, reinforcement of community-building skills, and the development of ecological sustainability initiatives at the grass-roots level.

My aim began with a rudimentary evaluation of this coastal community because of my association with WLC and its marine research over the past ten years. I wanted to determine whether the community had any awareness of this coral research, and how this might affect cultural food resource preservation at the grassroots level. Following my independent study in Guatemala, my own research into aquaponics, and my feasibility study in 2012, I presented a poster proposal at the Second International Conference on Food Studies at the University of Illinois, Champaign-Urbana. There I connected with other individuals working to interpret the role of practice-based discussion, research and policy around issues of food studies, agriculture, environment, equity and cultural perspectives. That opportunity exposed me to like-minded persons, which then shaped my choice to enter the Master of Arts in Cultural Sustainability program at Goucher College, where in early 2015 I was beginning to understand pathways that link partners which seek to inform, educate and support citizens in related topics of environment, ecology, culture and food security.

Still early in my graduate studies, I had been introduced to ethnographic methods (Denzin 2014) (Madison 2005), cultural sustainability practice (Block 2008), and foodways (Brown Mussell 1984). I was learning questions about sustainability that involved culture directly, and the importance of asking the community, for whom a project may be directed, to design and develop its capacities in sustainability. The biology department head at WLC, Dr. Robert Anderson, understood that if the project were to expect a measure of success, they had to have a willing audience. He welcomed my employing the tools and

methodologies used to understand the culture we would work in, and to build upon the rapport I had established previously as a bridge between the biology team and the local community. In June of 2015, following a yearlong aquaponics pilot lab established in WLC's greenhouse, they prepared to bring those skills to Grenada. Employing asset-based, community building methodologies, I introduced resiliency concepts and facilitated two community discussion groups. Following these discussion group sessions, participants volunteered to attend an aquaponics training workshop taught by the WLC biologists, with subsequent additional training.

Having a Cultural Sustainability perspective has reshaped my analysis of how one can be more effective when planning, introducing and implementing a project in a foreign country. In my understanding and appreciation for the need for diversity and voice, I sought to practice inclusiveness, listening, and respect for others traditions. In 2012, my aspirations were to begin the conversation to see if an idea (aquaponics) had merit, and if it would be accepted within that community. By 2015, my participation and presence in the community helped to establish my place and role, shaped by the principles of my discipline.

Anthropology's holistic perspective recognizes that change will not occur in a vacuum, and that projects such as mine will cause multiple effects that may be entirely unforeseen (Kottak 2008). I was cognizant that it was I who was the "other"; the guest in their world that was facing environmental stresses. However, cultures are adaptive; people can learn, create new meanings, and reshape their societal traditions so that it can respond to the external events that challenge it.

This report formulates a critical look over a four-year period at my engagement with a coastal community, its culture, beliefs, history and governance, taking the time to broadly

understand its social structure, then sitting together to hear its views. My role in this community began as an undergraduate student asking officials questions about the environment and food security. When I returned in 2015, I was in graduate school, and my thinking became newly shaped by principles within the discipline of cultural sustainability.² In 2016, one year later, with the rapport I had established with the community, I returned as a liaison between the college (WLC), the church (Grace Lutheran) and the community (Grand Anse at large), to evaluate how the community responded to the project as it developed.

This approach, and my evaluation, sheds light on the value and challenges of pursuing integrated strategies for effective partnership, and whether the aquaponics program, as implemented, has potential for replication in future community-led initiatives in other coastal communities.

In order to apply the principles of cultural sustainability that reinforce understanding culture, I begin with a look at Grenada's terrain, its Colonial past, its severe weather hardships that affect everyone, and the people and organizations that address its current strategies for food security. I introduce the importance of understanding how Grenada's past colonial history lingers in the present, continuing to affect its current culture described to me by locals as tribal, communal and guarded. A continued theme of farming being regarded as an old man's occupation is linked to a slavery past, which still affects the agricultural sector and persists with locals hampered by current land policies that limit full

² Of particular importance in shaping my understanding of cultural sustainability was through collective writings of Block 2008, McKnight 2016, Behar 2014, Feltault 2006, Denzin 2015 and others (see References). These authors helped me recognize and then navigate the issues of structural inequalities.

access. I define how local fishing practices and growing pressures from tourism all combine to affect current fishing resources and subsequent food security issues.

In order to understand obstacles Grenadians currently face, we must look at the impact of their geography, how climate affects their agricultural community, and how it links to present food traditions. After the introduction to geography, history and the Grenadian people, I further explain my transition from initial undergraduate involvement at the implementation of an academic community project, to how it resulted in a study as a graduate student in Cultural Sustainability evaluating its impact. I introduce the methodologies employed, and evaluate how rapport with a community produced insights that serve to valuably inform Westerners on insider and outsider positions.

At the conclusion, I critically explore the strengths of cultural sustainability practice in the evaluation of how to best work with communities, both academic and indigenous, to reach culturally appropriate goals with a keen sense of the different scopes of expertise each bring to the collective table. Finally, I examine the processes that worked, and those that remained incomplete; what I learned from a position of rapport and trust within the community; what remain as challenges, and what lies ahead; and how I grew during a complex process of working toward building relationships employing cultural sustainability perspectives.

Section 2. Geography and Colonial Plantation History

Grenada, because of its geographical location, has been a remote destination, allowing it to develop a culture unique to its history. Grenada is a state of several islands,

with the three largest being Grenada (population 110,694), Carriacou and Petit Martinique. Grenada belongs to the Lesser Antilles, along with Trinidad & Tobago to its south, yet belongs to an even smaller grouping called the Windward Islands situated between latitude 12.3 and 11.5 degrees north and longitude 61.2 and 61.3 degrees west. Between Grenada and St. Vincent are tiny chains of islands, few of which are inhabited.

Throughout Grenada's history until the later 1780s, until divided by Great Britain, these entire islands were known as the Grenadines. To this day, locals continue to consider themselves Grenadine Islanders, moving freely from one island to another. Merely 21



Figure 2 Map: Location of Grenada

miles long and 12 miles across, somewhat oval in shape, it was formed by volcanic action during the Miocene Period. Between Grenada and Carriacou is the Kick 'em Jenny submarine volcano, still highly active and constantly monitored by the Seismic

Research Center of the University of the West Indies (Steele 2003). The majority population is classified as of African or of Mixed descent; the median age 30.4% (male and female) with a life expectancy of 74.05 years. Urban population (35.6%) centers in Grand Anse along the southwestern shore (CIA World Factbook 2015).

Heavy annual rainfall keeps the tropical forests lush, and slopes of vegetation (90% of island topography) an inviting profusion of greenery and splashing waterfalls. With two seasons, wet and dry, 77% of annual rain falls during the wet season. Grenada maintains forest reserves, but due to the ravages of hurricanes over the centuries, replacement of some original flora occurred with faster growing commercial species. Bougainvillea spill

over garden walls, banana trees are plentiful, as well as citrus and coco bean trees, which grow in soils with a high degree of chemical weathering producing highly leached clay, with high levels of iron and aluminum oxides visible in their reddish appearance, with poor nutrient storage capacity (CBD Report). Many explorers over time have brought to Grenada a

diverse imported

variety of

agricultural

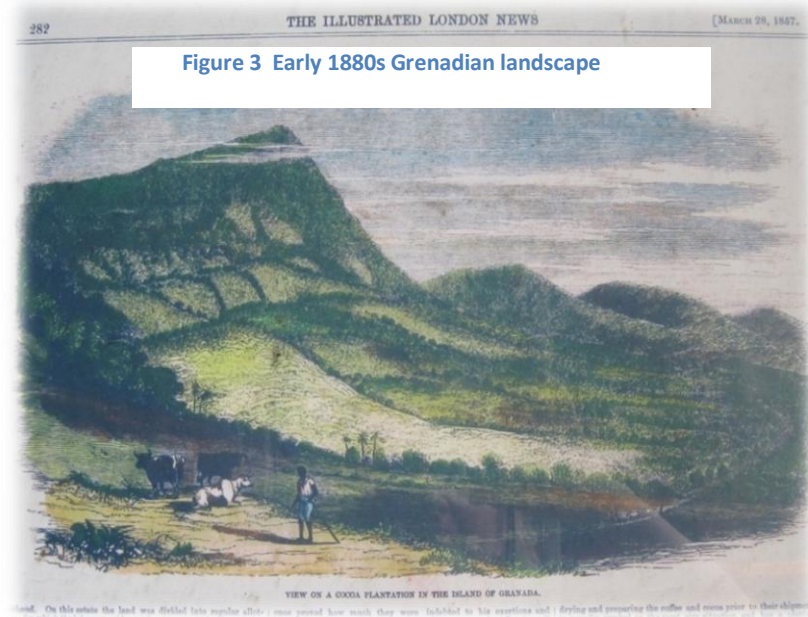
crops; nutmeg

from Indonesia,

breadfruits from

Polynesia,

mango, coconut



and black pepper from India, while England's rule brought cabbage and beetroot. The indigenous plants were plantains, sweet potatoes, guava, pineapples and others, along with a rich variety of spices, from which the island takes its fame as The Spice Island. Cinnamon, cloves, vanilla, bay leaf, nutmeg and turmeric fill the air at the spice markets around the island.

Prior to 1700, Grenada had a varied history of inhabitants; indigenous Kalinago predecessors were discovered by Christopher Columbus. They are recorded as a people with a culture of fishing and hunting, canoe building, knowledge of the sea and of nature, skilled in pottery making, and cassava manufacture. Their diet included turtle, manatee, pig and eels, along with fish, shellfish, waterfowl, iguana and crab (Steele 2003). They

baked, stewed and roasted, but particularly liked meals prepared slowly in pots adding pepper, meat and fish, called *Pepper-pot*, which remains a lasting tradition from the indigenous people to the food traditions of Grenadians today.

In 1763, Grenada was formally ceded to Great Britain. During the time of French settlement treaty, agricultural lands developed into agricultural plantations, or estates.³ Statistics for the year 1700 given by *Encyclopedia Britannica* of 1774-84 recorded the population at 835, with sugar estates and fifty-two indigo plantations (Steele 2003). By the early 1800's Grenadians had developed a French culture, adopted Roman Catholicism as their primary faith, and worked in agriculture as slaves until 1838 when they received their freedom. "With the loss of profits at sugar estates when Emancipation began, many estates fell into debt or were abandoned. The social structure began to change. People began to live off the sea. "Its population...struggled for existence in an environment of fertile soil and seas teeming with fish. The knowledge, overall mechanisms and capital to grow rich off the land were missing from the equation of hardworking labor and a land that could be made productive" (Steele 2003:183).

Grenadians of color, now free, raised their status by becoming educated, taking ownership of plantations themselves. Yet, unequal access, recruitment of labor to other islands, inexperienced peasant proprietors, poor money lending practices, unfair labor practices, and the lure of the whaling industry lead to difficulty in agriculture that would continue into the 20th Century. John S. Brierley, Department of Geography, Manitoba, Canada, studied this system during the period of 1940-1988.

³ The treaty intended to provide French protection, agricultural development, and trade and peaceful co-existence. It was simply a ruse by the French to ensure acceptance until their settlements were established. The intent of the French was to take over all of Grenada, establish plantations and use natives in the workforce. Grenadians would learn they were duped; those that stayed would become slave laborers (Steele 2003:39).

His concise summary: “Throughout this century, the demise of the West Indian estate agricultural system has been occurring relentlessly. At different times and varying degrees, the decline of this farming system is most evident in Grenada, where the political events of the past 20 years have hastened the process. Initially, it was the confiscation of some estates through a program of ‘land for the landless’. Then, between 1979 and 1983 it was the People’s Revolutionary Government promoting state farms at the expense of individual estates. More recently, the government has been divesting parcels of acquired land to ‘potentially suitable’ small farmers, via a model farm scheme.”

Brierley explains that the once economic backbone of agricultural systems suffered a collapse, leaving an agrarian vacuum. Subsequently, hurricanes further affected the commodity futures of cocoa bean, banana and nutmeg crops, exacerbating the decline of land sales to investors abroad or the land lying abandoned. Landowners choosing to leave Grenada for extended periods of time leave behind usable land that current residents find cannot be farmed. Brierley reported; “A chronic feature of Caribbean agriculture is the extent to which potential arable land lies idle. Some of this region's densely populated islands have more than one-third of their farmland in such a condition. Yet their populations have relied increasingly upon imported food for sustenance. During the 1970s this paradoxical situation was exemplified by Grenada, where possibly as much as 45 per cent of its farmland lay abandoned and imported food accounted for one-third of the national import bill” (Brierley 2008). Today, eight years after Brierley’s report, Grenada imports nearly 80% of its food.

The local Grenadian newspaper, *Caribbean News Now!*, June 13, 2011 reported the government's concern that the younger generation that wishes to cultivate the land is being thwarted by abandoned land restrictions. The Ministry of Agriculture policy advisor, Ferron Lowe, reported, "A substantial amount of land that was once under cultivation in Grenada is now 'abandoned and underutilized.'" Under Prime Minister Tillman Thomas, retired in 2013, private landowners were encouraged to rent or lease their land.

This condition of land use was one of the criteria that both discussion group attendees in 2015 identified as a primary detrimental contributor to the health and wellbeing of Grenadians, contributing to food insecurity. Agricultural land policy reportedly aggravates residents attempting to use owner-absent land. Attendees indicated that young persons interested in agriculture were thwarted by a lack of access to farm idle land, and that Grenadians overall found their diets had become heavily reliant upon imported foods (Author discussion notes and surveys, 2015). The issue of land use, already limited by geographic challenges, lends support to alternative systems of food production that require less land, may be performed in vertical application, and do not require soil.

Grenada's estate farming system saw dramatic change over a period of forty-eight years. Table 1 illustrates the percentage of losses over 3 decades. During the discussion group sessions in 2015, participants reported that the demise of Grenada's estate agricultural productivity supplying local, traditional foods led to fewer opportunities for self-sufficiency.

Table 1 Land Use Changes

Agricultural Census	Agricultural Land (acres)	Percent Change
1961	60,200	
1975	46,600	-23%
1981	34,200	-21%
1995	35,000	2%

Section 3: Marine Sector, Tourism and Food Security

The ability to endure and thrive is confronting the world at large. Governments are examining the world's ability to sustain our current industrialized ways of food production and procurement that exhausted soils with intensive farming, polluted land and sea with sewage and plastics, filled the air with toxic chemicals, depleted forests, and spread further into what had been pristine natural environments. Richer governments have exploited the resources of their lands, and now seek the corners of the world left to exploit again. Global agribusiness and fisheries have fed billions, but depletion, high cost of transport and global climate change are affecting future access and outcomes. As Grenada is an exporter of fish, global export food-system demands have become an issue for fisheries in their attempts to balance those demands while addressing the pressing issue of sustainability of the island's important resource, upon which the local economy is additionally dependent. The balance between integrating into a global system, while maintaining their uniqueness, and meeting the needs of their own populace following harsh climate occurrences, has become a moving target for a government still working on its own independence since 1983. While we seek international partnerships toward

environmental movements and social change, we must learn again to value the cultivation of our own spaces.

Being an advocate for sustaining biocultural diversity involves recognition that culture, and specifically food traditions, drives vulnerability reduction strategies that encourage perceptions of wellbeing. Food is not only a need; it is a core component in culture. For Grenadians, their food traditions include the ability to harvest fish daily from shore. This tradition is part of what has been their continued form of food security; always accessible, and always meeting their historic food preferences.

There are twenty-seven islands in the small island developing states (SIDS) in the Caribbean Sea, located between 9-22°N and 89-60°W, including the independent state of Grenada. The sea is highly stratified and has a low productivity with long food chains; making for biological resources being limited and sensitive to overexploitation. This limited shelf area of the SIDS support most of the Caribbean's marine ecosystems in the form of coral reefs and seagrass beds.

Having a favorable beach area and climate desirable to vacationers, the marine shores provide Grenada an attractive asset to the tourism market which is sensitive to anything less than pristine. Soil erosion on Grenada, a volcanic island with steep hillsides, can precipitate the leaching of sediment, nutrients and pesticides into streams. As most of the agriculture is along the coastal zone where land is flatter, concentrations can travel quickly to shorelines and affect the status of corals. This can take the form of algae blooms, which negatively impacts coral health, leading to a reduction in water clarity. This in turn can negatively affect visibility perceptions of the tourist divers, snorkelers and the yachting sector, which can decrease future growth in marine tourism.

