Living in the shadow of loss and damage: uncovering non-economic impacts

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About this resource

Through 14 case studies from climate-hit communities in Africa, Asia and the Pacific Islands, this multi-author resource reveals the true impact of 'non-economic loss and damage'. Unlike the destruction of infrastructure or assets, these harms cannot be easily quantified and are often overlooked. But the consequences of losing traditional ways of living, cultural heritage and biodiversity cannot be ignored: they trigger the erosion of community cohesion and resilience and cause trauma, displacement and danger, especially for the most vulnerable people and groups. Each author describes the climate hazards assailing a community, who is impacted and how, and current coping mechanisms. This unique resource is intended to support policymakers in understanding the nature and urgency of non-economic loss and damage, and to encourage practitioners to exchange knowledge and solutions from the community level.

About the editors

Ritu Bharadwaj is a principal researcher in IIED's Climate Change Group (ritu.bharadwaj@iied.org)

Tom Mitchell is IIED's executive director (tom.mitchell@iied.org)

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International Institute for Environment and Development
235 High Holborn, Holborn, London WC1V 7DN, UK
www.iied.org

@iied
www.facebook.com/theIIED

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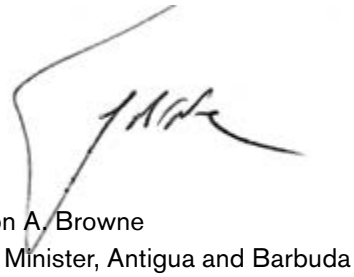
Cover photo: a Pakistani resident stands on the roof of his house which is surrounded by flood waters, near Thul in Sindh province, southern Pakistan. Credit: Kevin Frayer via Alamy

Foreword

As Prime Minister of a country deeply impacted by climate change, I understand first-hand the acute vulnerabilities faced by Small Island Developing States and other climate-vulnerable regions.

This collection of case studies serves as an essential guide to the untold consequences of climate hazards. It goes beyond more easily quantifiable losses to explore deeper social, psychological, and cultural devastations that many communities are experiencing. From loss of cultural heritage to impaired mental health and forced migration, the variety of issues covered here reveals the multi-dimensional nature of loss and damage.

I believe that the narratives captured in this document can serve as a catalyst for more informed, inclusive and effective policymaking. I commend the researchers and contributors for shedding light on these critical dimensions of climate change, and I encourage all readers to consider this a call to action for more nuanced and humane approaches to addressing the challenges ahead.



Gaston A. Browne
Prime Minister, Antigua and Barbuda

Foreword

Climate change is no longer a distant threat but a present reality, causing irrevocable loss and damage, both economic and non-economic. In the Least Developed Countries (LDCs), despite our negligible contribution to the climate crisis, these impacts continue to worsen.

We are not just losing livelihoods and infrastructure, but our culture, community coherence, mental wellbeing and biodiversity: heritage rarely captured in traditional metrics. These non-economic losses and damages exacerbate existing challenges in our countries.

This case study collection highlights these less-visible impacts and details the unique challenges faced by LDCs. It enriches our collective understanding of climate-induced loss and damage, extending beyond the usual economic markers, and offers actionable insights into where support is best directed.

It is essential that we sustain this approach of knowledge and evidence generation, which can support effective decision making that is grounded in empirical information and represents the experience and knowledge of communities suffering loss and damage.

Ms Madeleine Diouf SARR
Chair of the Least Developed Countries on climate change
Republic of Senegal

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A note on methodology

Recognising local expertise

The concept of climate-driven 'loss and damage' stems from a growing recognition that adaptation and mitigation efforts are not sufficient to prevent or alleviate all the effects of climate change — there are bound to be residual impacts that need to be addressed. Loss and damage also occurs when adaptation measures have not been implemented in the most optimal way, because they are unaffordable, socially difficult to put in place, or physically and technically not viable.

While climate change hazards are increasing in frequency and intensity, some countries are vulnerable to loss and damage even when subjected to lower intensity climate stress. These countries may find their limits to withstand climate impacts breached earlier than others due to the state of their infrastructure, socio-economic development, fiscal capacity and so on. In contrast, wealthier or less geographically vulnerable countries may be able to tolerate a higher risk.

Similarly, certain communities, social groups and Indigenous people are often at a higher risk of experiencing the adverse consequences of climate impacts, including loss and damage. This is because other exacerbating factors limit their capacity to cope with climate impacts, such as preexisting poverty, social marginalisation and limited access to essential services.

Policymakers and practitioners must understand clearly the forms loss and damage is likely to take — both that which is easily monetised and that which is not — as well as who is liable to be impacted and how, so that pre-emptive responses can be designed to address the specific vulnerabilities of the countries, regions, communities and households that are most at risk.

At IIED, we strongly believe that the most insightful experts on the risks of loss and damage are the community members and practitioners who are already confronting, managing and supporting recovery from climate-related impacts. Therefore, it was imperative that the process for creating these case studies be led and owned by stakeholders with grounded experience from climate-vulnerable countries.

Taking a co-development approach

IIED initiated an open call for abstract submissions from stakeholders in countries actively dealing with loss and damage, with a number of partners helping to spread the word. We asked that the submissions speak to one (or more) of five categories representing different types of non-economic loss and damage: loss of cultural heritage; loss of quality of life (shelter, food, health, skills, education); mental and physical health impacts; social disruption (migration and displacement); and loss of ecosystems and biodiversity. To ensure as wide as possible a response, the case study proposed in the abstract could be delivered in written or video form.

We received 55 abstracts for written case studies and 12 for video case studies. These were then rigorously evaluated by a panel comprising loss and damage and communications specialists, and 12 written and 2 video case studies were shortlisted for further development. The selection criteria included: covering different types of non-economic loss and damage, geographical diversity, the analysis of challenges faced by vulnerable populations, current adaptive strategies, and proposed future interventions.

South-South capacity building and mentorship

To provide tailored support to the selected authors — a mix of local civil society organisations (CSOs), subject matter experts, academic researchers and non-governmental organisations (NGOs) — we designed a South-South capacity-building approach. This facilitated collaboration and peer learning, allowing each author to engage in self-guided learning under the mentorship of loss and damage experts from countries experiencing similar climate crises. The role of the mentors involved:

- Clarifying the foundational concepts and terminologies inherent to the loss and damage domain
- Guiding the authors in articulating local challenges, recommendations and solutions through creative and impactful writing
- Individualised support in an iterative process of case study refinement, including continuous feedback loops until the case study reached its final form
- IIED established and facilitated this process, by:
    - Bringing together important stakeholders from vulnerable developing countries (communities, CSOs and NGOs) with advocates and experts on loss and damage; creating an awareness of the need to generate local evidence and a knowledge base, and to draw learning from them to come up with local solutions
    - Supplying background materials and technical support to create an understanding of the conceptual aspects of economic and non-economic loss and damage and the framing of its risks
    - Creating a space for climate-vulnerable developing countries and communities to tell their stories about loss and damage, communicate their priorities for action and share their solutions
    - Enabling South-South collaborative learning, support and sharing experiences around loss and damage. With sustained support, this enabled the co-generation of a critical mass of compelling knowledge and evidence; this can now support representatives of vulnerable developing countries and communities to elevate the priority of loss and damage in international and national policy discourse.

Acknowledging the mentors

Special acknowledgement is due to the experts who generously shared not only their considerable knowledge of loss and damage, but of the process of developing a robust evidence base and writing for impact. In alphabetical order, sincere thanks to:

Raashee Abhilashi, who brings over a decade of action research experience at the intersection of climate change and developmental issues, with a focus on climate resilience, social protection, loss and damage, migration, and gender issues concerning vulnerable communities.

Devanshu Chakravarti, an expert in climate resilience, social protection and loss and damage based in India.

Swati Chaliha is a natural resource management professional with experience in research at the intersection of policy and practice. She primarily works on climate change adaptation, restoration and agroforestry.

Sudin K has more than two decades of experience working on the issues of rural livelihoods, human rights, sustainable and regenerative farming and the role of sacred groves in biodiversity conservation.

1. Introduction

The increasingly harmful effects of climate change are driving loss and damage (L&D). These occur when the capacity of affected communities and countries are compromised to such an extent that they are no longer able to absorb the effects of climate risks or adapt to climate impacts.

Many countries are experiencing new forms of climate impact, with higher intensity and frequency, which they are not equipped to handle. These impacts often exceed these countries' existing preparedness or coping mechanisms. Such overwhelming impacts compromise the ability of communities to either adapt or effectively manage these escalating risks, leading to loss and damage of lives, livelihoods, and infrastructure or economy. For example, in 2017 the Caribbean experienced three Category 5 hurricanes — an unprecedented event, where the damage exceeded the annual gross domestic product of many countries.[1] The 2022 floods in Pakistan impacted one third of the country and caused over US$30 billion in economic losses.[2]

Beyond the direct loss of livelihoods, assets and infrastructure, L&D from climate change has other consequences. These are often referred to as **non-economic loss and damage (NELD)**: climate change impacts that are hard to quantify and often go unnoticed by the outside world, such as the loss of traditional ways of living, cultural heritage and biodiversity. For example, many communities in the Cook Islands are being forced to relocate due to sea-level rise, which is disrupting the transmission of traditional language and cultural practices from one generation to the next. In Lake Chad Basin, climate change is having far-reaching social impacts, such as increased inequality, social conflict and a loss of sense of identity. These losses can erode the social fabric and further undermine the resilience of communities.[3] Climate shocks can also expose women, girls and disabled people to new forms of exploitation, slavery and trafficking, for example women migrating due to drought are exposed to slavery-like conditions in Ghana.[4] Recurring impacts and loss of livelihoods and displacements are leading to psychological impacts, such as stress, trauma and mental health disorders, which affect the wellbeing of individuals and communities. For example, pastoralist communities in Turkana County (Kenya) are becoming susceptible to addiction, anxiety and emotional distress as climate change threatens their livelihoods and triggers internal migration.[5]

Tackling loss and damage is not straightforward

L&D impacts are caused by a wide variety of hazards, ranging from extreme weather events such as flooding, droughts or cyclones, to long-range slow onset events such as sea-level rise, salination, desertification and glacier loss. L&D impacts are highly varied, encompassing economic impacts that can be readily quantified, such as damage to infrastructure, loss of land value and reduced productivity, and others that cannot be expressed in monetary terms, such as loss of cultural heritage, language or identity. L&D impacts are also highly contextual. Some countries may be vulnerable even to a lower intensity climate stress and its limits to withstand climate impacts may

1 Heinrich-Böll-Stiftung (2021) Unpacking finance for loss and damage: Why do developing countries need support to address loss and damage? Heinrich Boll Stiftung North, Washington, DC. https://us.boell.org/en/2021/04/06/why-do-developing-countries-need-support-address-loss-and-damage

2 www.worldbank.org/en/news/press-release/2022/10/28/pakistan-flood-damages-and-economic-losses-over-usd-30-billion-and-reconstruction-needs-over-usd-16-billion-new-assessme

3 Bharadwaj, R and Shakya , C (2021) Loss and damage case studies from the frontline: a resource to support practice and policy. IIED, London iied.org/20551iied

4 Bharadwaj, R, Chakravarti, D, Karthikeyan, N, Hazra, S, Daniel , U, Topno, J and Abhilashi, R (2022) Climate change, migration and vulnerability to trafficking. IIED, London iied.org/20936iied

5 Bharadwaj, R and Huq, S (2022) Climate-induced migration and health issues: a toolkit for policymakers. IIED, London. iied.org/21256iied

be breached earlier than other countries because of the state of its infrastructure, socioeconomic development, fiscal capacity etc. Similarly, L&D impacts also manifest differently for different people (such as women, along with children, disabled, Indigenous and marginalised people); regions (small islands, land-locked areas and coastal regions); and countries (different fiscal capacities, political structures, infrastructure and institutions). Addressing L&D risks across the wide range of national and local contexts where it occurs, requires the use of diverse context-specific approaches. Support and finance to tackle L&D must therefore be grounded in the everyday realities of L&D, and tailored to the vulnerabilities of different people and places. It also requires a comprehensive approach that is anticipatory and agile, as well as responsive to immediate, medium and long-term needs.

Planning for, responding to and recovering from such profound impacts is not just beyond the national budgets of affected countries. It also exceeds the current knowledge, skills and capacity of governments, civil society and communities.

2. Recognising the knowledge gaps around loss and damage

As L&D is happening now and these impacts are only expected to get worse, we urgently need to develop new approaches or build on existing ones to manage the more diverse climate risks countries and communities are facing, and those they expect to face in the future. However, L&D issues cannot be adequately addressed unless we understand them clearly and use that knowledge to inform decision making and financing.

Existing knowledge and technical support mechanisms are not sufficient

While there has been a welcome increase in literature and evidence focused on L&D, there are still major knowledge gaps in understanding the wide range of impacts created due to L&D caused by climate change and the issues it creates on the ground. The key reasons for this are:

a. **Significantly less focus on NELD.** Most research has been theoretical in nature, and focused on estimating economic L&D and conceptualisation of L&D from a variety of perspectives. There has been significantly less empirical research on understanding the multi-dimensional nature of climate risk, the NELD it creates and measuring the impacts of those losses and damages.

b. **Limited coordination within the research community.** Even though there is expertise available in national think tanks and local universities, there is limited collaboration and efforts for collective research. L&D research is primarily conducted by a handful of experts who largely operate in silos, and there is currently no mechanism to break down these institutional barriers and country boundaries, to work in multidisciplinary teams and develop more coordinated approaches for research on L&D. This has hindered the development of cutting-edge inter-disciplinary research and methodologies for assessing NELD.

c. **Not enough evidence originating from the global South.** There is little or no peer-to-peer quality control mechanism or collective learning among researchers in the global South, and this is reflected in the relatively low number of publications in high-impact journals. Consequently, research originating from the global South has poor visibility and is not able to influence scientific discourse, policy making or international negotiations as much as it should.

International support mechanism for loss and damage is not adequate

The international support mechanism created through the United Nations Framework Convention on Climate Change (UNFCCC) has not been adequate to respond to these needs. The actions of L&D was formally institutionalised under the UNFCCC through the Warsaw International Mechanism (WIM) on Loss and Damage in 2013, and given firm consideration in the Paris Agreement in 2015. WIM is responsible for enhancing knowledge generation, coordination and the provision of technical support to vulnerable countries.

The Santiago Network on Loss and Damage (SNLD) was created in 2019, to support the work of WIM by catalysing access to and organising the availability of technical assistance, knowledge and resources to climate-vulnerable developing countries. SNLD is still not operational. The Subsidiary Body for Scientific and Technical Advice (SBSTA) serves as a technical arm of the UNFCCC, for providing timely information and advice on scientific and technological matters.

But despite the existing remit of these international bodies, there are still significant gaps in collective knowledge and understanding of what L&D means and the support that is needed (in terms of technology, capacity and finance) to address it in vulnerable countries and communities. This is because of:

The limited scope of current mechanisms

Both WIM and SNLD have primarily been focused on the traditional and economically quantifiable aspects of L&D. This narrow focus overshadows non-economic dimensions like cultural heritage, social cohesion and mental wellbeing. Although WIM was established under the UNFCCC with a broad mandate, it has struggled to invest sufficient attention and resources in non-economic losses, leaving an important gap in international efforts.

Bureaucratic hurdles and lack of coordination

There have been operational delays within UNFCCC mechanisms. For example, as of June 2023, the SBSTA and Subsidiary Body on Implementation (SBI) have failed to select a host agency for the SNLD. This has caused a cascading delay, pushing the operationalisation of SNLD to early 2025 at the earliest. Furthermore, WIM and SNLD have experienced limited inter-agency collaboration, resulting in fragmented approaches to L&D that fail to address its multifaceted nature.

A disconnect between international and local levels

The top-down approach commonly employed by these international bodies often excludes grassroots perspectives, which are critical for addressing NELD. For example, despite its mandate, the SNLD has not yet been fully operationalised to collate and analyse localised knowledge or provide tailored support to vulnerable communities.

Lack of multi-disciplinary input

Both WIM and SBSTA have limitations in the incorporation of multi-disciplinary knowledge. As L&D intersects with multiple academic fields and human rights issues, the lack of a multi-disciplinary approach results in a fragmented understanding and ineffective solutions. For instance, while SBSTA provides scientific and technical advice, it does not fully integrate anthropological, psychological or human rights dimensions into its analyses and recommendations.

In effect, despite the existence of comprehensive international mechanisms, there remains a substantial inadequacy in addressing the complexities of L&D from climate change, particularly the non-economic aspects. These shortcomings call for a more inclusive, interdisciplinary and bottom-up approach that is sensitive to the unique challenges posed by NELD. Only by doing so can we hope to construct international frameworks that are as nuanced and multifaceted as the issues they aim to address.

