



NUTRITION *in* CITY ECOSYSTEMS

Climate change research

Small farming households and climate resilience

How is climate change threatening the livelihoods of small farming households in and around secondary cities? And what to do about it?

Showcase:

Rusizi, RWANDA



The impacts of climate change are already visible across East Africa, which is one of the world's most climate-vulnerable areas. This change is putting the food supply in danger for city populations and farmers who rely on agriculture for their food and income. In Rwanda, access to fresh, local, and nutritious food is also impacted by climate change, which has emerged as a key threat to food security in the country.

The projected shifts in weather patterns attributed to climate change are characterized by extremes in East Africa, where Rwanda is located. East Africa is anticipated to undergo an increase in both the magnitude and frequency of hot days. East African cities, in particular, are projected to have an up to 2000-fold increase in exposure to dangerous heat (days >40.6°C) compared to the period between 1985 and 2005. Meanwhile, projections suggest an increase in average annual rainfall, heavy rainfall events, and the average duration of dry spells¹.

Rwanda is already grappling with the burdens imposed by extreme weather events. Over the past decade, Rwanda has witnessed a rise in frequency and severity of natural disasters like floods, droughts, and landslides. These events have taken a toll on the country, affecting around 2 million Rwandan people in the last 20 years². The aftermath has been severe, causing damage to infrastructure, disrupting food systems, and leading to loss of human lives.

In Rwandan agriculture, the changing climate poses a challenge to crop cultivation, particularly impacting crops dependent on rainfed farming. This vulnerability is alarming, considering agriculture's pivotal role as the backbone of the Rwandan economy – a country predominantly relying on rainfed farming. The repercussions of extreme weather events on Rwandan agriculture extend beyond threatening food security to endangering farmers' livelihoods and the overall economy.

Amidst the worsening climate crisis, the rapid expansion of cities amplifies the pressure on farmers to meet the needs of a growing urban population. Within the Rwandan context, small farming households play a vital role in ensuring a local food supply for cities. Positioned on the front line, these farmers bear the brunt of the harshest climate change impacts, yet their struggles have largely gone unnoticed. The potential consequences, if disregarded, extend to compromising the access of city populations to fresh, local, and nutritious food.



Figure 1: A local market in the Western Province of Rwanda.

NICE helps farmers in and around secondary cities to deal better with climate change

The objective of the Nutrition in City Ecosystems (NICE) project is to enhance nutrition and reduce poverty in six secondary cities in Bangladesh, Kenya, and Rwanda by increasing the supply and demand for healthy foods that are produced using agroecological practices. Agroecological practices are important because they can address food insecurity, enhance climate resilience, and promote sustainable agriculture through the same methods.

To change food systems, we need to improve not only food production but also encourage more people to choose healthy, sustainable options while making sure there is enough of those. If more people show interest in healthy, nutritious food produced using agroecological practices, this boosts scaling up production of these foods. This shift also means that farmers will use more agroecological practices. This aspect is vital as agroecology equips communities to handle challenges linked to negative climate impacts and to become more climate resilient. In essence, it's a dual strategy involving on the one hand the demand for healthy foods produced using agroecological practices and the sustainable growth of its production.

Secondary cities are geographically defined urban jurisdictions or centres performing vital governance, logistical, and production functions at a sub-national or sub-metropolitan region level. Generally, the population of secondary cities ranges between 10–50% of a country's largest city, typically <500'000 citizens. In secondary cities, producers of food are located not far away from the urban consumers, meaning the route that food takes is quite short and few people are involved. This simple producer-to-consumer linkage is practical to change the ways of agriculture to more sustainable ones^{3,4}.

Agroecology, at its core, involves utilizing ecological principles within the context of agriculture. In recent years, the approach has gained considerable attention in science, agriculture, and in the political fields. It has evolved from principles focusing only on field and farms to principles including entire agriculture and food systems. The Food and Agriculture Organisation (FAO) has compiled a framework of 10 elements of agroecology to guide the transition to sustainable food systems^{5,6}. The NICE project focuses on five elements.

Resilience is the ability to withstand, adapt, and recover from a challenge. Adding climate to resilience – climate resilience, means to withstand, adapt, and recover from adverse impacts of climate change.



Figure 2: Local youth packing carrots for transport in the Western province of Rwanda.

One of the important steps to promote agroecological practices in the NICE project is to first understand farmers' climate resilience. A climate resilience assessment was conducted to provide a starting point for working with local governments, communities, and farmers to make changes to improve the food system. An adapted version of the SHARP+ (Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists) survey helped to find out what the weaknesses and strengths are in farmers' climate resilience. The survey took place in the secondary city of Rusizi, in Rwanda, as well as in the other five cities where NICE is active.