The declining state of marine environments, through root and proximate causes of ecosystem degradation leave a combination of agricultural displacement, biodiversity loss, dismantlement of traditional social networks, and loss of cultural identity (among others)(Manuel-Navarrete 2007). The causes of degradation have been studied sporadically. Singh identified four major issues affecting sea health; "...pollution from land and marine-based activities, habitat destruction, loss of biodiversity through poor fisheries management and external natural events such as hurricanes. The anthropogenic activities listed above were linked to inadequate management of waste⁴, unmanaged economic

⁴ Tourists who take ordinary precautions while traveling around the world may visit the Centers for Disease Control (CDC) website prior to a trip to Grenada. Under the heading, "Preparing for Your Trip to Grenada" are helpful recommendations regarding immunizations and disease exposure risks. In addition, a tab "Other Diseases Found in the Caribbean" has a link to ciguatera poisoning. Ciguatera is seafood poisoning from marine toxins under-recognized by tourists. The CDC advises, "The risk is increasing because of factors such as climate change, coral reef damage, and spread of toxic algal blooms." (CDC 2012) The poisoning occurs after ingestion of reef fish contaminated with ciguatoxin or maitotoxin. Originating from dinoflagellates living on and around coral reefs, they pass up the food chain into large carnivorous fish, and concentrate in the liver, intestinal tract, roe and head. This risk is reported to likely increase as coral reefs suffer from nutrient run-off, climate change and construction.

The risk to travelers is that fish contaminated with ciguatera are also the fish found at markets, caught while on fishing charters, served at local restaurants and part of the abundance offered on cruise ship menus. Barracuda, grouper, moray eel, amberjack, sea bass and sturgeon are headliners in the carnivorous category, with omnivorous and herbivorous fish like parrot, surgeon, and red snapper also at risk. The contamination is not obvious; toxins do not affect color, taste, texture or smell, and cannot be destroyed by gastric acid, cooking, smoking, freezing, canning, salting or pickling (CDC 2012). There is no antidote; symptoms are gastrointestinal, neurological, paralytic, respiratory, coma, and in small cases, fatal. It is important to note that once infested, it is a permanent condition where symptoms are managed, lasting for years in some patients. Recurrences of symptoms are reported to reoccur when consuming alcohol, any type of fish, and certain other foods, even years after initial exposure.

Specialized analytical methods and/or particular bioassays are the only methods of detection, which are not methods available in the common range of medical treatment facilities. Incidences in the United States are reported as 50,000 per year, but it is difficult to ascertain due to under-reporting and symptoms are easily falsely associated with other diagnoses. In Miami-Dade County, it is suggested that for every reported case of ciguatera fish poisoning (CFP), between 10 -100 cases go unreported. The FDA currently conducts testing on fish in the United States, in a two-tiered protocol involving in vitro assay and analytical chemistry technique known as liquid chromatography-mass spectrometry. Currently, avoidance is the only prevention, or the recommendation to avoid the viscera of reef fish, and to reduce consumption size. Specific reefs or seasons of toxicity need to be identified for local fishermen by health authorities. In the United States the Center for Food Safety and Nutrition (CFSAN) conducts research and collaborates with academic and government counterparts to inform and protect the public health, along with the National Oceanic and Atmospheric Administration, and the Centers for Coastal Ocean Sciences. Therefore, in the interest of public health, and the importance to avoiding the negative impact to the tourism, CFP should be on the radar of the Grenada Food & Nutrition Council, The Grenada Board of Tourism, and other governmental agencies.

activities, poor land use planning and lack of effective integrated management of coastal and marine-based resources” (Singh & Mee 2008). Of high significance is control of effluent discharge limits. The Convention of International Trade in Endangered Species (CITES) and the International Coral Reef Initiative established protocols, of which Grenada is a ratified participant, by designating MPAs within its jurisdiction. Grenada has responded in recognizing the importance of its biodiversity loss.⁵ It has implemented management of watersheds and coastal areas.

Managing these issues is something the government of Grenada has focused upon over the last few years. Ultimately, as Grenada’s GDP rests heavily upon the influx of tourism, it realizes the issue will affect every sector. This was simply stated by the Honorable Peter David (Senator), attending the First Annual Root Crop Festival, who said, ‘Tourism is everybody’s business, because when natural disaster strikes Grenada, every sector is affected, from farmer, utilities, banks, hoteliers, transportation, spice markets and ecosystems-all are circles of vulnerability’.

Section 4: Aquaponics & Cultural Sustainability Practice

From ecotourism to global environmental movements, there is a rising alarm and increasing interest in protecting life on the planet (Sernau 2009). The lingering effects of industrial agriculture are many; exhausted soils from intensive farming; polluted soils from pesticide use; indiscriminant waste dumping contaminating waterways; depletion of forests and overuse of fossil fuels; and overfishing practices resulting in dramatic loss of catches

⁵ The hotel industry has had to streamline their operations through certification programs targeting waste disposal and energy conservation, part of Green Globe Certification benchmarking improvement toward sustainable travel and tourism. Grenada as of 2008 had 30 hotels in compliance.

worldwide. Sustainable agriculture is based upon smaller systems, integrating animal and plant production and maintaining a higher biodiversity (Horrigan et al. 2002, 445).

Preserving healthy natural ecosystems is an important part of maintaining the earth's biodiversity and nurturing a healthy and meaningful life for the earth's inhabitants. Grenadians at governmental and citizen levels have expressed that shoreline fishing is a valued tradition. A system that promotes the maintenance of local fishing accessibility supports local food traditions, health and economic welfare, and works to support those community values. This is further supported by principles within cultural sustainability; understanding what sustains a community allows us to identify the external factors that affect it, and to work toward utilizing methods that reinforce a community's stability. Establishing a food system that involves closer connections through direct exchange or consumption that eliminates food transport are the core benefits of fresh, higher nutritionally density foods, a direct benefit from personal aquaponics systems. Since agriculture accounts for about two-thirds of all water use worldwide, and irrigation is depleting underground fossil aquifers faster than they can be recharged (Horrigan et al. 2002: 447), a system that utilizes low volumes of water that is also purified as a byproduct of production, small-scale aquaponics is an answer to larger, inefficient systems.

In evaluating the impact of food production on the environment, aquaponics is not only able to relieve stress on local fisheries, enabling them to recover, but is able to address pesticide use, soil degradation, land and water usage, energy, and biodiversity concerns effectively. It does not contribute to global warming, and the entire small amount of waste byproduct becomes a source of fertilizer for soil. The concentration of fish in a small tank

does not threaten the environment as industrial animal production does; further, there is no need to introduce antibiotic use that can create microbe resistant strains in humans.

Agriculture in Grenada during the era of plantations was for export, not for indigenous dietary needs. The general response to sustainable food focuses on expensive, comprehensive agricultural methods to meet large civilization needs typically administered from a top-down approach from large governing agencies. Any system of food production needing a financial investment that requires subsidy in order to be attainable for individuals of lower income, or governmental regulation that requires approvals for authorization to employ a food system, are factors contributing toward a continuance of top-down structures of control. Individual production serves to end the cycle of dependency, exploitation and domination that First World empires brought to Grenada (Sernau 2009: 28-29).

Aquaponics in small scale (differentiated from aquaculture) is in some ways a return to horticultural roots that had sustained fisher-farmers in pre-colonial Caribbean society. It is meant for the individual regardless of age or gender, or for a family, in small production as part of the recognition that not all natural resources are infinite. A portable system that has low start-up costs, it can utilize locally resourced materials. Lessening stress on water systems and improving dietary intake of clean vegetable and protein foods are factors feasibly met by small-scale aquaponics systems in a bottom-up approach. This community based strategy aims to retain fish as a food tradition while reducing malnutrition at the individual level. It informs and supports self-sufficiency while preserving the natural ecological resources that remain essential to a varied diet.

Aquaponics is a sustainable food production system that combines aquaculture (growing of fish in tanks) with hydroponics (the cultivating of plants in water) in a symbiotic environment. The system consists of a tank of water for the fish to grow, with water circulated by a pump to an upper level where plants are growing.

Section 5: Beginning My Fieldwork in the Grenadian Culture

My first stay in Grenada in 2012 had a three-fold approach; first to determine what local Grenadians knew about the ongoing coral reef research conducted each May by the Wisconsin Lutheran Biology Department; second to speak with key governmental agencies about perceptions coral reef stress and its relationship to food security; and third to determine if through partnership-building the development of aquaponics initiatives had any merit as a method to broadly involve the local community in these issues.

The duration of my first stay was for two weeks beginning at the end of May. I housed in the dorms at the University of St. George campus where I had security, library access and limited bus transportation to a drop-off point in Grand Anse. During this time I navigated the public transportation system, shopped at the local grocery, visited several public tourism destinations, ate at a variety of local cuisine spots, attended festivals and public service events, toured the reefs in a glass-bottom boat during a MPA community awareness event (Dragon Bay), was interviewed by the local press, attended worship services, and daily engaged with many people from a cross-section of life. I formally interviewed several people however, at this time I was unschooled in ethnography or the principles of cultural documentation. I did not have a structured plan other than to ask people a set of questions that focused upon shoreline fish eating traditions, if they had

heard about aquaponics, and about the threats to the coral reefs. I did not have technological tools beyond a small digital recorder. What I did bring with me was extensive travel experience that included frequent trips to the Caribbean; an ability to engage in respectful conversation that recognized ethical issues; and a natural curiosity that brought focus as I observed the culture.

During my return visit for two weeks in May-June of 2015, I was graciously hosted at a private residence with access to a car, which was essential to reach the agricultural properties in the mountainous areas, where I informally interviewed farmers. This trip was designed to implement the invitations to my discussion groups. The preparation for this involved meeting again with people I met in 2012, with additional introductions to persons in business and educational arenas I had not met before. I revisited governmental offices for repeat interviews and extended personal invitations to the discussion groups. I went to see Mr. Rennie again, who remembered me, and I reminded him of the words he gave me about fishermen as hunters, and how much that made a difference in defining the participant focus of my research.

I further explored the island beaches and restaurants; spoke with local merchants; filmed a locally organized political action street march; visited a construction site for a new shoreline hotel development; casually interviewed fishermen on the coast; and was a guest on a local radio station program. The three following individual experiences will illustrate the nature of Grenadians, as I experienced it, which provides some dimensionality to the patterns within the community's relationship with one another, and with me.

Occasion #1.

I spent an entire afternoon in a police station that illustrated first-hand how the local community deals with crime on a professional, interpersonal and community level.

The local Kingdom Workers representative had arranged a trip up in the mountains to meet a family in the beginning stages of building their own aquaculture project. After lively discussion over their proposed system, we returned to our vehicle to find it had been broken into, a wheel cut, and the interior contents of a laptop, keys and wallet were stolen. As we all stood around looking at the situation, the local response was to not call the police. Instead, our hostess, the family matriarch, left on foot to go ask around the neighborhood if anyone knew anything. After about a half hour, a man carrying a machete and a backpack walked by us. The family's son approached him, and his words were along the lines of, "Sir, I see you are walking today. Do you see our situation? Now, we are not accusing you of anything, but do you know anything about who might have done this? Would you have any objection to my looking into your back pack?" The man had no objection; in fact, he took part in our collective dismay, staying to help the men change the tire.

After nearly an hour, the matriarch returned. She had a general idea who the person might have been, but she would not say. She was so upset; her body language conveyed how badly she felt for causing her guests this distress. After an hour, the police, looking crisp in their white shirts, drove up, examined the car, and we all headed to the Police Station.

Inside the Royal Guard Police Station, we were directed into a room. Two officers sat opposite us, declaring,

“Now, first, we would like to hear what happened. While you tell us, we will listen. Then, we will ask you to tell us the whole story again. During that time, we will take notes, and will have a few questions.”

Each culture has its own way. What I witnessed during this occasion in the police station for hours was the matter was treated as important, yet all remained calm while taking in the details, without any expression of judgment. Little was said; the officers would go in search of the suspect, with whom everyone seemed to be familiar. Nevertheless, the matriarch remained burdened that this happened, as though her honor had been wounded. She apologized repeatedly for having this happen on our first day of visiting. As we drove her back to the farm, she saw a lady along the road. Asking us to stop, she got out, moved the lady away, and talked with her. When she returned to the car, she told me that lady was the mother of the likely suspect. She wanted to tell her not to worry; it could not be helped that her son was overtaken by drugs, that his mind was not right, but to let her know the police would be looking to question him. The next day, the police caught the young man, he confessed, and eventually the computer was recovered. The matriarch, still apologizing to me a week later, praised God for answering her prayers, but was still seeking to hear from me that we did not think poorly of her or Grenadians. She was sorry the money had been spent, but then, the mother of the man in jail had apologized, and now he was caught, so the whole community felt good about that.

Occasion #2.

I was in a salon, having had a service done. As I went to pay, I discovered the shop did not take credit cards. I blushed for not having enough cash. A local woman in the salon overheard me ask where the closest bank was found. The woman, feet soaking for a pedicure, got up, dried her feet, and told me she would take me there. She drove me the approximately two blocks distance to the bank, chatting along the way, and then returned me to the shop, and her feet to the footbath.

Occasion #3.

I was at Grace Lutheran in the morning, where two volunteers had arrived to volunteer to help with ongoing needs for the aquaponics project. They were painting IRB tanks and clearing out a storage room. While I waited in the upper office, I asked permission to make a local call to try to arrange a meeting with Denyse Ogilvie, who lived up in Mt. Moritz. During this time, one of the male volunteers came into the office. I recognized him as having been a participant in the 2015 discussion group. I asked him if he knew of a bus route from Grand Anse that might take a person to Mt. Moritz. The man gave me encouragement; he told me to watch for a bus with a certain sign in the window, and to be certain that the driver dropped me off not at the bottom of the hill, but all the way to the top. After thanking him for the information, he turned and said, "If you wanted to wait until I am done here, I would be happy to take you. I live in that direction."

Naturally, this sounded terrific because to hire a taxi would be expensive. He asked me about where Denyse lived, so I called her to ask for specific directions. The man got on the phone, cheerful and patient, asking her to explain the way. Confident he knew, he told me he would be back when he was done with his work downstairs.

The drive to Mt. Moritz took at least a half hour, ending on a road that had deep potholes. I expressed concern that he not damage his car, suggesting he could drop me off where we were, and that I could walk the remaining distance. He insisted all was fine. He talked about his volunteer work at Grace, saying he had worked twelve hours the night before, and was very tired, but he had given his word over week ago, so he could not go back on his word about showing up. Then, with a sense of caution, he added, "Because of my having been up so many hours, I am afraid I won't be able to stay. Will you let Denyse know that I will not be able to stay?"

I was somewhat perplexed because I had not intended for him to stay, but agreed that I would tell her. I asked him how far from this location did he live, and he then admitted he lived on the other side of the mountain. Before I left, I told him I would like to donate to the cost of his petrol, which he declined, but I left it discretely in the passenger door pocket, letting him notice it. He expressed humble thanks. When Denyse met us on the mountainside road full of smiles, I got out of the man's car, and she reached to embrace me. I explained to her what the man had said; she replied to my driver, "Oh, I see. Okay. That is fine. You have a safe journey back home then."

What I did not grasp at the time was the interchange of meaning that transpired between the man and Denyse. Later she would explain to me that normally, having brought me, a person would stay so that the return trip would be upon the arriving party, not the host we visited. The return ride represented a sacrifice; the cost of petro is high.

Hours later, after a half day of fruitful listening to her wisdom and walking her permaculture property, followed by a small meal, it was time to go. When Denyse and her husband drove me back to my campus, I too left money for him. Getting out of the car,

she took both my hands in hers and said, “Marilee, the work you are doing here is important. Do not get discouraged. We’ll get there.”

These are just three of many occasions where I observed that ordinary people took the time to lend a hand. They acted not out of false sincerity in hopes of gain; they were just kind to their neighbor. That they extended this courtesy to me was unexpected. At times when I was cognizant I was the single being of my race present, standing out of place in a setting, as I was at the glass bottom boat tours, in the salon, riding the public vans, and standing inside a prison, there were no external signs of any distinction that made me feel awkward. This nature seemed to be what one could expect, rather than be surprised by, if one watched, listened, and engaged with local people. All of these experiences captured the flavor of the Grenadian approach to me as a visitor, and how they relate to one another with common courtesy, respect and awareness of each individual’s honor.

This respect for one another’s honor would again be noticed when I sat with people to complete their 2016 surveys. Though not an intended direction of the survey, each of the respondents volunteered concerns for their fellow community member’s honor. They noticed that while the project meant for good, a requirement of beneficence is that it does no harm; in their estimation - to one’s honor; or to diminish the individual contributions that were given freely and without seeking compensation. This element that defined the Grenadian community in my experience, over three separate visits, portrays a consistent thread of the social structure of caring that I experienced as immersed within its exchange.

Occasion #1 spoke to listening without judgment, because they understand the hardships that a community can face. Even when the man with the machete had to be cleared of suspicion, the exchange first stressed that his honor was not questioned. At the

police station, though it seemed everyone knew whom to suspect, there was an effort to carefully listen to calm those involved, and to inform and alert the suspect's mother so that her honor was not questioned and compassion was expressed. In the second occasion it was to assist someone in saving face; although I could have walked that short distance to the bank, this act of generosity allowed me to resolve my embarrassment, and I suppose ensured the shop would receive the fair exchange for services provided. Finally, the third occasion illustrated that someone regarded me enough to offer a lift, but when the expected duty of a return trip became apparent between the driver and Denyse, they couched their responses to one another in a way that hid the hardship. These three occasions illustrate the practices within the community that gave me a first-person witness to their dynamic of cultural exchange that rested in individual honor and mutual respect.

