

Building Resilience in Jamaica's Farming Communities: Insights From a Climate-Smart Intervention

DONOVAN CAMPBELL¹ AND SHANEICA LESTER¹

¹ Department of Geography and Geology, The University of the West Indies, Kingston, Jamaica
Email: donovan.campbell@uwimona.edu.jm

ABSTRACT Rural farmers, especially those with limited resources, are on the frontline of the climate crisis. In the Caribbean, vulnerability of agri-food systems to climatic disturbances is recognized, but empirical evidence detailing effective adaptation strategies remains patchy. In Jamaica, a combination of challenges—ranging from diminishing availability of arable land and stagnant agricultural innovation to the marginalization of small-scale farming and recurrent climatic shocks—has led to significant agricultural setbacks and socioeconomic distress for local farmers. This case study is based on a synthesis of quantitative and qualitative data derived from a climate adaptation initiative in Peckham, Clarendon, a pivotal agricultural hub in Jamaica. The data acquisition methodologies encompassed livelihood baseline assessments, community engagement surveys, training workshops, and focus group discussions. Synthesis of data from 31 agricultural training sessions and 16 climate-smart agriculture workshops, involving 458 farmers, offers cogent evidence of the initiative's tangible impacts on the Peckham farming community. The initiative was guided by two core objectives: (1) enhancing food security and rural livelihoods through the implementation of a renewable energy-powered aquaponics framework, and (2) improving land and water resource management practices. To achieve these goals, the Farmer-Field School approach was employed to promote climate-smart agricultural practices and strengthen the institutional capabilities of farming groups. The insights from the assessment underscore the potential of integrated climate-resilient agricultural practices in addressing both economic and environmental challenges faced by rural farmers. **KEYWORDS** agriculture, Jamaica, resilience, climate change adaptation

INTRODUCTION

Agriculture accounts for approximately 10% of the GDP of Caribbean countries. However, there are significant variations across the region, from as high as 20% in Guyana to roughly 0.5% in Trinidad and Tobago. Of the CARICOM countries, only Belize, Guyana, and Haiti produce more than 50% of the total food consumed by their populations (Food and Agriculture Organization of the United Nations [FAO], 2019). Specifically, in Haiti, nearly a fifth of its populace relies on agriculture, which forms 22% of its GDP. Conversely, Jamaica's agricultural sector, while contributing 7% to its GDP, supports 18% of its population (Planning Institute of Jamaica and the Statistical Institute of Jamaica, 2019; The World Bank Group, 2022). In 2018, food import expenditures in CARICOM nations amounted to US\$4.75 billion, marking a 44% increase since the year 2000 (Ewing-Chow,

2020). A core objective of Jamaica's national development policy is to reduce disaster vulnerability by supporting capacity-building initiatives to enable people to protect life and livelihood. In the agriculture sector, this can be achieved through climate-smart solutions designed to safeguard lives and livelihoods, while strengthening resilience to multiple agro-climatic hazards.

Jamaica is expected to experience climate trends characterized by more frequent and intense climate extremes, increased rainfall variability, and more frequent agricultural droughts (Climate Studies Group, Mona, 2022). The southern plains of the country, specifically the parishes of St. Elizabeth, Clarendon, and St. Catherine, are critical for the country's food security (Buckland & Campbell, 2022; Campbell et al., 2011). Clarendon is a major agricultural hub, but the average rainfall in the region is significantly lower than the national average

(Eitzinger et al., 2022). This makes rainfed agriculture a risky business for farmers in the area. Farmers in the region have adapted to the local climatic conditions by implementing practices grounded in a robust ethnoclimatological tradition (Beckford et al., 2007). However, recent studies of agricultural transformation through innovation projects demonstrate that not all farmers can adopt available innovations to cope with changes (Buckland & Campbell, 2022). This is because underlying social vulnerabilities often constrain uptake within the region. These current vulnerabilities are influenced by historical patterns of structural imbalances, as well as novel economic and environmental challenges.

