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Food insecurity in paradise: An exploration of food system resilience in the U.S. Virgin Islands

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Abstract

Despite being a world-class tourist destination, the U.S. Virgin Islands (USVI—St. Thomas, St. Croix, and St. John) face significant challenges related to diversified crop production, food distribution, and food security. High poverty rates among islanders perpetuated by historical iniquities, frequent hurricane damage, drought, poor soil quality, high food production costs, and limited food distribution networks are just a few of the challenges residents face. Consequently, 97% of the food consumed in the USVI is imported. Frequent hurricane damage, such as the recent damage from Irma and Maria (back-to-back Category 5 storms that hit the islands in 2017) complicated these challenges even more and disrupted food import processes. This manuscript focuses on a case study involving a literature review, participant observation, and a series of semi-structured, face-to-face interviews with key informants about issues related to food insecurity, resilience, and farmer needs regarding business sustainability. The results highlight how the political,

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economic, and cultural complexities of the USVI stymie efforts to lower barriers related to food accessibility and affordability. The results also reveal a new and vibrant entrepreneurial spirit among native islanders and transplants alike, providing novel entryways into food system change and development. Finally, we share policy implications and next steps toward building agriculture and food system resiliency.

Keywords
food security, food system sustainability, resilience, semi-structured interviews, U.S. Virgin Islands

Introduction

The U.S. Virgin Islands (USVI)—St. Thomas (STT), St. Croix (STX), and St. John (STJ)—are a premier tourist destination located in the Caribbean Sea nestled between Puerto Rico and the British Virgin Islands (BVI). The islands are part of a Caribbean archipelago, the Lesser Antilles, stretching eastward from Puerto Rico and arching southward toward South America (see Figure 1). These are volcanic islands, with lush, tropical northern sides and dry, arid southern sides, producing a remarkable biodiversity of plant and animal life across their divergent geographies. St. Thomas and St. John have significant slope and elevation change while St. Croix is flatter, particularly in the middle of the island. St. Thomas is the most populous and houses the territory government. St. Croix is the largest island, 70 miles south of St. Thomas and St. John. St. John is the smallest and least populated, with 75% of the island designated as a national park. The islands are a short flight from the U.S. mainland and easily accessible by cruise ship, yacht, and sailboat.

The islands were sold to the U.S. in 1917 by Denmark and are currently considered an unincorporated U.S. territory. On the surface, the USVIs are a tourist haven with their tropical setting, clear blue waters, and remarkable beaches. Beneath the surface, however, residents and communities on the islands are dealing with an array of significant environmental issues. Food insecurity and the lack of agricultural production at the scale needed to feed residents consistently and sustainably are two of the most serious issues (Crossman et al., 2010; Martinez-Brockman et al., 2023). Using the Food Insecurity Experience Scale (FIES), the moderate to severe food insecurity rate in the Caribbean region was 71.3% in 2020—the highest rate in Latin America (Martinez-Brockman et al., 2023). For comparison, the global food insecurity average is approximately 29.6% according to The State of Food Security and Nutrition in the World 2023 (Food and Agriculture Organization of the United Nations [FAO] et al., 2023, p. xvi). Residents in the USVI consistently experience significant food shortages and accessibility issues for many reasons. The most prominent of these issues are high poverty rates among Afro-Caribbean islanders, frequent hurricane damage and drought (potentially due to shifting climate regimes), poor soil quality, high food production costs, and challenges with food distribution (Barker 2012; Lenderking et al., 2021). In September 2017, the USVI experienced

Figure 1. The U.S. Virgin Islands (USVI) Shown Alongside the British Virgin Islands (BVI), as Part of the Greater and Lesser Antilles Chains in the Caribbean Sea

two hurricanes (Irma and Maria) that damaged the islands' natural and built environments. Recovery efforts have been slow, and access to food and fresh water have been seriously lacking. Other documented problems related to food security and resilience are:

- the USVI imports approximately 97% of its food;
- there is little to no value-added processing on the islands;
- there is a lack of government programs or incentives to start food or agricultural businesses; and
- the islands are carrying significant government debt (~US$2.6 billion) (U.S. Government Accountability Office, 2023)

This paper provides a snapshot into the USVI food system, including obstacles and opportunities, and offers suggestions for moving forward using case study methodology to (a) explore the island's historical experiences of slavery and the global sugar trade; (b) interview key informants about the challenges and opportunities the islands face related to food production and agricultural resiliency; and (c) observe and participate in current-day agricultural and food-forward events.

Resiliency

Ensuring a stable supply of food in the face of environmental change and natural disasters is a crucial component of resiliency. The development of diverse and sustainable agricultural practices can enhance the ability of food systems to withstand shocks and stressors. Investing in local food production and distribution networks further strengthens resilience by reducing dependence on global supply chains, which the pandemic illustrated can be especially fragile during times of international catastrophe. Tendall et al. (2015) defines food system resilience as "capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances" (p. 19).

Within a given food system, people grow, purchase, eat, and transport food. These food stakeholders are challenged to collaborate and find ways to implement sustainable strategies in response to climate change, economic uncertainties, and inequal distribution of wealth. Food systems can be understood utilizing the same theoretical approach that guides complex, ecological food webs. Ideally, communities work toward an interconnected approach that considers large-scale impacts that lead to small-scale, local effects, while also recognizing that resilience is "not a finite or objective outcome, but rather a continuously contested process of responding, adaptation, and livelihood making" (Walsh-Dilley et al., 2016, p. 6).