A multi-dimensional approach to understanding loss and damage is needed

Effectively addressing L&D across the wide range of national and local contexts where it may occur urgently requires better understanding in the following areas from governments, nongovernmental organisations (NGOs), civil society organisations (CSOs), and those who engage in national and international policy discourses and negotiations on L&D:

A nuanced understanding of how loss and damage is currently impacting communities is crucial, especially among the Least Developed Countries (LDCs) and Small Island Developing States (SIDS). Here, the focus should not only be on the economic toll but also on non-economic aspects like cultural heritage, social fabric, mental health and other quality-of-life measures. Solutions must be diversified to address the full range of these losses, recognising their impact on different vulnerable groups within these communities.

Identifying which approaches and practices are (or might be) most effective in tackling different forms of L&D risk in any given context. Decision makers need to particularly focus on non-economic losses. Are traditional risk-transfer mechanisms like insurance adequate for non-economic loss? Should there be new frameworks that consider the cultural, psychological or sociological dimensions of L&D? Evidence on effective approaches could guide international bodies like WIM and SNLD in designing their support structures and potentially enlighten climate negotiations on the options available.

Finding out what resources (technology, finance and capacity) will be needed to adequately respond to the range of loss and damage impacts is vital. The need for comprehensive resources — technology, finance and capacity — is indisputable. When limits to adaptation are forcing consideration of more radical responses such as relocation or rehabilitation, understanding the full breadth of resource needs becomes essential. This includes understanding the non-economic dimensions that require specialised resources like cultural preservation or psycho-social support. Further, these resources must be delivered efficiently to the most vulnerable countries and communities, factoring in the different temporal scales of rapid onset and slow onset events. This requires actions such as anticipatory action, humanitarian support, rehabilitation and recovery support.

A toolkit for filling the knowledge gap

By addressing these key points, we can achieve a far more nuanced and effective approach to L&D, particularly NELD, which has been largely overlooked in international processes so far. This toolkit aims to support learning in these critical areas. It seeks to fill the knowledge gap that exists not just in understanding the economic aspects of L&D but, crucially, the non-economic aspects as well. Only by addressing these gaps can national governments and international frameworks like the UNFCCC, WIM and SNLD become truly effective in serving the vulnerable communities they aim to support.

This toolkit seeks to support this learning and fill in the critical knowledge gap.

3. Tackling the challenges of loss and damage: how to use this toolkit

This toolkit has been created primarily for stakeholders from climate-vulnerable countries looking for practical solutions to L&D impacts and for policy advocates seeking evidence to inform the international and national policy discourse. It is designed to:

- Address the current knowledge gaps around L&D
- Create a picture of the current economic and non-economic L&D risks and responses, and
- Suggest how this evidence can be used to inform L&D discourse and action at multiple levels.

Closing the knowledge gaps

The importance of incorporating NELD is increasingly recognised in comprehensive climate research. The 12 case studies presented here serve as a critical asset, shedding light on both economic and non-economic vulnerabilities, as well as the various coping mechanisms in place at the local level. Compiled through partnerships with civil society organisations, local experts, academic researchers and NGOs, these studies employ a bottom-up, iterative and collaborative methodology (further details on methodology can be found on page 5).

These case studies reveal the multifaceted nature of local experiences of L&D. Utilising both primary and secondary data along with local knowledge, they furnish evidence of the challenges, potential strategies and support needed for addressing the complexities of L&D, including both economic and non-economic aspects such as cultural heritage, social cohesion and psychological wellbeing. This nuanced understanding serves as a foundational guide for creating more effective and holistic policies and institutional mechanisms that aim for proactive and responsive management of climate-induced L&D.

Together, the case studies consider the following:

- **Detail the range of climate hazards:** they illustrate the economic and non-economic impacts of various climate hazards like droughts, floods, soil degradation, glacier melt, sea-level rise, salination, coastal erosion and biodiversity loss.
- **Diverse impacts on vulnerable populations:** these studies highlight the varied effects these hazards have on the lives, living conditions and livelihoods of vulnerable populations, as well as the ecosystems and infrastructure they rely on. They also delve into how these impacts are experienced differently by various groups.
- **Exacerbation of other risks:** they show how L&D not only has standalone impacts but also compounds or exacerbates other socio-economic and non-economic conditions, such as poverty, health issues, social marginalisation and conflict.
- **Community and societal effects:** in addition to economic repercussions, the case studies address how L&D affects communities and societies at a deeper, non-economic level, and how it impacts access to basic services, causing population displacement and a loss of cultural heritage, rituals and customs.
- **Coping and adaptation measures:** the case studies feature the traditional and innovative coping and adaptation measures that households and communities are employing to minimise or avert L&D risks, including strategies for addressing non-economic losses.
- **Gaps and challenges:** they highlight the existing gaps and challenges in preparedness, resource availability and coping strategies, by laying out what needs to be done to assist communities in preparation, coping and recovery.

- **Actionable priorities:** finally, they set out priorities for action on L&D at local and national levels, offering solution-oriented recommendations that acknowledge the gravity and complexity of both the economic and non-economic aspects of L&D.

Understanding the current landscape

The local-level information, insights and lessons provided by the case studies will support L&D practitioners, policy advocates, climate negotiators and other interested parties in their consideration of following:

a. Comprehend the many types of non-economic loss and damage risks

The case studies demonstrate the forms L&D impacts are likely to take in different geographies, as well as who will be affected and how. This will support designing responses that address the specific vulnerabilities of the countries, regions, communities and households that are most at risk.

The 12 case studies are organised into 5 distinct categories that focus on different aspects of NELD. These categories are tailored to reflect the multidimensional impacts of climate change on vulnerable communities, encompassing women and men, disabled people, children, young people, older individuals, marginalised groups, and Indigenous communities. Here is how each category adds depth to the understanding of NELD:

Loss of cultural heritage

The case studies reveal how climate change poses existential threats to the cultural heritage of communities, particularly for Indigenous communities. The loss of traditional practices, local languages or sacred sites and artifacts erodes the cultural fabric and identity of affected communities. Furthermore, climate change can inhibit religious and spiritual practices, at the expense of places of worship and even burial grounds.

Loss of quality of life

Climate change's impact on quality of life goes beyond mere economic metrics. The case studies delve into how disruptions in local ecosystems affect the food security, water access and traditional cooking practices of communities. For example, shifts in local resources might force people to abandon traditional ingredients or walk longer distances for potable water, adding layers of drudgery to daily life.

Mental and physical health impacts

The case studies investigate the toll of climate change on both physical and mental health. There are obvious implications for physical health, such as respiratory issues, heat-related illnesses and infectious diseases. And, in terms of mental health, climate-induced stress can lead to anxiety, depression and PTSD. These mental strains can also have a cascading effect on community dynamics, impacting areas like confidence, risk-taking and overall community wellbeing.

Migration and displacement as forms of social disruption

Climate change-induced migration can dismantle social support networks, disrupt traditional lifestyles, and even expose migrating communities to human trafficking and modern slavery. Furthermore, migrating to new areas can give rise to conflicts with native communities, exacerbating social tensions.

Loss of ecosystem and biodiversity

Finally, the case studies show that climate change has severe implications for ecosystems and biodiversity, affecting the availability of ecosystem services. Moreover, these changes can disrupt local medicinal practices as Indigenous communities often rely on local plant species for traditional treatments.

As the case studies cover different geographic regions and climate vulnerabilities, readers will understand the impacts of L&D to be:

- Caused by a wide range of hazards, from rapid-onset events (for example, flood, cyclone and other extreme weather) to slow-onset (such as sea-level rise, salination, desertification and glacier loss)
- Highly varied, encompassing quantifiable economic impacts (such as damage to infrastructure, loss of land value, reduced productivity) and those that cannot be expressed in monetary terms (including loss of biodiversity, cultural heritage or identity)
- Not always reversible: many losses will be permanent
- Experienced differently by different people (for example, women, children, disabled people, Indigenous People and other marginalised groups), regions (small islands, land-locked areas and coastal regions) and countries (different fiscal capacities, political structures, infrastructure and institutions).

In summary, these case studies offer a holistic understanding of the multifaceted nature of L&D, including both economic and non-economic elements. By doing so, they can inform more comprehensive policy decisions and interventions, ensuring that climate action is as nuanced as the challenges it aims to address.

b. Examine how countries are currently managing risks

The case studies provide a comprehensive understanding of various strategies, both effective and ineffective, within different contexts. These actions encompass a spectrum of approaches that address not just the economic, but also the often-overlooked non-economic aspects of L&D. Specifically, the case studies offer insights into:

Preventive measures before events

These include early warning systems and risk-informed early action. These preventive actions also touch upon safeguarding non-economic values like cultural heritage sites and communal gathering spaces that might be at risk due to climate events.

Minimising impacts during events

Strategies include practical actions like moving livestock to higher ground during floods or evacuating communities to shelters during cyclones. These measures also consider the protection of elements like community wellbeing, mental health and social cohesion during the disaster phase.

Reversible and irreversible impacts

The case studies delve into rapid humanitarian responses for recovery and rehabilitation, as well as more permanent strategies like planned relocation in areas prone to irreversible impacts like sea-level rise. Here, non-economic aspects such as the emotional and cultural costs of relocation, as well as the loss of cultural or natural heritage, are also examined.

Transformative measures

The overall study goes beyond crisis management to involve pre-defined dynamic approaches that enable timely and effective responses. These include non-economic considerations like preserving social networks, community integrity and cultural values during transformative changes.

By integrating these various dimensions — economic and non-economic — the case studies offer a more holistic understanding of the complexity of L&D, specifically what has worked — or not worked — and under

what circumstances. This enriches the discourse and contributes to more informed decision making in both policy and practice.

c. Explore multi-dimensional loss and damage risk responses

The case studies offer a nuanced view that goes beyond the economic dimensions, providing insight on the diversity of L&D experiences and vulnerabilities:

Vulnerability across contexts

The studies provide evidence that some countries are especially susceptible to even lower-intensity climate stressors due to various factors such as inadequate infrastructure, level of socioeconomic development and fiscal capacity. Beyond these, they also highlight non-economic vulnerabilities like cultural heritage at risk, compromised community cohesiveness, and potential loss of local knowledge and customs.

High-risk groups

The evidence highlights that certain social groups may be at a higher risk of adverse non-economic consequences from climate impacts. Pre-existing conditions like poverty and social marginalisation can exacerbate both economic and non-economic losses and damages, such as the erasure of cultural identity, mental health deterioration, and restricted access to social and community services.

Context-specific responses

The case studies underline that L&D risk responses need to be framed with an understanding that extends beyond the economic sphere and encompasses a wide range of national and local contexts. For instance, preserving cultural heritage may be a high priority in some communities, while psychological wellbeing could be a focus in others.

The case studies will thus offer an in-depth look at which approaches and practices are most effective in addressing diverse forms of L&D, both economic and non-economic. This rich, evidence-based knowledge will be useful for shaping international and national policies and practices that are holistic and responsive to the complex dimensions of L&D.

Informing policy discourse and identifying response mechanisms

The evidence compiled here serves as a comprehensive guide for addressing the economic and non-economic aspects of L&D caused by climate change. It aims to equip readers with evidence and knowledge to inform and influence discussions at regional, national or international forums by offering insights into:

The realities of climate change loss and damage, and what should be considered in responding to it

In addition to the economic impacts, this evidence emphasises the necessity of considering NELD, such as cultural heritage, social cohesion and psychological wellbeing. Policymakers and stakeholders need to understand the multifaceted nature of potential risks across different contexts. This includes appreciating the factors influencing the scale of impacts, such as loss of cultural practices or mental health deterioration and identifying the appropriate levels at which these diverse forms of L&D can be mitigated or managed.

Which types of solutions are working, and in which contexts

Governments and communities in climate-vulnerable regions are striving to preserve cultural heritage, improve social resilience and address mental health challenges. The case studies presented offer an understanding of how

effective these diverse approaches and mechanisms are in different circumstances. This shared knowledge could serve as a basis for identifying which methods could be scaled up or adapted to handle different types of L&D risks, both economic and non-economic.

The existing gaps, and where support is needed

It is important that the kind of support and finance needed to adequately address the dynamic and differentiated risks of L&D over time is understood by decision makers. This will require an understanding of the support mechanisms needed to also address non-economic losses such as social disruption, cultural loss and psychological strain. Resource and capacity needs will differ based on the complex interplay of vulnerabilities — both economic and non-economic — and the developmental deficits specific to each context.

By integrating these multi-dimensional considerations into discussions about L&D, this evidence aims to contribute to the formulation of more holistic, responsive and effective policies and support mechanisms.

4. The roadmap for an inclusive approach: an observatory for loss and damage research

In our ongoing effort to facilitate knowledge and evidence generation on tackling L&D, we are committed to a comprehensive approach that encompasses both economic and non-economic dimensions. Our endeavours not only aim to address economic vulnerabilities but also give due attention to critical non-economic losses, such as the loss of cultural heritage, degradation of mental and physical health, and the loss of biodiversity and ecosystems.

To enhance the outreach of the evidence and knowledge from these case studies, we are proposing the launch of the 'Observatory for L&D Research'.[6] This platform will act as a focal point, featuring these case studies and other vital research in both economic and non-economic L&D. The Observatory aims to provide a searchable repository for experts, university researchers and policymakers. The features of the Observatory include:

a. **An online dashboard** with a user-friendly interface, to guide users to pertinent information, research and experts.
b. **A searchable database** housing a range of research papers, analyses, methodologies and findings, with explicit guidance on their suitability in different contexts.
c. **A clearing house** for researchers to disseminate their findings and methodologies, subject to scrutiny and validation by a research advisory group.
d. **Skill and capacity building** via online courses, tutorials, glossaries and good practice guides, to foster the professional growth of researchers.
e. **A news and events section** to disseminate the latest updates, developments and opportunities in the realm of L&D.

To better serve the communities and stakeholders affected by these multi-dimensional challenges on climate change, we warmly welcome your feedback and suggestions on the following:

Enhanced outreach

How can we better reach key stakeholders who are concerned not just with economic loss, but also with non-economic dimensions like cultural heritage, psychological wellbeing and social cohesion?

Collaborative approach

How can we deepen our collaborations with a wide array of expertise and perspectives, including those of civil society organisations, academic researchers and local communities, especially in the global South? Such collaborative efforts are crucial for addressing the holistic nature of L&D.

Inclusivity

How can we better incorporate the voices of the most vulnerable and marginalised populations, who are often disproportionately affected by both economic and non-economic aspects of L&D?

As we continue to evolve and refine our approach, we are committed to producing actionable insights that contribute to more sustainable, resilient and inclusive strategies for tackling the full spectrum of L&D challenges. Your active engagement and input will be invaluable in this collective effort to address one of the most pressing issues of our time.

6 Bharadwaj, R, Mitchell, T and Huq, S (2023) Non-economic loss and damage: closing the knowledge gap.IIED, London iied.org/21311iied

Loss of quality of life (shelter, food, health, skills, education)

Secondary category: mental and physical health impacts

Climate change impacts on health and quality of life in the Makoko Community, Lagos, Nigeria

Samuel C. Okorie, Research Cordinator, Loss and Damage Youth Coalition (LDYC)

Location	Lagos, Nigeria
Climate hazards	Flooding
Non-economic loss and damage	Disease; depletion of aquatic biodiversity; maternal mortality; coastal erosion; malnutrition; educational inequality/children out of school
Coping measures	Pilot project on capacity building and empowerment programs highlighting WASH

Context

Flooding and the consequent outbreak of diseases are two of the major climate change impacts affecting communities living in urban slums.[1] Frequent flooding due to climate-induced impacts has resulted in a significant increase in the loss of lives, properties and ecosystems; this in turn contributes to climate mobility, communal conflict, poverty, food insecurity, disease and the depletion of aquatic biodiversity.[2] In the past decade, 31 out of 36 states in Nigeria have been grappling with increased flooding, affecting over two million people, with damages estimated at over US$17 billion.[3] The commitment of nations and communities to address climate change has increased since the Paris Agreement was ratified in 2015, resulting in a variety of climate initiatives and activities to slow global warming. The term has also become a topic of conversation among communities. However, not much has been done for slum residents in Nigeria to protect them from the catastrophes that climate change brings. If there was ever any doubt about climate change, it has been dispelled by the fact that it is already impacting on people's health, both in the slums and elsewhere. The World Health Organization (WHO) has projected that between 2030 and 2050, the pace of epidemics brought on by climate change is anticipated to result in an additional 250,000 fatalities per year from malnutrition, malaria, diarrhoea and heat stress. Death from these conditions is more likely for more vulnerable people, such as slum residents.[4]

Figure 1. Map of Nigeria, showing location of Lagos State

Figure 2. A satellite view highlighting the location of the Makoko Community in Lagos. Source: www.maphill.com/nigeria/lagos/lagosisland/makoko/maps/physical-map/free/

The Makoko Community is a low-income settlement situated in the coastal region of the Lagos Mainland Local Government Area, across the Third Mainland Bridge, Lagos State, Southwest Nigeria. It is bordered by Iwaya and the University of Lagos to the north, Ebute-Meta to the west, the Third Mainland Bridge to the South and the Lagos Lagoon to the east.[5]

1 UN Integrated Regional Information Networks (5 September 2006) Lagos, the mega-city of slums. Africanews.

2 D'Souza, R (June 2012) UN Chronicles, Floods and Climate Change: Sustainable Development and Other Imaginations. www.un.org/en/chronicle/article/floods-and-climate-change-sustainable-development-and-other-imaginations

3 Olagunju, L (20 November 2022) FACT CHECK: Were 31 states in Nigeria submerged by flooding? The Cable. www.thecable.ng/fact-check-were-31-states-in-nigeria-submerged-by-flooding

4 Ramin, B (2009) Slums, climate change and human health in sub-Saharan Africa. World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/270589/PMC2789375.pdf

5 Oduwaye, L, Ilechukwu, V and Yadua, O (2010) Socio-economic determinants of urban poor housing types in Makoko area, Lagos. *International Journal of Educational Research* 2010(1) 1–16.