In the past two decades, Jamaica has been besieged by a series of climatic catastrophes, including droughts, floods, and hurricanes, which have wreaked havoc on its economic trajectory and jeopardized the sustenance of numerous farmers. The total cost of the combined impacts of several storms and hurricanes (including associated severe flooding damage, loss of lives, and destruction of goods and services in the past decade has amounted to over US\$129 billion; Planning Institute of Jamaica, 2018). Scientific consensus suggests that the Caribbean region is experiencing a more variable climate of stronger dry season droughts (Herrera & Ault, 2017) and more-stormy wet season conditions (Taylor et al., 2018) which have profound implications for food and livelihood security at multiple levels. For breadbasket regions such as Clarendon Parish, some of these impacts are already being experienced by farmers.

Historically, Jamaica has been susceptible to multiple climatic shocks in quick succession. In 2008, Tropical Storm Gustave caused devastating damage to Jamaica's agriculture sector. A report by the Inter-American Institute for Cooperation on Agriculture (IICA) (2017) notes that Clarendon had the highest number of affected farmers, and sustained damages estimated at JMD 12 million. Similarly, with the passage of Tropical Storm Nicole in 2010 and the associated weeklong intense rainfall, Clarendon experienced the second highest damage in the agriculture sector (over JMD 80 million) surpassed only by St. Elizabeth in the southwest of the island (Selvaraju et al., 2013). Periods of drought have also been common in Jamaica in the last decade and have seriously impacted farmers (Gamble et al., 2010; 2017). Drought conditions in 2010 caused a 10%–30% reduction in crop yield in Clarendon (IICA, 2017). As a result of all these events,

farmers in Peckham expressed a deep sense of urgency for the implementation of measures to reduce future impacts on their livelihoods.

Agriculture is the primary use of farmland in Clarendon, where most of the island's tobacco is grown along with cotton, allspice, ginger, livestock, bananas, coffee, and cocoa. Peckham, located in the northern section of Clarendon (figure 1), is one of seven forest reserves in the upper region of the Rio Minho Watershed and has a population of 4,129 people. In Peckham, citrus, coffee, yam, banana, breadfruit, callaloo, mango, cocoa, pumpkin, sweet pepper, scallion, and corn are the main crops grown. The community frequently experiences natural disasters such as drought, landslides, bush fires, and soil erosion. The region represents one of the most severely degraded watersheds in Jamaica, and the communities face a range of interrelated socioecological and governance challenges. In Peckham, unemployment and limited livelihood opportunities exacerbate the underlying vulnerability to disasters.

Peckham and its surrounding communities heavily rely on agriculture and have limited alternative livelihood opportunities. Unfortunately, many farmers continue to use unsustainable farming techniques such as slash and burn, charcoal burning, and high external input farming systems. Female farmers are well represented in livestock production and have organized themselves into groups to offset adverse climate impacts on their livelihoods. Evidence synthesis from surveys and focus group discussions confirms that farmers in Peckham are increasingly affected by severe water shortages and lower agricultural output, which threatens their livelihoods.

CASE EXAMINATION

This case study highlights the lessons learned from a climate change adaptation intervention in the Peckham farming region of Clarendon, Jamaica. The initiative was supported by the Community Disaster Risk Reduction Fund (CDRRF) of the Caribbean Development Bank and involved a deep understanding of the community's vulnerabilities and capacities through comprehensive data collection methods. Livelihood Baseline Assessments (LBAs) and Community Engagement Surveys (CES) provided in-depth insights into the local dynamics. The LBAs were guided by the FAO's Livelihood Assessment Toolkit and used to prepare livelihood profiles for vulnerable groups, while the CES, which collected feedback from 950 residents, measured the six foundational pillars