In tropical island systems, two major geographical considerations emerge: (a) response to climate change; and (b) reliance on imports. Climate change is driving biodiversity loss, disease outbreaks, northward expansion, and shifts in growing seasons (in the Northern Hemisphere). Island systems have limited arable land, often imperfect infrastructure, high development costs, and little room for expansion, making them even more vulnerable to environmental disasters (Beckford, 2012; Beckford & Campbell, 2015; Saint Ville et al., 2015). The United Kingdom is an example of a fragile island ecosystem that relies on significant food imports (approximately 48%) to feed the population; Most island nations, in general, are susceptible to disruptions in trade, both logistically and politically (Zurek et al., 2022). Many island systems import double the proportion of the UK imports, which warrants reimagining and possibly rebuilding island food systems so that resiliency is not out of reach. Based on current food imports in the USVI and the other challenges already mentioned, agricultural and food system resiliency seems almost out of reach. Agriculture continues to be the least supported sector in the USVI government, with tourism being the most supported, bringing in the most funding and capturing the most attention (L. Petersen, personal communication, November 5, 2018). Still, there is a growing recognition among farmers, food system actors, and stakeholders globally that, particularly after COVID-19 and a climate crisis that does not seem to be going away, building in equity and resilience in food systems is essential (Stone et al., 2024).

Change Is Coming

In 2008, rising public demand for locally grown products and increasing inclusion of farmers across various sectors prompted a resurgence in agriculture in the USVI, prioritizing agritourism and education (Laurencin, 2017). Farmers were no longer satisfied relying on governmental assistance and began operating as independent entrepreneurs to regain control of their lives and achieve greater self-sufficiency (Freeman, 2014; Laurencin, 2017). In addition, they aimed to redefine the narrative that farmers are backward, uneducated, and unskilled by embracing modern pursuits in innovation and flexibility in business practices, such as introducing new crops and collaborating with other farmers to form cooperative relationships to advance product marketing. Given the lack of governmental support in the form of incentives, equipment, suitable market locations, etc., they took matters into their own hands (Freeman, 2014; Laurencin, 2017).

Despite the obstacles preventing a sustainable and resilient USVI food system, there are many reasons to be optimistic regarding increased food security and development of a regionalized food production strategy on the islands. University of the Virgin Islands (UVI) Agricultural Experiment Station (AES), located on St. Croix, worked with students and faculty to conduct basic and applied research designed around the needs of the local agricultural community. AES explored ways to support farmers on the islands, including teaching and training in animal science, agroforestry, agronomy, and biotechnology. (Unfortunately, there has been little focus on regional food system development.) Also, according to the Censuses of Agriculture in 2007 and 2018, individually operated farms increased from 194 to 473 in the 10 years between (U.S. Department of Agriculture National Agricultural Statistics Service [USDA NASS], 2007, 2017). Further, agricultural sales increased from US$2,071,022 in 2007 and to US$3,334,662 in 2017 (USDA NASS, 2007, 2017).

There are several new agribusinesses in the USVI that, despite significant hardship, are beginning to take root. These new ventures represent reimagined ways to grow and distribute food locally and regionally. But what else is happening on the islands regarding food system development and resilience? How have the historical experiences of slavery and indentured servitude of USVI residents impacted current day agriculture? What support and infrastructural needs do farmers in the USVI have that would help them grow and sustain their businesses, to strengthen the islands' food system resilience? How should island governance focus its support related to agricultural sustainability and food access?

A literature review provided the context for historical roots of slavery and experiences with early agriculture. Using a case study approach, we carried out a series of semi-structured, face-to-face interviews with key informants about issues related to food insecurity, food system resilience, and farmer needs related to business sustainability. In addition, we did participant observation at several agricultural events to explore these issues in an attempt to better understand the potential for increased food resiliency in USVI. The data we collected are qualitative and focuses on stakeholder interests and key areas of need. The data, analyses, and conclusions could help provide leverage for future funding.

Methods

We used a case study research approach that allowed us to inquire and observe events, individuals, and programs bounded by time and activity (Yin, 2009). A case study approach affords opportunities to triangulate data sources for comparing and integrating qualitative and quantitative data to better advocate and give a voice to underserved or underrepresented members of the community (Creswell & Creswell, 2017). This approach was appropriate for this study because it allowed us to develop a deeper contextual understanding of the USVI, the people living there, and their respective histories, followed by data analysis highlighting key themes and issues regarding food system resiliency in the USVI (Creswell & Creswell, 2017; Wolcott, 1994; Yin, 2009). Triangulation was used to strengthen the validity of our findings by recognizing the convergence of information from several different sources. This helped us identify and, at times, highlight information that was relayed to us multiple times and from multiple sources.

Historical Contextualization

Understanding USVI's current food system and implications for food and farming resiliency requires explorations into USVI's past experiences with agriculture, and how that shapes USVI's current food system with significant influences such as colonization, slavery, and the sugar trade. Understanding these historical roots helped us to contextualize our recently collected interview and participant observation data to untangle the complexities and dependencies embedded in USVI's current food system, and perhaps better understand how to move forward toward resilience. We focused our historical dive on the triangular trade involving slaves, sugar, and rum across the Atlantic Ocean and Caribbean Sea. Then we walk through USVI's agricultural history and the challenges their food system faces as a direct result of their history and life experiences.

Participant Observation

The authors used participant observation on several occasions, including a forum that featured a panel of speakers with expertise in agriculture and food systems. The forum followed the release of a documentary about food and farming in the USVI. Panel participants included the filmmaker, two native chefs, a native farmer, a representative from an agricultural training nonprofit organization, and an editor from the local paper. The authors also attended an agriculture festival in the Bordeaux region of St. Thomas. The event combined a farmers market and education, with booths representing agricultural and food-related organizations (e.g., USVI Agricultural Extension, USDA Natural Resources Conservation Service [USDA NASS], agricultural technologies, etc.). The authors also attended a farm-to-fork dinner event on St. Croix that featured locally grown produce and food items prepared by an island chef. This event was held at a farm that encouraged volunteers to help and interact with interns. The authors stayed two nights and participated in farm activities during that time.