Section 6: Value of Community Ownership

Philanthropic endeavors historically involve donations of time and generous fund support that delivers goods or services to those in need. As I formulated my approach to present the idea of aquaponics as a solution for food insecurity, I had at the forefront of my mind a valuable lesson I learned during a mission development trip in several Central American countries. Though intentions for doing good are admirable, the key to effective and lasting change is community ownership. Without ownership by the recipients of the design and benefit of a program or project for a community, program sustainability is doomed to failure.

Peter Block articulates how transformation occurs in communities by thinking in terms of structure of belonging, within a simple, clear and easily accessible format for

anyone who wants to participate (Block 2008, 2009:4). Rather than focus on the shortcomings of a community in regards to its constraints with land use, the taxation on natural resources and the other difficulties the community would identify as disadvantages, I chose to focus on illustrating how one could look at obstacles and see possibilities. Instead, I followed the principles of cultural sustainability that suggests that individuals within community, regardless of skills, education or training, represent a natural asset to the landscape they occupy. My primary goal was to implement a format within the discussion groups that supported the building of social capital, one that drew upon the richness of the Grenadian horticultural and fishing past that lies within the collective memory of the older population. The discussion groups were an invitation to hear if the community was willing to inform me about its interests or knowledge of coral reef ecology, and what fishing threats it might have observed. These were the first steps in creating the format where the community might determine any desire for ownership in the project.

Section 7: My Introduction to a New Community

In the realm of smaller communities, and specifically in Grenada where a British formality remains present in local dialect and in social customs, one needs an introduction to announce your presence *as an invitation*, rather than a trespass. Respecting this cultural tradition, I arrived in 2012 by way of an introduction to the community by the well-regarded manager of Grace Lutheran Church, Minister Dy Sylvester. At that time services were held in rented space in a local mall, but land had been purchased and a new school facility was under construction. His willingness to introduce me, along with the WLC staff that had become familiar faces in the community, allowed me to flow into the social graces

that one must properly extend in this society. This was also important because the Lutheran faith community was new to Grenadians, who for the past hundred years had



Figure 4 Grace Lutheran Church & School

strong membership in the Catholic, Anglican or Adventist churches. This dynamic played an important role the following year, when Grace Lutheran Church &

School (further referred to as Grace) would be a brand new facility located in the Woodlands, a semi industrial area just outside Grand Anse. Grace aimed to establish its reputation in the community, and to draw new membership, by offering excellence in education and a new opportunity to join an inclusive faith community. Grace recognized it would face challenges being accepted in a community that had some uncertainty about the “new” religion that presented itself to the Woodlands. It sought the help of Kingdom Workers, a Christian organization that works with churches to build presence within communities. Through Grace’s affiliation with WLC, the WLC aquaponics pilot program presented potential for a partnership that reinforced laying groundwork for sharing of knowledge; something the Grenadian culture respects and defines as valued. Its new geographic placement was in a valley, easily viewed by a main road that ringed it. With its visible location, security and acreage, it worked in partnership to become the 2015 WLC Discussion and Workshop site. This partnership offered the unique placement of a project where the current enrollment of students and church members learned, ate, performed and socialized together in a multicultural setting.

The building is a large, concrete facility painted white, with a bright and colorful playground visible in front. The school provides its own bus transport for enrolled students and staff as it is not located along an approved public transport route. In accessing its staff and outreach goals, it offered its facility to become a place where leadership through community could develop by emphasizing strengths rather than deficiencies, a policy supported in sustainability practice (Borup 2011:140). Grace has experience in community collaboration, and demonstrates a broad concern for the community; it has symbolic position as a resource for transformation, faith and hope; it is respected by civic and governing agencies; and has a history of strong pastoral leadership. These are criteria Borup stresses as necessary components when looking to become an advocate for others. However, equally important is that community development resonates at the local level, matching outreach to locally identified needs.

As a WLC alumnus, I was keenly aware of the principles that guide its institution, its academic goals, and its relationship to its doctrine of faith. WLC seeks to share its academic excellence with others; to train its students to become moral, ethical Christian leaders that seek to be in service to others. This quality of reputation is a part of clarifying what value one brings to a community outside its own, one brought to Grenada for ten consecutive years through the ecological and biological research conducted in the coral reefs along the Grand Anse coast. Working in conjunction with the University of St. George, the Marine Protected Areas (MPA), and the Fisheries & Agriculture Organization (FAO), they promote marine protection by informing the community about which human practices lead to significant ecological stresses or damages. The WLC community exercises

clear goals, has the support of its constituency, and have adequate funding each year. It has further impact within the academic community through publication of its scientific findings.

Dr. Robert Anderson, who spearheaded the coral reef initiative, recognized the science community's focus was upon a process ensuring inexpensive, locally resourced aquaponic materials and training technology. He knew the quantitative goals, but sought to ensure its success with qualitative potential. In his evaluation of how to further ecological conservation at the community level, he recognized the value of a cultural sustainability collaborator as bridge to translate scientific concerns into an adoptable vision comprehended at any grassroots level (Borup 2011:154). To bring an interdisciplinary approach to evaluating aquaponics as a tool to inform about ecology, my feasibility study examined the community from an anthropological perspective that asked questions about what the community values. My role would illuminate how we as a team could deliver a project that allowed the community to consider themselves as partner contributors in the same science community; one that might embrace a readiness to recognize the value of ensuring coastal health in order to ensure its own personal health and wellbeing.

Section 8: Development Methodology

The dynamics of participatory development, though helpful as a logic model, were not chosen at the inception of the WLC project. The pitfalls of its processes are summarized well in the work of Christens & Speer's review of *Tyranny/Transformation: Power and Paradox in Participatory Development* (FQS 2006). Critics level the charge that community development is the domain of white men with westernized versions that retain developmental power and expertise under the guise of involving the community (FQS

2006:2. They characterized it as only serving corporate agendas retaining control over decision-making that ignores local knowledge, and that the goals are deemed to be thinly veiled attempts at a new form of commodity development. Further, it claims outsiders make the decisions; participant facilitators were generally not residents in the community and therefore absent in majority; and the language around empowerment tended to be cloaked in rhetoric.

Drawing upon experience as a participant-observer in a community development program in 2010, I witnessed how manipulation can exhibit itself, reinforcing these types of critiques as legitimate. The attempt to try to steer a community toward a programmed outcome will eventually expose its intent. What occurred in that project was that the participants, already engaged, dismissed the organizer's aims. That community did not give voice of their realization to the organizer; it merely moved along its own self-directed path.

To avoid this type of disconnection in our partnerships, I made a concerted effort to empower the Grenadian community through their own ownership at each stage; in their identifying the food security criteria; in the process of prioritizing that criteria; by offering further training; and to build a relationship through partnership that first serves by asking about their interests, both personally and collectively, as a community that faces ecological changes that are hidden from ordinary view. *Those points follow principles in cultural democracy; cultures coexisting as equals, with equal participation for all, and that healthy cultural process should include democratic control; meaning that participation should be freely directed, allowing engagement and full expression of the participants* [emphasis added] (Adams 1995). Electing to include individuals from all economic and occupational walks of life, something the participants vocalized as important, also allows for

dissemination of information to public sector elites with ability to formulate policy, and to the rural grassroots individuals who seek to enhance their autonomy.

This approach aimed not to simply inform Grenadians about becoming better stewards of their shoreline, but for local people to learn from their own observation that their ecology was changing. Was their own indigenous knowledge, or folk stories of the past, or recently remembered conditions, lending comparative knowledge about the changes in current fish catches? What were the culturally based interpretations of fewer fish catches? How did they view this would affect their food chain, their food traditions, and their perceptions of healthy diets? Who were the members in their society that transfer that knowledge, and was that happening? The measure of whether aquaponics was a worthy method of resilient domestic food production that had the potential to begin a movement toward a solution to these questions needed to come from the people who have the natural rights, and the primary stake in Grenada.

Section 9. DISCUSSION GROUP METHODOLOGY AND PROCESS

Section 9: Step 1: The Invitation

On an island the size of Grenada, people are known to one another. Though they may not be in close daily proximity, through education, work and interpersonal relationships Grenadians are connected as residents on a relatively small land mass. This factor helped in the process of inviting people to attend the discussion groups, as I extended personal invitations to locals with the encouragement to invite anyone else they knew might have an interest. We also used social media by posting an announcement on the Grace website and its Facebook page.

With singular, personal grass-roots invitations, I was advised by Kingdom Workers that attendance was expected to be low; limited incomes, transportation costs, or job obligations might complicate or override any initial interest. However, as Block advises, social fabric is created one room at a time (Block 2008:11). The focus became one of finding a good mix of people that I knew, or the Grace/Kingdom Worker staff might suggest had or might consider an interest and enthusiasm for discovery of something new. Each invitation stressed my interest to hear what people knew about their coral reef assets and food security; if they were aware of the ongoing reef research and its implications; and whether they had heard of aquaponics. It was also likely helpful that the weekend prior to the start of our workshop, our guest appearance on a local radio talk show boosted interest.

Section 9: Step 2: Formulation of Discussion Group Presentation

Asset-Based Community Development (ABCD) is a worldwide movement. Professor Emeritus John McKnight founded the Institute for Policy Research at Northwestern University. McKnight's approach to making communities stronger is to avoid the typical studies and program development that focuses on deficits and neediness, but instead identifies the existence of a community's assets, resources and talents. It avoids the tendency of outside agencies, which look to bring in a commodity, or program to "fix" what is perceived as missing from a community. Focusing on a community's gifts is fundamental in expanding the capacity for people to view themselves as possessing the potential to create transformation.

As a student of Cultural Sustainability, it was important that I also stressed my belief that communities also contain cultural histories that are repositories of active or latent knowledge. Though Grenada has been independent since 1983, negative memory of modes of production and plantation life linger as a deterrent against positive recognition of the knowledge that was contained within this historical period of agricultural productivity. I believed that Cameron's explanation (2012 Executive Director of the Food and Nutrition Council of Grenada (GFNC): See pages 55-57 below) that Grenadian's yearning to disconnect with this past, and its negative associations with colonial rule, had served to suppress one of this community's historically strong assets – that of exceptional agricultural, horticultural and fisheries knowledge. Instead, I sought to reinforce that they are heirs to this knowledge, which when re-nurtured, or reactivated, reignites a positive cornerstone of their cultural identity. Included was the recognition that Grenada's government officials were actively working on the global stage to address the issues of increasingly threatened natural resources, but that they too recognized and called for innovative responses emerging at the grass roots level. The application of traditional knowledge, application of innovation at the community level, and reinforcement of cultural heritage is supported in the laws and policies undertaken in the United Nations Convention on Biological Diversity (1992) and in the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Cultural sustainability principles stress the importance of creating inclusion, and purposely avoiding marginalizing people. A deliberate emphasis on bridge building and collaboration is a tenant within anthropology and community participatory design (Sanoff 2006) so that social engagement can occur. Biocultural methods recognize that indigenous

peoples have unique customs for interacting with one another (protocols). Grenadians had presented themselves to me in my past visits as courteous, friendly and respectful of one another. These protocols and their incorporation into the structure of the Discussion Group format followed this guidance;

“Indigenous peoples and local communities are increasingly engaging with external actors such as government agencies, researchers, companies, and non-governmental organizations (NGOs). However, external actors often do not understand customary protocols and governance systems because they are codified in ways specific to each community, culture, and location. Failing to respect community protocols, whether intentional or not, can lead to conflict, deterioration of otherwise constructive relations, and negative impacts on the environment” (Shrum & Jonas 2012).

Cognizant that our Western presence will continue to give pause to post-Colonial memory, my personal introduction made clear that I was a facilitator representative of WLC. It was also explained that I was there in a voluntary position, and as such could not offer them anything other than a desire to share information. Grenadians themselves were not being studied; instead, we were seeking feedback to determine if they saw merit in a possible new eco-friendly approach toward sustainability initiatives. This model mimics collaborative ethnographic methods where it “shifts control of the research process out of the hands of the anthropologist and into the collective sphere of the anthropologist working on an equal basis with community researchers” (Rappaport 2008). The emphasis was on introducing current research, explaining its purpose, informing about its findings, sharing how it has been effective in other places, and illustrating how it meets with local governing plans. Then, if they felt it was a legitimate tool that met their interest in

sustainability objectives, to consider a no-cost workshop to learn the skills it takes to run an aquaponics project.

Section 9: Step 3: Visual presentation format

The discussion group oral presentation needed to be understandable to the average person with a primary education, but also informative enough to

stimulate those with a higher comprehension of ecological and science-based concepts. I

began the session by asking if the community had any awareness of the research that had

been conducted along Grand Anse Beach by WLC for the last ten years. If not, that was

understandable because the research occurred under water, and was published in scholarly

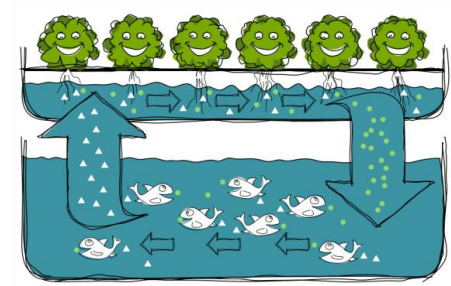


Figure 6 How aquaponics works through continuous circulation



Figure 5 Plastic barrel backyard system

journals that community members may not have known nor had access to. As we were discussing new ideas, I also wanted to be certain that everyone understood my terms; I explained what the word aquaponics meant, what food security means, and then

conversely, what it meant to be food *insecure* [emphasis added]. In order to approach the topic of sustainability and aquaponics, I used a cartoon image while explaining how aquaponics works. I inserted several playful illustrations, along with humor and storytelling, in order to build the understanding that all of us at some time find chemistry, science and technology to be intimidating. I explained how my life as the daughter of a chemist is filled with examples of how different minds think. As an icebreaker, I told a

humorous story about the differences between how my father expressed himself that led me to believe science guys were odd. The group smiled, and seemed to enjoy the intentional humor. I illustrated the differing appearances of corals when healthy, or when degraded into what is referred to as blight.



Figure 7 Healthy corals

Next, I illustrated some of the causes of coral reef damage inadvertently caused by individuals, both by local or tourist practices. I next presented a slide that illustrated their government's global response; and

Foreign Minister Nikolas Steele's addressing the threat of climate change and the importance of education for people in the Small Island Developing States (SIDS) at the United Nations



Figure 8 Coral blight

General Assembly in 2015. Following this, pictures of the test pilot aquaponics tank at WLC showed our basic system, and I showed pictures of the wide variety of systems that exist all around the world.

Finally, I explained that without local traditional knowledge, this new technology's merit was incomplete. This was when I outlined the next step in the meeting was to break into two smaller groups, and to begin to find out from their neighbors how their own observations or experiences could better inform the evaluation process.

Section 9: Step 4: Discussion Group Ground Rules

Another component of Block's approach is emphasizing associational life. Citizens brought together can support one another, and those who have perceived disabilities can be transformed in the process. Part of the design of the discussion group followed the principle that peer-to-peer interaction is where significant learning takes place. Both groups listened attentively, and once the Power Point was completed, there was immediate interest about the aquaponics process, advantages to its waste byproduct, how much volume could be produced, and other questions that showed great comprehension and interest. I recorded their questions on a white paper hung on the wall. I informed them that the processes would be addressed in the workshop, but that their questions would be "parked" for addressing by the biologist. I provided assurances that once they had completed the discussion phase that their knowledge and familiarity would grow during a subsequent workshop, where the concepts of living bacteria, media beds, hydroponic plant selection, fish care, and water testing would occur.

As facilitator, I introduced the beneficial use of ground rules. I asked the group to identify their rules that would respectfully welcome the voicing of everyone's ideas. These rules were written on white paper hung on the wall as a reminder. The rules the community offered were:

- Respect for what every person has to say
- Allow one person to speak at a time
- Bring unity
- All opinions are valued
- No use of cell phones during our meeting

- All answers are correct
- Keep Jesus first in our minds
- Knowledge shared should stay on the topic

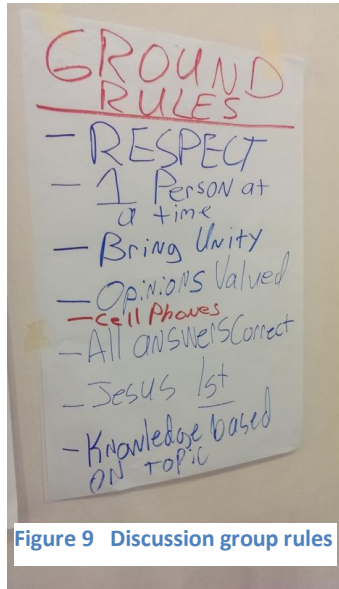


Figure 9 Discussion group rules

In order to manage the expectations of the group participants, they were informed of the next steps. The discussion group was divided into two smaller groups where a humorous icebreaker encouraged familiarity with one another. Each group had a volunteer recorder, and I observed active individual participation. Respecting their overall investment of time, at the end of an assigned time they were asked to present their groups self-determined findings which they believed contributed to food insecurity.

The following discussion questions were posted on a white paper:

1. Other than money, what are the causes related to food insecurity?
2. What are the techniques/ways to get food if there were no more fish?
3. What role can aquaponics play in addressing food insecurity?
4. What is resiliency – and how would you rank aquaponics?