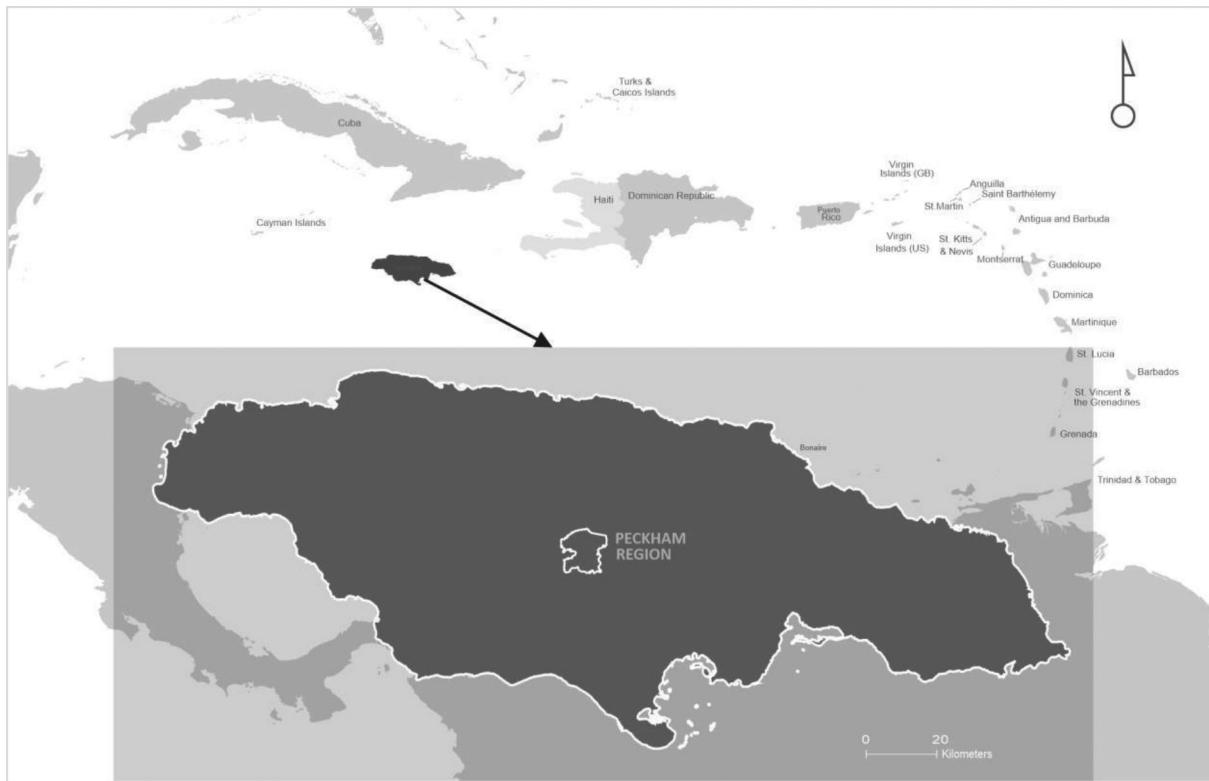


FIGURE 1. Peckham farming region, Jamaica.

of community readiness: governance, safety and justice, social transformation, socioeconomic development, physical transformation, and youth development.

The initiative's central focus was on training in Climate-Smart Agriculture (CSA), which empowered 180 farmers with modern and resilient farming practices. The project's holistic approach, which addressed physical challenges and socioeconomic dynamics, was evident in the active engagement of the communities. Data from 31 training sessions and 16 CSA workshops, involving 458 farmers, were synthesized to provide evidence of the project's impact on the Peckham farming region. This intervention has the potential to catalyze transformative adaptation. By equipping the farmers with knowledge and practical skills and emphasizing a comprehensive approach to adaptation, Peckham is not only prepared to cope with climatic challenges but is also poised for a fundamental transformation in its agricultural and community practices. The widespread community engagement, coupled with the actionable insights derived from Participatory Learning Action Tools, strengthens Peckham's path toward a sustainable and resilient future. The examination of this case study will focus on (1) the disaster risk context under which the farmers

operate, (2) the adaptation intervention, and (3) emerging insights.

DISASTER RISK CONTEXT

Farming systems in Peckham are vulnerable to multiple hazards, including intense and unpredictable rainfall that leads to flooding and soil erosion, periodic pest and disease outbreaks, frequent drought events, and bushfires. A Rapid Climate Change Vulnerability Assessment (RCCVA) conducted in Peckham in 2019 highlighted the differential impacts of disasters on farmers' livelihoods (Environmental Health Foundation [EHF], 2018). Farmers identified spatial variability in microclimate as a factor that influences differential exposure to drought and flooding. During the 2016 drought, farmers suffered from severe water shortages, resulting in lower agricultural output. To cope with droughts, farmers mainly rely on local knowledge regarding land preparation and plant care. Some farmers indicated that they use the dry season for land preparation to avoid the impact of drought, a practice observed in other farming communities across the island.