Figure 3. Map of the Makoko Community, located in the Lagos Island Local Government Area, Lagos State, Nigeria. Source: Bing Maps

There is little information on the origins of the Makoko Community. However, historical records show that in the 18th century, fishing activities and social interaction already existed there.[6] The community comprises people who live on land and on water. About half the population live on water, with this group now known as the Makoko Urban-Slum Community. The Makoko community shares links with the people from Egun, who are known for fishing, and with the Iwaya community on the waterfront and in Oko Baba.[7]

Makoko is a 'village in the city' that has been abandoned by the government and has insufficient basic social services. The residents lack adequate sanitation: "Communal latrines are shared by about 15 households, and wastewater, excreta, kitchen waste and polythene bags go straight into the water."[8] The oily black water is no longer suitable for fishing. It emits a pungent odour, and a thick layer of white scum gathers around the shack stilts. The conditions turn particularly unpleasant when it rains.[9,10]

Impacts

Around 86,000 dwellers of Makoko are sitting ducks for climate change and its corrosive consequences on community health, due to poor sanitary conditions and their impact on hygiene, the lack of bathrooms, a continual exposure to vectors, and the harsh weather. There are over a thousand of these slums in Nigeria, the majority of which are in Lagos. This makes these problems much worse, as a larger population is vulnerable to climate induced impacts. Additionally, these slum residents are at a greater risk of illnesses, major epidemics and even death.

6 Garcia, E, Vale, B, and Vale, R (2021) Collapsing gracefully: Making a built environment that is fit for the future. Springer Nature, Berlin.

7 Babalola, Y (1 May 2009) Makoko residents and their unwanted guest. This Day, allAfrica. https://allafrica.com/stories/200905010060.html

8 Kilani, A.M (2012) Renewal Plan for Makoko Residential Neighbourhood Spatial Analysis Based Evaluation. Unpublished M.Sc. Thesis submitted to the Department of Geography, Obafemi Awolowo University.

9 Udoma, O (2013) Makoko: Venice of Lagos. World Bank public participation policies and Processes in Relation to the Lives of Beneficiaries in slum upgrading projects: case study: Makoko, Lagos, Nigeria.

10 Oyinloye, M (2017) Urban renewal strategies in developing nations: A focus on Makoko, Lagos State, Nigeria. *Journal of Geography and Regional Planning* 10(8) 229–241.

Figure 4. A black water tank, with no power source to pump in clean water. The community lacks access to clean water for drinking and other necessities. Damaged buildings lead owners to explore coping measures, such as using waste to reduce the flow of water. Such measures prevent future flooding incidents from causing further damage. Credit: Samuel C. Okorie

Inhabitants in Makoko are at an alarming risk of being displaced due to an increase in downpours, floods and rising sea levels, due to rickety wood and corroded zinc shelters not having been constructed to adapt to the changing climate. Inhabitants' existence depends almost exclusively on water. Climate change has resulted in population displacement, greater cases of mental illness and more incidences of diseases. The poisoning of water supplies, severe injury and death are other consequences. The most vulnerable groups within the community are women and children, making up over 60% of the population in Makoko.

> "For Makoko women, surviving childbirth is a game of chance."
>
> Tessy Igomu (Journalist)

Women and children in Makoko are highly vulnerable to infectious waterborne diseases such as cholera, measles, diarrhoea and malaria, as the area has little or no medical support.

> "It is very difficult to get medical services, as all the medical centres are located on the land and accessing [them] could be very hard, especially for some critical cases"
>
> Makoko resident

1. Loss of quality of life (shelter, food, health, skills and education):

The Makoko community experiences three to four flood events each year and it typically takes around five days for the flood water to subside. The riverbank often overflows due to the blocking of the drainage water channel by accumulated plastic waste that has been carried by water and also improperly disposed of by the community.[11]

Each time coastal erosion occurs, the Makoko community is confronted with a challenge emanating from poor hygiene, the spread of diseases and contamination of water, as well as possible loss of lives and damage to properties.[12] Urban slums are more vulnerable compared to other coastal areas.[13] This is due to poor house construction – leading to those buildings being easily damaged by coastal storms, wind or cyclones – and ineffective maintenance of drainage systems. Furthermore, flooding disrupts

11 Idowu, O (13 February 2016) Adapting to Climate Change: The Venice of Africa. #Makoko www.linkedin.com/pulse/adapting-climate-change-venice-africa-makoko-olumide-idowu-idowu/

12 Dewan, T. H (2015) Societal impacts and vulnerability to floods in Bangladesh and Nepal. *Weather and Climate Extremes* 7,36–42.

13 Egbinola, C. N, Olaniran, H. D and Amanambu, A. C. (2017) Flood management in cities of developing countries: The example of Iba-dan, Nigeria. *Journal of Flood Risk Management* 10(4) 546–554.

socio-economic activities, which affects the income and livelihood of people and disrupts the education of school-going children. Access to education is limited in the area. There is only one primary school, which is funded by donations from community members, with free education for the children attending. However, there is a shortage of teaching staff. One teacher in the school says she teaches 90 children and is given four distinct courses to teach in various classes. More than 70% of the people in the Makoko community do not have formal education beyond the secondary levels. Lack of education exacerbates the poverty level in the area.

2. Mental and physical health impacts

Children from low-income homes living in dense urban slums are considered most vulnerable to infectious waterborne diseases. According to Jeje Aide, the Baale (Village Chief) of the Makoko Egun Community, the area has a high infant mortality and maternal death rate, as almost every family in the slum has lost a woman or child during pregnancy or childbirth. The nearest hospital, the Federal Medical Centre at Ebute-Metta, is always strained, making the residents travel longer distances to reach other maternity hospitals in Lagos Island. Baale Aide shared that, in most cases, the lives of both mother and child were lost before they could reach any of the government-owned hospitals located outside their neglected area.

> "We have no choice but to travel a large distance, especially in a wooden canoe, to various Island Maternity in Lagos Island Hospitals such as LUTH and LASUTH. Makoko women will continue to die during childbirth unless they can get to the hospital in time. Imagine kayaking for hours across the Lagos Lagoon with a pregnant woman. It has cost the lives of our women and babies"
>
> Baale Aide

However, the people of the Makoko community have become accustomed to their environment, as there have been few reports related to wider mental health issues resulting from deaths during childbirth in the community. However, frequent cases of poor physical health, particularly due to waterborne diseases, have been reported to influence mental health.

Compounding risks/impacts created

Most of the population has limited access to medical supplies, due to the lack of standard hospitals, facilities, equipment and medical personnel in the area; people contract malaria as a result of the extreme rising temperatures and floods that make the water an easy breeding ground for mosquitoes. The flood also carries all the filth and waste into the water, which the slum dwellers continue to use, rendering them susceptible to waterborne diseases. The area is already saturated with dirt of various types, including human waste. Additionally, children are restricted from attending school or any event that could endanger their lives during the flooding periods, which last for about four to five weeks or more at different intervals in the year. Religious activities are minimised, and ceremonial activities are often cancelled. In worst-case scenarios, the flooding could lead to the destruction of public and private properties and damage to family valuables. The economic impacts of flooding (coastal erosion) faced by the community are evident when business owners are unable to go to work or open their shops, causing a disruption in the economic activities of the community. Also, employees struggle to sustain themselves during such a period, due to loss of employment or reduced productivity.

Vulnerabilities/impacts from compounding risks

Makoko has a stilt housing infrastructure built on water, with the bulk of the houses built extremely close to power lines.[14] Most of the houses are made from locally obtained bamboo, concrete blocks and other local materials,[15] and are vulnerable to extreme events. For decades, residents have been denied access to basic infrastructure like clean drinking water, electricity and trash disposal.[16] This has resulted in unusually difficult environmental circumstances for the residents. Public latrines are shared by households, and effluent runs straight into the water on which they live.[17] Marine life is suffering due to the contaminated water.[18]

> "The Dwellers of the Makoko Community seem to have gotten used to Life in Makoko Slum."

> "The only time we feel the presence of the government is during an election campaign ... They bring a basket full of promises. Apart from children, we have over 500,000 people here ... We have the most registered voters in Mainland Local Government"
>
> Baale Aide

Coping measures

Despite challenges, the Makoko community prides itself on its resilience. The Chief of the community has noted that he was born in Makoko and witnessed a lot of life-threatening situations. He believes any child who is born in the slum and survives is destined for greatness. The residents of Ilaje-Bariga and Makoko settlements are not passive victims of flood dangers: they have adapted to the changing context and become resourceful, devising measures to reduce the effects of flood dangers on their livelihoods and habitats.[19] Members of the community have observed that areas of the neighbourhood with moderately good drainage systems have less flooding than areas with dilapidated drainage systems. Clearing clogged drainage channels is one of the community's coping methods. Furthermore, children are always instructed to stay inside the house until the water subsides. In other cases, streets are filled with sand or with wood shavings to assist transportation and socioeconomic operations. People wear rain boots and use routes unaffected by water logging when travelling for urgent tasks. Some of the outcomes of the coping mechanisms employed by residents have increased their understanding of coping with coastal erosion, with them making predictions and strengthening locally led adaptation measures against climate, as well as building resilience against coastal flooding to foster their socioeconomic activities.

Support needed in future

14 Lamond, J, Joseph, R and Proverbs, D (2015) An exploration of factors affecting the long-term psychological impact and deterioration of mental health in flooded households. *Environmental Research* 140 325–334.

15 Adama, O (2020) Slum upgrading in the era of world-class city construction: The case of Lagos, Nigeria. I*nternational Journal of Urban Sustainable Development* 12(2) 219–235.

16 Duthiers, V and Kermeliotis T (2012) Lagos of the future: Megacity's ambitious plans. CNN. https://edition.cnn.com/2012/08/22/business/lagos-urbanization-regeneration-infrastructure/index.html

17 Udoma O (2017) Makoko: Voice of Lagos. Futurecapetown.

18 No author (18 August 2012) Destroying Makoko. *The Economist.* www.economist.com/middle-east-and-africa/2012/08/18/destroyingmakoko

19 Eshiet, I (July 2022) Flooding and Adaptation: slum dwellers' coping strategies in Lagos, Nigeria. www.researchgate.net/publication/362016516_FLOODING_AND_ADAPTATION_COPING_STRATEGIES_OF_SLUM_DWELLERS_IN_LAGOS_NIGERIA

Baale Aide has said he feels the town is entitled to the basic infrastructure of a well-equipped hospital to service the growing population. However, he considers this akin to wishing for the moon. Despite the accumulated health risk, the community's major demand is for government interventions on livelihoods improvement programmes and waste management. Tope, a youth advocate in the community, has shared that coastal erosion requires immediate attention. Sea-level rise has resulted in an increase in coastal erosion and residents are finding it difficult to adapt to frequent flooding events due to a lack of sufficient knowledge or application of effective coping mechanisms to curtail the erosion and reduce the impact it has on houses, lives and livelihoods. To address the challenges, the residents in Makoko community need capacity building and empowerment programmes that highlight WASH, basic health services and innovations in coping strategies.

Lessons learned

Makoko is a climate-vulnerable community impacted by disruptive disease outbreaks, property damage, childbirth mortality and poor health conditions. These issues are exacerbated by flooding and waste disposal, unemployment, food scarcity, and very high levels of poverty. The Makoko community has been neglected by the government for decades, and politicians only remember them during elections. Community stakeholders and young people have called for immediate intervention to reduce climate change vulnerability and strengthen their adaptative capacity, as well as address health issues contributing to child mortality and the spread of communicable diseases. It has also been overwhelmingly apparent that most climate-vulnerable communities are in desperate need of climate aid and intervention, and the Makoko community should be included among those prioritised for support.

Figure 5. The Makoko community lacks adequate sanitation and waste goes straight into the water. This leads to contaminated water (and associated risk of waterborne diseases) as well as greater vulnerability to flooding. Credit: Samuel C. Okorie

Synopsis

The Makoko community is neglected by the Government of Lagos State, which considers it an illegal settlement and has issued several notices of vacation to the residents, which have proved abortive. The community is impacted by intense coastal erosion, disease outbreaks and maternal fatalities. Capacity-building programmes and locally led adaptation practices are needed to facilitate nature-based solutions where national infrastructural aid has not yet been received. Educational programmes are required to promote behavioural change. Community members who depend on ecosystem services for their livelihoods are best suited to lead this adaptation strategy. The programme will give the intended audience the necessary information and training and demonstration of cutting-edge strategies to support resilience and adaptation responses to climate disasters.

Loss of quality of life (shelter, food, health, skills, education)

Secondary category: mental and physical health impacts

The impacts of climate crises on education: disruptions and disadvantages at Mitole Primary School in Malawi

Chimwemwe Sakunda Ndhlovu, Chancy Sibakwe and Aaron Kandiwo Mtaya

Caritas Malawi/Catholic Development Commission in Malawi (CADECOM)

Location	Zomba district, Malawi
Climate hazards	Increased frequency and intensity of cyclones Heavy rains
Non-economic loss and damage	Renovated classrooms used as evacuation centres; trauma and stress, leading to mental health issues; women and girls at risk of gender-based violence and injuries in camps; lost customs and practices
Coping measures	Use of traditional Indigenous knowledge for early warning; rehabilitation of broken points of the dyke; provision of psychosocial counselling sessions for children; capacity building for the civil protection committees on social protection

Context

Malawi continues to face a plethora of climate shocks with increasing frequency and magnitude. In the past ten years, the country has experienced prolonged dry spells, cyclones associated with heavy rains and strong winds, mudslides and floods. The recurrence of disasters makes it difficult for victims to recover from losses and rebuild their lives. For instance, Malawi was heavily hit by Cyclone Idai in March 2019, Tropical Storm Ana in January 2021, Cyclone Gombe in March 2022 and, most recently, Cyclone Freddy in 2023. Unfortunately, extreme weather events are projected to increase in frequency and severity in the future, making the country even more vulnerable to climate-related disasters.

Figure 1. Map showing location of Mitole Primary School in Malawi. Source: Google maps

Tropical Cyclone Freddy made a huge impact in Malawi's high-lying districts and there were a great number of casualties due to landslides in the Southern Highlands, which in some cases impacted entire communities and public infrastructure. The cyclone impacted more than 2,267,458 people, of which 659,278 were displaced, 679 suffered fatalities, 537 were reported missing and 2,186 suffered injuries. Among those affected, 1,308,064 (more than 57% of the total) were women and girls of reproductive age. Cyclone Freddy also caused significant damage to public and private property, including roads, bridges, health facilities and school infrastructure. As a result, the delivery of essential public services was severely affected. According to government reports, the total effects of Tropical Cyclone Freddy across social, productive and infrastructure sectors are estimated at $506.7 million, with physical damages valued at $347.2 million and economic losses assessed at $159.5 million.

Among the schools heavily affected by climate-induced impacts is Mitole Primary School, which is located in the Group Village Headman (GVH) in Mbalu, within the Traditional Authority Mwambo in the Zomba district in Southern Malawi. The village is in a low-lying area, surrounded by Lake Chilwa and the Likangala River, which makes it prone to flooding. The area has also faced several other disasters, leaving the community in perpetual distress.

Table 1. Summary of disasters impacting the area since 2015

Year	Disaster	Impact on the school
2015	Floods	There was damage to the school's infrastructure, with suspension of classes due to inaccessibility by both learners and teachers until the water receded
2016	Dry spells	This resulted in low yield and food insecurity, which also led to low school attendance and an increased number of dropouts
2017	Dry spells and floods	Continued low crop yield and food insecurity affected school attendance and increased school dropouts
2018	Prolonged dry spells	Declining crop yield in the area resulted in reduced academic performance in school and an increase in dropouts

Year	Disaster	Impact on the school
2019	Floods due to Cyclone Idai and Kenneth	Severe damage to public and private infrastructures, including those of the school, led to discontinuation of classes. The school was also used to shelter the affected households
2020	Floods and dry spells	This worsened the damages by Cyclone Idai and Kenneth. It also slowed the recovery process
2021	Floods and dry spells	The situation further worsened following disasters in previous years. Food insecurity worsened, affecting learners
2022	Floods due to Cyclone Ana and Gombe	There was damage to public infrastructures, including school infrastructure. The school was also used as an evacuation camp, disrupting school sessions. This continued to affect the schools' performance
2023	Floods due to Cyclone Freddy	The repeated use of the school caused disruption in the school session, resulting in poor performance of learners and increased school dropouts

About Mitole Primary School

Mitole Primary School, one of the four government schools in GVH Mbalu, had 1,757 students during the 2022–23 academic calendar, with 941 girls among them (53% of the total). The age ranges at the school are: infant classes (grades 1 and 2), for pupils aged between six and nine years; junior classes (grades 3 and 4), for pupils aged between eight and 12; and senior classes (grades 5 to 8), for pupils aged between 13 and 17. The school presents a microcosm of the ugly scars that cyclones and other disasters have left on the education sector in Malawi. The school infrastructure, including classrooms, WASH facilities[1] and teachers' houses, were damaged during prior cyclones. Some classrooms were used as evacuation camps when disasters struck. The consequences of these events have continuously disrupted the operations of the school, keeping learners out for extended periods.