After the allotted time, the group had one volunteer be the spokesperson for their group to list the criteria for question #1. All were listed on white paper for all to see. Subsequently, they were asked to use a pair-wise ranking system to narrow down their findings to the top five most pressing issues. This was done by democratic voting (show of hands). The recorders provided a written list with these themes:

- Seasonal influences: weather conditions, labor, lack of planning unity, 5 farmers-same food, planning culturally

- Lack of knowledge: access to is limited; cultural diversity; youth; naturally grown
- Competition of imported foods: knowledge of our food, support local, knowledge of tasteful with our food; value.
- Lack of youth: not wanting to die from hard farming; attitude to agriculture as hard; not entering food production arena; how to make it fun?
- Non-organic: nutritional value; waste of food
- Natural disasters; weather events; land degradation
- Storage needs
- Non-sustainable practices; bad planning;
- Lack of training
- Land use: poor land use; housing in bad places; throwing sewage into the sea; indiscriminant destructive clearing; increased pollution;
- Bad dependence on imports; need to replace with local;
- More affluence; more demands on land space; lifestyle change; unnatural consumption

The discussion groups, (two groups over two days) decided upon the following ranking criteria as the answer to question number one: “Other than money, what are the causes related to food insecurity?”

May 28, 2015	Final Top Rankings	May 29, 2015	Final Top Rankings
1.	Lack of Knowledge	1.	Thievery
2.	Seasonal Conditions	2.	Access to Land/Cultural Block/Soil erosion
3.	Land Use and Planning	3.	Climate change
4.	Dependence on Imports (food)	4.	Natural Disasters
5.	Access to sustainable resources	5.	Governmental Policy support

Despite my anticipation that all four questions would be addressed, outside facilitators must recognize that the community will drive the final outcomes. The shared exercise allowed people who did not know one another to express themselves, and the pace they chose to take allowed for openness to hear voices from different backgrounds and social skills. The indication that this format was acceptable was evidenced in active discussion, engagement with eye contact and body language, voluntary written recording of points, and focused attention throughout the exercise. That the other questions on the board were not addressed specifically seemed less about engagement, but instead owed more to the limitation of time.

The final question to the group was to consider was that if training were provided to learn aquaponics processes, and if local materials could be sourced inexpensively, could it be a solution to their identified top five contributors to food insecurity? By a show of hands, both groups for a total 30 out of 32 agreed it could (93%). Following this, an open invitation was extended to attend the free training workshop (three days later) to become trained in aquaponics. They were very interested that they would be building the pilot system during that time. Attendees were informed that if their schedules did not permit full attendance of all five days from 8:00 a.m.- 5:00 p.m., that they could elect to drop in, or send a friend or family member to fill in for them. In addition, a free lunch would be provided at noon, and any travel expenses reimbursed.

Section 9: Step 5: Workshop - Initial successes

I contacted the local media about the kick-off of the first training session. Not knowing how many people would attend, a classroom at Grace was made ready with ten

chairs. By 8:15 a.m. we had 25 people; by 9:00 a.m. fifty-two people of different genders, education and economic backgrounds filled the workshop seats!

Zach Pappenfus, the WLC biology major in charge of the training event, stood at a white paper board and began his curriculum. Each day a new facet of aquaponics was explained. People took notes, and were actively involved in each step; cutting the blue barrel, cleaning it to emphasis bacterial control; discussion about options they saw where local materials could be substituted. For example, rather than using PVC pipe for the plant support, attendees suggested bamboo. During this time, leadership skills were reinforced.

The workshop training was under the direction of the biology team, and as I had to travel back to the States, I was unable to attend the subsequent days of the workshop. I heard how attendance surpassed expectations each day. The participants built their first

aquaponics lab, learning to plan, implement, and built as a team.



Figure 10 Dr. Anderson leans over the tank while participants scrub the surfaces

Once completed, two trained individuals volunteered to monitor the system daily. Spirits

were high, and the results brought enthusiasm into the Grace community. The aquaponics lab, situated near the school building, could be viewed and cared for by the managing volunteers. Staff introduced new vocabulary to the student curriculum to stimulate interest in aquaponics that would transfer to parents. People were invited to visit the lab any time; new visitors arrived on Sundays, and Pastor Dan Rautenberg was pleased to find five new members within a few months. A second aquaponics training was offered a few months

later. The two key individuals that volunteered daily oversight were dedicated and excellent voices within the community, promoting the program at Grace.

In terms of immediate positive feedback following the workshops, the WLC team learned three attendees expressed interest in furthering their training to begin to implement aquaponics in organizations outside the Grace community. Following volunteer input, the team began addressing any revisions or new applications recommended. In some cases, volunteers with differing opinions revised parts of the system, utilizing local materials, which over time would prove to be variance learning tools that had either success or failure.

Figure 11 Tarp, lining and first set up



Section 10: 2016 Survey and Interview Findings

Three weeks in advance of my arrival in May 2016, I sent individuals in the 2015 discussion group who had provided me with their contact information an alert that I would be back in Grenada. Grace members were also aware the WLC team would be returning. I

let them know I would be eager to hear, a year later, their opinions about how they felt the discussion group, workshops, and the overall aquaponics project was doing.

As part of the preparation, I prepared an Institutional Review Board (IRB) consent form that informed voluntary participants that their contributions would remain confidential. It explained how their participation would assist me in my study about community participation in the arena of coastal ecology and related food security, and that the questions were intended as a follow-up to the discussion group held at Grace Lutheran Church and School in May of 2015. Its purpose was to hear what they experienced resulting from their participation, to hear their thoughts on the materials presented during the discussion group, and any resulting changes in perceptions about coral reef preservation and food security.

Section 11: Two Active Local community projects post the 2015 workshops: Two Local Endeavors: Her Majesty's Prison (HMP) and People in Action (PIA)

In the process of the 2015 discussion groups, I learned that several people were thinking about, or just beginning to invest in the idea of aquaponics. In 2016, I was fortunate to tour two community-driven systems that were catalyzed by attending the WLC discussions and workshops. The locations of both are in the central zone of Grenada, at higher elevations. Both were organized by two individuals highly committed to community development. The first tour was to Her Majesty's Prison, where I followed up with Christopher Stroude, Social Worker at the prison.

He informed me the total number of prisoners was 468; eight of them were women. Nearly 70% arrive as illiterate. The prison follows a system of non-confinement; this means

that within the walls of the prison, inmates are not in cellblocks; they are allowed to move about within the parameters of the grounds. The females are separated and secured from the males within an internal walled area.

Fenced and walled at the top of a high mountain, the grounds include a valley between hills. On the day of my visit, Christopher took me to the aquaponics system that is near the highest elevation of the property. He is using an IBC aquaponic system (plastic shipping containers.) The fish were active, healthy, growing well and on schedule. His vegetable growing at that time was cucumbers; the one he picked for me was a hearty seven inches in length.

Christopher reports that this system is rounding out his program goals by teaching new value-added skills important in human livelihood security. It fit well with his other programs; raising cattle, pigs, rabbits and chickens; the making of charcoal; the making of concrete blocks; auto repair; woodworking; and crop training. Christopher guides the prison community in education that will provide his wards with an opportunity for self-sufficiency and employment once they are released. His methods are intended to help reduce the 70-75% return rate that occurs when inmates are not provided with new skills. He explained, “With the skills learned, there is a 25% less return-rate when they take the religious and

academic classes offered.” These numbers inspire him to work through associations, form strategic alliances, and be inclusionary.

One personal experience is worth sharing as it also lends a view into Grenadian culture.

While standing on a narrow path that led down to



Figure 12 Cucumber raising at HMP

the valley, I saw inmates working on building and tending elevated gardens. Several inmates started to head up the hill. Due to its steepness, the paths weave back and forth. As the men came closer, I noticed they were

carrying very large machetes. It startled me, as I realized they would have to pass behind me in close proximity. As each passed I greeted them, and they extended courtesies back. One man stopped, sat on a plastic bucket, and began to chat. He told me



how much he was learning at the prison, and how it was preparing him for a future where he could take care of himself. As we chatted, more men passed, carrying machetes. I thought how having weapons, plus open movement over vast acreage would not be standard procedure in an American prison. It made me look around, watch the exchange between the guards and the inmates, and notice the pace and sense of purpose as they went about their tasks. In my view, this freedom of movement and use of machetes illustrated how the Grenadian prison culture manages relations between inmates and guards without cells, chains, locks and leg irons.

The second example is in Mt. Moritz, where there is a local woman named Denyse Ogilvie, who by anyone's standards would be described as a powerhouse of enthusiasm for permaculture. I had met Denyse in 2015, where we spent a few hours together as she explained her role as CEO in a UNESCO supported non-profit, People In Action, which promotes permaculture. During our informal time together then, she was excited to meet someone familiar with the methods she incorporates in her project, and looked forward to attending the aquaponics discussion to hear about how this community event might benefit her goals for the community, which has a motto for sustainability; *Begin in your backyard*.

Denyse attended the discussion group, and sporadically attended the workshop, so when we met again in 2016, I was eager to hear her perspectives one year later. I was invited to her home, and though I thought we would sit and begin the survey, instead she engaged in conversation outside, where we began to walk the grounds. Located on a steep mountainside, the PIA aquaponics system consisted of three tanks that have integrated a small solar system as an energy backup for the pumps. Other methods of food security were evident in the growing of fruit trees, raising goats, and a channel to divert rainwater to garden beds. She pointed out an interesting cistern that incorporates charcoal, sand and tree roots as its filtration system for grey water recycling that utilized traditional environmental knowledge and local charcoal making skills.

As we stood near her aquaponics system, she informed me about how her communities which are actively involved in PIA are adapting the knowledge gained through the workshop to fit into their environment. She reminded me that people in Grenada had had previous interest in aquaponics prior to the WLC/Grace project, seeming to re-emphasize that the system was under their ownership and development. This informal discussion calls to mind indigenous research methodologies which aim to ensure that research be carried out with respect, is sympathetic, ethical and useful, while seen from the point of view of the local or indigenous peoples. In Jelena Porsanger's *An Essay About Indigenous Methodology* she addresses how looking at indigenous perspective and consulting indigenous communities as participants can help predict possible negative outcomes (p.8). It stresses whose interest a project serves, who benefits from it, and who will carry out the end results. Although my evaluation of the impact of the WLC/Grace aquaponics project was not indigenous research per se, the principles Porsanger refers to in indigenous methodology promote "the consideration of survival, recovery and development, which are conditions and states of being, through which indigenous communities are moving." (p. 9)

Denyse explained to me a mentality that their community is working to overcome. It is expressed in the proverbial saying: "While the grass is growing the horse is starving." She said it meant there are resources right under your nose, but without knowledge, people starve. She works

toward people-centered growth, which appreciates where people are, what they have to bring to the table, and how to work together. She shared her view that learning is to serve; not the other approach, which is service learning.

Denyse smiled, touched my arm and said there was a nature I needed to understand. She brought up the topic of colonialism as being in their [Grenadian] recent collective memory. She asked me to consider that, "...during the American Revolution, Americans did not appreciate foreigners taking their land and resources. It's the same thing." In like manner, Grenadians are guarded about any Western solutions. This was a not intended to be a thinly veiled reference to the WLC/Grace project; it was a critique of sorts that was alerting me to consider that locals want control over how they are involved, and how outcomes evolve.

Denyse recalled being excited to see that the new knowledge offered through the discussion format and workshops would help the community, one that she knew already had an interest in aquaponics, and that it would support the initiatives that People in Action is advancing. Their focus, as outlined on her website, is "to formulate and research innovative, sustainable programs for the socio-economic development that respects our natural resources, human resources and cultural equity." She promotes empowering the community toward its own development.

Denyse was in control of the discourse of how our day would progress. She was giving me information she felt I needed, but it was on her terms. We stood outside for more than 2 hours, while she spoke about topics she wanted me to hear about. I was acutely aware that her sharing with me was privileged, and that we had a relationship of trust. She expressed her seeing me as in the "grey zone," and she joked that we should create a grey revolution, where the voices that are in the middle can be heard.

Later as we spoke over lunch, Denyse explained how she perceived my role as "part of the Wisconsin team, but as a bridge builder." She cautioned that people with needs will seek free offers, and if disappointed, they may circulate negative gossip if their needs are not met. She explained,

though they might take what is free, it does not mean automatic acceptance or continued interest beyond a handout. She wanted to stress that communication must be clear so misunderstandings do not shed a negative community caution toward Grace or Kingdom Workers. Though she appreciated the discussions and the training, she pointed out that the project was viewed as a catalyst toward implementing a new technology, but repeated again that Grenadians were already on the path toward sustainable food production. She also offered that a perceived limitation was the site of the training location, and how it might have been better in a “neutral location” rather than at an institution.

Seeing the PIA site illustrated another example where the aim of the WLC/Grace project seemed to have met a community’s needs by providing the catalyst toward forging the spread of information which is at the beginning of embracing new methods of resiliency.

Section 12: Food Security Focus

The 2015 State of Food Security Report reminds us the definition of food security is that “food security and nutrition targets requires that food is available, accessible and of sufficient quantity and quality to ensure good nutritional outcomes” (FAO 2015).

Additionally, the report emphasizes the importance of small family farms is essential to food security and good nutrition. In order for small farms in Grenada to continue to interest the next generation, land use policy at the governing level must be addressed. Yet aquaponics, providing production in small square footages, is not limited by this current issue. Not needing soil, and requiring less water volume, it models conservation, and helps ensure greater local food production while increasing personal economic stability, better dietary outcomes, and less stress on the local fish supply.

To evaluate the nutritional status from a governmental level, I interviewed Director Marcia Cameron in 2012. The council goals support good health through locally grown



foods. Cameron, a native Grenadian, returned to Grenada in 2011 after twenty years in New York. Cameron reported noting an absence of fruit trees that had been abundant during her childhood. She noticed a new dependence upon imported foods. Having returned to Grenada with a personal interest in

holistic foods, seeking hands-on approaches to agricultural aspects promoting locally grown foods, she welcomed the idea of aquaponics.

When I explained how aquaponics matched the premise of holistic eating, sustainability, improved nutrition and a means of attracting more of the eco or agri-tourism market, she welcomed exploration. She supports the, 'Eat what you grow, grow what you eat' philosophy. She indicated that locals eat what is caught, like barracuda, jack, snapper and other seasonal varieties. The vegetables commonly eaten are watercress, lettuce, calliloo (a soup made of green vegetables), bok choy, wild zapina (known in Trinidad as "bhagi"), spinach, and broccoli. The Agriculture and Consumer Protection Department under the Food and Agriculture Organization of the United Nations listed in 2010 that Grenadian women and school age children suffer from iron deficiency anemia (Food and Agriculture Organization 2010). Grenada's population is relatively young with about 50% under the age of 25 years. There is a lack of current resources available to cite eating habits.

Ms. Cameron explained that fish in the diet is occasionally still regarded as a poor person's food, and that chicken, pasta or rice is considered better. This may be based upon older history of diet on the island, and that progress has brought the other choices and they are somehow thought of as superior, though the people are not aware of the new chicken processing has a raised issues of contributing toward ill health through over-use of antibiotics and forced feeding. The Food & Nutrition Council is working to develop public awareness strategies to hype the benefit of locally grown foods, for the nutrient they bring, and the seasonal benefits. Ms. Cameron explained a new word in nutrition circles, *locavore*: a word that identifies someone in the following way; one that is committed to eating and growing or purchasing locally grown food. I was invited to the Nutrition Council hosting of the First Inaugural Root Crop Festival in June of 2012, which tied into the agricultural festivities and promotion of *locavore* mentality.

With regard to fishing, Cameron described the local impression that it is considered risky business. They often do not have good boats. The average person, generally males, will fish from shore, with a net or spear, in shallow waters. Most view fish as superior, healthier than chicken, but chicken is cheaper to buy. Chicken is culturally accepted as a norm in the diet.

I attended the festival, held at the Pedestrian Plaza Careenage in St. George, on June 1, 2012. Open to all residents of Grenada, it was attended by adults, students, and NGOs. It appeared to have excellent media coverage with plenty of government representatives attending. Mr. Aaron Francois, Permanent Secretary



Figure 15 Root Crop Variety

of the MOA, began the event. He indicated the initiative began in 2010 to promote vegetable root crops, beginning with cassava, and an important commodity he felt could transform the sector. He reported the current cost of importing food was topping \$150 million. Cassava has moved from a subsistence crop to commodity status, becoming a top food security crop (OECD-FAO 2015). He noted that if the Caribbean took just ten percent of what it invested in wheat, and used it for cassava; he felt it could see great profits. He noted that Grenada was experiencing a high incidence of non-communicable diseases (high blood pressure, obesity, diabetes), and that root crops could reduce this. Tannilog, a dark brown root is peeled, grated and boiled with spices and becomes porridge. Cassava and Dasheen are also prepared in similar fashion and made into pies.

