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Investigating the Connections Between Food Choices and Climate Change Mitigation in Fijian Households

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Abstract Climate change negatively impacts Indigenous people's food sovereignty. The choices communities make to manifest that sovereignty fluctuate in response to environmental conditions and access to resources. To investigate how communities in coastal Indigenous Fijian (iTaukei) villages balance risks related to food production and food access we conducted 71 interviews in three coastal communities across Fiji. We asked which foods were purchased from nearby towns, which foods were grown or harvested locally, and how different spatial locations and climatic factors affected food choices. Geography, weather patterns, and extreme events influence food production, while village remoteness influences food access. These factors also affect risk exposure mitigation in iTaukei communities. Our cluster analysis comparing food items in town and village groups showed there was little overlap between community-grown and purchased foods for each village. However, there was a higher degree of variation within the community-grown foods. Purchased food and frequency of travel were consistent among all locations regardless of distance or cost of travel, suggesting that items from towns were relatively inelastic to travel costs. We find that coastal iTaukei communities are splitting risks by maintaining two complementary food systems, providing the ability to alternate between purchased and community-grown foods to adjust for varying risk levels. While grounded in Fiji, this work speaks to broader conversations about barriers to Indigenous food sovereignty.

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Introduction

A changing global climate negatively affects access, availability, utilization, and food stability in many countries (Mbow et al. 2019). Those in the global south are disproportionately affected, and Indigenous groups are particularly affected within these countries (Ngcamu 2023). Food security is an ongoing political issue whose impacts are exacerbated by climate change (Gregory et al. 2005). While having predictable caloric intake, food security, is important, not all calories are equal nor arrive in the same foods. Food sovereignty refers to a community's right to their own food and agriculture systems that produce healthy, culturally appropriate foods in an ecologically sustainable way (Patel 2009).

Food sovereignty actors emphasize local foods and reject the privatization of natural resources to give control of water and land to the food producers local to that area (U. S. Food Sovereignty Alliance 2024). This notion is especially important to Indigenous communities because colonization, climate change, and neoliberal capitalist markets diminish food sovereignty (Ferguson et al. 2022; Whyte 2016). Heat waves and incremental increases in temperature cause species to retreat to cooler areas, out of their natural distributions, where people harvest them for food (Corlett 2011). In tropical coastal communities, rising temperatures strongly correlate with coral bleaching; these events threaten the local supply of protein in Indigenous coastal

communities because coral die-offs decrease fish and invertebrate species abundance and body mass (Cinner et al. 2012). Extreme weather events destroy reef and mangrove habitats that protect coastal communities from erosion (Hernándes-Delgado et al. 2024). In other studies, Indigenous Fijian men have reported that it is now harder to grow crops due to changes in soil composition and saltwater intrusion from rising sea levels (McKenzie et al. 2022). Many crops will reach the limit of their heat tolerances and cease to grow in hotter conditions (Corlett 2011). The rise in sea level here is considered a local effect, whereas more significant climate disasters such as cyclones can be considered a regional effect because they can disrupt supply chains and make it more challenging to access food from local towns. Due to these compounding variables, Indigenous communities are faced with adversities in achieving food sovereignty including barriers that hinder growing, harvesting and purchasing the food they desire.

Fiji: A Case Study

Fiji is composed of approximately 300 islands in Melanesia. The first settlers arrived some 3,500 years ago (Clark and Anderson 2001). Later, the British Empire colonized Fiji on October 10th, 1874. The first governor, Sir Aurthur Gordon, created policies that limited Fijians from participating in commercial and political developments. Fijians were also taxed on agricultural products instead of traditional currency. To maintain these policies and grow Fiji's economy, the governor introduced indentured Indian laborers to work on sugar cane plantations and processing mills. The indenture system was terminated in 1920, and many Indians stayed in the country (Chand 2015) influencing Fiji's cuisine and customs. Fiji gained independence on October 10, 1970; the current demographic is 56.8% iTaukei, or Indigenous Fijian, 37.5% Indian, and 1.2% Rotuman. Although most of the land mass of Fiji is mountainous, about 90% of Fiji's population lives on the coast (Sutton 2013).