Figure 2. One of the school blocks at Mitole Primary School, which is also used as a disaster shelter. Credit: Chancy Sibakwe

Impacts

According to the school authorities, these disruptions from frequent disasters have led to a decline in the overall performance of learners at the school. The school's enrolment has also reduced significantly and dropout rates have increased. The recurrent disasters have also brought about traumatic experiences to the victims, including learners, which have adversely affected their academic performance.

Jenifer Chakalamba, a student in grade 7 at Mitole Primary School, is 16 years old. Her family was one of the many that were hit by the devastating impacts of Cyclone Freddy. Their house was destroyed, and they

1 World Health Organization, Water Sanitation and Health. www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health-(wash)/health-care-facilities/wash-in-health-care-facilities

lost all their belongings, including food and clothing. Jenifer also lost her school materials: books, notebooks and pens/pencils. When she returned to school after the temporary closure, she had to begin afresh:

> "For me to do better in school, I use the notes which I write in my notebooks, but this year I lost all my notes as well as my school uniform. This affected my performance during end-of-term examinations."

Jenifer mentioned that witnessing her parents struggle to meet basic needs after the disaster affected her concentration in school and she dropped from position five to position seven in her end-of-term school results.

Jenifer's story is not unique. Many other learners at the school share similar stories. The devastating impacts of the cyclones, including Cyclone Freddy, have adversely affected the academic performance of numerous students in the region. Generally, the curtailing of teaching sessions has implications on the cognitive development of children, and the trauma and stress caused by the disasters has put them at risk of long-term mental health issues. Unfortunately, this significant non-economic loss and damage (NELD) is often not considered while designing humanitarian aid projects.

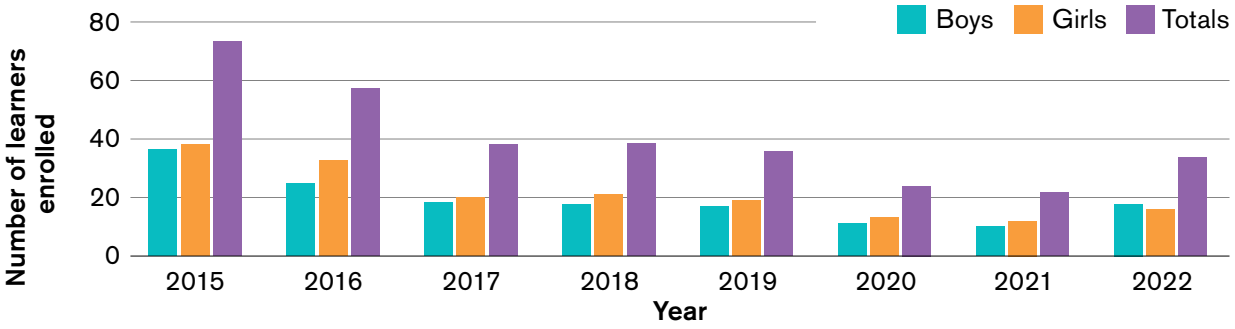
Mr Kwali, the headteacher at Mitole Primary School, also confirmed the following:

> "This year again, the school learning sessions were disrupted for over a month as we had to accommodate people who were displaced by Cyclone Freddy, and some of the school infrastructure was also affected. This comes at the expense of the learners who are forced to stay out of school. The school had to accommodate the affected people because they had nowhere else to go."

> "Even when we opened, many learners still could not come to school because they had accessibility challenges due to the flooding of Likangala River and Lake Chilwa. All these factors gravely affect the performance of our learners at the school and some dropped out of school."

The schools in the southern region of Malawi where Mitole is situated were suspended by the Government on 18 March 2023 and only reopened on 20 April 2023. Mr Kwali lamented that this suspension exposed learners to other risks, including pregnancies and early marriages.

Enrolment trends at Mitole Primary School since 2015



Data source: Mitole Primary School records

Generally, after disasters, children often do not prioritise education. Instead, their focus is on supporting their parents in the recovery and rebuilding efforts. The parents are also unlikely to encourage their children to attend school, due to lack of resources and support. This leads to increased dropout rates.

> "I have friends who dropped out of school soon after Cyclone Freddy. Some of them took up menial jobs as a way of helping their parents. Others are still waiting for their parents to provide resources that will enable them to return to school. In the process, they are missing out on what we are learning in school."
>
> Jenifer Chakalamba

Compounding risks/impacts created

Climate change has impacted the community surrounding Mitole Primary School, with both economic and non-economic loss and damage. Women-headed households bear a more pronounced impact of climate change. In a men-headed household, the responsibility is shared between both partners.

The community surrounding the school is situated between the Likangala River to the northwest and Lake Chilwa to the southeast, which often floods in rainy seasons. The floods frequently result in houses being submerged in water and crops and livestock being destroyed, rendering many households helpless. Access to basic services including schools is also a challenge as mobility is limited and most infrastructure is damaged.

Vulnerabilities/impacts of compounding risks

The disasters have had a significant impact on the livelihoods of the communities, leading to the migration of people, especially men, to other districts or even neighbouring countries, in search of employment. As a result, women and children are left behind and often at risk of facing gender-based violence and sexual exploitation.

Additionally, the displacement and relocation of families leads to the loss of customs and practices that are an integral part of most African communities. Loss of cultural heritage results in a sense of hopelessness and a diminished connection with one's roots. Frequent disasters have contributed to the weakening of cultural heritage, causing many individuals to experience low self-esteem and a limited sense of self-awareness. These factors further influence a child's cognitive development and mental wellbeing. As witnessed at Mitole Primary School, loss of cultural heritage makes children confused

and depressed and, in most cases, leads to poor academic performance. For some children, there is a complete loss of interest in school activities.

Coping measures

The management of Mitole Primary School, with the help of CADECOM, is providing psychosocial counselling to learners to strengthen their mental health and wellbeing, and to promote school retention and improved academic performance. The headteacher of the school shared the following:

> "As teachers, we know the ability of our learners. Looking at their performances, we knew that something was wrong. Additionally, the general appearance and attitudes toward lessons were vividly telling us something. This is why we asked for psychosocial counseling support from CADECOM."

The headteacher added that although some of the students have recovered, most of them are still facing challenges in catching up.

In addition, the school has also introduced boarding facilities for students in grades 7 and 8 to ensure they focus on their studies as they prepare for the Malawi Primary Schools Examination.

Through other CADECOM partners such as the Scottish Catholic International Aid Fund (SCIAF) and Trócaire, CADECOM has repaired the dyke, which protects the school from flooding waters. The organisation has also been building the capacity of some community organisations/groups, such as the Civil Protection Committees on social protection, to help those in need of psychosocial support. The project also runs a campaign encouraging learners to go back to school after the disasters.

Along with this, CADECOM is working with the local artisans and building their capacities in 'resilient housing construction' that can withstand climate shocks. The organisation is also promoting the use of Indigenous knowledge for early warnings, such as the beating of drums, blowing of vuvuzelas and use of whistles by people living upstream, to warn people downstream of upcoming disasters. Improved early warning reduces the loss of human lives and properties.

Support needed in future

The community needs support for the construction of an evacuation centre to provide shelter to the affected households in times of disaster. This will reduce the use of the school's infrastructure during disasters. Extension services are further needed to help communities build resilient houses that can withstand shocks during such events. This would reduce the stress associated with property loss when they occur.

Support is also required for the rehabilitation of damaged school infrastructure and the building of new resilient constructions. Currently, some of the school blocks cannot withstand shocks, which also poses a great risk to the learners.

Support to construct a durable bridge on Likangala River would also facilitate continued school accessibility for both students and teachers.

Economic empowerment initiatives are recommended to provide alternative sources of income to

households in the area that mostly depend on agriculture and fishing. With the increased frequency of disasters, it is proving difficult for those households to sustain their livelihoods in climate-sensitive sectors.

Finally, there is a need for comprehensive research to understand NELD in the education sector. This will also help generate evidence on NELD in the sector, which is often forgotten but has a huge impact on the country's overall development.

Lessons learned

- Loss and/or damage to public and private property have a devastating impact on the education sector, which is key to the development of the nation
- NELD in social sectors like education is an area that is still under-explored despite having both short and long-term devastating effects on communities
- Psychosocial support services must be prioritised and incorporated into post-disaster assessment and management. If not addressed, disasters could lead to long-term effects that could prove very costly to developing economies like Malawi
- NELD should be considered as a cross-cutting theme in Loss and Damage Funding windows, to ensure holistic support to disaster-stricken communities.

Synopsis

This case study highlights the impact of climate change on the education sector. Mitole School has been heavily affected by frequent climate-induced disasters that have disrupted its operations and damaged overall academic performance. Non-economic loss and damage to learners is often forgotten in humanitarian aid projects and in the NELD definition itself. This case thus strongly advocates for the recognition of NELD impacts in the education sector and calls for support to mitigate climate change impacts on education.

Mental and physical health impacts

Secondary categories: loss of cultural heritage; loss of ecosystems and biodiversity

Understanding the multidimensional influences of eco-anxiety in Nigeria: experiences from The Eco-anxiety Africa Project (TEAP)

Ayomide Olude, Project Manager, The Eco-anxiety Africa Project (TEAP) and Hope Lekwa, Head of Research, SustyVibes

Location	Nigeria
Climate hazards	Increased frequency and intensity of natural disasters; loss of biodiversity; reduced access to clean water and food
Non-economic loss and damage	Loss of life; linked impacts on physical and mental health; eco-anxiety
Coping measures	NGO-organised peer-to-peer support groups

Context

Nigeria, located in West Africa, is known for its diverse climatic conditions, rich cultural heritage and linguistic diversity. With over 200 million people, the country is home to more than 250 ethnic groups and over 300 spoken languages. The country is no doubt a melting pot of diversity. Nigeria experiences four main climate types: tropical rainforest, tropical monsoon, tropical savanna and desert. The southern region is defined by its tropical rainforest climate, where annual rainfall is 1,500 to 2,000mm per year. Moving northwards, the climate transitions into a tropical monsoon climate, characterised by distinct wet and dry seasons. The central and northern parts of Nigeria have a tropical savanna climate, with a pronounced dry season and a shorter rainy season. In the far north, near the Sahara Desert, the climate is arid, exhibiting desert conditions.[1]

Figure 1. Map of Nigeria showing states. Credit: Adobestock

One of the significant climatic events affecting Nigeria is an increase in the frequency and intensity of extreme weather events, particularly flooding down south and an increase in droughts in the northern part of the country. Nigeria experiences two main seasons: the wet season, which typically lasts from April to October, and the dry season,[2] which typically lasts from November to March. However, climate change has led to changes in seasons, resulting in more frequent and intense rainfall events and longer dry seasons, causing detrimental impacts across the country.

Impacts

In 2022, Nigeria experienced its worst flooding in over a decade,[3] with over 1.4 million people displaced, 500 reported dead and thousands injured. The catastrophic series of floods was caused by the combining factors of heavy rainfall, the release of water from the Lagdo Dam in neighbouring Cameroon and limited/inadequate basic drainage systems. Despite the hurried aid distributed to assist people and reduce impact severity, due attention was not given to the non-economic loss and damage impacts of these extreme events, such as to mental and physical health, culture and biodiversity. Though the crisis is now an event of the past, the losses and wounds are still being experienced by the affected citizens.

Northern Nigeria also has its share of climate crises as the country has the largest desertification rate in the world, with a loss of over 55.7% of its primary forest and an annual cost of $5.1 billion due to rapid desertification.[4] In a region deeply dependent on agriculture, it is evident that water scarcity, rising temperatures and climate-induced conflicts will continually increase vulnerability levels and worsen living conditions.

1 Curry, T (2009) Culture of Nigeria: history, people, clothing, traditions, women, beliefs, food, customs, family. Everyculture.com. www.everyculture.com/Ma-Ni/Nigeria.html

2 United States Agency International Development (USAID) (n.d.) Nigeria: CLIMATE VULNERABILITY PROFILE. www.climatelinks.org/sites/default/files/asset/document/nigeria_climate_vulnerability_ profile_jan2013.pdf

3 TVC News Nigeria (12 October 2022) FG Names 2022 Flood Disaster The Worst Ever Experienced In Nigeria. www.youtube.com/watch?v=gatSSQxFYsg

4 Aminu, A (2022) Nigeria loses 55.7% primary forest, tops global desertification rates. Naturenews.africa. https://naturenews.africa/nigeria-loses-55-7-primary-forest-tops-global-desertification-rates/

In describing the myriad impacts of climate change in Nigeria, it is important to understand that those being experienced go beyond the fiscal, putting stress on the mental and physical health of individuals, as well as resulting in a loss of cultural heritage, biodiversity and history. These impacts can be particularly pronounced among different segments of the population, including among disabled people,[5] children, young people, older people, and marginalised and Indigenous groups or communities, contributing to a wide range of nuanced challenges for these groups.

The non-economic consequences of climate change are difficult to define or quantify. These impacts are usually on a spectrum and include a range of difficulties, from loss of traditional ways of life, cultural legacy and biodiversity, to even deaths and injuries resulting from stress, health challenges, anxiety, despair and post-traumatic stress disorder (PTSD). Bearing in mind the category of mental and physical health — the focus of this case — there is currently no reliable data on the challenges in those areas that are linked to climate change. However, the mental health consequences of climate change on young people are increasingly being recognised and studied. The uncertainty and fear associated with the climate crisis leads to feelings of eco-anxiety (sometimes termed climate anxiety). This is a specific form of anxiety and distress that individuals experience in response to the environmental and ecological challenges associated with climate change and environmental degradation. We investigated the experience of eco-anxiety and environmental-related emotions among Nigerians under The Eco-Anxiety Africa Project (TEAP). As part of the project, a survey was completed with 176 respondents who were aged between 15 and 55 years and drawn from the six geo-political zones of the country. The respondents were asked if eco-anxiety was something they could relate to, and what major factor triggered this for them. More than 91% of the respondents shared that a climate crisis is at hand, with 66% confirming that eco-anxiety was something that they could relate to and 32% confirming they had heard of eco-anxiety prior to the survey.

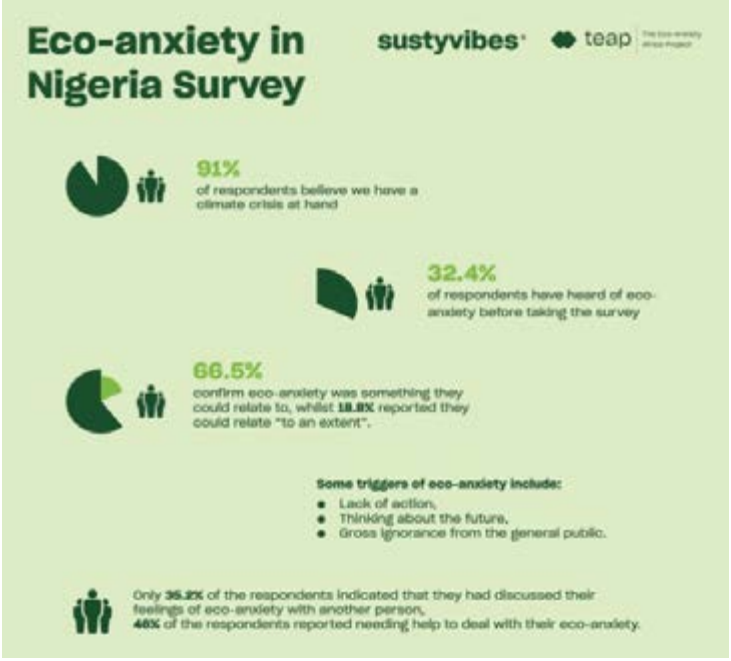


Figure 2. Understanding eco-anxiety in Nigeria survey. Credit: The Eco-anxiety Africa Project

Non-economic impacts of loss and damage — like eco-anxiety — are exacerbated by factors such as social inequality, poverty and poor access to healthcare.

Heatwaves in Nigeria can have profound consequences on the mental wellbeing of young people and the vulnerable population. Experiencing discomfort due to extreme heat can trigger a range of negative emotions, such as irritability, anxiety and depression. These psychological responses, together with the physical and socioeconomic challenges faced by individuals in the country, make people more vulnerable to the harmful effects of heatwaves. When individuals already suffer from pre-existing physical or socioeconomic impairments, the impact of heatwaves can be particularly severe. Physical problems

5 This is the preferred terminology in the country of publication (UK), reflecting a rights-based approach to disability advocated by leading organisations run by and representing disabled people. Other countries will have other norms.