Daniel Lewis, Chief Agricultural Officer, indicated in his speech that food security could be met by most of these crops. He felt Grenada had good soil to raise the crops, and that they are highly nutritious.⁶ He remarked that in Cuba root crops are used extensively because of the small starch molecules, which allow digestion to occur more quickly; this means it is desirable for infants, children and seniors. Though Grenadians have a great likeness for imported foods, they simply are not as nutritious. He felt Grenada needed to adopt the Jamaican attitude where greater than 80% of their food is local, whereas Grenada attained only 15-20%; this needs to increase, along with national pride in the local foods. He concluded by a plea to be 'an ambassador' for hope that more will use root crop vegetables.

During the Root Crop Festival, I had the opportunity to meet Teresa Merryshow, a Grenadian woman who runs the Grenada Network of Rural Women Producers (GRENROP), an organization registered in 2005. She focuses on small parcel subsistence farming on one-quarter acre on up to 4-5 acres. Primary herbs, it is an all-woman effort, though recently

⁶ Nutritional content was not available, but emphasis at the festival was on variety, storage, cooking techniques, sampling, plant identity and recipes.

men are asking to participate. She teaches soil improvement and structure, composting kitchen waste and use of grasses, cassava products training, collaborates with NGO's and is establishing a brand for these products. She reports people have a keen interest.

Theresa Merryshow is health conscious and bothered that she sees many young people getting cancers. She believes it is related to the high use of preservatives, herbicides, fertilizers and modern adaptations of fertilizers that are all chemical. She believes that the elders who used animal manure were smarter than modern shortcuts, as they rarely needed an artificial supplement. Today the amount of animals have decreased dramatically on Grenada; they are losing sheep, goat and cattle due to less interest in agriculture, and to theft during hard times from a lack of jobs. The unemployment rate is high (34% Gov. of Grenada: 2009) from the losses in the nutmeg and cocoa tree destruction from Hurricane Ivan. The FAO appealed for funds for a "livelihood project" to replace small stock of sheep and goats, about 3 years ago. Neighbors are sharing the labor in order to keep up with the demands of work and animal husbandry. Ms. Merryshow had indeed heard of aquaponics and indicated she believed this would be a very interesting and beneficial system, but was at that time unaware of any training available. This festival provided me with a good view of the role the government, community and individuals placed upon its food traditions, under-nutrition trends, and how this view could possibly be receptive to aquaponics.

During my conversation with Marcia Cameron, who I must note also chaired the then newly established Steering Committee to create a food security action plan, noted the positive shift toward securing food resources. She indicated that people wanted to move away from still lingering plantation ideology; the negative remains of this are the young do not value agriculture as a career choice. This theme, reinforced through several local conversations and in the Discussion Group notes in 2016, where the youth in Grenada view

the elder farmers as “worn, thin and struggling” and do not wish this for themselves. Instead, they are seeking less physically strenuous jobs that lean toward technology fields.

Cameron’s mention of a lingering plantation ideology raises the question of how Grenadians view themselves, and how they formulated their identity from this past, and its reflection upon the present.

This lingering tie to plantation memory was vividly illustrated in May of 2016 during a tour of Belmont Estates, a leading agri-tourism business located in the mountains that had just celebrated revealing its new rebranded corporate logo. This occasion was highlighted in *The Grenadian Voice*, a local supermarket newspaper (*Grenadian Voice*: Vol 36; No 17: 15. April 22, 2016) Belmont is a cocoa bean producer, and recipient of numerous regional and international awards for recognition of heritage, eco-tourism, environmental and resilience efforts. The article, *Belmont Estate unveils new logo*, explained the images of the new logo; the intertwining of two cocoa pods within their prominent bell symbol. The bell hangs from a tree on the property, a remnant of plantation days when slaves were called to work by the ringing of the bell. The new logo is described this way;

“The bell’s ringer was omitted intentionally as the ringer suggests that the bell is in use. Given that the plantation is no longer occupied by slaves, its absence is appropriate.” Further, the “second part of the logo adopts the shape of the cross-section of a cocoa pod.

Its imperfect shape is a symbol of time, representing the many different moments the Estate has undergone



Figure 16 Belmont Estate logo

some form of transition. From its ownership by different aristocrats to the abolition of slavery; from the purchase of the Estate by Norbert and Lyris Nyack and to its rebuilding following the devastating passage of Hurricane Ivan."

This article points out how this commitment to never forget its origins, and reveals who they are, what they stand for, and what they value.

A second article in the same paper, *Stage Set for Maroon Festival this weekend* is another example of a community revealing how it celebrates its heritage. This annual event includes music, food, and performances providing "the importance of...sustaining the island's culture...and that the festival is one which seeks the interest and welfare of the natives." To further understand what the name meant, I reflected upon a conversation I had with Denyse Ogilvie, a local woman who is heavily involved in her permaculture movement called People in Action. Invited to her home one day, she told me who the maroon community is.

"Maroon is the community together, eking out a living. It began in Carriacou, its people known as Carriacouans, who were boat builders. Their vessels were called kayaks. The actual event celebrates collectively working together on a project, like the barn raisings of the past. This celebration began during harvest season, in a Catholic setting, and told the story of reaping and storing. Locals also have

Figure 17 Grenadian Voice Newspaper



the 'lego season', where it let go animals to graze anywhere in the dry season. This was how they celebrated annually, sharing smoked foods and prayer traditions to end the dry season. Ogilvie pointed out, "It is great for tourists who do not want staged productions; show us how your ancestors gave it!"

From slavery to sustainability, each story illustrates deep, lasting memories. These conversations focused on grassroots cultural identity and its link to food culture where traditions are embedded. This was an important part of evaluating the Grenadian food culture and helped to determine how deeper linkages to food customs, agriculture and fishing livelihoods live in memory. The sharing of this past is a refilling of memory, a continuation in the creation of cultural identity, through the passing of privileged knowledge and stories. This tradition is "crucial to the excavation of the region's submerged histories" (Ashi-Nikoi 2007:6). The maroon community celebrates its food traditions against a changing landscape being absorbed by tourism that turns once public waterfront into private resorts, contributing to limiting a coastal community's natural food resource access, and thereby challenging its cultural sustainability.

At the Delmarva Folklife Project represents a similar case where fishermen faced the challenge of how to earn a living fishing while remaining in their community. The issue of human security is one of the characteristics the United Nations defines as "protection from sudden and hurtful disruptions in the patterns of daily life" (United Nations 1994:23) In this case; the influx of the elite new residents, and changing environmental factors including nutrient pollution had reduced seafood harvests. The region had hurried to meet development of hotels and waterfront condominiums which economically disadvantaged the local community, but most similarly began disconnecting the local community from its natural resources. A fisherman asked Feltault, "How are you going to preserve my culture

if you don't save my right and ability to fish?" This discourse further illustrated two models in modernization theory:

"Two models within modernization theory stand out as epitomizing the culture versus development dichotomy: W.W. Rostow's five stages of growth and Arthur Lewis's dual economy theory (Rostow [1960] 2003; Escobar1995). Rostow's theory argues that all societies progress along a five-stage linear path to growth and modernization—traditional, preconditions to takeoff, takeoff, maturity, and mass consumption. The characteristics of a traditional society –limited economic production due to lack of science and technology, kin-ordered, fatalist, agriculturally-based – must change to allow for growth" (Feltault 2006:97). The summary of Feltault's work reflected how culture is somehow viewed as backward, or a roadblock to progress. The traditional knowledge that allows for individual autonomy in food resourcing along Grenadian shores may, in this case, not be as threatened by development per se, but by the waste dumping, eco-threatening activities and unfamiliarity with ecological processes. These stresses damage the very habitat needed to allow shoreline food access. Programming and training that provides education about the value of this natural ecological asset that is rooted in the community's food and occupational traditions is part of the imperative of culturally sustainable food practices that measures the practices that best support them.

Section 13: Fisheries

Grenada has its long history of skilled fishermen with ancestral training. I wanted to form a relationship with their Fisheries officer, and gain a broader understanding of their impact at the community level. On May 31, 2012, I met Mr. Justin Rennie, Chief Fisheries Officer at Grand Anse. Background was provided regarding my role at the time with

Wisconsin Lutheran College and our collaboration with SGU, and with Dr. Steve Nimrod, with whom Mr. Rennie is acquainted. I explained I was not there on any official capacity, but as a student interested in the nutritional and cultural aspect of fish in the Grenadian diet, and the impact those overfishing, environmental challenges and other threats imposed upon a fishing livelihood.

Mr. Rennie pointed out that the challenges to the relative health of the Caribbean coral reef are complex, and therefore difficult to pinpoint. He mentioned various topics; for example, that the Amazon River flows into the Atlantic and as such has an effect on Grenada, as it does Trinidad. Grenada has developed a branding in fish markets; it is regarded as the Yellow Fin Tuna Island. The US and Japan both desire in particular to import this fish species. The proximity of Grenada to the US is ideal in regards to costs and storage considerations in getting fresh fish to the US market in best condition in 2-3 days. This is not as true with Japan, considerably further. Japan focuses on the fishing industry in Grenada by earmarking Grenada for development. The Grenadian Fisheries cooperates with the EU, Canada, and China in efforts toward developing human resources and training. A relationship with Japan is an engagement that began over 30 years ago, working toward capacity building and structures, which enhance the fish market.

Grenada complies with a quality Program Standards Training; this provides Grenada with a level of desirability in trade. Grenada is a multi-species island; the coastal pelagic are varied, provide affordability and good nutrition options for locals.⁷

⁷ Fish provides protein and health benefits from Omega oils. However, addressing health concerns about the fish contaminated by waste dumping, specifically about Ciguatera Toxin, Rennie said he was aware of this problem but that it is located more in the northern Indies like in Puerto Rico, not the Windward Islands. He has only heard of 3-4 cases in the last year. When I mentioned that the CDC website cautions tourists in Grenada, and that the barracuda is at the top of the list, he implied that is not eaten much here. He indicated

I suggested that the topic of small-scale aquaponics could be advantageous because of the favorable climate, knowledge of fishermen, no import regulations, low cost to implement on a small scale, and it has potential to provide an option for additional income and eco-tourism, Mr. Rennie countered by referring to some *larger aquaculture* attempts.⁸ He said they had failure not because of lack of technical training, but because of economies of scale. It was not a question of technology but of economics. Larger operations must be subsidized; the entire Caribbean has seen the same result. He said the largest expense was energy, followed by the cost of feed. When lower cost feed was looked at, the concern was it would compromise the end product in terms of quality in product. (Nutritional value) The centers in Guyana, Belize and Jamaica, plus some in Trinidad, had all made attempts and found the same result. He mentioned CITES; an organization that deals with controls and trade. The restrictions on trade can allow for recovery of species that are overfished. The EU is using a process of requiring catches to be legally caught, by vessels that are registered and licensed, and that they operate with the appropriate gear and equipment. This in and of itself helps recovery of specific fish.

The production of fingerlings was an additional obstacle.⁹ FAO looked at a centralized location in the Caribbean for a provider of fingerlings that would make obtaining them more reasonable and provide the most commonly appreciated species. However, ‘as we are islands, transport is expensive by boat or air,’ and this presents an obstacle. One island is not going to bear the cost of all the production only to find importation costs prohibit the feasibility.

that if the fishermen travel far to the north for their catches, then he could see that being the case as Ciguatera is found in the largest species.

⁸ Note the distinction between Aquaponics and Aquaculture; the first being small-scale, while the latter is large capacity production requiring huge investments in equipment, training, land, capital and regulation.

⁹ *Fingerlings* are infantile fish typically purchased for any aquaponics system.

Mr. Rennie agreed that in smaller scale, as I was suggesting, could work if targeting small groups. His key point was a transformative to my direction in terms of who should be key partners, because he vocalized a key component of the fishermen's culture:

"What we must understand that fishermen are *hunters* [emphasis added]. When in the past, following natural disasters for example, training was provided to fishermen as a skill toward other means of income earning, such as in agriculture or technical trades, the programs fail. Why? Because we must recognize *the mindset of a fisher is the hunt* [emphasis added]. Agriculture, even when it includes fish in it, will not be attractive for men who are accustomed to risk and enjoy being out there fishing every day, as they have been. I have not met a fisherman who was interested in agriculture as they are two entirely different mindsets, despite the fact that the synergy connection is food."

This singular statement shared during our conversation changed the direction I had anticipated for who to approach for partnership in coral reef ecology and food security. The fishermen (fisheries) performed far out to sea; their interests at a grassroots level would not be compatible with this project's goals. Learning this during the feasibility stage was crucial information. This helped me to realize that even when I thought I understood functioning concepts of organization, hearing this expression of fishermen identity from a local voice crystallized what should have been obvious, but had not been.

In conclusion, Mr. Rennie welcomed the idea of small-scale aquaponics in Grenada, but that the Fisheries Division has learned from the past that the fishermen are not likely to have any interest in it. Generations of divisions between agriculturalists and fishermen have inculcated traditions that would be at odds with island occupations; the Hunter nature that

is inherent in men of the sea is at odds with a system better utilized by those who embrace the Gatherer nature, one who lives for his enjoyment of soil, rather than sea.

Section 14. Effects of Severe Weather and Need for New Strategies

Members of the Small Island Developing States (SIDS) are particularly at risk for severe weather and its impacts upon food security. Damage to infrastructure and agricultural sectors have immediate effect upon small family farms and overall food security (FAO 2015). Individual farmers are less likely to have insurance against losses. Local people who fish from shore for daily nutritional needs are affected by near shore pollution following the disruption severe weather imposes. In order to reduce the vulnerability of fish resource loss, the effort to preserve coral reef ecology requires a comprehensive strategy.

Compounding these problems, Grenada was confronted in 2004 with Category 5 Hurricane Ivan followed by Hurricane Emily in 2005, resulting in both short and long-term destructive forces upon its agricultural and marine ecosystems. Prior to this weather event, it was second only to Indonesia in nutmeg production. The loss of 90% of its nutmeg trees has led to a crisis in its agriculture sector. The Caribbean Agriculture Research and Development Institute (CARDI) reported aging farming population combined with a defection from agriculture into the tourist service industry, agriculture employs 24% of the population contributing 5.4% to Grenada's GDP in 2009 (CARDI 2009). The CARDI strategic mandates include protection of natural resources, and deployment of science, technology and innovation to contribute to food security. Under this proposal, they support the

introduction of protected agriculture and biotechnology development, the utilization of human resource capacity, and building of stakeholder relationships. The CARDI emerging objectives include the development of new agriculture technologies including meeting the needs of a better-informed public that is health-conscious and concerned about environmental sustainability (CARDI 2014-2016).

The Grenadian government and its people have established careful and targeted goals to rebuild agriculture and its importance to tourism segments but experiences challenges due to a lack of consistent program funding. Consistently, my search for relevant reports from all governmental agencies and programming in Grenada published only as recent as 2008, or it later, omit updated data.

The FAO identified inclusive growth – that which focuses upon assisting those with meager assets to learn new skills as important in alleviating hunger and malnutrition. To manage and cut risks improving productivity that allows small landholders or rural families access to methods of better nutrition are part of the FAO key findings for social protection. This goal matches well with the goals of the aquaponics program started in 2015 by WLC.

Section 15: Interview with Dr. Steven Nimrod, PhD

My first meeting with Steven Nimrod occurred in 2012 as a recommendation through meeting Dr. Clare Morrall, Marine Biologist at St. George University (SGU) campus. Both biologists teach at SGU, and have expressed passionate care about coral reef ecology.

I had the opportunity to meet with Dr. Nimrod again this May. He brought two of his interns along to sit and talk at a picnic table along the beach. I reminded him of how fortunate I had been to accompany him in during the week of my visit in 2012 to the MPA

Community Awareness Event, held by the Fisheries Division of the MOA, in collaboration with the North West Development Organization. I had attended the last day, at Dragons Bay, just north of the city of St. Georges on the leeward side. The free educational event included a ride aboard a glass bottom boat for children and their families living in the coastal villages of Grand Mal, Moliniere, Happy Hill, Beausejour and Brizan.

I am including the informal interview information as background to my relationship with Dr. Nimrod and its relevance to our interview in 2016.

Section 16: 2012 INTERVIEWS at MPA EVENT

The setting at Dragons Bay had no physical buildings or facilities; upon arrival, folks sat in white plastic chairs near to the bay. There had been an educational video on a portable screen anchored between two trees, with amplifiers hung high in strategic trees. The video showed the variety of animal life in the sea, and was followed by a musical group that had composed a song that promoted sustainability in a Caribbean steel band genre that was highly contagious for a sing along.

It was in this setting where I made some observations about demographics; there were of a good variety of ages, with an even distribution of males and females. I began my interviews in a casual manner, without notepaper and pen, simply saying hello while asking if they planned to go on the tour, had they heard of the MPA before, and what their initial thoughts were. Everyone I approached was kind and most willing to share some information.

Having watched several tours go out on the boat, I joined one boat tour, of which the majority of guests were youth under the age of approximately 8 years of age, a few women and one couple with an infant perhaps six months old.