In many Pacifika communities the natural world is viewed in relational terms. The land is not something that is owned, it is something that communities are part of. Being part of that relationship implies certain rights and responsibilities: nature does not exist outside of people and people do not exist outside of nature. In Fiji this relationship is encapsulated in the term *vanua*. *Vanua* is the interconnected nature of physical objects like people, places, ancestors, relatives (both human and non-human) and the actions that are necessary to maintain those relationships. For example, when an iTaukei child is born in the village its umbilical cord is buried near the home under a tree or rock. Thus, that child becomes part of the land and vice versa (Long 2018). The child and the tree are part of *vanua*, but so is the act of burying the umbilical cord because it is that act that facilitates that relationship.

Perhaps unsurprisingly, ecosystems have strong intrinsic value to iTaukei communities as expressed through this epistemological concept of *vanua* (Stutton 2013). Climate change and other stressors like urbanization are threatening *vanua* and the natural resources it supports. Episodic events like hurricanes or flooding may represent real and punctuated disasters. Events that have a "before" and an "after" and are often named. For example, Cyclone Winston ravaged Fiji during 2016, making landfall as a category 5 hurricane with sustained winds over 170mph. This landfall had, and continues to have, indelible impacts on communities and reframed climate conversations, especially among coastal people. These punctuated events can shock a system - opening opportunities for new conversations, new political alignments and, unfortunately, disruptions in civil society.

In contrast, the "slow violence" of sea level rise (*sensu* Nixon 2013) is not a single event. Unlike hurricanes or flooding there is no option of a "before" to move toward. This insidious creep places communities in increasing levels of danger. The danger of sea level rise is multifaceted. Sea levels in Fiji are already rising by 6mm per year, while an estimated 6.2% of the shoreline infrastructure of Fiji is predicted to be inundated by 2100 (Shiiba et al. 2023). In low lying coastal areas, particularly those on coral rock, sea level rise can contaminate fresh groundwater, rendering agriculture more challenging.

To further explore people's relations with land and understand how climate and its associated impacts influence access to markets and food choices, we worked with three communities experiencing a gradient of food production and access: Nagigi, located on Vanua Levu; Qilai, located on Viti Levu; and Mua-i-ra, located on Naviti island of the Yasawa group (Figure 1). We investigated how iTaukei communities balance food choices to minimize risk exposure considering that physical geography, weather patterns, and climate change influence food production while the remoteness of each community