Key Informant Interviews

Key informant interviews were used as a data collection method to gain a deeper understanding of the current barriers and opportunities facing farmers in the USVI, regional perceptions of food insecurity, and impacts of extreme weather on both farming and food access. Recruiting interview participants was purposive. Key informants were selected based on their positions in the community, association with a particular agricultural or food security organization, or by their locally described reputations and knowledge surrounding farming and food insecurity in the USVI (Elmendorf & Luloff, 2001). The authors spoke with farmers (both native and transplants); government officials who worked in the agriculture sector; representatives from the extension service and USDA NRCS; and other key individuals. The authors deployed a snowball sampling procedure, which helped to identify additional informants who might not be readily identifiable. They might not be employed by a key organization or had an association with farming or agriculture directly, but they had specialized knowledge or adjacent experience that was related (Gordon et al. 2013; Heckathorn, 2002). Interviews took place on all of the three islands in November and December 2018. Discussions focused on food availability and costs in the USVI, perceptions of agriculture, trends in the local food movement, food distribution and disruptions related to extreme weather events, and visions for supporting local agriculture and food systems. The use of open-ended questions encouraged participants to offer spontaneous answers without having to respond to specific questions. Their rich and spur-of-the-moment replies provided an understanding of the reality of the USVI, including broad patterns of relationships among actions and actors with respect to agriculture and food insecurity within the local environment (Elmendorf & Luloff, 2001).

The authors obtained institutional review board (IRB) approval to conduct the interviews. Participants were asked to read a brief consent form relaying the purpose of the study, their rights, and benefits and harms related to participation. They were also asked to sign consent forms and authorize audio recordings. The interviews took place in locations convenient to the interviewee (e.g., their place of work or home) and were captured with a digital recorder. Supplemental notes augmented the recordings. Interviews lasted between 30 minutes and two hours and were con-

ducted until data saturation was reached. Recordings were transcribed verbatim, coded, and analyzed for common themes related to food system sustainability and food insecurity. The authors transcribed detailed observations during field site visits, which were also part of the coding process.

Digital recordings and transcribed documents were kept in the lead author's password-protected computer while at the study site and subsequently at Ball State University (BSU), Muncie, Indiana. The handwritten notes were kept in a locked suitcase while on site, and a locked file cabinet in the lead authors office at BSU. Only the authors had access to digital or handwritten data. The transcripts and recordings were reviewed multiple times to ensure reliable interpretation of each participant's intent and context.

Interview Analysis

Content analysis was used to code transcripts according to individual units of meaning. Similar codes were condensed (and recondensed) in a two-part process and ultimately organized into relevant themes. Words and ideas generated from the participants themselves revealed several common themes. The authors collaborated through multiple strategy sessions to ensure the themes and supporting quotes captured the true essence of what study participants were saying. Peer debriefing, in two independent sessions, enhanced the study's validity as authors shared the data collection methods, themes, and supporting quotes with two academic colleagues.

Results

USVI's past experiences with sugar and slavery frames modern-day farming and the complexities of its food system, which are hampered by dependencies like extremely high rates of food imports and cost of food. Also, the more recent transition from agriculture to tourism is part of this story that helps explain continued dependencies, miniscule economic support for agriculture, and the potential for new markets in the future. Our results begin with historical contextualization to help build the framework for understanding the current food system, which we explore through key informant interviews and observations while in the field.

Historical Context

Understanding the slave trade, the sugar industry, and the tourism juggernaut (circa 1960–70s) provides essential historical context, laying the groundwork for the associated decline in agriculture over the past decades. Before the Danish established sugar plantations in the USVI and before Christopher Columbus landed in St. Croix in 1493, native tribes lived there and worked the land. The islands were eventually purchased by the Kingdom of Denmark-Norway, then the Kingdom of Denmark, which established sugar plantations on the islands and brought slaves from west Africa to work the land (Knight, 1983).

The First (and Second) Coming of Colonization

By most chronological and geographical accounts, the Arawak tribe (South America) was likely the most dominant native group prior to the influx of enslaved peoples (Capetillo-Ponce & Galanes, 2013; de Albuquerque & McElroy, 2021; Roopnarine, 2021). Other accounts identify the Arawak and two subgroups: Taíno (Puerto Rico) and Ciboney (Cuba and Hispaniola) tribes as the likely inhabitants. Later, the Caribs, a Guianan subgroup of the South American Kalinago tribe, conquered many of the Taíno peoples and established residency. While this narrative may best align with a popular consensus of Caribbean historians, the authors wish to acknowledge the anecdotal nature and ambiguous accounts that make records difficult to confirm (Dick, 1977).

As the islands underwent expansion and development as U.S. territories, a legislative framework was established and several iterations of a constitution were drafted, none of which has been formally ratified (Klopf, 2004). Under what would be the second colonization event, the legislative descriptor "native" or "indigenous" was applied to the existing Afro-Caribbean dominant group.

USVI: The Birth of an Identity

Despite the uncertainty of the island identity prior to the U.S. acquisition, a few themes emerged during the years that followed: (a) Afro-Caribbean culture began to take shape; (b) land rights were not clearly outlined, leaving limited and unclear governance driving disputes that would span more than a

century; and (c) the goal of anti-colonial and agricultural independence became overshadowed by exploitation and disempowerment as the transition toward a tourism economy materialized.

Economy of Production: Slavery, Sugar, and Agriculture

The hilly terrain on St. Thomas and St. John was terraced and used to grow sugarcane, which was used to make molasses, then shipped to the northeastern U.S. and Europe as a major ingredient for rum production. This triangular molasses trade lasted from the 16th to the 19th century (Campell, 2023) and relied significantly on slave labor to work the sugar cane fields and other ancillary and related tasks. This helped to establish agriculture, as Laurencin (2017) alludes, as an essential ingredient of the islands, representing a historical and cultural identity and tradition. Modern-day residents recall this as a time of horrendous cruelty, oppression, and significant inequality. Unfortunately, many farmers and others now view agriculture negatively—as a backwards and outdated occupation that people do as a last resort. The work was incredibly grueling as the steep hillsides had to be terraced and watered and sugar cane chopped and hauled to the sugar mills. The average life expectancy of enslaved workers in those times was 35 years (Ward, 2023). Eventually, the slaves rebelled in 1848, which fueled the abolishment of slavery—17 years before it was abolished in the United States.