Drought conditions have a severe impact on crop health, yield, and livelihood diversification possibilities.



FIGURE 2. Spatial pattern of flood risk in Peckham and Clarendon.

In the Peckham farming region, plant diseases and pests have significantly affected agricultural production and the livelihoods of farmers. Focus group discussions have reached a consensus that the increased frequency of bushfires, resulting from practices such as slash and burn, has adversely affected crop production and soil quality, leading to increased crop and livestock losses, and damage to dwellings. Deforestation and environmental degradation caused by charcoal production have increased vulnerability across communities.

The drought problem has been compounded by the increasing rates of deforestation. Trees are often removed during land preparation for farming and charcoal production. Recent storm events have resulted in increased sediment loads, indicating watershed degradation. This

degradation has caused severe flash flooding in the area, with large volumes of surface runoff transporting sediment, debris, and pollutants such as solid waste and sewage. To characterize the flood hazard, flood hazard maps were created using a combination of logistic regression and multivariate spatial statistics. Multiple relevant input factors such as bedrock geology, soil, land use, the drainage network, and precipitation were used to create the maps (figures 2 and 3).

The National Oceanic and Atmospheric Administration (NOAA) predicts a 95% chance that El Niño, the warm phase of the El Niño Southern Oscillation, will persist through the winter of 2023. Additionally, above-normal hurricane activity is predicted for the Atlantic Hurricane season. These predictions have significant