What is Rusizi like?

Rusizi city is located in the Southeast part of Rwanda, in Rwanda's Western province, and at the shore of Lake Kivu, the largest lake in the country.

This secondary city's local economy benefits from trade and logistics opportunities with neighbouring countries, particularly Burundi and the Democratic Republic of Congo. Due to its strategic location and access to infrastructure, Rusizi is a thriving economic hub, with many people in Rusizi working in agriculture and trade. The favorable soil conditions enable high agricultural productivity, with various food and cash crops grown, including rice, maize, tea, coffee, beans, cassava, bananas, tomatoes, or passion fruits.

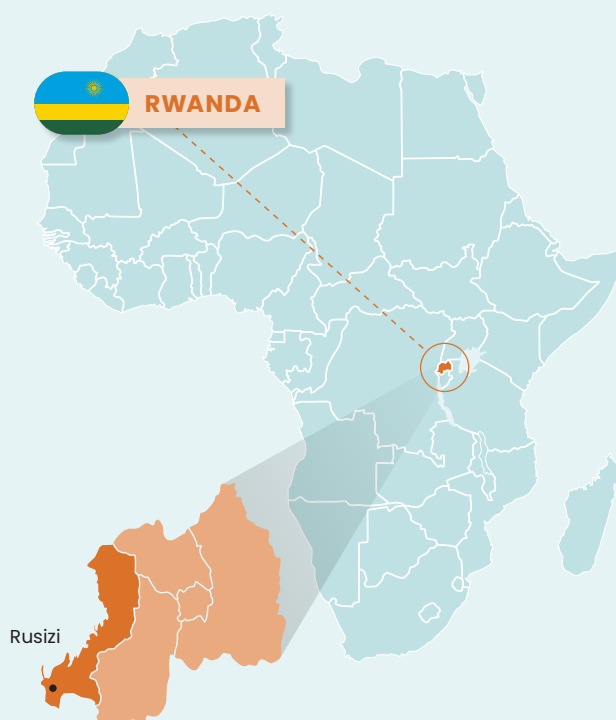


Figure 3: Map of Africa and Rwanda highlighting the Western Province and Rusizi.

As migration from rural areas to cities in Africa continues, the importance of secondary cities will only grow in the years ahead. The fastest growing African cities, like Rusizi, are exposed to a multitude of severe risks posed by climate change⁷. In Rusizi, farmers are grappling with the unpredictable shift in weather patterns. Unfortunately, it's becoming increasingly common for their crops to be either soaked by floods or dried out by droughts. Consequently, the number of harvestable crops that can be sold after extreme weather events declines. Already burdened by hunger and malnutrition, the people of Rusizi are facing a grim outlook as the expectation of fewer crops for food being produced could worsen their situation.

Secondary cities, however, can play an important role in enhancing resilience to shocks in the food system⁸. Food producers are not far from these cities, so the path food takes is short and involves fewer people. This makes it easier to suggest changes in the food system to improve farmers' resilience and ensure a steady supply of healthy food produced using agroecological practices to the city. Additionally, since the local community runs the food system in Rusizi, they can be empowered to do so in a more sustainable way and remain key contributors to their food system.

What were the general findings obtained from the climate resilience assessment in Rusizi?

As climate change varies across different parts of Rwanda, there are differences in how it affects each area. For instance, Rusizi's proximity to Lake Kivu creates a unique climate situation. The specific local climate might not align with predictions for neighbouring regions that lack significant water sources nearby. Understanding how these differences influence food systems and people's livelihoods is crucial.

Using an adapted version of the climate resilience assessment tool for agriculture called SHARP+ (Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists)⁹, our study looked at how well small farming households in Rusizi are prepared to face the challenges of a changing climate.

The adapted SHARP+ for the NICE project included a mix of quantitative and qualitative questions categorized in thematic criteria. Quantitative questions aimed to gather data on farm characteristics (e.g. kind of crops produced, land size etc.) and disturbances (e.g. frequency of droughts). The qualitative questions covered the farmers' reflections on how well their own methods are working to handle climate challenges⁹. Question responses are given a score which are averaged to obtain a criteria resilience level. The resilience levels of 23 selected SHARP+ criteria were obtained a sample of 150 farmers in Rusizi. In addition, this research explored the potential

of agroecological practices to enhance climate resilience.

By considering farm characteristics, disturbances, weather patterns, and other relevant criteria, we found that the average climate resilience level in Rusizi was moderate. This means that the farmers are somewhat aware of the disturbances and are using some ways to adapt to them, but the practices were not particularly effective in the past. Farmers are still facing major challenges with adapting to shocks, and they have few resources to deal with them.