Denmark sold the islands to the U.S. for US$25 million in 1917. The U.S. kept the islands as an unincorporated territory, so they were taxed but not represented by Congress. The last sugar plantation was shut down in 1966. Oil and gas companies and other industries were invited in to fill the void, but eventually the USVI government saw the writing on the wall: the economic engine that would fuel growth in the USVI was not gas, oil, or industrial interests, but tourism.

Between 1790 and 1960, the USVI produced most of the food it consumed (Crossman et al., 2010). But as sugar production declined in the islands, so did agriculture in general (Mills, 1984). This decline continues to persist. Despite government interventions and modest federal funding inputs, agriculture has had to compete with commercial, industrial, and most recently, tourism interests (Mills, 1984). Blaut et al. (1965) suggest that as the sugar industry was failing, many cane farmers did not know how to transition toward growing other crops, and the land used by previous generations to grow was overtaken by developmental interests rather than safeguarded for agricultural land use. During this time, the tourism sector burgeoned and afforded economic opportunities for seasonally employed sugar workers and the jobless. Mills (1984) comments, "given the social stigma that clings tenaciously to farm work throughout the region, many a farm laborer willingly traded his overalls for a bellboy's garb" (p. 28). Working in tourism was perceived as lucrative, so as a result, the construction industry boomed. Tourism and construction were strong drivers of agricultural decline during this time. Not only were farmers trading their growing tools for hammers, but the influx of immigrant labor for construction demanded the use of agricultural land to build supplemental living quarters.

In addition, due to the proximity of the USVI to other island nations and the U.S., there was now easy access to significant amounts of low-cost foods like eggs, chicken, milk, pork, beef, and vegetables (McElroy, 1979). In the 1980s, the USVI was importing 99% of the food consumed, and this remains true today. McElroy (1979) noted what he called an "anti-agricultural policy," enacted by letting prime agriculture tracts go fallow after 1966 and indirectly promoting rampant suburban sprawl by sponsoring labor-intensive tourism, federal highway construction, and less-than-optimal finance and realty practices. The decline in the number of operational farms and cultivated acreage was substantial.

In 1980, the Department of Agriculture's efforts to revitalize agriculture intensified due to a noticeable increase in dependence on imported foods, concerns over energy conservation, and a realization that agriculture is an essential component of the territory's economic development. Mills (1979) reported that 91% of Virgin Islanders surveyed felt that it was "important" or "very important" for government to exert efforts to expand agriculture. The Department of Agri-

culture also reported that very few young people were currently involved in or entering farm production (Padda, 1979). Obstacles included inadequate availability of land, capital, and the lack of technological assistance. Padda (1972) pointed out other obstacles, including a lack of trained personnel, labor shortages, inadequate water supplies, and insufficient marketing.

Still, to the government's credit, it put in place several pro-agricultural policies during this time to encourage farming activities. These included (a) direct subsidy payments of US$40.00 per acre to farmers who cultivated sorghum; (b) a 95% exemption from real property taxes for land officially certified for agricultural use; (c) a 90% reduction of tax on income derived from agriculture to any certified applicant; (d) the provision of a number of direct services to small farms (e.g., land preparation, fertilizer, seeds, and slips); (e) the enforcement of zoning and building regulations to minimize residential and commercial encroachment pressure; and (f) the acquisition of land purposed for farming. Still, even according to Mills (1984) the tax incentives and subsidies were not enough to suppress the continual infringement on agrarian land.

There have been multiple programs, often led by the extension service in the USVI, to reduce barriers to farming and sustaining agricultural businesses (e.g., "Virgin Fresh" Apiculture Project, Operation Breadbasket). The goal of these programs was to reduce the risks incumbent to farming, increase production, maintain permanent employment in agriculture, and spur the economy to improve residents' quality of life (Crossman et al., 2011). These projects, and others, promote the recovery of the agricultural industry by teaching farmers sustainable agriculture, financial planning and management, income tax preparation, and how to turn a profit. Despite these efforts, starting and sustaining farm businesses continue to challenge islanders due to factors beyond farmers' control, for example, the lack of markets for local goods and distribution pathways, the exorbitant cost of fertilizer and other inputs, and the cost of electricity (Crossman et al., 2010; Iowa State University Food Systems Team, 2020; Laurencin, 2017).

Key Informant Interview Results

Fourteen key informant interviews were conducted across all three islands and included natural resources agencies, government personnel, native and transplanted farmers, UVI faculty, kindergarten through twelfth-grade (K-12) educators, and a chef. Results were divided among four main challenges, or themes, facing USVI's food system (cultural, environmental, infrastructural, and political) and steps toward resiliency.

Cultural Challenges

The lack of interest in farming came up in several interviews. For native islanders, this reluctance was linked to painful memories associated with working the land and slavery. One native farmer in St. Thomas put it this way: "we are still associating farming with slavery. A farmer is a businessman. We need to treat it as such." An agronomist from UVI offered the following remarks:

> Agriculture for people didn't improve when slavery ended. It got worse. Here in particular, just like in the deep south, they went from slavery to indentured servitude. In some cases, more extreme poverty/hardship and the race relations were the same… nothing changed.

Native farmers also reflected on how farming appears to kids growing up in the islands. Much of the agricultural land on St. Thomas is steep and there is not much machinery or automation to make the physical labor easier, so children see their parents or families doing back-breaking work. A native farmer said it this way "Our agriculture is so manual and labor intensive. [Kids] just see their grandfather out there hoeing weeds. That's the ag they know, and it brings back some of those bad memories."

Another issue that emerged from the data linked farmers, particularly native farmers, to a "lifestyle" of farming rather than the business of farming. This was especially true in the Bordeaux region of St. Thomas, where the terrain is steep and most farmers centered there are Rastafarian. This is related to the painful memories of slavery. The Bordeaux region, also known as Estate Bordeaux, was once a thriving sugar plantation.

The farmers still working there do so on their own terms. This promotes a sense of freedom, rather than an obligation to work; they can now farm as they please, when they please. For NRCS this creates some challenges in terms of supporting farmers' efforts. "Rasta" farmers do not think of farming as a business; to them it is a way of life. "The cucumber comes when it comes," an NRCS employee stated about the farmers' point of view. They showed little interest in systemizing their business, moving toward regularity, making consistent profits, and building a sustainable business.