One woman, approximately in her mid-twenties, was asked what type of fish she ate; she said a small fish called sprat, jack, marlin, crawfish, crab, sea eggs and snail "*brigo*." She prepared them many ways; frying, boiling for broth or gravy, or barbequed. She noted she did eat chicken but believes fish is better for you than chicken due to less fat. I asked if she knew of any health concerns when selecting fish. She replied sometimes at the Fish Market they are too bloody or smelled bloody, or they had a bad texture, or seemed they had been out in the sun for too long. These she would avoid, but this did not present itself as a common problem. Her husband did most of the fishing, bringing home whatever comes from the sea. They did not fish for any one type of fish, as she said they 'will eat anything.' She said the men who bring fish to market use large nets. When I asked if she knows what harms the MPA, she was not sure, but then offered it had something to do with the coral. She expressed some fear about getting in the boat, as she did not swim. She confirmed for me that many people on Grenada do not swim; they are not afraid to play along the water's edge, but most do not receive training to go swimming. Following the boat ride, she said she really enjoyed seeing the fish. I observed her husband during the trip and he was smiling and seemed very pleased also, holding his son near the viewing boxes for a while. Another young woman, approximately 21, was asked what she understood the MPA is protecting. She was not sure but she offered that many people do know. She said she did not swim- that most Grenadians do not- and that she only goes along the shore. She did not eat fish often 'because it is very, very expensive' in the grocery or market.

A young woman, 15 years old, said she knew they were protecting the area, but did not know what actually damaged it. She said she ate fish about two times a week that her uncle would catch. She thought it was snapper or grunt fish. She herself had never fished; she said mostly the men do the fishing. Her second favorite food to eat was chicken.

A woman in her twenties expressed how surprised she was at the different types of fish she had seen. She did not know the fish types she eats, which was about once a week. She did not have someone who fished for her, and to buy fish was too expensive. She likes a fish she called *Oceango*. I asked her if she had ever heard of aquaponics; she had heard of it in the States but that no one she knew did it in Grenada. She also mentioned that she did not swim, and was afraid of what was in the sea. After Hurricane Ivan, she mentioned that fishing dropped off for a while as people had to spend time rebuilding, but otherwise men go fishing every day.



A woman approximately 30 years of age told me she ate fish three times a week. She eats different types, not one type. Her husband did not catch the fish; he got it from a boat each day, and that the fishermen use lines. She indicated the price for market fish averages \$5-6 EU per pound. She said the wife does not get the fish. I asked if she had heard of aquaponics; she said no not by name, but she knew of the process; her husband works for the MPA. For herself, she does not eat any fish with scales and fins. She said this was for religious purposes; she was a Seventh Day Adventist, and that her belief is scripture based;

we are not to eat the bottom feeders. She said people do not understand this-that crustaceans eat bad things. While we were talking, she was eating a fish bowl and feeding it to her two-year-old daughter. She said a fish dish like this would usually be snapper with the bone in, a dumpling made with flour, salt and water made tough, some green banana, carrot, yam or okra. The men usually made the broth in the home.

Another woman, about 50 years of age, told me she ate fish two times a month. When I expressed surprise at this, she told me she just prefers chicken, even though she lived near the sea. When she ate fish, she preferred Flying Fish, but as it is seasonal, this limits availability. I asked if, when growing up if her family taught that fish was a good source of nutrition. She expressed only having learned about nutritional values when she went to secondary school. She agreed most do not know the names of fish that are around in the sea, even though they are an island people; when they learn of fish it is as an animal, as one learns there are cows or pigs, but there is no formal instruction about the different types. She then informed me that this is something of which she is very acquainted, as she had been a teacher for 31 years. Her explanation was that people would only learn about the types of fish by accident, as they go along. She expressed that in the last 20 years the teaching, nutritional value of food was being taught in the primary schools, from pre-school on up.¹⁰ During this time, an announcement was made over the loudspeaker by Roland Bolero, of the MPA. He introduced the purpose of the invitation was to help them become aware of what the MPA is doing, and why, and how they might benefit from it. The area, Dragon Bay, was protected with the hopes that it would be good for Grenada; he indicated an increase in tourism, citing 13,000 tourists had come to snorkel and dive in these waters

¹⁰ Coral reef conservation concepts had promotion throughout the Grenadines in primary schools during The National Fish and Wildlife Foundation and the UNEP Caribbean Environmental Programme in association with The Sustainable Grenadines Project of 2004-2009. Twenty-four teachers took training in environmental education.

in the last seven months. He wanted the area residents to benefit from this positive increase. He encouraged interest in what lies in the reef could spark a desire in youth toward a career one day, and perhaps provide an alternative livelihood. Continuing, he stressed the MPA belongs not to the government but to the



Figure 20 Dragons Bay info sharing

people, and that protecting the reef was in effect protecting Grenadians. He wanted that they recognize that climate change was really happening. He closed by playing a music video to share the message.

Figure 19 MPA Glass bottom boat tours



The video was shown on the portable screen, and the music was upbeat and very enjoyable. The refrain of the song was, '*...it doesn't matter, where it is now, climate change, is happening now.*' Within the text of the song were phrases mentioning '*we're losing our beaches constantly...greenhouse gases in the atmosphere....severe flooding....longer droughts...that's what climate change is all about.*'

The event, scheduled to run three hours, was well attended and the hosts had to

turn families away. I counted 150 guests. Dr.

Steve Nimrod expressed the attendance was certainly positive.



Figure 21 Human forms at Underwater Sculpture Park

In summary, the most compelling information was confirming that local people not learn to swim. The assumption that

islanders know what lies under the sea was an

outsider's error; in truth, a different approach is necessary to bring a culture to value what it has never seen. It begs the question how can you protect from harm what you have not seen. How do you teach to value the fish that one never sees on their table? How can you substantiate something diminishing when it is not on the radar of the common experience? How does one impress upon the daily fishermen that dropping his anchor into the sea is harming the corals he may not know is a living, viable part of the delicate balance of nature? This confirmed how events of this type are crucial to community awareness and meeting the targeted goals of sustainability, and I wanted to address the progress the MPA was having with their community awareness events.

Nimrod believes that the single greatest exposure came from the addition of the Underwater Sculpture Park,¹¹ located at Dragons Bay. When Hurricane Lenny hit in 1999, Nimrod witnessed storm surges at 30', hitting right where we sat for our interview. The extreme weather caused brain corals the size of humans to roll like bowling balls over the campus. It was an unprecedented situation – roads were covered with water; no one could

¹¹ The Underwater Sculpture Park is a non-profit volunteer-based group endorsed by the Grenada Board of Tourism. Made of concrete, human forms are of local Grenadians, submerged underwater, creating an ideal substrate for new coral growth. <http://grenadaunderwatersculpture.com/>

get petro (gas). The park attracts snorkelers to view a vast array of human forms, and other culturally informative forms, along the ocean floor where new coral growth occurs. This helped expose the issue on a global level, where everyone became aware of its location and that an effort for conservation was under way.

The MPA since 2012 runs summer camps for children for three weeks in July. It is in the pilot stage now, adjacent to the MPA areas; there is no charge for the students. They also have a Reef Guardian Farmers group that teaches older groups working with pigs to understand how to avoid agricultural run-off. He found charts, posters, models and live specimens in aquariums helped reinforce the messages. His interns were working on a Junior Rangers Program; the students receive training in nature and environmental education, scuba ethics, and leadership skills. The funding is not consistent, but has the support from the Nature Conservancy's Eastern Caribbean Marine MPA Network, and the Fisheries Division.

I related to him the interviews where people talked about not swimming, and I asked him to explain. He confirmed that it is a matter of safety. Slowly, he believes, they are "breaking into it," the idea of the pleasure aspect. He addressed that fishermen were the ones in most cases to be able to afford equipment, like spears (in the event of shark or barracuda), or goggles. Gear for the sake of pleasure simply would not occur to the average Grenadian. Further, he said that if a Grenadian were to see a fish, his first response would be, "Wow, that's a big fish to eat!", rather than the concept of just viewing them for pleasure. He added that the few who do any snorkeling are usually doing the fishing. They often use nets, and some fishermen are aware of using the regulation size nets that allow the smaller fish to escape, while others are not aware. Pulling the nets over sensitive areas over seagrass and coral beds was a greater concern.

Dr. Nimrod confirmed that since 2012 the community at large does not understand what the protected areas are for, and how it might relate to food security. He believed that the most effective tools for teaching young and old was through outdoor events, rather than a formal setting, or at desks. In this way, they can become comfortable with the setting. He felt that the aim was to work with the young; that the elders “may be a lost generation, too old and set in their ways.” In this effort to capture the young, they also hope to have students make a progression into marine sector jobs.

Finally, Nimrod expressed that the aquaponics program at Grace was a positive part of community outreach into the arena of teaching about ecology and sustainability. It was clear that he and his interns were actively at work with programming that was moving in the right direction. As I mentioned the WLC marketing team was seeking input, he added, “The plunderers of the sea tend to be the lower economic class, so to capture them is important.”

Section 17 CONCLUSION

Food security governance is high on the agendas of global and national institutions, political economic and social policy makers, and powerful elites. Much of their management strategies are short-term, self-serving and ignore associated social, cultural, and environmental factors. If we are to prevent irreparable damage to the environment and address food security and inequities, and begin solving diet induced health issues, we need a more holistic and ecologically sound approach to the production, distribution, and consumption of food. Fortunately, community-led responses to food security and loss of food sovereignty are attempting to address these issues at the local level, and offering hope for the future. Processes of resource management need to be at the local level, managed by those with lived experience in *that* land (Food Studies 2015).

The WLC aquaponics project in Grenada is setting the example of joining academic research with community-led responses that can ignite fresh interest in science and

technology into the agricultural sector for Grenadian youth, while reinforcing the sharing of traditional knowledge by its elders. Moving from a place of disempowered import-dependency toward holistic and organic natural food resources enlivens a community to support natural resource preservation, allowing historic fishing traditions with sustainable practices, and increasing food security. Based upon the continued volunteer interest at the Grace Aquaponics lab, and with the establishment of two community-driven aquaponics systems (PIA/Her Majesty's Prison) that are productive and garnering further community interest, optimism is high.

The definition of community begins with how we define ourselves. The Grenadian community presented itself to me as one with close kinship ties that link back to a tribal nature. It is one that expresses, as primary importance, the respect and recognition for one another at all levels of society, and it seeks to share in the burden of satisfying its basic needs. It also enjoys its liberty of freedom of movement, speech and independence and enjoys the opportunity to be involved in collective planning that enhances its assets; and appreciates the gaining of knowledge when hardships otherwise limit its access. Above all, my interactions with all Grenadians included kindness, the enjoyment of a good laugh, and everyone was patient with me. They appreciated our approach; to ask first; to extend an offer to share our blessings with others as servants of Christ; to seek how to best maneuver in a culture that is unique from ours, so that we might not inadvertently offend. They asked we recognize their aspirational hopes for themselves and their children, through seeking entrepreneurial opportunity in an aquaponic endeavor, but to recognize that most are not in a position to take even minor risk.

What I observed on this last trip is that Grace and Kingdom Workers are committed to becoming a future certification training facility, overcoming a major infrastructure goal

that is currently lacking elsewhere on the island. Their location does present one limitation for the agricultural community who will most likely seek training: meeting the need for provided transportation and incentives to attend.

During a marketing meeting I attended with Kingdom Workers and the WLC Business (and marketing) group at the Grenadian National Training Center (GNTC), the GNTC expressed having the Grace facility available would be a positive addition toward enabling future job training. The GNRC expressed it is seeking to establish a relationship with the Grace/Kingdom Workers/WLC project to develop a template for training, assessment, and verifiers that lead to completion of Certification in Aquaponics that can contribute tiered skills that are transportable within the CARICOM community. The next phase of development, providing a new public education awareness campaign, aligns with the Grenadian government National Protected Areas System Capacity Development Plan (July 2007) to integrate a curriculum into secondary schools, and to identify audiences in the general populace that seeks training in new enterprises. These partnership development meetings with the local businesses and development sector are providing pathways toward meeting Grenadian community development, educational and economical goals.

However, there was one obvious omission during these meetings of which I observed - the absence of any of the local aquaponics participants from Grace. Exhibiting actions more guided by a Western philosophy that moves with corporate swiftness, they missed an important cultural cue; the indigenous perspective that seeks first to build upon social and contextual realities necessary to preserving dignity, manifested in inclusion, and by recognizing shared governance of the project from its inception. The absence of these key people, the ones who invested and took ownership in the project from its beginning, illustrated that lessons of inclusion were being ignored. If the bottom-up approach is to be

practiced, the grassroots presence must be mandatory during all the processes of ownership and future development.

Block noted that customary governmental approaches center in a push for more legislation or regulation, or to profess the need for more funding for more programming, or as he stated so well, “the argument for monarchy”, something Grenadians are well acquainted. He points out one usual corporate approach to fixing problems is applying their leadership structure upon a community in attempts to solve its social needs. This process of thinking does not recognize that it operates by omission; it marginalizes the transformative works of public compassion, where community generosity is not motivated by that structure, and does not view its own process as a liability. Partnerships with people who are meant to be the recipient of project development are at the outset disadvantaged in the scales of influence. As my two heroes of cultural sustainability Block and McKnight promote, it is local people, armed with new tools, which want to solve local problems without a big system fix. Local people should be involved in the planning for what works best within their community. Those who may be timid in their ability to contribute will still learn by observation about how community structures operate that affect them. We should not dismiss even the few voices that express areas of concern, cultural conflict or disappointment. Investing in long-term relationships requires an establishment of trust, and I believe all the partners began well. We must maintain transparency and a balance of shared interest so that those who are striving toward that level of power are not disenfranchised by a sense of loss of appreciation, or unequal representation at the table of future planning.

PART II: REFLECTION

I have come a long way on this journey into practicing cultural sustainability within a community. Like many philanthropic, academic and church organizations before me, I started with an idea that rested in “doing good” by providing a pathway to build community capital through sharing new technologies that could help build resiliency against food insecurity. What I learned in the MACS program mimicked this adventure; that this endeavor was at once both simple and complex; and that it began with basic principles and evolved into more complex layers of understanding. In order to sort this reflection into its final potential as a paper that can serve to inform future projects, I begin in the first section with what I believe worked well, and was supported by individual conversations or surveys. In the second section, I will address key themes and issues that present challenges, and hopes for the project moving forward.

Key Frameworks with positive contributions

1. Fieldwork: Initial Community Contacts

Though I began my first exploration into the culture of Grenada in 2012 as a novice without cultural sustainability skills, the ability to think broadly enough to gather information from a diverse sampling of the community at a grassroots level was important. I balanced my list of who to inform me by seeking random folks as I navigated the area, to scheduled appointments with agencies that might expand my understanding of the community. My early affiliation as a student at WLC associated me with the biology research team, able to demonstrate knowledge about shoreline ecology. It also allowed me to be independent by framing further inquiry along my interest in cultural food traditions and related food security. During my first conversation with the Fisheries Officer Mr.

Rennie, his insights regarding the local fisherman's perspective about who is best to approach for interest in coastal fishing and food security was critical. Though it may seem obvious to approach the agricultural community, my focus at that point had been through the lens of the biology department where coral reef studies originated. Later, as I moved about in community events, speaking with many people I began to receive suggestions from the grassroots level as to whom I might meet with in the future. This created a chain of associations, invitations and exposure that I could not have easily achieved without being there, and those links expanded the potential to broaden inclusion. This initial visit also afforded me time to learn about social relations and structure, and to discover individuals who might find interest in food security issues. Block, in evaluating successful leaders and entrepreneurs in social innovation projects found slow-growth and small scale were part of a model that could become sustainable (Block 2008:27). So initially, and what had importance later, was that I was an outsider with time to spend informally asking questions, seeking local ideas about food security and ecology, and hearing the voices from people at the grassroots level.

2. **Framework & Context**

By 2015 when WLC decided to move forward with its pilot aquaponics project, the few graduate courses I had at that point alerted me to the complexity of cultural sustainability methodologies. The community would look at the project from its own vantage point. Understanding the community identity was critical, and is one that continues to evolve over time. It is shaped by its past; has evolved *from* its past; and its present is affected by its current characteristics like race, religion, relations to power, economic position, and the forces of nature upon its environment. How communities define

themselves and how outsiders perceive them differ depending on context, and in this particular study, the context was located within the proximity of a rural religious community.

Grenadians understand being vulnerable. They have experienced it through their political and economic history, and through their exposure to severe weather. The topic of food security, framed within the relationship to resiliency, speaks to achieving well-being. Yet because of powerful storytelling traditions that prevent acceptance of swimming, Grenadians do not witness an early warning system about threats to their food catching traditions. Introduction to aquaponics within this context was of interest to them because it speaks to the benefit of good stewardship of their own natural resources upon which they depend.

3. Discussion Group format

An exit survey after the 2015 discussion groups and during the administration of the 2016 survey I was able to answer key questions about whether or not the format I used was equitable and a positive experience for attendees. In both surveys, the majority of people expressed full satisfaction that they had voice within the groups through their ability to collectively rank what they valued would ensure their resiliency and food security. Use of ground rules was confirmed as appreciated, and also revealed more about what the community itself thought were ways of satisfying their expressed need for equity. The gradient of positive impact was a low initial expectation for attendance, progressing toward actual high attendance in both discussion groups and at the workshops. People expressed their appreciation for “coming together” as a way to increase their social capital.