The SHARP+ tool is an open-source tool developed by the Food and Agriculture Organisation (FAO). The focus of the tool is to identify the main weaknesses and strengths of farming systems and agriculture-based households. It has been used in multiple countries such as Kenya, Bangladesh, Gambia and Switzerland as a tool for climate resilience assessment and for monitoring and evaluation of progress over time⁹.



Figure 4: Farmers being interviewed by enumerators with the adapted SHARP+ tool.

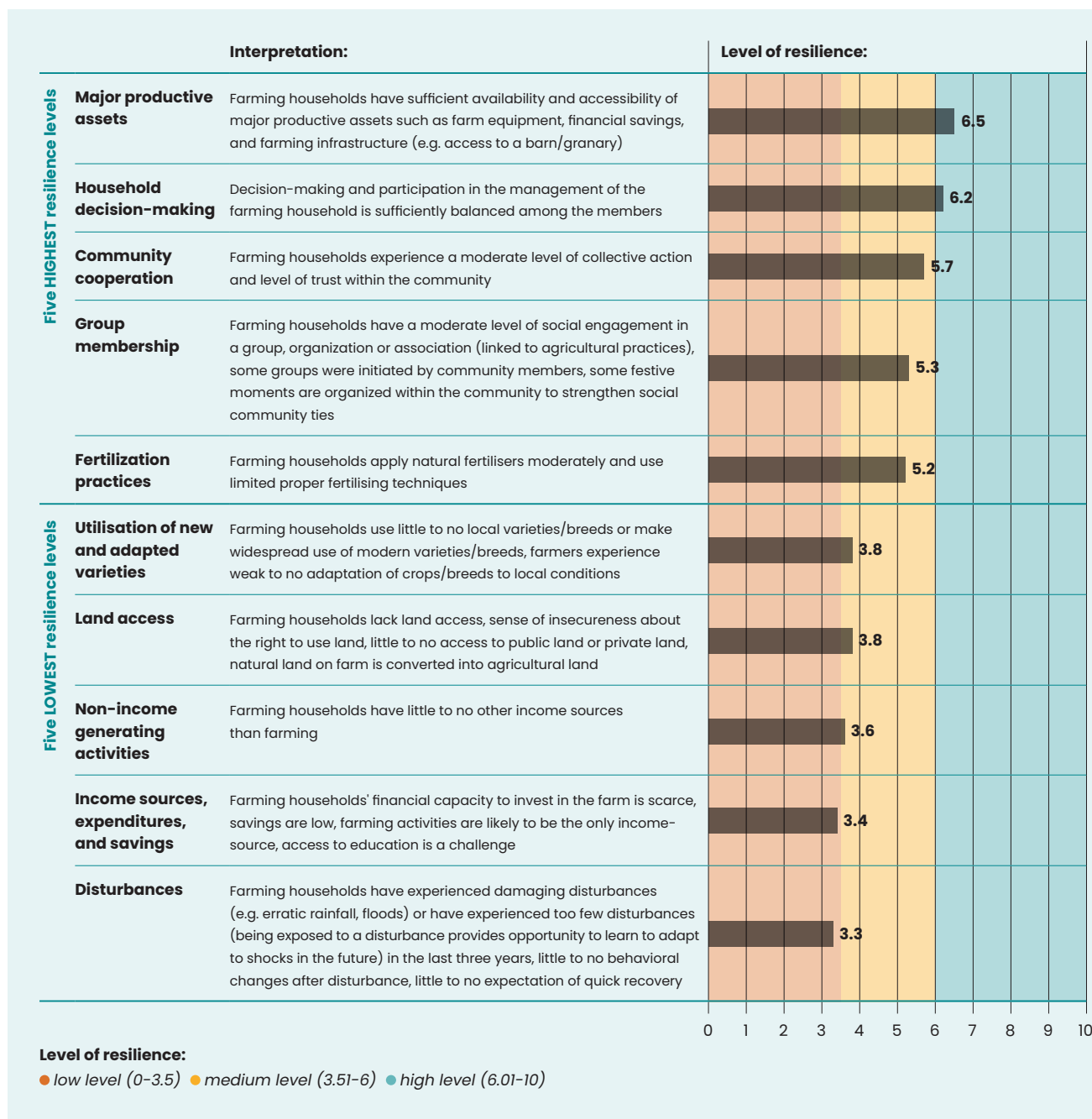


Figure 5: Average resilience levels of the five SHARP+ criteria scoring highest and lowest, respectively, in the assessment of climate resilience of farming households (assessed through 23 SHARP+ criteria). The criteria resilience levels were scored on a scale of 0 to 10.