(such as respiratory issues, cardiovascular diseases and renal conditions) can worsen in excessive heat. Individuals who lack access to cooling systems or suitable shelter may also struggle to find relief, exacerbating their agony and suffering. From a socioeconomic standpoint, marginalised populations are at greater risk from the effects of heatwaves. Limitations in financial resources may prevent people from acquiring the necessary means to mitigate heat-related risks, such as through air conditioning or access to healthcare services. These limitations contribute to a heightened susceptibility to heat-related stressors, further compromising physical and mental wellbeing.

Deforestation in the northern part of Nigeria is another serious issue requiring attention, as not much is known about how this environmental change is causing other climate-induced impacts like conflicts and displacements and how it is taking a toll on the mental health of the people directly experiencing them. A very distressing truth about the data on climate impacts, both fiscal and non-fiscal, is that the victims are often represented by numbers, and these figures are mostly for quantifiable impacts. The Sahara Desert advances at an annual rate of 6% towards the south, accounting for the loss of over 55% of land mass in Nigeria to desertification. This is affecting agricultural activities and causing home losses.[6] This desertification has led to demographic displacements in villages across 11 states in Northern Nigeria.[7] Certainly, this displacement is being met by conflicts and other underlying issues, such as migration from ancestral homes and a loss of the cultural way of life, all of which take a toll on the mental health of the impacted communities. This is not unique to Northern Nigeria. In the coastal regions of the country, rising sea levels and increased flooding can lead to the destruction of archaeological sites and historical landmarks. These sites are not just physical structures; they hold significant cultural and historical value for the communities around them. Their loss would mean severing a connection to the past and disrupting cultural continuity among the communities.

Compounding risks and their impacts

The living conditions for an average Nigerian amid the climate crisis can be very challenging. From socioeconomic factors to political ones, there seem to be multiple issues playing a combined role in climate-induced mental health challenges. Poverty is a critical issue in Nigeria, with four out of 10 Nigerians living in multidimensional poverty (Nigeria Poverty Map, 2022). Unemployment has been on the rise in recent years: as of 2022, the unemployment rate in Nigeria stood at 37.7%; this year it stands at 40.6% and is projected to hit 43.9% in 2024 (KPMG, 2023). The combination of high unemployment rates, increasing poverty levels and continued climate impacts creates a complex and daunting challenge for Nigerians to secure adaptive measures at the individual and community level, thereby amplifying the vulnerability of those already living in poverty. The vicious cycle of poverty persists, hindering sustainable development and hampering efforts to improve the overall wellbeing of the Nigerian population.

The existing grievances and wounds experienced by young people intensify their sense of hopelessness and apathy towards climate-related worries, hindering their ability to recover and develop resilience. A poignant example of this is the widespread police brutality that has been targeting young people, some of whom have even been killed by the military, which sparked the #EndSARS protest in Nigeria in October 2020. The mismanagement of this social issue by the Nigerian government has further eroded trust in governmental institutions and their capacity to effectively address crucial matters.[8]

6 Elnafat, I (2022) Desertification in Nigeria and its Impact on Climate Change. The Renata. https://therenata.com/desertification-in-nigeria-and-its-impact-on-climate-change

7 Odiogor, H (3 May 2010) Special Report on Desertification in Nigeria: The sun eats our land. *Vanguard* News.

8 Nigeria Poverty Map (2023) Explore data on Multidimensional and Monetary Poverty in Nigeria. www.nigeriapovertymap.com

The handling of this civil protest has added to the disillusionment felt by many Nigerians, who believe that the government has not been paying adequate attention to the pressing issue of climate change. This sentiment has contributed to a sharp increase in economic migration, leading to a brain drain of skilled professionals with valuable expertise in innovations, thereby hampering initiatives for improving the country's climate resilience.[9]

Among rural communities, the impacts of climate change are highly pronounced for women, who are the primary caregivers in households. Rural households rely heavily on natural resources for their survival and livelihoods. With the depletion of natural resources and the degradation of ecosystems, women travel longer distances and expend more energy in collecting water, firewood and other essential resources. This increased workload not only leads to physical fatigue and exhaustion but also exposes women to physical and mental health risks. The unpredictability of weather patterns disrupts agricultural cycles, exacerbating food insecurity and placing immense strain on households, which induces anxiety and mental fatigue for the women within them.[10]

Figure 3. Welcome signage into Ayetoro Community, Ilaje, Ondo State, Nigeria. Credit: International Climate Change Development Initiative

In Ayetoro, Ilaje, Ondo State — a small community in Nigeria — the impact of climate change, exacerbated by human activities, has resulted in the loss of over 10km of land to relentless sea incursion. This destructive force has not only brought about a devastating change to the landscape but also to infrastructure.

The sea incursion has also caused immense emotional distress and mental anguish within the community. Families have been torn apart as their homes and neighbourhoods have been swallowed by the encroaching sea. Their residences, landmarks and possessions have held deep cultural and spiritual significance, connecting them to their ancestral roots, so the loss of these has left them with a deep sense of grief, helplessness and uncertainty about the future (Momoh, 2023). In various Indigenous communities like Ayetoro, the profound connection families have with their land is now being disrupted by climate-related events. This disruption has had severe repercussions on their mental health, manifesting as complicated grief, post-traumatic stress disorder (PTSD), anxiety and depression. When asked about how people are coping with these devastating impacts, the traditional ruler of the community, Oba Micah Olaseni Ajijo said:

> "As there is no social justice, there is also no environmental justice in the policies of the political class. We only cry to God, as the sea eats our land and coastal towns in Nigeria. May our God and Creator give us peace and command the ranging waves to be still."[11]

The Oba explained that the ocean surge has been threatening the existence of the Ayetoro community for the past 20 years. From 2015 to date, no fewer than 500 to 700 buildings have been destroyed or washed off. The profound loss this community experiences, both in terms of physical space and cultural heritage,

9 Ogbenika, G. E (2022) THE EFFECT OF BRAIN DRAIN AND MIGRATION ON NIGERIAN'S DEVELOPMENT. *Journal of African Studies and Sustainable Development* 2(1) 2630–7073 2640-7065. https://acjol.org/index.php/jassd/article/view/2644.

10 Akinsemolu, A (24 March 2023) Water scarcity on Nigeria's coast is hardest on women: Six steps to ease the burden. Phys.org. https://phys.org/news/2023-03-scarcity-nigeria-coast-hardest-women.html.

11 Momoh, A (24 April 2023) Ayetoro: Ondo community slipping into the Atlantic Ocean. Sunday Magazine, *The Guardian Nigeria News*.https://guardian.ng/sunday-magazine/newsfeature/ayetoro-ondo-community-slipping-into-atlantic-ocean/.

leaves them grappling with a complex range of emotional and psychological challenges. And people with existing health conditions are particularly vulnerable to these changes, as factors such as poor air quality, increased temperatures and extreme weather events can intensify chronic physical conditions, especially for disabled people, leading to increased distress and anxiety.

Coping measures

In the face of these impacts, individuals and communities strive — whether knowingly or unknowingly — to reduce their anxiety and manage the associated mental and physical challenges. Most impact victims in Nigeria rely on religion and words of encouragement to navigate the conundrum. Some other popular coping measures we found in our study included talking to other people about feelings, along with knowledge gathering, resting, reducing the use of single-use plastics, intentionally disassociating from climate change news and taking environmental action.

a. "I try to ignore it. I've decided to classify climate change as a problem that I'm aware of but won't actively campaign for, even while supporting those doing that work, so that I don't get overwhelmed."

b. "I take a break from work to get a breath of fresh air in a naturally conserved area."

c. "I limit media consumption and explore realistic lifestyle changes, being patient with myself and others. I also connect with nature, get involved with my community and remember that I am not alone"

Coping strategies from participants on The Eco-anxiety in Nigeria survey. Credit: The Eco-anxiety Africa Project

But we have realised individuals cannot protect themselves enough. Hence, introducing intentional contextual coping mechanisms is important. These measures aim to intentionally address the psychological, social and cultural dimensions of climate impacts from a relatable and needs-oriented perspective. This provides support and tools to help individuals and communities adapt, understand and effectively manage the mental and physical stresses caused by climate change.

Interventions like TEAP provide support services that help individuals process and validate their emotions, by offering a space for expression and healing. TEAP's intervention aids in building resilience and developing healthy coping strategies that are specific to the community and individual's context. TEAP achieves this by prioritising dialogues/safe spaces, sharing inter-generational wisdom and voicing local perspectives to empower people to navigate through their own challenges. TEAP takes proactive steps to decode eco-anxiety from an African perspective and promote wellbeing and care. We achieve this through the synergy of workshops and webinars, research and outreach.

Support needed in future

Support to help deal with the non-economic impacts of climate change will be essential for helping individuals and communities effectively address the psychological, social and cultural consequences of climate change. When we conducted our survey under TEAP, we realised Nigerians feel unsupported and unequipped to cope with the climate crisis and its resulting mental health impacts. Some of these can be attributed to the country's flawed healthcare system, which is unable to identify the multifaceted health impacts of climate change and provide appropriate support. There is also inadequate support from the government on climate issues, with a lack of provision of other economic, political and socio-cultural solutions, which exacerbates mental distress.

Figure 4. Factors triggering eco-anxiety in Nigerians (sample size: 176). Credit: The Eco-anxiety Africa Project

Support for people, in this case, would involve the de-stigmatisation and easy accessibility of climate awareness, with mental health knowledge and care that specifically addresses climate-related stress, anxiety and trauma. It would also include implementing community resilience programmes that foster social support networks and community cohesion.

There is also a need to support Nigerian researchers to explore the different perspectives in understanding and living through the impact of the climate crisis on mental wellbeing, including intersections of socioeconomic ecosystems, politics, public health and cultural heritage. Such research would provide valuable information for policymakers and individuals making decisions related to climate change.

Respect for diverse cultural values and practices and capacity-building programmes will be crucial for enhancing ability for climate resilience. Integrating mental health considerations into policies, conducting research and promoting international cooperation and funding will be important aspects of support. By addressing these areas, individuals and communities will be better equipped to navigate the non-economic impacts of climate change and build resilience for the future.

Lessons learned

Our work at TEAP has shown that spaces for dialogue matter, and that meaningful conversations validating climate emotions are critical for the psychological resilience needed to adapt to these unprecedented changes. It is important to bring back valuing non-fiscal things such as culture, identity, ecosystem services and biodiversity: aspects of life that are often overlooked in traditional assessments but are crucial for the wellbeing of communities. Recognising these values can help inform strategies that prioritise the preservation of cultural heritage, social cohesion and biodiversity in the climate crisis. Acknowledging that local communities have a deep connection with cultural and emotional values that are at risk from the climate crisis, as well as incorporating community leaders' knowledge and perspectives in decision-making processes, will help ensure that strategies are locally relevant and effective. For example, the Nigeria Erosion and Watershed Management Project (NEWMAP) has adopted innovative integrated approaches based on community participation to link poverty alleviation with sustainable ecosystems and better disaster-risk prevention.[12] This holistic approach has improved the lives and safety of more than 12 million people in 23 states in Nigeria. Another lesson learned is about the introduction of training programmes that enhance individuals' and communities' capacity to adapt to climate change mentally and physically. This can include skills development for sustainable livelihoods, disaster preparedness, climate-smart agriculture, eco-anxiety management and environmental conservation.

12 World Bank (2017) The World Bank Nigeria Erosion and Watershed Management Project (NEWMAP) – Additional Financing (P164082) (Combined Project Information Documents/Integrated Safeguards Datasheet (PID/ISDS). https://documents1.worldbank.org/curated/en/193161525194153230/pdf/Project-Information-Document-Integrated-Safeguards-Data-Sheet-Nigeria-Erosion-and-Watershed-Management-Project-NEWMAP-Additional-Financing-P164082.pdf.

Synopsis

This case highlights the non-economic impacts of climate change in Nigeria and the importance of supporting individuals and communities in addressing the resulting psychological, social and cultural consequences of the climate crisis. Nigeria's diverse climate types and vulnerability to extreme weather events, such as floods and droughts, contribute to mental and physical health challenges, along with loss of cultural heritage and biodiversity. Factors like eco-anxiety, heatwaves, deforestation and coastal erosion further compound these impacts. The intersection of poverty, unemployment and socio-political issues exacerbates the challenges faced by Nigerians, particularly the young population. Coping measures, both individual and community-based, are explored, along with the necessity for intentional support systems tailored to the local context. The Eco-Anxiety Africa Project (TEAP) is highlighted as an intervention providing dialogues, research and mental health support. Supporting non-economic impacts entails destigmatising mental health, providing accessible care, implementing resilience programmes, supporting research and promoting international cooperation. The importance of recognising non-economic values, incorporating local perspectives and introducing training programmes for climate adaptation is emphasised. By addressing these areas, Nigeria can enhance resilience, preserve cultural heritage and improve the overall wellbeing of its population in the face of climate change.

Annex

Table 1. Understanding eco-anxiety in Nigeria survey

Sample size (n)	Age range	Percentage (%)	Response to eco-anxiety
176	15-55	66	Yes
		19	To an extent
		9	Not exactly
		6	No

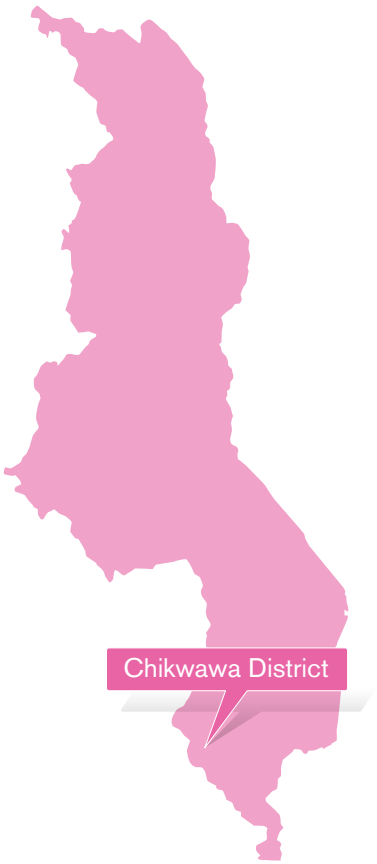
Table 2. Factors triggering eco-anxiety in Nigerians (based on responses to the 'Understanding eco-anxiety in Nigeria' survey)

Triggering Factors	Percentage (%)
Lack of action	83
Thinking about the future	68
Government inaction to the climate crisis	68
Gross ignorance from the general public	64
Lived experience with climate change and environmental degradation	37
Reading about climate change online	36
Media coverage of climate disasters	34

Mental and physical health impacts

Living in fear: climate-induced disasters damage the health of communities in Kanseche Village, Malawi

Temwa Mhone, Correspondent with Nation Publications Limited (NPL-Malawi)



Location	Kanseche Village, Chikwawa District, Southern Region, Malawi
Climate hazards	Floods; hailstorms and raging water run-offs intensified by cyclones
Non-economic loss and damage	Post-disaster depression; post-traumatic stress disorder; anxiety and fear; physical, psychological and educational impacts on children
Coping measures	Lessons and activities for survivors provided by local and international organisations

Context

This case is from Kanseche Village in the Traditional Authority (T/A) Lundu, which is within the Chikwawa District in the Southern Region of Malawi in Africa. Communities here are mostly farmers with small-scale businesses. The place is located approximately 70km south of Blantyre, Malawi's commercial city, on the west bank of the Shire River. Chikwawa is one of the two low-lying districts at the foot of the Shire Highlands in Malawi.

Figure 1. Map of Malawi. Source: Nations Online Project, Political Map of Malawi

Like the majority of rural Malawians, people in the village are mostly smallholder farmers growing maize, millet, rice, cassava and sweet potato for food and business. They also rear cattle, goats, pigs, chickens and ducks. They rely on free education and health services from the government at Mwanza Primary School, and at Bereu Health Centre and Chikwawa District Hospital, respectively.

The area is prone to floods, droughts, prolonged dry spells, hailstorms and raging water run-offs. For years, the Mwanza and Shire rivers in the area have been getting shallower: buried in silt coming from heavily deforested highlands. Even normal rainfall is known to force rivers to break their banks and flood homes; the situation gets much worse when cyclones hit the area.

Recently, there has been an increase in the frequency and intensity of cyclones, bringing months of rainfall in less than a week and causing floods that severely test the coping capacity of the people. Since January 2019, Malawi has been hit by seven major cyclones with each one inducing floods that have ripped homes, washed away crop fields, and killed people and livestock.