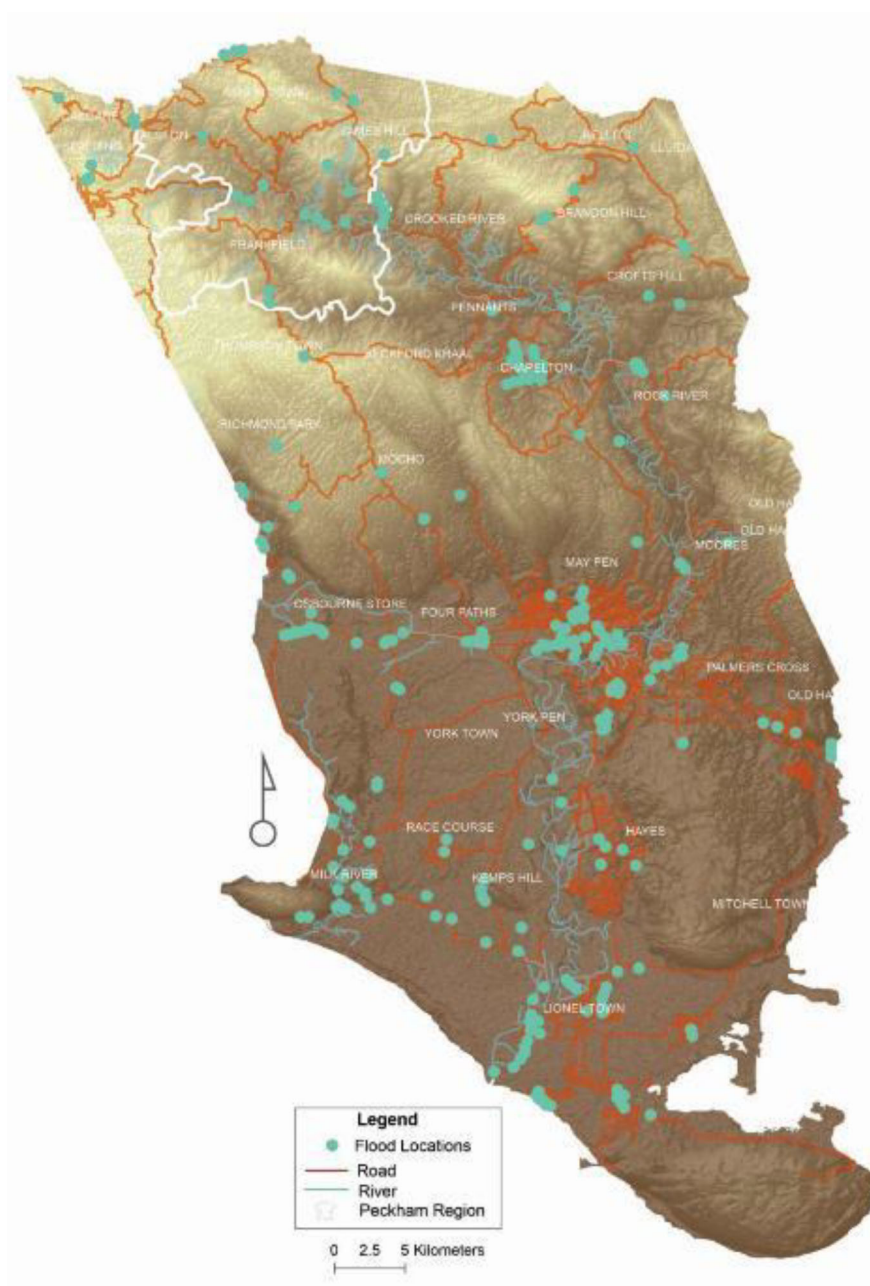


FIGURE 3. Historical pattern of floods in Peckham and Clarendon.

implications for vulnerable farmers in the Peckham region and across the island. For instance, in 2018, a 3-month period from July to September had higher-than-normal temperatures with lower-than-normal rainfall, prompting the National Meteorological Service of Jamaica to issue a drought alert for sections of Clarendon parish, including the Peckham farming region. Therefore, Peckham was already experiencing drought-like conditions at the start of the project, with many farmers reporting significant production losses due to drought conditions. Focus group

discussions revealed a hyper-awareness of climate-related hazards among farmers across Peckham.

A consensus from focus group discussions is that environmental problems are becoming more frequent and are anticipated to increase due to climate change. Increased climate variability is likely to impact water supply, including a reduction in the safe yield from some water sources, increased sediment loads due to the frequency of heavy rains, and decreased groundwater recharge. These changes demand site-specific climate risk management and

adaptation strategies to strengthen the resilience of local food systems. Recognizing the urgent need to strengthen climate resilience, the CDRRF project supported adaptation practices related to improved land and water management, better farming practices, community awareness, and the promotion of sustainable livelihoods.

THE ADAPTATION INTERVENTION

Given the importance of the Peckham farming area to domestic food supply and the multiple risks facing the region, the Caribbean Development Bank (CDB) and the EHF launched a 2-year project to strengthen the resilience of communities and farming systems. The project was implemented under the CDRRF with the intended outcomes of (1) enhanced food security and livelihoods through the establishment of an aquaponics system powered by renewable energy, (2) improved land and water management, (3) preparation of hazard maps and completion of vulnerability assessment and disaster risk reduction (DRR) strategies for the community, and (4) increased public awareness about climate change.

Significant progress was achieved toward building capacity for improved water and land management practices. A total of 400 farmers from eight farming groups received training in sustainable farming practices, small-scale poultry management (including climate-smart livestock production and housing structures), food safety principles, establishment of sweet potato demonstration and replication plots, small business/farm planning strategies, ginger treatment and fertilizer management, land husbandry, and postharvest practices and marketing strategies.

Improved water and land management practices can help alleviate many of the production challenges faced by farmers in Peckham. According to Focus Group Discussion (FGD) participants, the most pervasive challenges include marketing difficulties, lack of institutional support for small-scale farmers, particularly following adverse events that result in production loss, water availability, and praedial larceny. Soil erosion and the availability of suitable lands are challenges reported among farmers who cultivate in hilly areas. Notably, farmers are aware of and express interest in a wide range of land management solutions to remedy soil erosion. FGDs on farming challenges highlight that being a farmer in Peckham means more than generating income. Crop production is tied as much to a sense of purpose (dignity of work) as it is to income

generation. Consequently, despite challenges to production and farmers' expressed frustrations, most farmers are willing to remain in farming.

An assessment of the local farming conditions revealed an urgent need to address poultry management challenges. As a result, two livestock feed companies delivered small-scale poultry management training to farmers in the target communities. The project also upgraded the physical infrastructure of selected poultry farms to complement this training to make them more resilient to climate-related impacts. Small-scale poultry producers in Jamaica are highly vulnerable to the effects of climate variability and climate change; these farmers account for 30%–35% of national production and experience some of the worst damage during the passage of hurricanes.