> A lot of them consider [farming] more like a lifestyle than a business. So, they don't think of it like having to keep track of paperwork and all. … Extension offers record keeping workshops and other workshops, but they don't open their mail, they find out about things last minute … so they don't enroll in programs, they can't claim benefits. (Natural Resources Conservation Service employee)

There was a sense of frustration among agency personnel whose jobs are to provide outreach and education, financial literacy, and help farmers qualify for benefits and incentives. However, their guidance is shunned and stymied by the perceived indifference of their target audience.

Environmental challenges

Participants often spoke of hurricanes as being both a curse and a blessing. As a curse, hurricanes are ripping off what small amount of topsoil is left, particularly on St. Thomas and St. John. Both islands have little topsoil due mostly to decades of cultivation for sugar plantations, steep slopes, and the resultant soil erosion.

> Friends of ours, they came up here and helped rebuild the farm. They came day after day. … We started replanting … then the second storm came and then we lost the momentum, I said no way… Hurricanes are the hardest things. Land wiped clean. The soil. The soil is the hardest part … so now you have to start all over again. (Transplant Farmer 1)

Some participants spoke of losing their livelihood once the plants were ripped from the soil and the topsoil was washed or blown away. A transplant farmer on St. Thomas remarked about this after visiting the Rasta farmers in the Bordeaux region after the hurricanes:

> We went out [to Bordeaux] after the storms. And they are very positive, energetic people who fend for themselves. I've never seen them sadder. They lost what was most important to them, their livelihood. Their plants … they're wiped out. They got nothing. (Transplant Farmer 3)

Conversely, many participants spoke of the positives that accompany the hurricanes. For example, they contended the extension service and NRCS were listening and being more responsive to farmers' needs after the storm. Hurricane relief funds seemed to help agricultural professionals respond more quickly and frequently to farmers' needs.

> Before the storms [the Department of Agriculture] were a lot more out of touch. We couldn't reach them. They couldn't get the budget for it. The St. Croix office … since the storm they've got more money to travel more and are a little more accessible. So that's positive. After the storm they're more accessible so it's positive. (Transplant Farmer 1)

On a more personal level, one farmer referred to the hurricanes as a blessing because they helped them prioritize and become more organized.

> The hurricanes were a blessing. Uh huh. Because … it's an opportunity, to get your head out of your ass. Yeah. Get out of the mud. Reinvent into something better, sharper, and more organized. It's like we had things that were able to shed that we couldn't before. (Transplant Farmer 2)

Infrastructural challenges

There were other significant infrastructural challenges, such as the cost of electric power signifi-

cantly stifling any move toward cold storage and refrigeration, that no one can afford. The lack of value-added processing was reflected in the following comment by a university researcher: "We grow a lot of cucumbers, but we don't see one damn pickle." Labor is another cost-prohibitive item that keeps the labor force small. The minimum rate per hour for farm workers is US$15/hour, but the going rate, and what is often more widely accepted, is US$20/hour. Few farmers can afford the help.

By far the most crucial elements that emerged, particularly with the farmers we spoke with, were related to water: sources of water, but mostly water storage and distribution. The tropical island's climate cycles between wet and dry seasons, making the ability to collect and store rainwater essential for farming during periods of limited rainfall. Water limitations have been problematic for generations and the problem continues to stymie farmers and Department of Agriculture officials.

> Water is an issue. We have adequate rainfall, but it's wet-dry-wet-dry—we need to be able to store water then use it when it is dry. I have been farming for 42 years. Nothing is changing. I am still crying for water. (Native Farmer 3)

When it rains, farmers can collect water, primarily from roofs, but the capacity to store and use it during the drier seasons has remained a challenge.

> Water program storage capacity, cisterns, tanks. It sounds so simple in the States you take it for granted. But right here—water. So, something like … 1,000-1,500 sq. foot [139 square meter] flat roof, a couple of hours of a rainstorm … how much water can you collect. Thousands of gallons. Nowhere to put it. (Transplant Farmer 1)

The Department of Agriculture can truck water to farmers, but capacity limitations and poorly timed delivery afford very little reassurance to distressed growers.

> I've been out of water for a week, and I called the department agriculture to tell them I was out of water. … But they still haven't brought my water. And that's from last week Wednesday. And no one has called me. So that's how serious this is because you have to have a plan A, plan B, plan C about water. (Native Farmer 1)

The Department of Agriculture recognizes this issue and has secured USDA funding to purchase large water storage tanks for the Bordeaux region of St. Thomas, but the project has yet to move forward, according to many of the farmers' accounts. Despite government reports of successfully securing funding, no tanks have been placed yet.

Political challenges

Of all the sectors that help move life forward in the USVI—agriculture, tourism, transportation, social services, etc.—the one that encumbers the lion's share of government funding, developmental efforts, and support is tourism. Since the late 1960s or early 1970s, the USVI's tourism star has risen to develop the island in many ways. Better harbors, improved roads, and other infrastructural updates have bolstered the island landscape. Despite these upgrades, study participants described tourism as the dominant sector, with agricultural prioritization being nonexistent. The agriculture budget is US$4.5 million annually, and the majority of those funds approximately 85%) is allocated to personnel remunerations.

> The USVI used to be a very agrarian-oriented community, that changed in the '60s. It changed when we decided to close the last of our sugar plantations; it changed when we decided to convert all of those agriculture-zoned lands into industrial lands; and it changed when we decided to make tourism the hub of our economic wheel. So, all the resources went into tourism. (Previous Commissioner of Agriculture)

A seemingly greater obstacle to overcome is the ability for farmers to legally lease land. Currently, if land parcels have not been surveyed by

the government (i.e., marking boundaries), citizens are barred from cultivating or even living on the parcels. Backlogged municipal survey efforts, particularly on St. Thomas and St. Croix, limit citizens' ability to legally inhabit, produce food, or do anything else on the land. Several farmers, particularly in St. Thomas, have resorted to self-help measures that circumvent lawful expectations.