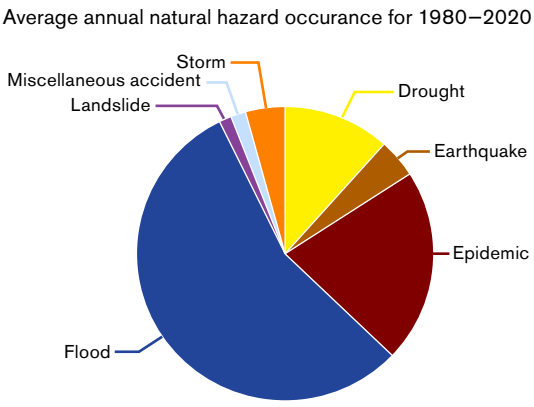


Figure 2. Malawi's average annual natural hazard occurrence for 1980–2020. Source: World Bank Group, Climate Change Knowledge Portal. https://climateknowledgeportal.worldbank.org/country/malawi/vulnerability

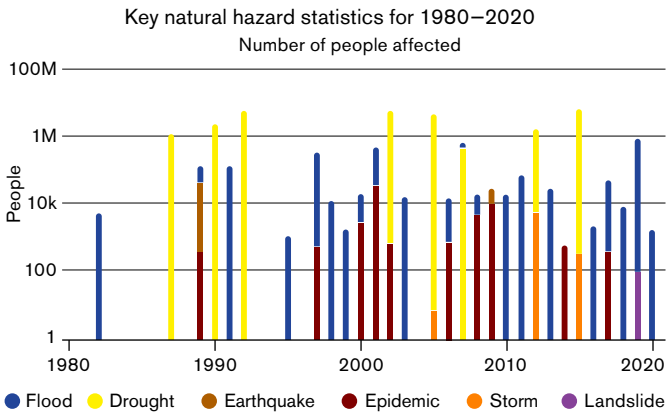


Figure 3. Statistics for key natural hazards in Malawi for 1980–2020. Source: World Bank Group, Climate Change Knowledge Portal. https://climateknowledgeportal.worldbank.org/country/malawi/vulnerability

The floods caused by Cyclone Ana in January 2022 were, together, the latest and among the most severe rapid onset climate events in the country before the disastrous Cyclone Freddy of 2023. The three-day torrential rainstorm forced Mwanza River to break its banks, shattering 505 houses in this part of T/A Lundu on the night of 25 January 2022. As a result, the entire community had to be relocated to a new location in T/A Maseya. For more than 18 months, they have been living in makeshift shelters, facing an uncertain future. With dwindling prospects of returning to its roots, the community remains gripped by fear and mired in hopelessness.

Impacts

There have been one too many floods induced by Cyclone Ana for the affected communities that have been at the receiving end of frequent climate disasters in recent years. Not only have they lost their homes forever, but their collective spirit as well. The latest climate disaster has sapped their morale and the mental scars are as palpable as the physical ones.

Chrissy Lingson, 19 years old, from Kanseche Village, is afraid to go back to school after the raging floods destroyed her entire village. This displaced girl's family of four and another 2,380 people fled to a crammed emergency evacuation camp on 26 January at Dala Village in T/A Maseya. Like other survivors, Chrissy escaped the floods with only the clothes she was wearing. "Without hanging on trees, we could have been swept to the grave," the teenage girl recalls. "Water was everywhere. My parents helped me and my siblings to climb a tree. It was heartbreaking to see from there the floods damaging our home and washing away our possessions, including our livestock." Chrissy says she is still haunted by the sight of the surging floods, crumbling homes and of the animals panting for air as they were being swept away.

Disrupting education

For the safety of school-going children, the Ministry of Education suspended classes for a day during the storm. But Chrissy, who was a Standard Six learner at Mwanza Primary School, could not attend for three weeks. She says she was mentally shattered and that she lost interest in school. "The floods took away my school materials, including uniform," she recounts. "I was depressed to the extent that I could not feel safe going out of the makeshift shelters to play."

Parents' fears and depression

Children who have experienced a natural disaster may suffer long-term physical, psychological and educational deficits, according to the Society for Research in Child Development. Further, the society says that these children experience depression symptoms such as feeling sad or losing interest in activities.

Parents are reluctant to allow children to go to school as they worry about their safety. "We had been displaced and floodwater was still above the classrooms' window levels. We opted to wait much longer and see our children at the camp rather than send them to school where safety was not guaranteed," says one of parents, Matinesi Thayo, with a dejected face.

Women and girls robbed of dignity

With all her belongings ruined, Chrissy adds that she felt traumatised by the struggle to manage her monthly periods at the congested camp. Before escaping the disaster, like other rural poverty-stricken girls, she improvised using pieces of old clothes as her sanitary pads. "I was ashamed and in pain for struggling to manage menstrual periods. I was not free to partake in public life," she says.

In Malawian villages, due to lack of good sanitary pads, girls' absenteeism during menstrual periods is high. This affects them psychologically and results in high school dropout rates. Further, child marriages are common and nurture a vicious circle of poverty. The women and girls are stressed due to myths around menses and people regarding them as outcasts.

With their land now flooded, the displaced Kanseche communities were given a safer settlement in a vacant area in T/A Maseya.

Figures 4 and 5. The new settlement in T/A Maseya is dotted with worn-out makeshift tents. Credit: Temwa Mhone

Shattered into poverty

The village's secretary Pilirani Mailosi says members of the community are struggling to rebuild their lives. The households lost everything and people were reduced to penury in the wink of an eye. "We (men) lack confidence, and struggle to take risks to improve lives of our families again because we fear losing the gains to floods and other climatic shocks," says Mailosi. The community has been affected by floods since 2014, but previous ones were not harsh like the one induced by Cyclone Ana. Mailosi says the previous floods did not damage their crops, houses and belongings.

The village's people stay in makeshift shelters at the new place. Stenala Jimu, the area's chairperson, says they cannot sprout from zero without holistic support, highlighting the weight of the stress the community is under: "We succumb to post-traumatic stress disorder when we think of our crumbled livelihoods and food." He paused and shook his head, adding: "Most days I do not know how I am going to feed my six children as piecework is becoming rare."

Burdened women and girls

Due to gender norms, women, children and girls have no peace of mind, as the village has no safe drinking water. The Malawi Red Cross Society (MRCS) drilled two boreholes for the population of 2,380, but the water is too salty for drinking. Patricia Kachiya says they have to endure lengthy and multiple trips to fetch drinking water outside the village every day. In Malawi, the task of fetching water is undertaken by the women and girls of the household.

Every girl has been groomed to take care of the household. This includes providing water and doing other household chores.

Figure 6. Patricia Kachiya (left) and Matinesi Thayo (right) carrying drinking water on their heads from Dala Village. They have to walk long distances to get drinking water from Dala and other villages. Credit: Temwa Mhone

Figure 7. Chrissy Lingson washes dishes outside her family's makeshift shelter. Credit: Temwa Mhone

"This is a burden and source of worry among women, children and girls," says the mother of eight. "We lose energy after six hours of collecting water from [the] Dala, Misiri, Mafuwa or Kaphiri villages. The long trips with water buckets weighing down our heads causes physical pains." The 45-year-old woman says she is always worried about not having time to manage her home well and take care of the children, adding that making space for adaption activities is also an issue, impacting her health: "With much time spent just on getting drinking water, we do not have enough left to innovate or plan on how to recover from the tragedy. Now I also suffer from high blood pressure."

Compounding risks

The people of the Kanseche area, along with the majority in the southern region of the country, are vulnerable to the impoverishing effects of climate change. Malawi is among the least-developed countries contributing the least to the global carbon emissions that fuel the climate crisis. Despite this, the poor and marginalised country is among the worst impacted by frequent disasters and a lack of resources to cope with the resulting loss and damage. These communities struggle to meet most of their basic needs. Though not rich, before the floods they were able to get food and other things they needed. They were not lacking much. A majority were just food secure. But all the food and their businesses were washed away with the floods. They have been rendered penniless. Poor people tend to suffer the worst consequences of climate change in a 'poverty-environment trap,' according to Crises of Inequality, 2022's United Nations (UN) Research Institute for Social Development flagship report: "Low-income households are likely to be located in or near flood-prone areas, to be displaced due to weather-related disasters and suffer from climate impacts because their livelihoods are directly dependent on agriculture."

This has been true for the people of Kanseche village. The Malawi Poverty Report 2020 finds that the district has a population of 61.2% categorised as poor. This is higher than the country's average of 50.7%. Each time an adverse climate event strikes, the community is pushed further back. The increased frequency of these events in recent years means that the community is rarely getting time to recover economically, engulfing them in despair, instilling fear in them and dealing a blow to their collective agency.

Pilirani Mailosi says the mental and physical health impacts of the tragedy frustrate their desire to curb poverty: "Depression prevents us from having clear heads to forge ahead. The floods eroded our years of hard work and development. Now life is hard," he says. Andrew Matewere, the area's civil protection committee vice chairperson, also describes the impact on people's capacities, saying they are stressed to the extent that they cannot strive to be economically active: "The stress thwarts our zeal to fend for our families. We struggle to think and plan clearly our way out of poverty because of the trauma caused by the loss."

Vulnerabilities

With floods ravaging crop fields, food and possessions, the survivors are sunk deeper into poverty and hunger. Stenala Jimu says they cannot produce food due to rampant droughts and floods: "Weather conditions are not conducive to grow[ing] food. We are toiling in vain as our crops wilt in the scorching sun or are buried in silt and washed away by floods," says the father of six. The 50-year-old man adds that this

has increased malnutrition in children: "We eat mostly once a day and it is a miracle for most families to eat twice. This makes children not to eat all six food groups; thereby, malnutrition is visible everywhere."

Matewere says poverty makes it hard for them to erect strong and resilient houses: "The little we do get from scanty piecework is also not enough for food. We cannot build strong houses. We are not safe in these makeshift shelters. We do not sleep when it is raining during the night, fearing for our lives."

Despite relocating to the new place made available, Patricia Kachiya says the area's vulnerability to disasters means it is not conducive to women and girls' health and development. Kachiya adds that they are riddled with myriad challenges to access social amenities, including health services. She says: "Lack of safe water, food, sanitation and hygiene facilities increases our susceptibility to waterborne diseases. Children especially are the most vulnerable. Toilets collapse frequently, pushing some into open defecation. We record 23 diarrhoea cases per day. This affects [the] ability of women to manage homes well, as the meagre income is spent on frequent hospital visits."

Chrissy Lingson and other learners walk long distances to access education at Mwanza Primary School, as the relocation has pushed them far from the institution. The long distance to access education is among the reasons children in Malawi, especially girls, drop out of school. It is a huge setback.

Pilirani Mailosi says the development also cost their identity, customs and values. They left their place of origin in T/A Lundu to settle on the east bank of the Mwanza River in T/A Maseya. He elaborates: "We had no choice, but we all feel that we have left a big part of our lives at the old place. Things will never be the same in terms of our way of life. We are failing to guide our children well as we struggle to settle here and arrange for the basic needs." It is a pity for the once productive population to be at the mercy of well-wishers and government to have their needs meet.

Coping measures

There have been several coping measures supported by local and international organisations in the survivors' communities to deal with the mental and physical health impacts of events. UNICEF and the Sustainable Development Initiative (SDI) have provided mental health and psychosocial support services.

Figure 8. Patricia Kachiya cooks her family's only meal of the day outside their makeshift shelter made with remains from their house damaged by the floods. Credit: Temwa Mhone

UNICEF has established children's corners that have become a core for youngsters' happiness. The UN agency has also provided temporary shelters and established recreation kits, furnishing them with assorted learning materials for children. The move was meant to inspire affected children like Chrissy Lingson to play and tackle disaster-related stress. UNICEF has also provided facilities to promote water, sanitation and hygiene: WASH. It has facilitated the construction of 10 pit latrines and provided tankers that gave people 3,000 litres of safe drinking water on a daily basis, and distributed soap and clothes among the affected population.

The survivors were supported from the time the tragedy struck on 24 January 2022 until December that year. The challenges these people are facing now are due to the fact that support has stopped and they are on their own now.

The makeshift shelters were provided by UN agencies, with materials provided by local organisations. But now most of the shelters are worn out and they are mobilising resources themselves.

The United Nations Population Fund (UNFPA) has donated dignity kits to adolescent girls and women. The prepacked kits have simple hygiene items such as underwear, flashlights, combs, soap, reusable menstrual pad sets, brushes and toothpaste. Meanwhile, the MRCS has drilled two water boreholes, but the water is saline and not drinkable. This means the community only uses it for washing kitchen utensils and bathing. Women and girls are forced to walk long distances to get clean, safe drinkable water from Dala and other surrounding villages.

Figure 9. Stenala Jimu walks by a worn-out makeshift shelter at the new location. Credit: Temwa Mhone

The UNICEF and SDI intervention on mental health has helped reduce stress and anxiety among the survivors that gives them a sense of safety.

Along with this, UNICEF'S children's corner at the camp has sustained the children's interest in education. They have also become happy again while doing schoolwork and playing games at the camp. This initiative has promoted children's wellbeing and right to education, while the WASH initiatives have made the camp safer.

UNFPA's act has restored the dignity of girls and women, giving them peace of mind, as the kits have improved their menstrual health hygiene, while the MRCS' two water sources have made it easy for women and girls to get water for bathing and cleaning dishes within the village.

Apart from giving the displaced communities a safer settlement, the government's efforts towards the wellbeing of the community are being complemented by the interventions of these local and international organisations. Meanwhile, the affected communities are trying their best to be active by participating in public life again.

Support needed in future

Early weather warnings are not enough in an area with high poverty levels. Communities need financial support to move to safer grounds and erect resilient structures. Parliament needs to enact a comprehensive 2019 Disaster Risk Management draft bill for the country to be able to set up a detailed response budget, and to help communities to deal with and prepare for disasters, strengthen eco-systems and reduce poverty.

There is a need for development partners to allocate more resources to the country through the management of disasters. Even though cyclones are becoming more frequent and intense in Malawi, the disaster department spokesperson Chipiliro Khamula has told Africa Climate News that the department faces financial constraints in disaster management: "Recovery and intervention needs are greater than available resources."

Regarding this topic, Stenala Jimu suggests survivors should be assisted with capital for small-scale businesses and the erection of durable houses, including food to cover them for six months.

The recovery needs of the survivors include funds to replace their belongings and to move to safer places. They also require funds for the erection of durable houses at their new locations, along with the provision of social amenities and capital to revive their businesses or livelihoods for self-reliant and sustainable development.

Additionally, resources are needed to educate communities on their responsibilities in conserving the environment and strengthening their resilience to the effects of climate change. Dedicated funds should be set up through international support to compensate poor communities for the loss and damage caused by the climatic shocks, as the most affected have contributed less or nothing to the climate crisis. The displaced communities should be supported with all their basic needs, including strong houses, and economically empowered to sustainably recover and rebuild their lives.

Lessons learned

Apart from emergency relief items, survivors need timely assistance in the form of mental and physical health support services as soon as tragedy strikes. Currently, most of this support is an afterthought and comes after the immediate needs of the survivors. Communities require holistic support to get back on their feet, and should be empowered to erect houses or dwelling structures considering what the climate will be like in the future. This will help them move out of flood-prone areas and restore the degraded environment to enhance their resilience to the effects of climate change.

Synopsis

This case highlights the mental and physical health impacts on the Kanseche communities in Chikwawa, Malawi after deadly floods swept away an entire village. About 2,380 survivors are depressed and experience post-traumatic stress disorder and anxiety, among other wellbeing challenges. They live in fear. For example, men lack confidence and struggle to take risks to rebuild their lives because of the fear of losing the gains to floods and other climatic shocks, while women and children worry about their safety.

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Mental and physical health impacts

Secondary categories: loss of quality of life (shelter, food, health, skills, education); social disruption (migration and displacement)

Unseen tides: the hidden health crisis after the 2022 monsoon floods in Sindh, Pakistan

Fiza Naz Qureshi, Manager Program Implementation, Indus Consortium

Location	Khairpur Nathan Shah town, district Dadu, Sindh Province, Pakistan
Climate hazards	Floods
Non-economic loss and damage	Loss of life; physical injuries; displacement; women and girls experiencing abuse, neglect, exclusion, harassment, exploitation and violence; deterioration in maternal, sexual and reproductive health; increased workloads; decreased protection against sexual and gender-based violence and early or forced marriages; loss of livelihoods, education and compensation
Coping measures	Psychosocial support for women and children provided by community organisations; limited support for affected communities from philanthropic, civil society and community-based organisations

Context

Pakistan is situated in the Asia-Pacific (APAC) region, which is the world's most disaster-prone area. Between 1970 and 2010, the average number of people in the region exposed to yearly flooding increased from 30 million to 64 million.[1] A number of circumstances have gravely impacted the lives of the people affected by such disasters: economic and political instability, an unprecedented rise in inflation, slow development growth, increased frequency of disasters, unpredictable effects of climate change, a weak coordinating system, and a lack of resources and capabilities to deal with disaster situations.

In June 2022, Pakistan was hit by extreme monsoon rainfall, leading to devastating flash flooding and landslides. According to the Pakistan Floods 2022 Post-Disaster Needs Assessment Report (PDNA) in October 2022, nearly 33 million people (more than 15% of Pakistan's 220 million population) were affected as heavy rains, flooding and landslides destroyed homes, critical infrastructure and livelihoods.