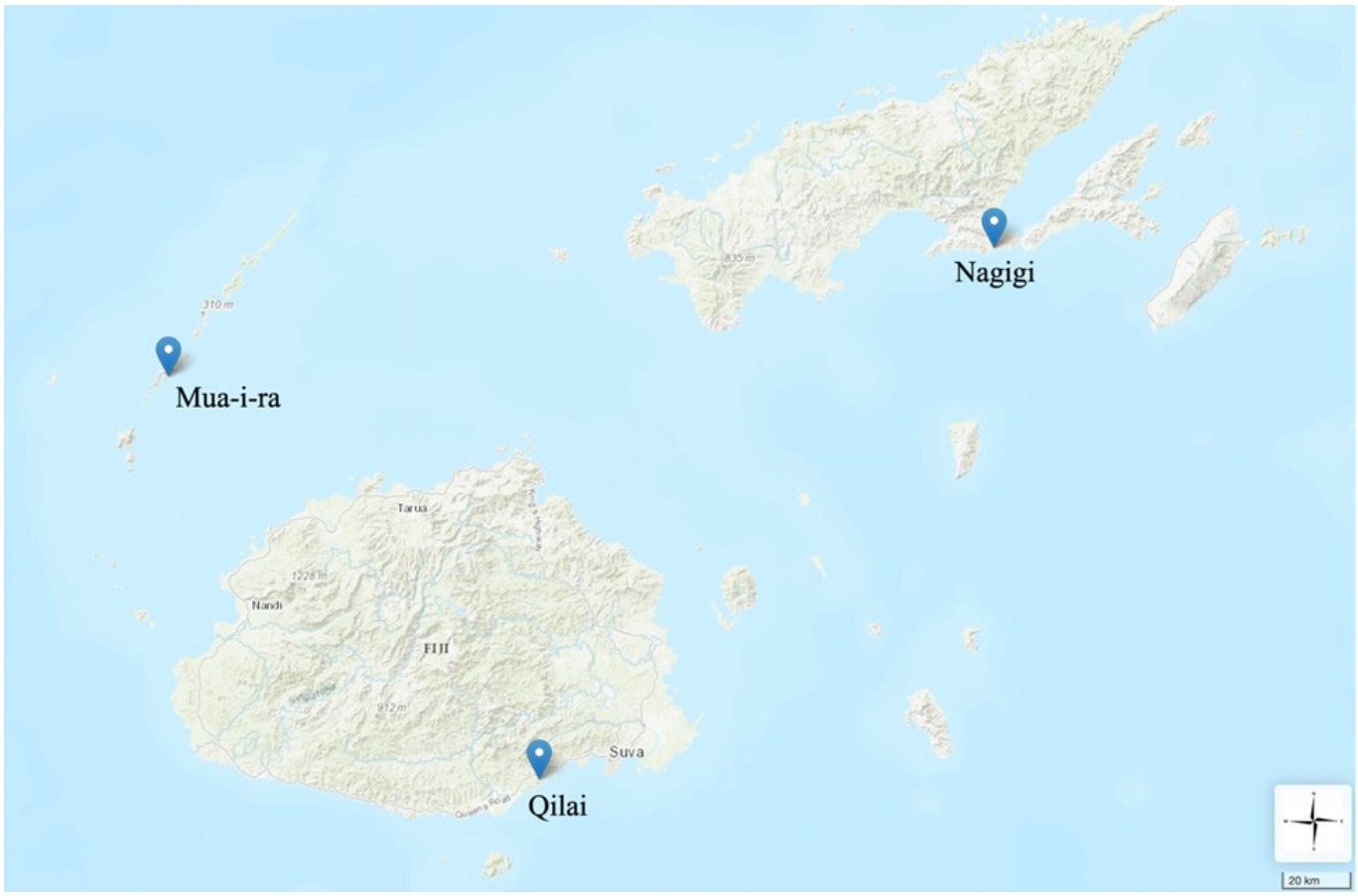

Figure 1 Map of Fiji indicating study sites of Nagigi, Qilai, and Mua-i-ra in 2024.

and climate change influences food access. Functionally, this means that certain foods are purchased from towns while other foods are harvested from villages. This provides redundant ways of acquiring culturally important calories. iTaukei communities practice risk spreading, where food is purchased and grown locally so nutrition is not entirely reliant on one source. Buying food decouples local food from community farms but is sensitive to supply chain shutdowns and barriers to travel following disasters. By contrast, locally produced food is less susceptible to geopolitical shifts but is sensitive to local perturbations such as saltwater inundation and habitat degradation.

Methods

We conducted research in three communities in the Republic of Fiji in May and June of 2024 and worked with partners based on preexisting relationships and villages' interest in collaborating with the authors (Figure 1). Interviews lasted approximately 10-20 minutes, depending on the level of engagement from the interviewee. Because of the heterogeneous distribution of knowledge in iTaukei culture, we involved various community members, including men and women aged 21 to 81. We conducted a total of 71 interviews across three villages (28 Qilai, 24, Nagigi, and 19 Mau-i-ra). Within the villages, the median age range was 48-53 and the majority of interviewees identified as women (74.6% women and 25.4% men). Our interviews showed a total of 86 different kinds of food products, which are foods identified by interviewees. Nagigi had 52 products, Qilai had 35 products, and Mua-i-ra had 70 products; significant overlap of products occurred within each site. A compilation of data that includes each food item mentioned, its scientific name, its English common name, and its Fijian common name, is available as Appendix 1. The largest community was Qilai with 80 households and the smallest Mua-i-ra with 32 (Table 1).