> Many farmers are technically squatting. They have chosen not to wait for the government. "I have to do what I need to do. I need to farm and I'm doing it." And if it weren't for them doing that we would have less to show. The honest truth. Not waiting for the government. (Previous Commissioner of Agriculture)

Decades ago, the government instituted a homesteading program that provided land lessors (i.e., farmers) with the ability to transition into ownership, once certain labor expectations and tenure were met. Many people still think this option exists, so they cling to their land in hopes the government will oblige. Many of these farmers are older and no longer farming due to age and health-related constraints—so they sit on their land, hold it fallow, and wait. We heard from an employee in Agricultural Extension that "50% of the arable land on St. Croix is not in production due to the land survey/legal lease issues." In some instances, people are holding the land to which they have secured rights, but not actively farming, because of financial, age and/or health limitations.

> Some of the people who have leases, some of them are not even able to farm anymore. They don't want to give up the land. … From way, way back, there was a situation where persons ended up with land in a homesteading program that the government had a long time ago. But still, in the minds of some of these people, they think that maybe they will be able to own the land. So even though they're not interested in farming anymore, not able to farm anymore. They don't want to give it up because they think they're going to lose an opportunity to own it. I would say it's about 50% of the farmland here in St. Croix. (UVI Researcher)

Part of the deeply embedded misfortune for farmers awaiting land surveys is the lack of true ownership, without which they are not eligible for financial and technical assistance. Things like cost-share programs for seeds and plants, water storage and transport, pest control and disease mitigation, or general managerial support (like book-keeping and other small business skills) are inaccessible. These are responsibilities of the USVI Agriculture Extension and NRCS, and the very reason these agencies exist. An NRCS employee said, "[The] majority of farmers on St. Thomas are squatters. Farmland needs to be surveyed, marked boundaries. … If they don't have legality, they can't be eligible for help."

Steps toward resiliency

Extension efforts aim to reframe agriculture in the islands and show youth that growing food is not just full of onerous tasks like hoeing weeds and digging trenches. Extension is actively developing programs to reintroduce youth to agriculture and tethering it to health and technology, such as the science of nutrition and soil quality. Other examples include exposing young people to new farming technologies like the use of drones and geographic information systems (GIS) and certain elements of precision agriculture.

> We want to nurture a new generation of farmers. … We have an ag discovery program here. Funded by the USDA. It is a residential program. Youth stay on campus—class activities, class lab, get a feel of what university is about. We're also working with young adults on St. Croix. July and August–ag enrichment summer camp … nurturing young adults who can step up. (Previous Commissioner of Agriculture)

Our participants recognized the power of the tourism sector for farmers and other related jobs. We spoke with several transplant farmers who were actively selling products to tourist venues, such as high-end restaurants and the private-chef industry on yachts. Crate Crops, an agriculture start-up with produce grown hydroponically in shipping containers, devised solutions to combat food issues in St. Croix but found no infrastructure to sell the pro-

duce on the island. Other farmers mastered growing microgreens indoors, but likewise found only limited distribution options. Transplant farmers worked to introduce tourists and locals to the hyperlocal food movement, and the craftwork of up-and-coming native chefs in the area.

Related to this, a government official put it this way:

> We need to pull tourists from the overburdened downtown shops to a local farm or farmers market so they can experience what a Caribbean mango tastes like, so they can purchase the local made mango jelly. … Give them an experience to take home and remember.

Discussion

Our data, drawn from semi-structured interviews and observations at agricultural and food-related events and framed by the historical context of slavery, sugar, and the rise of tourism, revealed many challenges to growing and distributing food in the USVI. These challenges encompass the infrastructural (e.g., capturing and storing water); the biophysical (escalating severe weather); the sociocultural (e.g., farming as a lifestyle rather than as a business, painful histories involving slavery and indentured servitude, and current land ownership issues); in addition to the political (e.g., small funding allocations for agriculture and issues related to the legal lease to land).

Navigating Water Woes

Many of our participants complained about the lack of water storage capacity on the islands. There is little natural water on the islands, so most water comes from the capture rain in cisterns and barrels (Iowa State University Food Systems Team, 2020). The islands' average rainfall is 39"–47" (100–120 cm) per year (National Weather Service, n.d.), with more precipitation falling on each island's northern slopes. The islands operate on a wet/dry seasonal cycle; dry times can stretch from January to August, while wetter months are September to November. Water storage could alleviate the shortages, but tanks cost money and require consistent cleaning and upkeep. Funds to purchase and maintain water storage containers were found to be in short supply among small-scale farmers, who were already fiscally strained.

Mills (1984) identified inadequate supplies of water and other issues (e.g., tourism development, labor shortages, and the unavailability of land) as the explanation for the decreasing performance in agriculture in USVI. This is not a new issue. Key informants identified the commissioner of agriculture and the government, in general, as those who should apply for grants to fund water-storage projects. A former commissioner of agriculture discussed a USDA grant secured to fund a water storage project on the east side of St. Thomas, which led to construction of a US$60,000 cistern under the parking area for the farmers market. Still, the commissioner admitted that the investment in infrastructure, particularly water storage and distribution systems, continued to be lacking.

The Virgin Islands Community Food System Assessment (2020) also identified the need for resilient water practices in preparation for shifts in climate and the water-holding capacity of soil. Permaculture and agroforestry practices could benefit the maintenance of soil health and crop diversity (Iowa State University Food Systems Team, 2020). In 2021, Act 8404 was signed into law by Governor Albert Bryan mandating development of a comprehensive agricultural plan for the USVI to make increased agricultural productivity, food security, and food sovereignty a reality for residents. Toward this goal, a task force convened to develop and address mandates granted by Act 8404 (VI Agricultural Plan Task Force 2021, 2021). Of the five high-priority projects proposed, comprehensive irrigation systems and water supply were at the top on the list (VI Agricultural Plan Task Force 2021, 2021).