Sindh province was badly affected. It is estimated that around 12 million people were affected, of which 7 million people were displaced in 24 of 29 districts: 823 people (347 children, 321 men and 155 women) died and 8,422 people (3,247 children, 2,964 men and 2,211 women) were injured.[2] There were physical damages and losses: 2 million houses were damaged and 0.4 million livestock died. Sindh faced an unprecedented food security crisis due to the devastating effects of the flood: 3.7 million acres of cultivated crops were wiped out there alone, where many farmers live hand to mouth and season to season.[3] Even after ten months, the people affected by the floods were not fully rehabilitated, despite the efforts of the federal and provincial governments and other humanitarian agencies. It appears that the post-flood situation has become the 'norm' in the daily lives of the affected population.

The monsoon floods have compounded existing socioeconomic vulnerabilities and hardships. The priority needs of the affected persons relate to emergency shelter, food, water, sanitation, hygiene, protection and healthcare. People also need support in rebuilding the livelihoods they lost due to the floods. Preliminary assessments reveal that the floods will cause the national poverty rate to increase by between 3.7 and 4.0 percentage points, pushing between 8.4 and 9.1 million people into poverty.[4]

Figure 1. Map of Sindh, Pakistan, with districts marked. Source: www.researchgate.net/figure/Map-of-Sindh-with-Districts_fig1_308928347

The process of development of this document is based on qualitative research methods: Focus Group Discussions (FGDs) followed by detailed interviews with the affected women and girls, with the support of the community-based civil society organisations' network Indus Consortium in three of the most flood -affected districts of Sindh province in 2022: Dadu, Sukkur and Sanghar.

The map on the left shows the whole of Sindh province and includes the three districts under study.

1 Asian Development Bank (ADB) (February 2014) Tip Sheet: Gender-Inclusive Disaster Risk Management. www.adb.org/documents/tip-sheet-gender-inclusive-disaster-risk-management

2 Provincial Disaster Management Authority, Government of Sindh (7 February 2023) Flood 2022 in Sindh. https://pdma.gos.pk/2023/02/07/flood-2022-in-sindh

3 See 2 above.

4 Asian Development Bank, European Union and Government of Pakistan (28 October 2022) PAKISTAN FLOODS 2022 Post-Disaster Needs Assessment: Planning Commission, Ministry of Planning Development & Special Initiatives, Pakistan.

District Dadu

This district is characterised by an agrarian economy, with a significant portion of the population engaged in agricultural activities. The region is prone to flooding due to its proximity to the Indus River and its tributaries. The floods of 2022 had a devastating impact on the local population, particularly those residing in low-lying areas near the river. Many houses were damaged or destroyed, displacing families and disrupting their livelihoods. In an area where agriculture is the backbone of the economy, the floods resulted in crop losses and damage to irrigation infrastructure, leading to economic hardships for farmers. The flood also exposed vulnerabilities in terms of healthcare, sanitation and access to basic amenities, disproportionately affecting marginalised communities.

District Sanghar

Like Dadu, agriculture plays a crucial role in the local economy of Sanghar. The floods of 2022 had severe consequences for its people. The inundation of fields and destruction of crops led to agricultural losses, impacting the livelihoods of farmers and their families. Displacement due to the floods forced many families to seek shelter in relief camps, where inadequate living conditions added to their difficulties. The floods not only disrupted economic activities but also strained the social fabric of the community, as people grappled with loss and displacement, along with challenges related to health and hygiene.

District Sukkur

This region is situated along the banks of the Indus River. It is known for its agricultural productivity, with the river playing a pivotal role in irrigation. The floods of 2022 had a profound impact on Sukkur and its surrounding areas. The flooding of agricultural land resulted in significant crop damage, affecting the income and livelihoods of farming families. Many homes were washed away, leaving families homeless and vulnerable. In Sukkur, where the river is both a lifeline and a potential source of devastation, the floods underscored the need for better disaster preparedness and mitigation measures.

Overall, in all three districts, the floods of 2022 disrupted the lives and livelihoods of the local communities, bringing to light the existing vulnerabilities and gaps in infrastructure, healthcare and social support systems. The stories from these districts showcase the challenges faced by individuals and families as they tried to cope with the aftermath of the disaster and rebuild their lives in the face of adversity.

Impacts

This section highlights the profound consequences of climate-induced flood disaster, focusing on three key areas: loss of quality of life, mental and physical health impacts, and social disruption. All three stories belong to the different districts of Sindh province, Pakistan.

When collecting these case studies, our team identified the following issues:

1. Unprepared displacement significantly affected women due to inadequate early warning information about the rains and floods. Many women lacked access to cell phones, relying instead on men in their families or electronic media they mistrusted. This limited information access prevented them from gathering essential items for emergency situations, underscoring the challenge they faced during the flood.
2. During rescue operations, women experiencing additional vulnerabilities — due to disability or pregnancy, for example — encountered obstacles. The absence of sufficient transportation, trained personnel and volunteers capable of assisting them posed challenges. Frequently, men in the family had to step in, physically carrying women and children on their shoulders to ensure their safety.

3. Relief item distribution mechanisms favoured men, leading to women encountering undisciplined behaviour that allowed men to secure most flood relief items. Women who headed households, along with elderly and disabled people, faced challenging and demeaning procedures to access relief goods. These difficulties often discouraged them from pursuing relief services and stipends provided through the Ehsaas Programme. Additionally, they voiced concerns about inconsistent payments and perceived favouritism within the compensation processes.
4. Most of the women expressed that women and girls' basic needs were ignored in emergency response. There was a lack of Menstrual Hygiene Management related materials, assisted devices for disabled access, medicines and family planning supplies, and food.
5. Women residing in makeshift settlements reported a significant absence of suitable and segregated WASH (Water, Sanitation and Hygiene) facilities.[5] They also suffered from inadequate lighting, exacerbating privacy and safety concerns for girls and women, especially during restroom use and menstrual management. Long waiting times or night-time usage restrictions due to the absence of men were common challenges faced by these women.
6. The majority of women were exposed to insulting behaviour, sexual harassment and discrimination during relief response. Adolescent girls experienced threats and intimidation from men residing in the same camps. Some incidents of abduction and manipulation were also reported in the camps and other nearby places.
7. In relief camps, there was lack of attention, availability of trained staff and emergency services for those who were expecting or for new-borns. This contributed to the trauma of stillbirth. Women also lacked the financial resources to pay for transportation or for the services of hospitals and doctors beyond relief camps.
8. The loss of livestock and agricultural labour made women more economically vulnerable, as these were the main sources of their livelihoods, and livestock is considered a major asset in Sindh's rural economy, as well as being a key source of nutrition for children. There were no arrangements for fodder or vaccination for the livestock. Women sold the animals at lower prices to meet their basic needs and to deal with the imminent threat of diseases. It was reported that rescue and prevention of disease in livestock was not a priority of the relief work.
9. Most women highlighted a surge in care work and subsequent mental strain. This increase in burdens was attributed to factors like the absence of productive engagements for women and their family members, escalating poverty, disrupting children's education and adding responsibility in terms of managing family necessities such as food, water and sanitation. Pregnant and disabled women faced particularly intense stress. The lack of suitable private spaces further hindered women and girls from openly discussing their grief and loss.
10. Most of the women — including those who had children or were disabled — lost their houses either fully or partially, and were still living in the open or sharing one room with animals and using it as a kitchen. There was no space for privacy. Women were insecure due to threats of robbery and kidnapping. Poor families had no assets or income to build their houses.
11. Most of the women were concerned about continuity of education for their children. Schools had been damaged during the floods, and there were no alternate learning arrangements for children. Parents were not able to give proper attention to the education of their children, particularly girls, due to economic constraints and other challenges. Children were engaged in labour work, making education less of a priority for parents and children alike.

5 World Health Organization (WHO) (2023) Water Sanitation and Health. www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health-(wash)/health-care-facilities/wash-in-health-care-facilities

12. Almost all women complained that most of the relief workers from government agencies showed insensitivity to women and other victims, by ignoring their plight and just focusing on photo sessions. There was a lack of female staff to interact with flood-affected women or provide security to them. There was also a lack of complaint mechanisms and information available to women.
13. There was also an absence of effective involvement of women in the planning of disaster risk reduction (DRR) and management at all levels, from community to district and to the provincial level. The lack of local-level women's leadership and volunteers made it difficult for women and other vulnerable groups to access and control relief and early recovery services.
14. Women lacked skills, training, education and information about their rights. This reflected how such disasters keep women vulnerable and subject to discrimination. Their vulnerability further increases due to dependence on irregular agricultural labour, lower earnings and an unpredictable informal economy. Additionally, their lack of access to the micro finance and market keeps them away from generating and controlling income resources.

Overall, this Impact section sheds light on the multifaceted consequences of natural disasters, extending beyond physical damage to encompass emotional, psychological and social aspects. The personal stories of individuals like Amma Mukhtar, Lal Khatoon, Sabhaagee and Majeedan provide a human face to these broader themes, urging readers to recognise the complexities and challenges faced by those in disaster-stricken communities.

Loss of quality of life

The section begins by sharing the heart-wrenching story of Amma Mukhtar, a traditional midwife who experienced the devastating effects of a flood in her village. This flood led to the loss of her son, livestock and home. Amma Mukhtar's personal tragedy serves as an entry point into discussing the broader impact of disasters on individuals and families. The loss of loved ones, shelter and necessities like food and water significantly disrupts the quality of life for those affected. The narrative highlights how disasters can particularly affect vulnerable groups, such as women and adolescent girls, who face challenges related to reproductive health and menstrual hygiene. This loss of normality and the struggle to regain stability become central themes in this section.

Case study: Amma Mukhtar: rebuilding life amidst irreversible loss

Amma Mukhtar, a traditional midwife from the Rohri district Sukkur, Sindh province, burst into tears and said with a sigh of pain that she lost her livestock, house and most beloved son on the saddest morning of September 2022, when the cruel flood hit her village. She shared in grief: **"In the blink of an eye, people brought my 23-year-old son Ali's dead body in front of me. My husband could not survive this grief and passed away due to a heart attack. My life was totally changed by this irreversible loss, besides the loss of shelter and basic commodities at home."**

The widow and children of Amma Mukhtar's deceased son went to stay with other family members, as she could no longer raise them due to her extreme poverty and suffering.

Amma Mukhtar tried to resume her role as a traditional midwife, but this was not welcomed in a disaster situation because more skilled and energetic staff were required by the clinics. Sharing her experiences as a birth attendant, she said she believes that natural disasters aggravate maternal and neonatal mortality due to poor public healthcare, and that addressing this should be a priority for the government. There is not merely an issue with a lack of food and shelter, but also an absence of sexual and reproductive health

facilities. The dearth of menstrual hygiene supplies causes many health issues and embarrassment to adolescent girls and women.

Mai Mukhtar, being highly conscious of women and girl's health, has asked the government to provide micro-nutrients to improve the health of women and girls who are struggling to bring their lives back to normal.

Mental and physical health impacts

This section introduces the story of Lal Khatoon, a woman who was already dealing with challenges, due to her disability, before the flood struck. The flood worsened her situation, displacing her family and exposing them to further hardships. The narrative delves into the mental and physical health impacts of disasters, as Lal Khatoon recounts the difficulties of living in a tent without proper sanitation facilities, particularly for someone with disabilities. This case highlights the toll disasters take on individuals' wellbeing, particularly those with pre-existing conditions. The call for better disaster response and relief management, specifically tailored to address the needs of vulnerable individuals, emerges as a key message.

Case study: Lal Khatoon: battling adversity in the wake of a flood

Lal Khatoon, of district Sanghar, was a middle-aged woman and mother of two daughters. She was no stranger to poverty, miseries and troubles in her life. Impacted by polio, she was already facing discrimination and coping with multiple challenges, which the floods only increased manifold. She said she thinks that the polio was due to the ignorance of her parents that she was not vaccinated. Her wrinkled face, trembling hands at the age of 42 years, damaged house and inability to feed her family were clearly telling the story of her poverty.

She sobbed, as she shared: **"The flood of 2022 was a torment for our family, as our house submerged, and we were compelled to spend almost three months on the roadside in a tent."** She acknowledged that her husband had carried her on his shoulders while wading through the flood waters.

Emphasising the harshness of living a tent life for three months, she said: **"Just imagine not being able go for toilet for entire day and wait for the night, as I even did not take … my wheelchair in emergency, which I used for using the toilet in my normal days."** This increased the challenge of using the toilet, as she was dependent on her husband every time she needed it.

Lal Khatoon had a lot of questions and complaints about the mismanagement of relief and emergency response and how it was making people more vulnerable, but her priority was to get her own home dewatered so she could stay in her own boundary wall with dignity.

She added, **"It is the government's responsibility to provide immediate relief to … vulnerable and disabled women in time[s] of disaster by recognising their needs in every aspect, including the sanitation facilities."** She further emphasised that it was equally important for the government to facilitate families to establish a decent livelihood where they can manage food, shelter, medicine and personal hygiene. Lal Khatoon said that, after being exposed to multiple threats of exploitation, violence and abuse, she is still optimistic about resuming her life by repairing the wounds of economic and emotional loss.

Social disruption

This section explores the social disruption caused by disasters, using the story of Sabhaagee and her daughter Parveen. Sabhaagee's experience of losing her mother during the flood and then facing the abduction of her daughter for forced marriage illustrates how disasters can create an environment

conducive to exploitation and harm. This story underscores the importance of considering social evils and safety measures during disaster response efforts. The need for gender-segregated relief camps and stringent safety measures becomes apparent, as the narrative advocates for a holistic approach to providing assistance and protection to those affected.

Another story in this section portrays the profound impact of emergencies on disabled people, using the case of Majeedan, a 35-year-old woman with intellectual disabilities. Her mother, Chhutan, her primary caregiver, faces immense challenges due to poverty and the flood of 2022. The flood has forced them into a relief camp, worsening Majeedan's care needs. The lack of facilities and privacy in the camp affects her behaviour and wellbeing. Chhutan's plea for government-established drop-in centres highlights the need for better support systems for disabled people during emergencies, suggesting it would ease the burden on parents.

Case study: Sabhaagee's struggle: safeguarding vulnerable women and girls in crisis

During the floods of 2022, Sabhaagee had to leave her house, which was irreparably damaged, and move to a rented premises where she faced further challenges and misfortune.

Sabhaagee is a health worker and a mother of two (a son and a daughter) from Depar Colony, U.C 1, in the Sanghar district. During the flood in 2022, Sabhaagee's mother passed away and the neighbouring family pretended to assist during her mother's burial process and other rituals. But it was revealed that they actually planned to take away her 14-year-old daughter Parveen for a forced marriage. The neighbours then manipulated, drugged, exploited and abducted her.

Sabhaagee screamed: **"I have knocked [on] every door, from police to politicians, from notables to courts, even sold my valuables to meet expenses to pursue this case. When my relatives and colleagues joined me to build pressure through [the] media, I was told that my daughter wishfully got married to the person, double her age. How come a 14-year-old girl can get married, which is unlawful? I pledged to [the] authorities to help me in bringing back my beloved innocent daughter."**

It is not only food relief that people require in such times of crises. Sabhaagee said: **"During displacement people become vulnerable to threats and harassment. Therefore, it is our collective responsibility to raise awareness about safety and security, and create secure environment for everyone, especially for girls and women."**

Sabhaagee, with deep grief, said she has urged the government to help bring her daughter back. She suggested that, in future, the government must ensure the safety of girls and women by organising gender-segregated relief camps with basic facilities and that, in the case of combined camps, there must be stringent safety measures to make girls and women safe and secure.

Case study: Chhutan's dilemma: navigating emergency care for those who need it

The case of Majeedan shows how emergency situations have a much more severe impact on disabled people, particularly women and girls: **"I never imagined that in my old age I shall have to nurse an adult but my 35-year-old daughter, Majeedan, is a woman with intellectual disabilities and is completely dependent on me,"** said Chhutan, a 65-year-old widow, resident of village Khair Muhammad of Union Council Kamal Khan, in Dadu. Chhutan added that, since her husband died, her daughter's lifelong disease had been especially heavy on her.

The struggle with extreme poverty and caring for a family member with restricted mobility was already a huge challenge and the flood of 2022 exacerbated Chhutan's situation. Due to the disastrous effects of the flood, the family was forced to leave their home and move to a relief camp in a school. Chhutan told us that carrying Majeedan during that time, in the middle of the rains, was difficult: **"I requested help from my sons and my neighbours, who assisted with huge reluctance. Majeedan was not able to maintain her own cleanliness, which bothered all those who were supposed to help her."** They remained homeless and lived under the harsh conditions for three months, with lack of access to water, as well as a lack of privacy to change Majeedan's clothes and help her keep clean. The discomfort in camp life made Majeedan so uneasy that she started screaming at the children and her mother had to tie her with chains.