All research was conducted under the auspices of the Syracuse University Ethics Committee IRB 24-

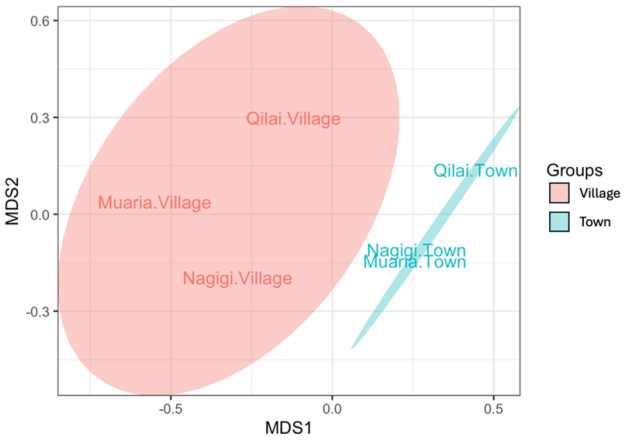

Figure 2 Cluster Dendrogram of Food Choices among iTaukei communities. Bootstrap values from 1000 replicates are listed above the node.

121. Survey questions were developed during conversations with iTaukei community members during summer of 2023 and were validated through preliminary evaluations with community members in Nagigi. While these evaluations were useful in developing the suite of questions, the resulting answers were not included in these analyses.

Each interviewee was asked a series of questions that began with basic demographic information (Appendix 2). We then asked, "what did you have for breakfast, lunch, and dinner," and "where did those foods come from?" This type of question is effective because it is more immediate and assists with active recall (De Keyzer et al. 2015). To assess the categories of climate susceptibility (global vs. local) participants were also asked what types of foods were typically bought at the grocery store and which were typically grown or gathered in the village. These data were then compiled into a table (Appendix 3) and were plotted as a cluster dendrogram, conducted in the package VEGAN 2.6-8 (Oksanen et al. 2024) (Figure 2).

Finally, to assess whether access to markets was an influencing factor we asked about transportation costs in terms of both the time and the price required to reach the nearest location for purchasing groceries. Data were gathered on the type of transport, shopping frequency, transportation cost, and transportation duration (Appendix 2). Notes were handwritten in field notebooks during each interview and subsequently transcribed digitally and re-checked with native Fijian speakers to ensure proper translations.

Results

Our cluster analysis revealed three key points. First, there was a high degree of similarity between all three locations for staple grocery store food items such as flour, sugar, and rice. Second, and in contrast, there was a greater degree of variation of foods grown within the communities, although such staples as plantain, dalo, bele, cassava, coconut, and fish were all commonly found. Finally, we saw little overlap between the sets of food obtained from town and in the village (Figure 2), indicating that these were largely non-overlapping sets.

Our investigation of potential barriers to markets indicated substantial variability in both the amount of time traveled and cost per visit that community members faced. Nagigi was the closest to a town, with an average reported travel time of 31.04 ±7.5 minutes predominantly by bus and the average cost of travel being $2.61 ±0.04 FJD. Qilai had an average reported travel time of 45 ±14.14 minutes, predominantly by bus, and an average cost of $7.65 ±2.54 FJD. Travel to grocery stores from Mua-i-ra was most time-consuming and expensive as the average reported travel time was 93.46 ±15.19 and cost $50 FJD via small motorboat over nearly 50 km of open ocean (Figure 1).

Discussion

Our analysis revealed distinct patterns in food systems between all three sites. Foods purchased from town exhibited a tighter clustering, suggesting highly similar food acquisition choices among all three villages. By contrast, there was a high degree of dissimilarity and minimal clustering among communities when analyzing foods produced within villages, displaying a

Table 1 Demographic data and food products of each community visited.

Site	# of Households	# of Interviews	% Female	Median Age	Median Residency	Distance from Town (km)	# products town	# products village	# of products both
Qilai	80	28	82	48	31	24.3	21	13	1
Nagigi	65	24	67	54	34	21	18	28	6
Mua-i-ra	32	19	74	53	31	56.84	35	33	2

higher degree of difference in choices around harvesting and farming. Despite the greater variety observed in food production, staple foods such as flour, sugar, and rice remain central components of the diets across both axes independent of the time, effort, or financial resources required to access them. This indicates that these staples are price-inelastic and essential to contemporary iTaukei diets. Additionally, our research revealed that, despite vastly different travel times, the average frequency of travel to town for supplies was similar across all three sites. This suggests that the cost and distance of traveling to town were not a deterrent for community members to obtain supplies.