Climate Threats to Island Ecosystems

Climate models predict increasing frequency and intensity of hurricanes in the Caribbean in the coming decades, emphasizing the importance of small-scale farmers adapting to these shifting weather patterns (McGinley et al., 2022). Since the double 2017 category 5 storms swept through the USVI, there have been 20 severe storms, and eight have been category 3–5 hurricanes (World Data,

n.d.). None caused as much damage as Irma and Maria, but several caused power outages, property destruction (particularly along the shoreline), and inhibited cargo ships from docking to deliver food and water supplies. Island nations are often the hardest hit by intense weather events and have the most difficulty rebounding due to supply chain issues and inadequate relief assistance (Betzold, 2015; Thomas et al., 2020). The ability for farmers to grow food on the island is essential to long-term sustainability and resilience. There are operations on St. John (e.g., Josephine's Greens) and on St. Croix (e.g., Ridge to Reef Farms) supplying leafy greens (lettuces, kale, and herbs) and other salad bar items to local schools, restaurants, and grocery stores. Although these operations were small, they continued to function despite weather setbacks. In addition, new transplant farmers on St. Thomas and Love City Fresh on St. John grew food indoors (microgreens in a basement and shipping containers used as grow rooms), which captured some tourist dollars. Those products were sold to several high-end restaurants and personal chefs who cater to the yachting industry. Despite the severe weather, small-scale farmers continued finding ways to grow and distribute fresh foods. Like other small island nations in the Caribbean, farming and food production have fueled the dichotomy as mechanisms of oppression pitted against community empowerment. Navigating food insecurity and food sovereignty in this modern day requires small-scale agriculture and autonomy (Conzo, 2022).

When asked about how Irma and Maria affected them, many farmer interview participants chronicled restarting their farms from scratch; some even rebuilt soil. Several farmers, however, responded in a way that suggested they were taking things in stride. Yes, the hurricanes were terrible, but afterward they moved forward in a new, albeit stronger, way. The storms wiped the slate clean and afforded new opportunities. They restarted, discarded old failing practices, and devised new ones. Participants hoped for more attention from the government, with potential support that was previously nonexistent. Rarely do island residents have economic and infrastructural support to rebound without governmental subsidies, so national and international backing is crucial during the rebuilding stages (Pernetta, 1992). In the USVI, land masses are small, populations are large, and supplies are limited because of costly and restrictive import practices, making storm recovery efforts challenging for all, but particularly those with limited financial means (Platenberg & Harvey, 2010).

Resilience Among USVI Farmers

The history and culture of farming in the USVI is multilayered. We have discussed the impacts of the slave trade and people who "settled" there, the crops that motivated the colonist mindset of "valuable," and the cultural influences that persist today. Examining the historical context magnifies both the resiliency of the contemporary island food system and the obstacles that affect current strategies.

The USVI farmscape is dominated by Black Americans working within (and against) a system that was not built for them, and one that pays little homage to the African diaspora (Edwards, 2022; Oboler & Dzidzienyo, 2005). They compete with corporate entities that prioritize tourism expansion and development over subsistence farming. Campbell et al. (2022) suggest that local governments, food policy councils, cooperative extension, and other food and agriculture stakeholders struggle to enact policy or programming that helps them achieve their goals of equitable food system change because they do not know what policy or program models exist to help. Despite the inherent racism, classism, and socioeconomic stratification that persist, the culture of Blackness is a key element that influences resilience of the islanders, still today (Edwards, 2022). The intersection of race, ethnicity, class, geography, and social hierarchy must not be overlooked.

African Influence on Global Agriculture: Resistance and Resilience

Many agricultural contributions and practices originated in Africa, including crop origination, farming and domestication techniques, and the bulk of the labor force in the form of chattel slavery and indentured servitude (Carter & Alexander, 2020; Moon, 2007; Sousa & Raizada, 2020). Despite the significant contributions to agronomy and the foundational framework put into place by Black people, farming technology, innovation, and work

ethics are often equated with whiteness. Historical narratives rarely depict the role of African culture in shaping contemporary food systems (Hoover, 2013).

"Freedom" in the form of legislative measures and widespread liberation movements ultimately led to hopes of amelioration, food sovereignty, and optimism among previously enslaved peoples. However, strategic disputes over land ownership rights, limited economic opportunities and performative replacements for slavery, like sharecropping and land leasing, allowed systemic oppression to persist (Johnson, 1984; Merem, 2006; White, 2018). Post-liberation movements further shaped Caribbean communities and exacerbated economic imbalances that perpetuated a socioeconomic segregation between racial and ethnic island groups.

Several key informants in our study recognized that native farmers, particularly the Rastafarians on St. Thomas, treated farming as a lifestyle rather than a business. This dramatically limited the kinds of governmental support they could be eligible for were they to attend agriculture extension programs, for example. The birth of Rastafarian culture was a direct response to historical (European) colonization. Afro-Jamaicans of the early 20th century sought ways to defy governance and rebel against the oppression and loss of autonomy of Black people that resulted from British colonial rule (Campbell, 1980). They strived for an identity that would thwart the expectations of conformity to Eurocentric culture and supremacy. Rasta traditions, once established, significantly influenced other Caribbean Island populations, including inhabitants of the USVI (Edmonds, 2012).

The VI Agricultural Plan Task Force 2021 (2021) recommends developing an Agriculture Business Center to aid farmers in increasing production and developing skills around the business of farming (e.g., book-keeping and grant-writing). These programs would have to be open to farmers who may not have legal title to their land and address the cultural and economic diversity of participants, particularly Rasta traditions. Still, how do we incentivize farmers to take advantage of this kind of programming? That problem will still exist despite the addition of an Agriculture Business Center.