In fact, for some of the most important criteria, like dealing with disturbances or finding new sources of income, farmers are particularly vulnerable. This is a big concern because these areas have the greatest impact on farmers' livelihoods.

Only a few criteria have a high level of readiness and preparedness for future disturbances (in green). Specifically, only the 'major productive assets' and

'household decision-making' modules were strong. This means that households had on average enough important resources to produce food (e.g. land, farm equipment, transport etc.) and that there is good cooperation among household members. These two factors are very relevant to be resilient for disturbances. Still, in most other areas there is a lot of work to be done to make sure that farmers are prepared for climate challenges that will come their way.

Why is it better for communities themselves to lead climate change readiness efforts?

Small farming households in Rwanda often rely heavily on their own social networks and capabilities when faced with climatic and weather disturbances. It is crucial to understand these local social networks and know-how, as international development efforts can inadvertently undermine the grassroots resilience of these communities.

Participatory approaches can help to enhance climate resilience by recognizing farmers and other important local people to take a leading role. In this way, farmers can determine their own adaptation needs and can be empowered to take action to strengthen their resilience. This approach also prevents people who are not local from imposing their own assumptions and worldviews about how local communities in Rwanda work, which can be counter-productive.

That is why the NICE project team works collaboratively with local experts, scientific experts and farmers to identify their unique needs and develop adapta-

tion strategies that suit their specific circumstances. This approach is essential to building the resilience of small farming households in Rwanda and ensuring the sustainability of the agricultural sector in the face of climate change.



What advice did local climate change experts give to help farmers adapt to climate challenges?

To identify possible adaptation options to climate change, a participatory workshop was conducted with local experts in the field of climate change and agronomy in the frame of the NICE project in May 2023. Participants consisted of representatives of governmental agricultural agencies, agronomists from the private sector, non-governmental organisations, youth groups, environmental activists, national agricultural, environmental and development experts as well as regional experts from Rusizi.



Figure 6: A participatory workshop with local climate change and agronomy experts was conducted on the topic of future climate risks and potential adaptation.

Participants shared what they consider as the biggest climate risks to food security in the future. Four risks were categorised as having a high consequence and a high likelihood. These were droughts, dry spells, flooding, and soil erosion. Participants shared that small farming households will be particularly vulnerable to these risks. Crop failures, food insecurity, and financial losses, were among the challenges mentioned. Sustainable farming in the future will need to account for the impacts of these factors.

The experts discussed important climate adaptation strategies for small farming households linked to agroecology:

- › sustainable irrigation
- › restabilising soil health in fighting against erosion
- › improving access to weather forecast information
- › increasing socio-economic resilience

Without targeted interventions addressing the needs of farmers, the experts warn that farmers may shift to alternative income sources, potentially causing more significant environmental damage, such as engaging in mining activities. Small farming households in Rwanda do possess willingness to adapt, as the experts explained, but face difficulties primarily stemming from a lack of knowledge and financial resources rather than a lack of motivation. It is crucial that the knowledge gap and issues they are facing are addressed to enhance the resilience farming households and ensure an ongoing supply of nutritious food to the nearby cities.

Our research also investigated the potential of agroecological practices to enhance climate resilience. It was found that farmers who perceived that they had implemented adequate agroecological practices had a higher assessed resilience score. This suggests that the implementation of agroecological practices in Rusizi could result in improved climate resilience.

The NICE project delivers capacity building in agroecological practices and accessibility to goods and other services to small farming households in Rusizi through so-called Farmers’ Hubs. A Farmers’ Hub is a centrally located ‘one-stop-shop’ that can help small farming households to farm better and improve their resilience. The plots of land adjacent to the Hub