Our findings in the context of climate change suggest that iTaukei communities are adaptable, balancing different kinds of risk to support their food sovereignty. Staples are purchased from town and are therefore subject to potential large-scale climate induced disruptions such as supply chain interruptions or fluctuations in global price and supply. On the other hand, many key foods such as the traditional iTaukei starches cassava, dalo, and yams are grown within community gardens or food forests. These foods are more resilient to large scale disruptions as they are locally grown, but they are susceptible to more local-scale perturbations such as sea-level rise, increases in cyclones, or drought. Thus, we see that coastal communities are choosing foods that distribute risk across global and local scale climate threats. This ability to shift between where and how to obtain food provides iTaukei communities some resilience and adaptability in maintaining their food systems.

The disruption of the COVID-19 pandemic served as a natural experiment, allowing us to view a disruption that might affect food access in ways similar to climate-induced natural disasters (Walters et al. 2021). When major cities were shutting down and employment opportunities were limited for Fijians, community members informed us that relocation from urban areas back to home villages was a common response (see also Leweniqila and Vunibola 2020 for a similar example). Upon returning to their communities, interviewees reported an increase in local-food production. Members returning from the city could access farmland, and thus community-grown food was a common response to the lack of imported food and a reduced access to metropolitan grocery stores and markets. This shift led to changes in food consumption, as well as in food production, including the emergence of food collectives (*solesolevaki*), such as in Nagigi, where community members collaborated to provide food for one another (Leweniqila and Vunibola 2020; McMichael et al. 2024). This adaptability illustrates the resilience of local food systems in the face of global market disruptions, as communities could switch between food production and market access as needed and speaks to the adaptive capacity of iTaukei communities (McMichael et al. 2024). In addition, strong family ties between rural communities and those members of an extended family (*tokatoka*) living in urban areas allow for the transfer of food and resources between the village to urban areas (Leweniqila and Vunibola 2020). For example, family members employed in urban areas can financially support family members in rural communities, supplementing their ability to purchase food from town. Together, this research highlights the importance of land access for iTaukei communities. In this context, because iTaukei communities were able to maintain land sovereignty and ownership over traditional farming/fishing grounds in a post-colonial context, they had greater access to ecosystem services including food production, and, thus, greater resilience to climate change.

We must also consider the adaptive capacity of the plants and animals grown and harvested in communities to understand their vulnerability to future climatic stress. Two crops that were prevalent in our results have had research suggesting their vulnerability to climate change. Cassava is commonly grown in communities and is highly drought tolerant (Meier et al. 2017). However, cassava is intolerant of flooding and cyclones, as dislodging and root rot occurs (Palanivel and Shah 2021). Another important crop grown in Fijian communities is papaya, which has a temperature tolerance between 21–33 °C. Above 35 °C papaya undergoes female sterility and no longer bears fruit (Palanivel and Shah 2021). Furthermore, drought induces lower production in papaya (Palanivel and Shah 2021). While Palanivel and Shah recommend genetic modification though crop improvement programs, many scholars have noted that genetically modified crops may be anathema to Indigenous food sovereignty (Gupta 2018; Mueller and Flachs 2022; Plahe et al. 2013). Thus, efforts that are grounded in Indigenous land practices such as utilizing seed banks and conserving unique landraces would increase the resilience of food crops in Fiji and

other Pacific islands.