Another significant achievement of the project was the establishment of demonstration farm plots to promote good agricultural practices in general and climate-smart agriculture in particular. Farmers were provided with the agricultural inputs needed to establish their plots. One sweet potato demonstration plot and 24 replication plots were established under the project. The “Uplifter” sweet potato variety (*Ipomoea batatas*) was introduced to farmers as it is considered more resilient to drought conditions and protects the soil from erosion. Widespread adoption of this crop by farmers could reduce losses associated with traditional potato varieties due to drought. Demonstration plots were also established for ginger, the production of which has declined in Jamaica due to the rhizome rot disease. These plots are also used to explore different measures to control future disease outbreaks. Farmers also cultivated pineapple on demonstration plots, which serve a dual role as a barrier crop to reduce soil erosion and an additional income source for the farmers. One demonstration plot and 40 replication plots were established in the community. The diffusion of agricultural innovation is not always straightforward. In this case, the farmers were receptive to the new crops and welcomed the opportunity to diversify their production system—thereby reducing vulnerability to climate impacts.

The Office of Disaster Preparedness and Emergency Management (ODPEM) and the Disaster Unit in the Clarendon Municipal Corporation were engaged to work with farmers in Peckham to develop Community Adaptation Plans (CAP). The plan includes relevant disaster risk management activities and the creation of hazard maps. In addition, community members received disaster

risk management training in Initial Damage Assessment, Shelter Management, and First Aid. The establishment of Community Emergency Response Teams (CERT) is a tangible product of these training sessions. The CERT is tasked with providing the necessary support to ODPEM and the Disaster Unit in the Municipal Corporation. Emergency shelters in the community were repaired, and 200 farmers received water tanks to support rainwater harvesting.

Farmers also benefited from the introduction of new farming technologies. A novel smartphone application with real-time access to agronomic and weather data were provided to farmers to reduce farm losses and maximize profits, thereby supporting their livelihoods. Additionally, a solar-powered aquaponics system was established in the community. Aquaponics is recognized as a sustainable and climate-resilient food production system with significant benefits, including improved water efficiency and limiting fertilizers or chemical pesticide usage.

DISCUSSION—EMERGING INSIGHTS

Promoting alternative livelihoods linked to agriculture is an important strategy to address multidimensional risks to farming systems in rural areas. Asset and livelihood diversification are overarching strategies that can reduce risk and increase options at the community level. One approach that can be implemented to improve adaptive capacity is the promotion of sustainable alternative livelihood strategies. In the context of Peckham's rural farming community, the interventions highlighted have the potential to bring about systemic shifts in the way the community approaches agriculture, technology, and resilience. The high-level of farmer and community engagement can be attributed to the effort put in at the outset of the project to sensitize community members, the sustained level of direct engagement with beneficiaries throughout the project to maintain involvement, and support from relevant political actors.

Providing farmers with the Revofarm mobile application can improve their access to climate and market information, positively impacting the community. This application provides farmers with real-time access to agronomic and weather data, supporting farm management planning and decision-making. By diversifying assets and livelihoods, the community is not only reducing its risk from potential climate-induced losses but also setting up a robust system that offers multiple economic avenues.

The embrace of technologies such as the Revofarm mobile application is especially significant. While traditional means of accessing weather and market data, like radio and TV, have their merits, the immediacy and specificity of a dedicated mobile application can be a game changer. It enables farmers to make timely decisions, optimize productivity, and enhance incomes.

The establishment of aquaponics systems in Peckham is another innovative adaptation technology implemented under the project. Aquaponics stands out as a groundbreaking intervention. Despite the high initial costs, its potential to simultaneously address food insecurity challenges and provide alternative income sources is revolutionary. As food security is integral to the acceptance of any CSA intervention, the duality of aquaponics—addressing both food and economic security—makes it a cornerstone of transformational adaptation.

Over 400 farm visits were conducted at the start of the project, which contributed to a high-level of engagement with the farmers. The establishment of trained CERTs further underscores the community's proactive stance toward resilience. By empowering community members to act as first responders, the community is significantly enhancing its ability to cope with extreme weather events, thus minimizing potential losses.

Results from FGDs reveal general sentiments on farming trends and conditions in Peckham. During multiple FGDs, farmers indicated that the community's population is aging, and the proportion of females is increasing. Recognizing the differentiated impacts of climate shocks on different genders and age groups will make adaptation strategies more inclusive and effective.