Historical Issues Driving Contemporary Problems

In the Caribbean, relic systems of governance, geographical isolation, and supply chain limitations reinforce mechanisms of widespread corruption or general negligence. Colonial legacies, nativist discourse, and an island-influenced racial divide serve as additional obstacles that U.S. citizens of the Virgin Islands continue to face (Austin, 2018; Capetillo-Ponce & Galanes, 2013). Food systems plagued by socioeconomic stratification and geographic barriers that limit oversight present unique challenges to small island states. Many islanders associate agriculture and physical labor with slavery and indentured servitude. This is a global phenomenon not linked exclusively to USVI. Historically, the labor force was rooted in mechanisms of colonialism worldwide (Barry et al., 2020; Williams, 2013).

Still, there is growing awareness that food-related policies and programs can address issues of equity and resilience (Campbell et al., 2022). There are specific national policy platforms aimed at building food justice in the U.S. (Beyranevand & Broad Leib, 2023; Valliant & Freedgood, 2020). Recent legislative indicators signal movements to attract, directly support, and engage people of color in agriculture. The Emergency Relief for Farmers of Color Act and the Justice for Black Farmers Act were passed to identify and address the needs of BIPOC farmers. A burgeoning local food movement across the U.S. over the last decade inspired many BIPOC farmers to engage in growing food. Multiple programs have encouraged BIPOC farmers on the U.S. mainland; the Rodale Institute and the Organic Farmers Association gave mini-grants for BIPOC farmers; several training programs specifically for BIPOC farmers exist; and the USDA Local Food Purchasing Assistance program (LFPA) has funded state, tribal, and territorial governmental local food purchases that support underserved producers. Thus far, the food sourced through these programs bolsters food banks and pantries, schools, and other emergency outlets in underserved neighborhoods. Despite these programs' growing success, there is a significant issue related to agricultural land access.

Land Rights to Whom

Land to practice agriculture on is scarce and expensive in the USVI. Perhaps one of the more significant barriers facing agriculture in the USVI currently is a farmer's ability to gain legal title to the land (VI Agricultural Plan Task Force 2021, 2021; Southern Region of the Sustainable Agriculture Research and Education [SARE], 2018). According to multiple sources, people were simply squatting on the land they hoped to one day own; but without parcel surveys, potential owners were prevented from pioneering legal business ventures. Since the 1970s, squatting residents often lived on the land without ever capitalizing on its potential. There were cases (on St. Thomas) of people using the land without legal rights to grow food. They were, therefore, ineligible to participate in financially incentivized educational programming that provided support in the forms of soil mitigation, water storage, small-business classes, bookkeeping, etc. Surveying these parcels could unlock significant arable acreage for growing food and provide pathways to legal farm ownership. This would take significant political will on the part of the USVI government, which depends on who is in office (particularly in the Commissioner of Agriculture role), their goals, and their power to make change.

We recognize that many Caribbean islands experience widespread political corruption with limited governmental or global humanitarian oversight. The land-grant framework struggles to identify or acknowledge clear and distinct minority rights, for example (Afro & Michelini, 1997; Klopf, 2004). In addition, laws and policies are often developed by leaders with conflicts of interests, who for example may benefit directly or indirectly from esoteric and abstruse language. Lack of focused leadership and governance like this certainly affects cohesive forward momentum that could lead to sweeping positive change.

Small-scale subsistence farming and land leases among smallholders and rural residents rarely compete with global stakeholders (Ávila-García & Sánchez, 2012; Vásquez-León, 2010). Globalization does not favor small-scale farming. Revenue from tourism dollars generates more money than maintaining sustainable food systems. Therefore, political, cultural, and legislative consensus rarely shapes a socioeconomic framework of governance that effectively prioritizes all USVI citizens equitably.

Future Directions and Recommendations for Further Exploration

Opportunities linking agriculture and tourism could incentivize people to farm. Tourism continues to be the premier economic engine in the USVI. Key informants discussed novel programs that would vitalize local food systems and yield positive impacts: (a) develop value-added products; (b) redirect cruise-ship tourists away from the overrun port shopping districts toward farms and food adventures farther inland; and (c) increase farmers markets and food-focused events on the islands. In a post-pandemic world, these innovative strategies aimed at linking agriculture-related ventures and tourism could empower strong partnerships. In this way, tourists would gain a more meaningful island experience, and residents would benefit from increased exposure and income. In terms of future research, we see value in better understanding how to incentivize farmers and would-be farmers to participate in agriculture and business education programming offered by USDA NRCS, UVI Extension, and/or a new Agriculture Business Center. Perhaps as a precursor to this, working toward forming farmer networks and/or peer-to-peer training opportunities to share knowledge and expertise related to farming, technical and business skills, would be time and funding well spent.

Conclusion

Our research has illuminated the complex barriers affecting accessibility, affordability and sustainability within the US Virgin Islands' food system while also uncovering promising pathways to enhance agricultural and food system resilience. Understanding the historical context of forced labor in sugarcane agriculture, driven by global trade, is essential for developing a more sustainable and resilient food system in the USVI. This history underscores the significance of transforming agricultural work from a burdensome legacy to a source of pride and empowerment. The Rasta farmers in the Bordeaux region on St. Thomas,

who operate farm businesses on land where their ancestors once toiled, epitomize this shift.

Efforts to make agriculture more appealing to younger generations—through technology, tourism, and health-related fields—are gaining momentum in the USVI. The resilience of the local population and the emergence of a dynamic entrepreneurial spirit are evident in initiatives like Ridge to Reef Farm dinners on St. Croix, which elevate regional foods. This, coupled with a rise in documentary films, speaking panels, farmers markets, and educational events, highlights a growing interest in sustainable food systems and food security.

Challenges revealed by this study point to the need for a dual-focused approach: sustaining local agriculture while fostering meaningful connections with the tourism industry. The islands' food system is vulnerable to external factors such as hurricanes and economic fluctuations, which necessitates a strategy that strengthens local agriculture and enhances the tourism experience with authentic, locally sourced products.

The vibrant and ambitious spirit among islanders and newcomers presents a unique opportunity to bridge agriculture and tourism. This integration can safeguard the islands' food sovereignty while providing a more immersive and sustainable tourism experience. As policymakers move forward, aligning strategies to support local agriculture will be crucial in developing a resilient and integrated framework that nurtures both the land and the economy of the United States Virgin Islands.

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