In addition to seedbanks and strengthened landraces, our findings offer insights for shaping policies that support food sovereignty and climate adaptation in Fiji. Investments in decentralized, climate-resilient infrastructure are essential. Fiji's Horizon 2030 strategy highlights the importance of diversified agricultural systems and local infrastructure development, recommending innovations such as climate-resilient crop varieties, seed banks, and agroforestry as key tools for climate adaptation (Government of Fiji 2021). Community-managed food forests and regenerative agriculture initiatives, particularly those that are women-led, can improve ecological and nutritional resilience. Further, improving equitable market access through transportation subsidies, mobile markets, or community cooperatives would reduce the burden on isolated villages and align with the inclusive market strategies proposed in Horizon 2030 (Government of Fiji 2021). Additionally, local responses during times of stress mirror the goals of the Pacific Adaptation to Climate Change (PACC) program, where the importance of decentralized, community-driven adaptation strategies (Secretariat of the Pacific Regional Environment Programme 2014) is highlighted. The NAP and PIFACC recommend integrating Indigenous knowledge into formal adaptation planning (Government of Fiji 2019; Secretariat of the Pacific Regional Environment Programme 2005) to design policies that resonate with local worldviews and governance structures.

Part of the adaptive capacity of food systems depends on the knowledge necessary to make informed choices about which foods will work under which climate scenarios. Our work shows the significance of gender in dietary decision-making within iTaukei communities. It recognizes the influence of women, who are often responsible for household food choices, while many men work outside the home. Our findings mirror previous research in Fiji that documented similar gender divisions in food-related knowledge and practices, including the central role that women play in food processing and natural resource provisioning (McKenzie et al. 2022) through their knowledge of food and forest products (Pearson et al. 2019), as well as through gendered divisions in fishing (Golden et al. 2014). The knowledge that women hold offers key insights into the biology, management, and use of economically valuable plants and animals, thus providing the raw material for adaptation strategies. (McMichael et al. 2024). Moreover, our research shows that the dietary choices women make daily are already incorporating differential risks of climate and that their food sovereignty is adapting to climate risks at both a local and national level. Women's leadership in food-related decisions, including managing food forests and other traditional practices, shows their role in maintaining community resilience (Fache and Breckwoldt 2024; Ferguson et al. 2022; Thomas et al. 2021).

Access to land and sea resources further strengthens these food systems' resilience, making them less vulnerable to global-level perturbations. However, it remains to be seen what happens when local agricultural systems, such as farms, are severely disrupted by events like saltwater inundation. Other communities reflect that changes in soil composition and sea level rise are creating unfavorable growing conditions, thus encouraging community members to more heavily rely on markets. (McKenzie et al. 2022). Future research should consider how these communities respond when their primary food production systems are compromised and whether their adaptability extends in both directions, back to market-based reliance when necessary. Research from other coastal regions has shown that having a strong base of locally grown foods provides economic and food-based resilience to environmental degradation and climate change (García-Quijano et al. 2023). Although our study focused on three coastal communities, exploring insights from inland communities could offer a broader understanding of food system resilience across diverse Fijian contexts.

Our findings speak to the adaptability of coastal Fijian communities. However, we acknowledge some biases in our study. A small sample size in each location was obtained due to the overall small sizes of each community and the availability of interviewees during working hours. Our reliance on self-reported data could have introduced bias as interviewee responses may not have been completely accurate. Furthermore, due to the temporal limitations of the study, we could not extend our interviews to all growing seasons, which could influence food items identified. Our limited sampling time in each community could also influence our results. For example, in Mau-i-ra the community had "Dahl Monday" to lighten the burden of cooking after large

Sunday family dinners. This may have overestimated the importance of imported Dahl in this community. Thus, we encourage future researchers to consider sampling in larger communities during all growing seasons and over several weeks to fully capture the diversity of food consumed.

Understanding how coastal communities in Fiji respond to environmental and market disruptions will be necessary for developing strategies to strengthen resilience in the Anthropocene (Shah et al. 2018). The adaptability and resilience of iTaukei food systems provide lessons for managing upcoming climate disruptions. Continued support for community-based and gender-sensitive adaptation strategies is recommended to enhance food sovereignty and resilience during ongoing environmental change.

Declarations

Permissions: Syracuse University Ethics Committee IRB 24-121. Village leadership permissions from Quilai, Nagigi, and Mua-i-ra.

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Conflicts of Interest: None declared.

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