Successful community-based adaptation planning in Peckham should be driven by locally specific (grassroot) climate change solutions. Gender has emerged as an important consideration based on the statistically differentiated impacts of climate shocks on men and women. By acknowledging the role of women in community organizations and understanding the unique capacities of both genders, Peckham is setting itself up for a future where adaptation is not just about battling climate change but also about leveraging the strengths of its community members for holistic growth and resilience.

A high-level of community participation and a sense of ownership for the project activities were highlighted by some farmers as key ingredients to successfully completing the project. The proactive approach in Peckham,

involving community sensitization, direct engagement, and political involvement, ensures that the community feels a sense of ownership and trust toward the project. Such involvement is crucial for the long-term sustainability of any transformative initiative.

CONCLUSION

The prevailing discourse surrounding climate change, particularly in relation to small islands and rural agricultural regions, tends to highlight vulnerabilities and constraints in adaptation. However, as demonstrated by the Peckham intervention, a transformative perspective that focuses on proactive adaptation strategies can catalyze a paradigm shift from a narrative of constraints to one of opportunities.

In Peckham, farming is not just an occupation, it is a lifeline. The introduction of interventions such as the replication plots and the “uplifter” sweet potato variety not only counters the immediate threats of climate-related adversities but also paves the way for economic upliftment. The immediate implementation of techniques from the Farmers Field School sessions into their agricultural routines underscores the receptive and adaptive spirit of the Peckham farming community.

Building resilience against the multifaceted challenges of climate change is a journey, not a destination. While external factors pose challenges, deeply entrenched socio-economic and cultural patterns can sometimes offer resistance to change. Yet, the transformative potential lies in viewing agriculture not merely as a subsistence activity but as a dynamic enterprise. By positioning farmers at the heart of this transformative journey, agriculture can evolve into a tool for sustainable wealth creation, knowledge enhancement, and community upliftment.

Consistent reinforcement of best practices, regular trainings, and on-ground support from agriculture extension officers are crucial to ensure sustained impact. Moreover, recalibrating DRR strategies post extreme weather events and fostering collective local actions, especially in areas like marketing, can further drive the agenda of transformational adaptation.

In essence, the Peckham case study underscores the immense potential that lies in viewing climate change adaptation not as a reactive necessity but as a proactive opportunity. While the sustainability of certain interventions may remain uncertain, the ripple effects of this initiative have unmistakably instilled a renewed sense of hope and determination in the community. The path

forward is clear: transformative adaptation offers not just survival but a chance to thrive in the face of adversity.

CASE STUDY QUESTIONS

1. How does the climate crisis impact rural farmers in the Caribbean, particularly those with limited resources?
2. What were the primary challenges faced by farmers in Peckham, Clarendon, before the introduction of the climate adaptation initiative? How did these challenges reflect broader agricultural and socioeconomic issues in Jamaica?
3. Considering the data acquisition methodologies used in the study (i.e., LBAs, CES, training workshops, and focus group discussions), how do these methods contribute to the depth and reliability of the findings?
4. The climate adaptation initiative in Peckham had two core objectives related to food security, rural livelihoods, and resource management. Were these objectives aligned with the most pressing needs of the community? Are there other objectives that might have been considered?
5. Discuss the Farmer-Field School approach and its efficacy in promoting CSA practices. How did this approach address both the economic and environmental challenges faced by rural farmers in Peckham?
6. Given the successes of the Peckham initiative, how might similar programs be scaled or adapted for other communities in Jamaica or the wider Caribbean? What potential barriers or challenges might arise in such expansions?

AUTHOR CONTRIBUTIONS

The authors are responsible for the preparation of the article.