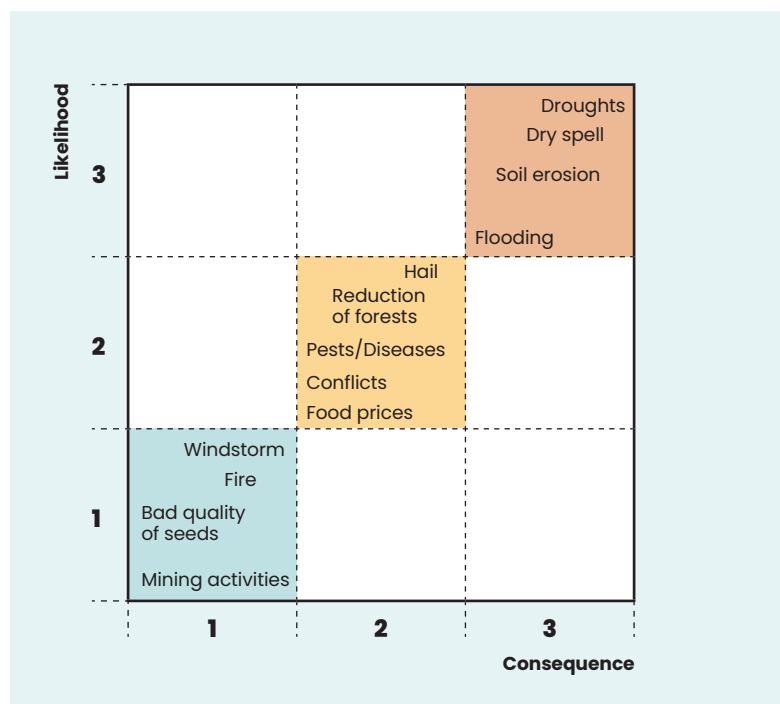


Figure 7: Biggest risks posed by climate change in the future. Risk matrix exercise conducted by workshop participants.

serve as interactive spaces for showcasing farmers’ agroecological practices, providing them with the opportunity to actively engage in the practices and gain a more comprehensive understanding, rather than simply observing. A Hub serves typically between 150–200 farmers within a community.



Figure 8: Exemplary Farmers’ Hub offering multiple services to local people in Bangladesh.

Closing remarks

For small farming households in the Rwandan city of Rusizi, climate change is a real threat to their livelihoods and the local economy. Meanwhile, the importance of local food production in supplying city populations with healthy foods is growing now that more and more people are moving to cities. Adaptation practices are needed to ensure preparedness for future disturbances. A very promising one is agroecology – a farming system approach that not only promotes sustainable practices in the field but also helps build resilience to climate risks.

In NICE we used a participatory approach to identify the critical challenges faced by farmers in Rusizi to evaluate the level of climate resilience among local farmers. The results showed that farmers face a range of disturbances and are missing out on capacities to adapt to them. However, our study also found that implementing agroecological practices could improve farmers' resilience to climate risks. By integrating food security and climate adaptation strategies, agroecology offers a promising solution to get prepared for climate change.

Sources:

1. Intergovernmental Panel on Climate Change (IPCC), Ed., "Africa," in *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge: Cambridge University Press, 2023, pp. 1285–1456. doi: 10.1017/9781009325844.011.
2. Ministry of Disaster Management and Refugee Affairs, "The National Risk Atlas of Rwanda," Government of Rwanda, 2015. Accessed: Dec. 27, 2023. [Online]. Available: https://www.gfdr.org/sites/default/files/publication/National_Risk_Atlas_of_Rwanda_01.pdf
3. B. H. Roberts and R. P. Hohmann, "The systems of secondary cities: The neglected drivers of urbanising economies," *Cities Alliance*, no. 7, 2014, Accessed: Jan. 05, 2024. [Online]. Available: https://www.academia.edu/7301062/The_systems_of_secondary_cities_The_neglected_drivers_of_urbanising_economies
4. K. G. van Zutphen et al., "Secondary Cities as Catalysts for Nutritious Diets in Low- And Middle-Income Countries," Center for Development Research (ZEF) in cooperation with the Scientific Group for the UN Food System Summit 2021, Report, Apr. 2021. doi: 10.48565/scfss2021-2y14.
5. F. Sinclair, A. Wezel, C. Mbow, S. Chomba, V. Robiglio, and R. Harrison, "The contribution of agroecological approaches to realizing climate-resilient agriculture," GCA: Rotterdam, The Netherlands, 2019.
6. FAO, "The 10 elements of agroecology: guiding the transition to sustainable food and agricultural systems," 2018, [Online]. Available: <http://www.fao.org/3/i9037en/i9037en.pdf>
7. Verisk Maplecroft, "Urbanisation and Climate Change Risks." Accessed: Dec. 29, 2023. [Online]. Available: <https://www.maplecroft.com/insights/analysis/84-of-worlds-fastest-growing-cities-face-extreme-climate-change-risks/>
8. A. Blay-Palmer, G. Santini, M. Dubbeling, H. Renting, M. Taguchi, and T. Giordano, "Validating the city region food system approach: Enacting inclusive, transformational city region food systems," *Sustainability*, 2018.
9. M. Hernández Lagana, S. Philips, and A. Poisot, "Self-evaluation and Holistic Assessment of Climate Resilience of Farmers and Pastoralists (SHARP+): A new guidance document for practitioners," Rome, FAO., 2022.

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