4. 2016 Return Survey Evaluation

Though the surveys were not a particularly useful tool in terms of quantitative data in 2016, it did open doors for confidential discussions that would serve me in the final analysis of how the project was accepted, or how it had changed in the eyes of the community involved with it. In relation to my capstone goals, it provided a two-fold benefit; I became a consistent presence within the community that associated me with WLC, yet I was outside its daily operation that was governed by Grace/Kingdom Workers. My earlier arrival was remembered and characterized by the positive rapport I established with each subsequent meeting. As I began this paper it originated with incomplete cultural sustainability skills, it did not have the potential to adequately become an ethnographic analysis. However, just as ethnography is about relationship, the rapport I established positioned me to hear more deeply about the views of the project perceived as an outsider of sorts, or at least perceived as less aligned because of my initial presence as a student.

Section 18: Key Themes and Issues to Address Going Forward: Inclusion, Exclusion and Power & Importance of Community Voice

Inclusion vs. exclusion

Indicators of success are things we can see, measure and document that provide a project with outcomes to evaluate whether the project is meeting its intended goals. The initial goal of this project was to incorporate involvement from a bottom-up approach within the community. The processes within cultural sustainability teach us to be inclusive, to be cognizant of those who may feel marginalized by various vulnerabilities, and to monitor that

decision-making as shared so that relations between the academic/scientific community and the local community are equally expressed.

Perhaps the single most poignant illustration of how *exclusion* manifested itself was how the volunteers who were closely associated with the aquaponics lab responded to changes that occurred without their being represented in the decision making process. This was expressed to me by several individuals while sitting with them taking their survey, or in general conversations while at Grace. They pointed to the recent occasion of the aquaponics lab having been fenced in with a locked entry door, with the key not freely available to the volunteers. Most important to them was that the volunteers were not given a role in that decision. Though the need for the lock could have been due to safety measures (being situated right within the playground area) or as security from tampering, people shared their concerns with each other, and me, how the locked access violated their feelings of project ownership. The exclusion of local community members with the imposition of locked access suggests a business model that focuses only on product development and does not account for community-based and cultural-based context, which is what I argue for in this paper. It represented the division of power, and who determined who was within that power structure. This discourse of insensitivity to the local voice and its ownership of the project speaks to patterns of top-down approaches that ignored that the community was initially approached to be a stakeholder. Community members demonstrated their understanding and embracing of that concept through the personal sacrifices made to attend training, active participation in the aquaponics construction, innovation, and daily maintenance. This issue, identified by the community, illustrates that our roles as joint stakeholders means we must seek to continually monitor our outsider

views so that we avoid the disconnections that occur when our lenses are shaped within different experiences of power.

I believe I have witnessed two diametrically opposed examples of “voice.” The first is how top-down approaches have served to diminish the voice of those who are marginalized. The second is the curious way that those who fall into that marginalized group rally through the use of gossip, which they explained to me is “just talk”, which is the sharing of what they perceive amongst themselves is really going on. This last example has a power of its own which I believe must be recognized by outsiders who intend for good, but face the inevitable possibility, through dismissing the importance of culture, the realization that this voice has power as well. That power includes the ability to self-determine a severing of partnership; and as they were not invited to the table to discuss the criteria that led to this severing, they may choose not to share how that will adversely affect the project’s future through their own use of inter-community voice.

The Community Voice

Just as I was completing this paper, I received a phone call from an important person in Grenada. The caller began by wishing to inform me of a serious matter that had begun within the Grace/Kingdom Workers aquaponics community. The details I will refrain from sharing, but the context serves as a vivid illustration of what I described in the previous paragraph.

Over the course of the next half hour, employing the same strategy that the Royal Grenadian Police used, I listened to the story unfold. Afterward, I asked questions that would allow further explanation. What was important was that as the events unfolded, the caller indicated this was an example of how the project “was no longer positive.” The

person expressed that outsiders had come in, involved people and then after gaining their trust, used them. People had been “pushed aside.” Finally, the caller concluded by adding, “It is disgraceful.”

I asked the caller why the call came to me rather than the direct parties involved. It was explained as because I was viewed, in their words, “as a neutral party,” and that I had asked to be kept informed about how the project was doing.

My association with WLC, and the caller’s lobbying my involvement, actually precludes my being neutral, however the disclosure was an indicator of my role as perceived by the community. The best I could do, as an honest broker, was to relay the information as expressed to the appropriate person.

What communities like Grenada have is a component of community capital that is based upon shared history, kin relations, struggles, faith, and cultural values, and these have been their modes of sustainability. The cornerstone of trust begins with shared goals alongside acknowledgement of a difference of origins. Grenadians may live at levels of poverty, but they are rich in the recognition of individual honor. They may not all own a television or cell phone, but they communicate in an oral tradition that carries weight. As outsiders in their environment, our success relies upon realizing the importance of understanding the value of a community that values each other first.

Ultimately, integrating cultural sustainability methods into the process, we can demonstrate that environment and culture *are* interrelated. Focus on environmental sustainability or economic opportunity alone misses the human component that is in relationship with nature in specific practice. People sustain or harm their local environment by practices embedded in their culture. To change damaging practices (anchor dropping, net fishing) that threaten a component of environment that is unseen by the local

community requires a process that seeks to be inclusionary, and one that respects a culture first by demonstrating it during each aspect of a project's inception.

I am looking forward to illustrating the fact that one facet of cultural sustainability lies in its food security, and I want to assist in the ensuring of it within the alliances of both the scientific community and the local community. I do not have something to sell, but a process to share. I am wedded to the idea that some of the wisdom of being self-supporting and resilient within one's environment of local food harvesting also opens a door to sharing, personal growth and building community assets.

Section 19: 2016 PAST PARTICIPANT (DISCUSSION/WORKSHOP) SURVEY INTERVIEWS

With the best intentions to meet as many people as possible, island life rhythms can impede progress; transportation difficulty, limited phone access, and people being off-island limited my access. The surveys and interviews I obtained were fortunate, as they were from people who had been actively involved at Grace during most of the time since the discussion groups were held in 2015.

I met with ten individuals, all of whom had attended both the discussion group and the workshops. I was pleased to find that each person I asked to talk with expressed a genuine willingness. They presented themselves as having a stake, and an equity position that spoke to an investment in a collaborative effort toward the common good of the project.

I intended to measure their perspective from one point in time, last May, but what I learned was all of the respondents were more interested in sharing what they were

experiencing more recently. Further, my expectation was that after they filled in the survey, and I had a chance to review it, I would ask for an interview next. I did not expect that in each case the first question launched the person into extensive verbalization. I quickly had to adjust. Though the general survey questions were answered, it was the comments that the questions generated that were more informative.

The IRB process is designed to inform, reduce vulnerability, protect identity and maintain complete confidentiality. To ensure this clarity, at the start of our sitting together, I read aloud to each person all the forms. I was prepared with audio recording devices, which also had express limitations for the same confidentiality. Each survey or interview was held in a room with open doors and windows, in a public location, with the exception of a casual conversation that occurred during transportation in a vehicle.

The individual information, requiring confidentiality that would not expose their identity requires that I summarize the information. Where comments or suggestions were made by the surveyor or interviewee that involved the expression of unexpected or unintended consequences, they were delivered with careful choice of words.

1. Did attending the Discussion Group expose you to new information about coral reef preservation research in Grenada?

Several people already had knowledge of marine restoration and of aquaponics for years, and were in the process of beginning it on their own, mainly using internet resources. The appearance of WLC was a fortuitous event; they did enjoy learning, and were excited to have the opportunity to share it. Funding for any new educational offerings are not dependable, so the opportunity to learn from a credible source was great. A few did

express this in the discussion groups, but time and the pace during limited time did not allow for more sharing of their stages of interest or investment.

2. One year later, did the information presented in the discussion group change any of your actions that affect the relationship between shoreline fishing and coral reefs?

For those who did not necessarily have a science-centered life, this was very informative.

There are individuals that are actively involved in the promotion, training and investment in furthering aquaponics as a form of healthy eating, resiliency, and food security. They support people-centered growth, and hope that there is a continued effort to appreciate and support those who have invested in aquaponics outside of the Grace community.

3. Did the information presented change your understanding of sustainable food resources?

Most people felt that they had a good idea what sustainability means. They understood a connection was being made between poor fishing habits that damage the corals, but they had not adequately understood the coral reef connection. They expressed that this was very valuable, and have shared that information with others. They embraced that the Grace community would have a tool to reach out to the community, and share the good things that the church has brought thus far to the area.

4. Did participating in the workshop provide you with usable information about how to apply aquaponics in your own situation?

Overall, yes, they gained information. For some, their age made the actual application less probable, but there were concerns about how much thought went into the climate conditions, and the type of tanks being used. Evaporation is a big concern. They thought

the initial system was problematic, but did not feel their voice was heard. In addition, there was concern that the level of vocabulary used during the workshop was too academic for the average person. Though this was expressed directly, no change was made.

5. One year later, did your participation lead to becoming involved in spreading the word about aquaponics and/or fisheries issues?

Some went into the village; others invited people to the Grace aquaponics lab. They felt this was an excellent way to bring the community together. They understood the need to fence and screen the aquaponics lab, but limited access occurred when a locked door arrived without explanation. Those who were indicated as actively involved were found left out of decisions; this caused feelings of marginalization, and loss of ownership.

6. Are you more or less interested in fish health in Grenada?

100% responded affirmatively.

7. Is the ability to fish from shore an important part of Grenadian food culture?

100% responded affirmatively. A note that Grenadians do not like a soft fish meat texture; Tilapia is soft. Men are the fishers; women fear fish that bite. You may have to overcome those obstacles.

8. Has participation in the discussion group interested you in being a part of future community information events?

They hoped that all persons, inside or outside the Grace community, would be invited. A suggestion was made that transportation is a difficulty, so consideration should be made to

host the events in a proximity that is more accessible, and neutral. They asked that youth be a target for the next events. They would welcome other topics also.

9. During the discussion group, people identified food security issues and then ranked them. Did this process give you a fair way to express your ideas?

100% responded affirmatively. This was viewed too as an exercise in conflict resolution, which was perceived as a good exercise.

10. What would you recommend might be helpful for future community discussions?

Keep meeting not too long. Great to have groups come together to get to know one another more. Better to have these discussions in the community rather than at an institution. Be certain to include a wide cross-section of people. Conservation projects a desired topic.

11. Did you attend the workshop, for any time, the following week? How many times?

These persons attended nearly every day.

12. Were you inspired to build your own aquaponics system?

The impracticality of being in a warmer location would be a limitation. Age may deter some, seeing it for the young to pursue.

13. Are you interested in aquaponics as a form of raising food for yourself?

Most agreed yes, whether they grew them or bought them from someone else.

14. Over the last year, have you noticed people in your community becoming more aware of aquaponics or coral reef health? Where?

Some expressed a desire to be a part of a team, to see a project through to positive growth. They are concerned about interest being deterred by costs.

15. Has the introduction of aquaponics by WLC and its partners have any unintended effects that you are aware of?

I will be answering this as a summary in Section 18.

Section 20: SURVEY-INTERVIEW SUMMARY

There were several concerns as expressed by the survey-interviewees coming from a genuine interest that the aquaponics lab continue and be successful. However, there were expressions that can be summarized as *collective* concerns.

1. As the aquaponics project was presented as one that the community would learn, build, watch, and attend to as volunteers, this established the project aim of creating community ownership. Any commitments of time, evidence of progress, or occasions for praise or appreciation should be expressed toward the community; otherwise, the question of ownership, inclusion and voice becomes threatened. This should include the space within the Grace venue, and as it extends to the broader community through mass media opportunities, public statements, or social media.
2. For any individuals that participate, it must be assumed they have done so at some expense to themselves, so awareness of materials expense they absorb or supply should be recognized with reimbursement, or recognition.
3. Keep a balanced group of participants. There can be challenges as time progresses, but keep a watchful eye for inclusion of all economic, educational, gender, or social class participants so that perceptions do not form that the project belongs to one segment of

society. Periodic group meetings that afford an exchange of ideas would reinforce this extension of community inclusion.

4. A perception that the focus of who the project was for, and who was best suited to belong to it occurred when the goals of the aquaponics lab shifted from Grace to outside the Grace community. People noticed and questioned where the changes were coming from. They report that there are now only two individuals that are involved from Grace; they wonder how this is perceived outside. Does it mean failure, or does it mean progress without their ownership?

Addendum I: Aquaponics in Current Communities: Will Allen, Growing Power, Milwaukee, WI

In my preparations for the discussion group presentation, I wanted to illustrate an example of how aquaponics strengthened another community that faced food insecurity resulting from having lost traditional agricultural knowledge, and its reliance upon prepared foods. It further illustrated an example of the potential aquaponics has for the entrepreneurs. In Wisconsin, one man in particular gained national recognition as a leader in bringing aquaponics into the global sustainable food arena. Growing Power, a non-profit organization established in 1995 in Milwaukee, is spearheaded by Will Allen. His initial program involved inner city black youths in the restoration of a 2-acre greenhouse while providing training in community food systems.



Figure 22 Will Allen, Founder of Growing Power, Milwaukee, WI

Training includes “acid-digestion, anaerobic digestion for food waste, bio-phyto remediation and soil health, aquaculture closed-loop systems, vermiculture, small and large scale composting, urban agriculture, permaculture, food distribution, marketing, value-added product development, youth education, community engagement, participatory leadership development and project training.” (Allen 2014) Growing Power creates its own soil from composting millions of pounds of food waste from breweries, coffee companies and corporations. This partnership has changed the inner city landscape to a national example of global sustainable food systems, including aquaponics. In 2008 Allen was named a John T. and Katherine T. McArthur Foundation Fellow and received the Genius Award¹²; in 2010 Time Magazine chose him in their List of 100 World’s Most Influential People; he is member of the Clinton Global Initiative; he assisted First Lady Michelle Obama in launching “Let’s Move!”, her signature leadership program; and he authored *The Good Food Revolution* (2012). Allen is in final fundraising stage set to build the world’s first multimillion dollar five- story vertical garden building in Milwaukee (J. Hopkins 2012).

The system employed in Grenada began in 2015 as a NFT system, with improvements being employed to replace bamboo channels. Subsequently, in 2016, the system was being changed to a media-bed IBC system.

¹² Urban farmer Will Allen was named a MacArthur Fellow in 2008. The Fellowship is a \$500,000, no-strings-attached grant for individuals who have shown exceptional creativity in their work and the promise to do more. To read more, visit www.macfound.org



Figure 8 Aquaponic System at Grace as of June 2016



Figure 24 Newly fully enclosed lab as of June 2016

ADDENDUM II: Aquaponics Process, Illustration and Components

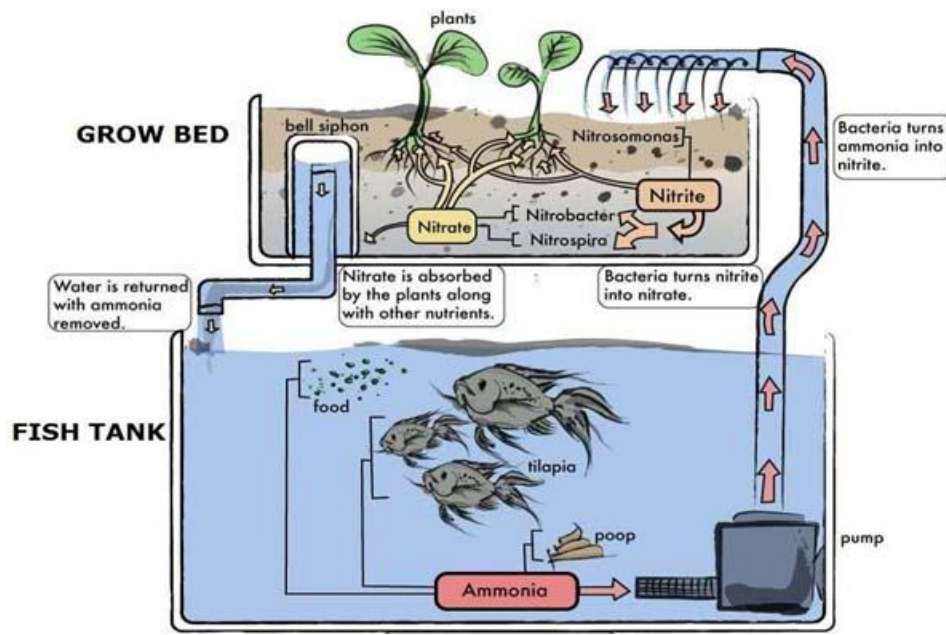


Figure 25 Illustration how aquaponics works

The benefit of using an aquaponics system is that it can provide fish and vegetables in a single system using minimal resources. An additional benefit for Grenadians is that its average high temperature range of 54-90°F January through December, with an average low temperature ranges of 30-70°F yearlong means additional heating of the water in the tanks is not necessary. Further, Grenada is a region with maximum natural light intensity and light duration, two desirable features for optimum plant growth. Tanks can be composed of plastic, vinyl, wood and rubber, or fiberglass. To adapt to the local island available resources, use of plastic barrel containers are a good choice that can be obtained for free, or very little cost, as they are a by-product waster from imported goods.