ACKNOWLEDGMENTS

The Caribbean Development Bank (CDB), the Environmental Health Foundation (EHF), and the farmers and community members of Peckham, Jamaica.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

REFERENCES

- Beckford, C., Barker, D., & Bailey, S. (2007). Adaptation, innovation and domestic food production in Jamaica: Some examples of survival strategies of small-scale farmers. *Singapore Journal of Tropical Geography*, 28, 273–286.
- Buckland, S., & Campbell, D. (2022). Agro-climate services and drought risk management in Jamaica: A case study of farming communities in Clarendon parish. *Singapore Journal of Tropical Geography*, 43(1), 43–61. <https://doi.org/10.1111/sjtg.12414>
- Campbell, D., Barker, D., & McGregor, D. (2011). Dealing with drought: Small farmers and environmental hazards in southern St. Elizabeth, Jamaica. *Applied Geography*, 31(1), 146–158. <https://doi.org/10.1016/j.apgeog.2010.03.007>
- Climate Studies Group, Mona. (2022). *State of the Jamaican climate (Volume III): Information for resilience building (summary for policy makers)*. Produced for the Planning Institute of Jamaica.
- Eitzinger, A., Campbell, D., Lizarazo, M., Tomlinson, J., Rodríguez, J., Valencia, J., Sandoval, D. F., Feil, C., Ramirez-Villegas, J., Prager, S., & Rhiney, K. (2022). Capacity building program to improve stakeholder resilience and adaptation to climate change in Jamaica (CBCA). CIAT Publication No. 525, 76. International Center for Tropical Agriculture (CIAT). <https://hdl.handle.net/10568/117966>
- Environmental Health Foundation. (2018). *Building resilience and adaptation to climate change while reducing disaster risk in Peckham, Clarendon and surrounding communities* [online]. Retrieved August 06, 2019, from <https://www.ehfjamaica.com/categories/featured-projects/building-resilience-adaptation-to-climate-change-while-reducing-disaster-risk-in-peckham-clarendon-surrounding-communities>
- Ewing-Chow, D. (2020). Five overlooked facts about Caribbean food security. Retrieved November 22, 2020, from <https://www.forbes.com/sites/daphneewingchow/2019/02/20/five-facts-about-caribbean-food-security/?sh=3e5db5650162>
- Food and Agriculture Organization of the United Nations. (2019). *Study on the state of agriculture in the Caribbean*.
- Gamble, D., Burrell, D., Popke, J., & Curtis, S. (2017). Contextual analysis of dynamic drought perception among small farmers in Jamaica. *Climate Research*, 74(2), 109–120. <https://doi.org/10.3354/cro1490>
- Gamble, D., Campbell, D., Allen, T., Barker, D., Curtis, S., McGregor, D., & Popke, J. (2010). Climate change, drought, and Jamaican agriculture: Local knowledge and the climate record. *Annals of the Association of American Geographers*, 100(4), 880–893. <https://doi.org/10.1080/00045608.2010.497122>
- Herrera, D., & Ault, T. (2017). Insights from a new high-resolution drought Atlas for the Caribbean spanning 1950–2016. *Journal of Climate*, 30(19), 7801–7825. <https://doi.org/10.1175/JCLI-D-16-0838.1>
- Inter-American Institute for Cooperation on Agriculture. (2017). *Assessment of the vulnerability of Jamaica's agricultural sector to the adverse consequences of severe weather events* [online]. Retrieved August 2, 2019 from <http://repositorio.iica.int/bitstream/11324/7229/1/BVE18040318i.pdf>
- Planning Institute of Jamaica and the Statistical Institute of Jamaica. (2019). *Mapping poverty indicators, consumption based poverty in Jamaica*.
- Selvaraju, R., Trapido, P., Santos, N., del mar Polo LaCasa, M., & Hayman, A. (2013). *Climate change and agriculture in Jamaica: Agricultural sector support analysis* [online]. FAO, 14–32.
- Taylor, M. A., Clarke, L. A., Centella-Artola, A., Bezanilla, A., Stephenson, T. S., Jones, J. J., Campbell, J. D., Vichot, A., & Charlery, J. (2018). Future Caribbean climates in a world of rising temperatures: The 1.5 vs 2.0 dilemma. *Journal of Climate*, 31(7), 2907–2926. <https://doi.org/10.1175/JCLI-D-17-0074.1>
- The Planning Institute of Jamaica. (2018). *Economic and social survey of Jamaica*.
- The World Bank Group. (2022). *Jamaica: Boosting recovery and sustainable economic growth systematic country diagnostic*. The World Bank Group Country Department, Latin America and Caribbean Region. <https://openknowledge.worldbank.org/server/api/core/bitstreams/08372d91-d4-dd-5b6a-961e-1e3ec71557e8/content>