The food produced is free of pesticides and herbicides; the fish are raised in clean water and ready for consumption or as a marketed as a commodity. In this circulatory system, after the initial level of water needed for the quantity of fish in the tank, theoretically you should not need to replace the water, however in hot climates, efforts to reduce evaporation prevention is beneficial. In keeping with the sustainability philosophy,

the waste from the fish is actually a valuable commodity, which benefits the plants.

Vegetables grown are typically tomatoes, beans, cucumber, watercress, papayas, herbs and leafy lettuces. Generally the type of vegetable chosen should relate to which will generate the highest level of income per unit, or highest nutrient value to the grower/consumer. For example, in the UVI's commercial scale system, basil production was 11,000 pounds annually at a value of \$110,000 compared to Okra of 6,400 pounds annually at a value of

\$6,400 (James E. Rakocy November 2006).



Figure 26 Hydroponic Bibb lettuce

Production is staggered planning so that harvesting is regular. Bibb lettuce reaches market size 3 weeks after transplanting, Red Leaf Lettuce requires 4 weeks. The type of fish best suited for Aquaponics is

s hybrid Striped Bass, Red Tilapia and Nile Tilapia. Fish are high in protein, and potassium, and low in fat, calories and cholesterol. The Red Tilapia is reportedly most acceptable to the Caribbean palate (Nelson 2012).¹³ Tilapia has a short life cycle from hatching to harvest (from six to nine months), tolerate drastic fluctuations in the quality of the water, and they can withstand low oxygen levels for long periods.

There are generally three primary methods in the industry; raft, MFT and media-filled beds. A method is chosen based upon size of production goals (Nelson Pade 2012). The raft system, or float system, has plants growing on polystyrene boards (rafts) which float on water above the fish tank. Beneficial bacterial live throughout this system. Extra water volume is an added benefit to the fish, reducing potential water quality problems.

¹³ Tilapia is a white fish, light in texture and flavor. Nelson & Pade report experience in Haiti and Trinidad where tilapia variety is selected as it most resembles Red Snapper. Its origin is the Middle East or Africa. Tilapia is the fifth most consumed fish in the United States where ten years ago it was unknown.

The University of the Virgin Islands refined this method over 25 years of research.¹⁴

Systems are also available where electricity is not dependable, that make use of siphons and counterweights to continue flushing of the tanks during electricity losses.

The NFT, or Nutrient Film Technique, has plants growing in long channels where water is recycled to a separate fish tank. Plastic tubing transporting water is narrow, as a cost benefit for the distance the water travels to the multiple channels. This system is used in commercial applications, and would not be appropriate for small-scale use with limited space requirements.

The Media-Filled Bed system is part of the closed system, where all waste is broken down in the plant bed and re-circulated to the fish tank. Using fewer components, it is simple to operate, and suits most small-scale intentions.

Costs for initial systems can vary. A review of online resources show simple home systems begin around \$500.00 (U.S.) while commercial farming systems begin at \$1000.00 (U.S.) and can reach \$50,000 depending on site variables. Technical training and support, container purchases, palletizing, and shipping are additional investments highly variable to needs, location and goals.

After building the tank, buying the fish fingerlings, and plant seeds, there are three main inputs:

- Water
- Mode of Circulation

¹⁴ Early work in Aquaponics began with Barnaby Watten and Robert Busch in their article *Tropical Production of Tilapia (*Sarotherodon aurea*) and Tomatoes (*Lycopersicon esculentum*) in a small-scale recirculating water system*. *Aquaculture*, 41 (1984) p. 271-283. Elsevier Science Publishers. The University of the Virgin Islands has a Center for Marine and Environmental Studies (CMES) researching and providing education on nonpoint source pollution, marine debris, and coral reef monitoring and shoreline protection.

- Fish feed

Factors that relate to the economics of Aquaponics are varied. Supply and demand, fluctuating wholesale prices, capital and operating costs, supplies, and many other factors will vary final profits. In a review of another Caribbean production, the Virgin Islands, reports the following:

The U. S. Virgin Islands represent a small niche market with very high prices for fresh tilapia, lettuce and basil, as more than 95 percent of vegetable supplies and nearly 80 percent of fish supplies are imported... the break-even price for the aquaponic production of tilapia in the Virgin Islands is \$1.47/pound, compared to a sale price of \$2.50/pound. The break-even prices are \$6.15/case for lettuce (sale price \$20.00/case) and \$0.75/pound for basil (sale price \$10.00/pound). (James E. Rakocy November 2006)

ADDENDUM III: Aquaponics Systems in Caribbean: Nelson & Pade Interview

One example of bringing aquaponics to the Caribbean is in St. Louis de Nord, Haiti. Part of a program designed by Nelson & Pade, Inc. of Montello, Wisconsin,¹⁵ called the *Living Food Bank*; it was installed at the Northwest Haiti Christian Mission to provide fresh food for the people of northwest Haiti. The Mission was looking to supplement their food programs, hospital and nursing home, and orphanage where they are feeding 15,000 persons a day. They currently spend millions of dollars annually on imported foods, which arrive nutrient-poor from shipping. The system has a solar assist and backup generators, with the tanks situated inside a metal framed tropical greenhouse. Training for the system

¹⁵ Nelson and Pade have been leaders in Aquaponics and controlled environment agriculture for over twenty years. They partnered with the University of Wisconsin-Stevens Point in 2012 offering full semester courses for credit through their Biology Department.

was undertaken by the Christian Mission staff during three months at the Nelson & Pade Wisconsin facility. Nelson & Pade has designed aquaponics systems specifically for missions and social projects in developing countries, using minimal resources. The goal is to reduce the reliance on imported foods and introduce growing fresh, local foods of higher nutritional quality. A single greenhouse covers 4144 square feet and is capable of producing 27,500 heads of leafy green vegetables and 3500 pounds of fish every year. It is serving as a training facility for future systems throughout Haiti.

INTERVIEW WITH NELSON & PADE, 2012

I interviewed Rebecca Nelson and John Pade on August 24, 2012 at their facility following a tour. The facility was impeccably clean, with an emphasis on keeping bugs out, with boot and hand cleansing prior to entry to the greenhouse. Publishers of the Aquaponics Journal since 1997, at that time they recorded visitors to their facility from 26 countries and 49 states. John Pade explained, "This is a viable solution to traditional agriculture. This is the future of food on this planet for food security for all nations." In the United States, on one acre of land 50,000 heads of lettuce are grown, requiring irrigation and pesticides. In an Aquaponics greenhouse, only one acre produces 500,000 heads of lettuce. He further added that in traditional agriculture 26 gallons of water are required per head of lettuce, versus 4 gallons of water in an Aquaponics system, from dry seed to harvest.

Caribbean islands all face severe weather; agriculturalists know it can take years of trying to restore lands obliterated by landslides or flooding following a hurricane wipeout. Following Emily in 2005, locals informed me that there was a period of months when people were advised not to fish locally due to mass contamination along the shore. In

addition, roads were closed, and petrol was unavailable, further complication access to food. (Nimrod) Aquaponics can be up and running in 30 days, producing edible produce, such as lettuce, from germination to table in 23 days. Even if the fish in the tanks were to die, the nutrient in the tanks can live for six months and be usable for vegetable growing. One one-hundred gallon tank of fish runs on energy likened to running one 60-watt bulb. Losses are also minimal: 3-5% mortality for fish or non-germinating plants. They are currently experimenting with an LED light source made specifically for aquaponics, which could further reduce the use of electricity.

Two other projects are under way, one on the island of Trinidad, at Las Lomas, where the First Church of the Open Bible has an aquaponics project located on 72 acres at the site of a newly developed eco-resort. In Ensenada, the Baja of Mexico, a model for a restaurant is underway with Carlos Leon, owner of Bofish Company, who is currently working with Nelson and Pade. Héctor Ramos, an engineer from Bofish responsible for the aquaponics system, maintains that:

...in order to irrigate one hectare of crops in the traditional manner, per season, on average 200 cubic metres of water is needed, which is the equivalent of three quarters of a football stadium filled with water, for an area the size of a block of houses. Aquaponics, on the other hand, uses a third of this quantity, in other words only 70 cubic metres. (Falcon n.d.)

Living in the outskirts of a small village is Enrique Strassburger, along with his wife, partner and fellow oceanologist, Naielli Estuvillo. Here they founded the Acuicultura del Desierto (Desert Aquaculture) company, which combines aquaculture with protected agriculture and hydroponics to breed tilapia and grow organic vegetables. The state of

Ensenada’s Ministry of Rural Development has suggested installing aquaponic systems in 11 municipalities.

...since it is estimated that aquaponic systems reduce the use of fertilizer (sic) by 45% and yield up to 500 plants per square metre each year. “Aquaponics not only meets the requirements of intensive farming. These techniques also solve an agricultural enterprise’s water and electricity consumption problems,” adds Ramos. Through the use of greenhouses, aquaponic farms can be located within a city and offer fresh produce to local consumers. For example, when in season, Strassburger’s tilapia is sold in the famous open-air fish market, the Mercado Negro, in Ensenada, where all types of freshly caught fish and shellfish are also on sale. A properly designed system, with alternative energy technology such as solar panels, can have minimal operating costs, although the initial outlay may be considerable. However, its potential constitutes an interesting option for the Mexican agricultural enterprise, assures Strassburger. (Strassburger n.d.)

Table 1. Aquaponics Benefits

Aquaponics Positives	Aquaponics Negatives
Conserves resources; fresh water	Cost of electricity involved
Easily started	Initial materials expense
Local transport costs	Limited crop production
Local, fresh produce to community, year round	
No waste material disposal	
Organic; fish and plants	
Quick product turnaround	
Reduces overall carbon footprint	
Reduces threat from climate change	
Reduces use of chemicals used in traditional agriculture	
Social alternative in meeting local food needs	

The U.N. Report illustrates examples of successful small-scale aquaponics:

A pilot-scale aquaponic system was built in Myanmar to promote micro-scale farming during the implementation of an e-Women project funded by the Italian Development Cooperation. The goal was to create a productive unit under low-tech and low-cost criteria by using locally available materials and stand-alone solar

energy. The system hosted tilapia and a wide range of vegetables. The system was used for the development of a cost–benefit analysis, inclusive of depreciation, for household scale systems with the objective to meet the daily income target of USD1.25 set by the Millennium Development Goals Using local prices, a 27 m² aquaponic system placed within a bamboo net house and powered by solar panel costs USD25/m². This system provides a net profit of USD1.6– 2.2/day from vegetables, and a daily ration of 400 g of tilapia for home consumption. The payback period is 8.5–12 months depending on the crops. The net house prevents any need for pest control and avoids seasonality by securing income against adverse climatic conditions (rain). Fry nursing, very common among farmers in Southeast Asia, could be another interesting option in aquaponics to further boost incomes in poor or landless households.

This pilot project showed that aquaponics could play an important role in securing food and livelihood in many areas across the world. The production of fish and plants with small plots allows vulnerable people to produce income, adds value to household work and empowers women at community level. (U.N. 2004)

ADDENDUM IV: Survey Data 2015 & 2016

2015 SURVEY RESULTS

In the 2015 Discussion Group survey, this question addressed diet and imported foods.

Survey Question #11: What issues of food, having enough or not, confront you or those you know?

Too little	Not Fresh	Imported	Poor diet	Dietary health issues	Little variety	Excessive starch	Not cooking much	Other:
3	7	11	3	3	7	6	2	Excessive sugar -1 Price -1

Relationship to land and food culture

When asked if they noticed any difference in the quality or quantity of their fish, and how recent they had noticed, 28% answered affirmatively; 19% noted changes occurring between 5-10 years ago.

Noticed difference in fish quality/quantity and how recent	Yes	No	Don't know
	9	3	1
Five Years ago	3		
Ten Years ago	3		
Did not answer	3		

When asked if they knew how damage to the corals occurred, 37% of the 32 respondents accurately identified agricultural run-off, poor boat anchoring practices, mangrove damage, rainfall erosion, tourism, waves, sea temperature change and alteration of pH, and pollution.

2016 SURVEY RESULTS

1. Did attending the Discussion Group expose you to new information about coral reef preservation research in Grenada?

YES 3 = 50%	NO 3 = 50%
-------------	------------

Comments: Were already informed

2. One year later, did the information presented in the Discussion Group change any of your actions that affect the relationship between shoreline fishing and coral reefs?

YES 3 = 50%	NO 33%
-------------	--------

3. Did the information presented change your understanding of sustainable food resources?

YES 3 = 50%	NO 3 = 50%
-------------	------------

4. Did participating in the Workshop provide you with usable information about how to apply Aquaponics in your own situation?

YES 5 = 83%	NO 1 = 16.6%
-------------	--------------

5. One year later, did your participation lead to becoming involved in spreading the word about Aquaponics and/or fisheries issues?

YES 5 = 83%	NO 1 = 16.6%
-------------	--------------

6. Are you more or less interested in fish health in Grenada?

MORE 6 = 100%	LESS -
---------------	--------

7. Is the ability to fish from shore an important part of Grenadian food culture?

YES 6 = 100%	NO -
--------------	------

8. Has participating in the Discussion Group interested you in being a part of future community information events?

YES 6 = 100%	NO -
--------------	------

9. During the Discussion Group, people identified food security issues and then ranked them. Did this process give you a fair way to express your ideas?

YES 6 = 100%	NO -
--------------	------

Comments:

Involve wider cross section of people X x		Hold in a community building, not an institution X
--	--	---

10. What would you recommend might be helpful for future community discussions?

1. Teach youth to pick up after themselves and not to pollute

For Aquaponics Workshop Attendees

11. Did you attend the workshop, for any time, the following week?

YES x	NO
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11a. How many times?

Every day all week 3 = 50%	2 days 1 = 16.6%	None 1 = 16.6%
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12. Were you inspired to build your own Aquaponics system?

YES 3 = 50%	NO 3 = 50%
-------------	------------

Comments:

Currently building one x	Our age prevents us from taking on x x
--------------------------	--

13. Are you interested in Aquaponics as a form of raising food for yourself?

YES 3 = 50%	NO 1 = 16.6%
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14. Over the last year have you noticed people in your community becoming more aware of Aquaponics or coral reef health?

YES 3 = 50%	NO 1 = 16.6%
-------------	--------------

ADDENDUM VI: 2016 Government/Civic Employee attendee interview results

2016 PAST PARTICIPANT SURVEY DATA THEMES

1. Since the Discussion/Workshop, have you had any change in your views about the usefulness of Aquaponics?
 - A. WATER SYSTEMS MAY BE OUT OF REACH OF GRASSROOTS PEOPLE
 - B. MY VIEWS HAVE BEEN STRENGTHENED IN ITS USEFULNESS
2. From your perspective, how does Aquaponics bring value to Grenada?
 - A. WATER AND FERTILIZER ARE COST CONCERNS
 - B. A SYSTEM THAT CAN HELP TO ALLEVIATE POVERTY AND CREATE SELF-EMPLOYMENT. IT ALSO STRENGTHENS FOOD SECURITY
3. Have you made any changes to policy or practices as a result of your participation in the Discussion Group or Workshop?
 - A. [no responses]
4. In your estimation, could Aquaponics be valuable to any of these sectors?
 - a. The agriculturalist community x X
 - b. The fisheries community x X
 - c. Governmental agencies x
 - d. Schools x X
 - e. Prisons x X
 - f. Other: COMMUNITY WATERSHED ADOPTION NECESSARY
 - g. In which way?
 - A. TEACHING PRISONERS SUSTAINABLE LIVELIHOODS
 - B. A FOODWAY TO TEACH SUSTAINABILITY. CAN HELP CHANGE THE WAY AGRICULTURE IS PERCEIVED
5. Have you witnessed any new approaches to introducing Aquaponics in Grenada? By whom?

- A. AQUAPONICS IS BEING DONE BY OTHERS. WE SUGGESTED YOU INVESTIGATE
 - B. KNOW OF AT LEAST 2 PERSONS WITH AQUAPONICS IN DIFFERENT APPROACHES
6. Has the introduction of Aquaponics by WLC and its partners had any unintended effects that you are aware of?
- A. SUBSEQUENT DOMINEERING DIRECTION FAILING TO TAKE INTO CONSIDERATION LOCAL EFFORTS AND LOGISTICS
 - B. NOT THAT I CAN SEE
7. Has your participation in either the Discussion Group or Workshop been a springboard toward any new agency sustainability goals?
- A. [No responses]
8. Do you believe more participant discussions could be beneficial in supporting issues of food security and sustaining related environmental resources?
- A. YES

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ACRONYMS

ABCD	Asset Based Community Development
CARDI	Caribbean Agricultural Research and Development Institute
GCRMN	Global Coral Reef Monitoring Network
GFNC	Grenada Food and Nutrition Council
IRB	Institutional Review Board
MPA	Marine Protected Areas
SGU	St. George University, St. George, Grenada. www.sgu.edu
WLC	Wisconsin Lutheran College. www.wlc.edu/about .

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