Chhutan's hands were trembling as she showed us her room that had been demolished by the 2022 flood, and she was unable to stop her tears: **"It feels so difficult not to have shelter and being unable to even change or wash [the] dirty clothes of my adult but mentally challenged and dependent daughter."** Chhutan also reported that there is no proper room or washroom available in the house. In summer, Chhutan and her daughter lived in a temporary shelter, which could not save them from heat or from wind and rain. According to her experience of safety-net programmes, the staff at the district level neither had the capacity for dealing with the public nor the compassion to listen to complaints and show empathy. Such attitudes made her discontinue pursuing her registration with the safety-net programme.

Chhutan suggested: **"The government establish drop-in centres with provision of proper food, shelter, care and boarding, where parents can drop in their physically or mentally challenged children. On the one hand, it will lead to the well-being of such children; on the other hand, it will also reduce the burden on poverty-stricken and elderly parents like me who have no family support available. Though its [a] hard decision, if this is in best interest of children, then it is worth it."**

Compounding risks/impacts created

The concept of Non-Economic Loss and Damage (NELD) intersects with existing vulnerabilities in complex ways, acting as a stress multiplier during emergencies. In the case studies provided, NELD has amplified the impacts of disasters by intensifying emotional distress, worsening psychological trauma and disrupting social dynamics. For instance, Amma Mukhtar's community experienced heightened vulnerability as the emotional toll of losing loved ones and shelter, alongside economic losses, deepened their hardships. Similarly, Lal Khatoon's case reveals how NELD has interacted with pre-existing vulnerabilities, making her mental and physical health challenges more pronounced, due to inadequate living conditions and emotional strain. And the social disruption suffered by Sabhaagee's community showcases how NELD compounds existing gender-based vulnerabilities, highlighting how disrupted social norms and safety exacerbate the harm faced by women and girls.

Moreover, the stories of caregiving amid calamity, such as Chhutan's case, underscore how NELD intensifies the emotional and psychological burden on caregivers. The non-economic impacts of compromised dignity, lack of proper facilities and challenges in maintaining wellbeing intertwine with existing vulnerabilities, compounding the difficulties faced by families with members who need care. In each instance, the interaction between NELD and existing vulnerabilities has created a feedback loop where the human toll of disasters extends beyond economic losses, emphasising the importance of comprehensive and empathetic disaster response strategies. Recognising these dynamics is crucial for effectively addressing the complex needs of disaster-affected communities and facilitating their recovery and resilience.

Vulnerabilities/impacts of compounding risks

The interplay between NELD and existing vulnerabilities intensifies a range of compounded vulnerabilities at the household level. Among women, NELD exacerbates emotional strain and gender-specific risks, particularly within patriarchal societies like Sindh. Disabled people face amplified challenges, as NELD disrupts routines and specialised care access, deepening both physical and emotional vulnerabilities. Children, especially in marginalised or Indigenous groups, experience heightened vulnerability due to disrupted education, emotional distress and inadequate support systems. Marginalised and Indigenous communities who are already facing socioeconomic disparities see NELD aggravating their losses of cultural heritage and traditional practices, thereby worsening their overall marginalisation. This intricate interaction underscores the need for targeted and comprehensive disaster response strategies that address the intertwined needs of these vulnerable groups.

In the context of Sindh province, the interaction between NELD and societal vulnerabilities manifests in a multitude of ways. NELD exacerbates challenges in accessing basic services and institutions, particularly for marginalised communities. Displacement resulting from NELD disrupts communities' social fabric and access to essential resources, leaving them even more susceptible to economic and social hardships. The loss of customs, places of rituals and cultural heritage due to NELD strips communities of their identity and erodes social cohesion, impacting their resilience and sense of belonging. In Sindh, where cultural traditions and community ties are integral, the compounded effects of NELD have deepened existing societal vulnerabilities, highlighting the urgency of comprehensive disaster response strategies that prioritise preserving cultural heritage and ensuring equitable access to resources and services.

Coping measures

In response to NELD impacts, households and communities in Sindh have undertaken a range of coping and adaptation measures, with support coming from diverse sources. Mutual aid networks have been strengthened through contributions from local philanthropists and overseas Sindhi groups, providing resources and assistance to affected households. Additionally, these philanthropic efforts have enabled the provision of emergency relief, including food, shelter and medical aid, helping alleviate the immediate impacts of NELD events.

Investments in disaster preparedness and resilience-building initiatives have equipped communities with skills and resources to better withstand NELD impacts. Moreover, support from abroad has facilitated the development of education and awareness programmes, empowering local communities with knowledge on disaster risk reduction and adaptation strategies.

The outcomes of these combined efforts have been significant. The collaborative approach between local communities, philanthropists and overseas Sindhi groups has led to quicker and more effective disaster response, mitigating the immediate effects of NELD impacts. By integrating traditional coping strategies with modern interventions, communities have been better equipped to navigate the complexities of changing climatic conditions. However, challenges persist, particularly in ensuring sustainable and long-term support, addressing systemic vulnerabilities, and building the capacity of local communities to adapt and recover effectively. Thus, the collaboration between local and global actors highlights the potential for comprehensive disaster resilience and recovery strategies that draw on both traditional wisdom and contemporary approaches.

Support needed in future

To effectively address existing and anticipated NELD impacts, a comprehensive framework must be established, focusing on four key areas: capacity building, policy development, technology enhancement and financial support. These interconnected strategies will empower communities to cope with and mitigate the diverse challenges posed by NELD events. Some of the future needs are outlined below, highlighted by the flood-affected women in the field.

Capacity building:

- Engage local government representatives and women activists in early warning communication
- Provide training to rescue teams on gender sensitisation and awareness
- Enhance the logistical capacity of local and district governments
- Increase the capacity of local civil society and women community groups in rescue operations
- Conduct training on complaint mechanisms and referral pathways
- Train staff of Provincial and District Disaster Management Authorities (PDMAs and DDMAs, respectively) and other relevant personnel on gender-inclusive disaster response.

Policy development and implementation:

- Develop gender-sensitive Standard Operating Procedures (SOPs) for relief distribution
- Establish gender and social inclusion (G&SI) cells at PDMA and DDMA levels
- Allocate gender-responsive budgets for climate change and disaster management
- Facilitate 100% Computerised National Identity Cards (CNIC) registration for vulnerable groups
- Regulate private sector clinics and hospitals to serve women and girls in disaster situations
- Activate and strengthen the local government system through capacity building.

Technology enhancement:

- Establish free emergency early warning toll numbers
- Provide updates through WhatsApp and mobile networks to local government representatives
- Establish various complaint mechanisms and methods like toll-free numbers and complaint boxes
- Map women and their skills in flood-affected areas
- Regulate banks and technical institutions to invest in initiatives for economic rehabilitation and empowerment
- Use technology to disseminate information about complaint mechanisms.

Financial support:

- Provide soft loans to women and other vulnerable groups for livelihood options
- Create opportunities for women and girls for cash-for-work programmes
- Offer cash grants and engage women in cash-for-work opportunities
- Facilitate women to gain housing entitlements
- Enhance the skills of women in traditional and non-traditional jobs
- Allocate gender-responsive budgets for disaster management and climate change.

Lessons learned

The case studies provide several key lessons that can be learned from the experiences of communities affected by climate change-induced NELD.

- **Gender-specific approaches:** it is essential to adopt gender-specific approaches in disaster management and relief efforts. Women, disabled people and other marginalised groups face unique challenges during emergencies and require tailored support.
- **Effective early warning systems:** early warning systems need to be accessible and trustworthy. Utilising various communication channels and engaging local representatives can improve the dissemination of crucial information, especially among those who lack access to technology.
- **Inclusive data collection:** gender-segregated data collection is crucial for understanding the diverse needs and vulnerabilities of affected communities. Involving local women activists in assessment processes can yield more accurate insights.
- **Training and capacity building:** rescue teams and relief workers should undergo training in gender sensitisation, ensuring they understand and address the specific needs of women and vulnerable groups.
- **Responsive relief distribution:** SOPs are vital for equitable and dignified relief distribution. Involving women activists in this process can enhance fairness and inclusivity.
- **Safe and supportive environments:** establishing safe and supportive spaces for women and girls, such as Women Friendly Spaces, is crucial for addressing mental and emotional wellbeing during disasters.
- **Preventing gender-based violence:** efforts to prevent and address gender-based violence (GBV) require proactive strategies, including awareness campaigns, separate and secure facilities, and strict enforcement of laws against harassment.
- **Empowerment and livelihoods:** providing economic opportunities, skill development, and support for livelihoods is essential for the long-term resilience of affected communities, especially women.
- **Education access:** promptly resuming education activities after disasters is critical to prevent the disruption of learning, particularly for girls who often face additional barriers.
- **Local government engagement:** strengthening local governments and ensuring their inclusivity can lead to more effective disaster response and management, with a focus on gender-responsive policies.

These lessons underscore the importance of holistic, gender-sensitive and community-driven strategies to effectively address the challenges arising from climate change-induced NELD impacts.

Synopsis

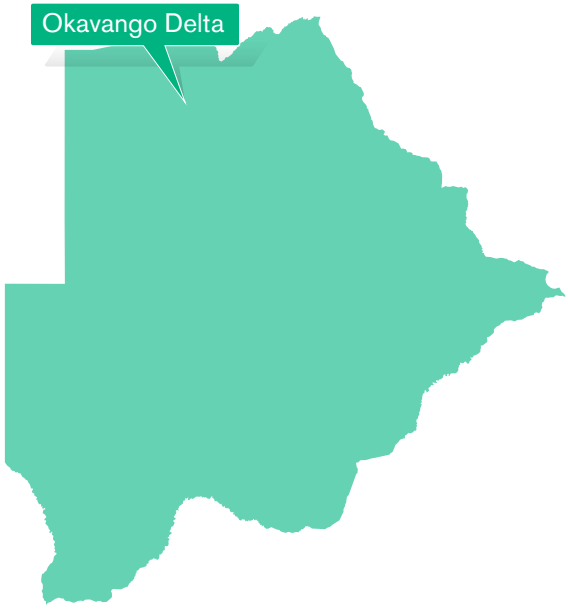
In June 2022, extreme monsoon rainfall struck Pakistan, causing devastating floods that particularly ravaged Sindh. This case study delves into the profound human impact of the disaster, with approximately 12 million people affected and 7 million displaced. Beyond the physical damages to homes and infrastructure, the flood exposed the underlying vulnerabilities in healthcare, sanitation and access to basic amenities, disproportionately affecting marginalised communities. The report paints a vivid picture of the social struggles, loss of life and ongoing challenges in rehabilitation. It stands as a critical testament to the real-world consequences of climate-related disasters, providing essential insights for future preparedness and response efforts.

Loss of ecosystems and biodiversity

Secondary category: loss of cultural heritage

Fighting a losing battle? A case study tracking ecosystem loss in nature-dependent Okavango Delta communities of Botswana

Sharon Tshipa, Chairperson, Botswana Society for Human Development (BSHD)



Location	Okavango Delta, Botswana
Climate hazards	Drought
Non-economic loss and damage	Negative impacts on community-based tourism/other livelihoods, traditional occupations and roles (including fishing, cattle rearing), access to safe drinking water, mental health and crop security; human-wildlife conflicts
Coping measures	Government safety nets; ceasing or reducing farming (animal and arable); migrating in search of water or to avoid human and wildlife conflicts; digging wells and boreholes, or relying on government water supplies; killing wildlife

Context

The Ngamiland district of Botswana is home to the Okavango Delta, a World Heritage and Ramsar site.

Given its biodiversity, ecosystem services and its significant contribution to human livelihoods, the Okavango Delta is viewed as an inland wetland that is of international, regional and national importance.[1] It is both a permanent and seasonal home to a wide variety of: i) wildlife such as lions, elephants and cheetahs; ii) fish such as catfish, tigerfish and tilapia; iii) birds such as the African green pigeon, ostrich and fish eagle; and iv) plant varieties including papyrus, duckweed and floating heart, to mention but a few species.

Figure 1. Map of the study area; the Okavango Delta.
Credit: Sharon Tshipa

The Botswana government's implementation of the Community Based Natural Resource Management (CBNRM) strategy in 1989[2] has continued to ensure that the Okavango Delta communities, such as Boro, Seronga and Kwai, benefit from their participation in natural resource management and tourism development through community-based organisations (CBOs).

For decades, the Delta has brought many tourists and foreign money exchange to Botswana.[3] The travel and tourism sector is a notable contributor to the country's GDP, with a share of 4.7% in 2019, accounting for 30,700 jobs before the COVID-19 pandemic outbreak.[4] However, the recurring frequency of drought,[5] a slow onset event, has become the biggest threat to the industry's longstanding role in poverty eradication and development. The increased frequency of droughts is demonstrated by the fact that, between 1961 and 1999, Botswana declared only five, but between 2001 and 2022, 13 were declared by the government. Yet most of the meteorological droughts experienced were mild to moderate since 1980/81, and Botswana's rainfall season trend has been slightly decreasing.[6] Relentless climate-induced impacts have left the country fighting economic, social and environmental pitfalls. The country is projected to become warmer, at approximately 1.5 to 2.5°C between 2016-2045.[7]

Both local and international scientists are of the view that climate change is likely to increase evapotranspiration over the Okavango Delta as wind speeds are increasing. It does not help that the Delta

1 Rutina, L, Mosepele, K and Masunga, G (2016) Challenges Facing Natural Resources Management: Human-Wildlife Co-Existence in The Okavango Delta, Botswana. In: Mmopelwa, G (ed). *Water Resource Management; Science and technology innovation for sustainable development.* Acta Press, Calgary.

2 Mbaiwa, J. E and Thakadu, O. T (2011) Community trusts and access to natural resources in the Okavango Delta, Botswana. In: Kgathi, D.L., Ngwenya, B.N. and Darkoh, M.B.K. *Rural Livelihoods, Risk and Political Economy of Access to Natural Resources in the Okavango Delta.* Nova Science Publishers, New York (275–304).

3 Wolski, P, Savenije, H. H. G, Murray-Hudson, M and Gumbricht, T (2006) Modelling of the flooding in the Okavango Delta, Botswana, using a hybrid reservoir-GIS model. Journal of Hydrology 331(1–2) 58–72. https://doi.org/10.1016/j.jhydrol.2006.04.040

4 Uppink Calderwood, L and Soshkin, M (2019) Travel and Tourism Competitiveness Report 2019. World Economic Forum (WEF). WEF, Geneva. http://reports.weforum.org/travel-and-tourism-competitiveness-report-2019/country-profiles/#economy=BWA

5 Moswete, N. N. and Dube, N. N (2010) Wildlife-based Tourism and Climate: Potential Opportunities and Challenges for Botswana. In: D'Amore, L and Kalifungwa, P. *Meeting the Challenges of Climate Change To Tourism: Case Studies of Best Practice.* Cambridge Scholars Publishing, Cambridge.

6 Batisani N (2020) National Drought Plan, Botswana. United Nations Convention to Combat Desertification (UNCCD) Drought Initiative. United Nations, New York.

7 SAREP (2014) Anthropogenic Climate Change and Hydro-Climatic Conditions in the Cubango-Okavango River Basin SAREP Technical Series-Volume IB Anthropocentric Climate Change and Hydro-Climatic Conditions in the Cubango-Okavango River Basin.

already loses 98% of its water to evapotranspiration.[8] What complicates the issue is that water in the Delta comes almost entirely from Angola. The water's journey begins in the moist highlands of Angola's rainy centre and drains into the Cubango and the Cuito rivers. These rivers converge at the southern Angolan border, forming a bigger river, the Okavango, which flows across the Caprivi Strip, a narrow band of Namibia, and into Botswana. On average, 2.5 trillion gallons of water a year flow into the Delta.[9]

Not only are temperatures expected to rise, but rainfall will decrease in the whole basin and the duration of the rainy season will shorten within up to 20 days in the Angolan Highlands during the period of 2016–2045.

Other than development projects in Angola and Namibia, drought is a critical factor contributing to non-economic loss and damage among communities of the Okavango Delta. Hence, this study seeks to capture evidence of non-economic loss and damage from the local level, with a proclivity towards community-based tourism operators.

The population of 36 waterbird species that tourists love to see in the Delta is positively correlated to river flows, and has been found to significantly fall with declining average inundation.[10] Aggravating the situation is the rise of human populations that are dependent on the Delta: an increase from 75,070 in 2011 to 123,452 in 2022 in Ngamiland East, and a growth from 49,642 in 2011 to 73,122 in 2022 in the Ngamiland West census districts.[11] This upsurge is increasing competition for limited resources. Overgrazing of rangelands, arable farming, wildlife decline, over-harvesting of veld products, deforestation, uncontrollable tourism development, over-fishing and bushfires are some of the key environmental stresses and threats in the Delta.[12]

Non-economic loss and damage impacts of greatest concern

1. Loss of ecosystem and biodiversity

Figure 2. Okavango Delta, Boro catchment dry.
Credit: Sharon Tshipa

The impacts of climate change are hard to quantify and often go unnoticed.[13] To assess this, this study conducted a content analysis of 18 local newspaper articles published during the drought season in 2019 that saw the world's largest inland Delta partially dry up. Subsequent investigations revealed that, compared to other effects — such as social disruption; mental and physical health impacts; loss of quality of life; and loss of cultural heritage — loss of ecosystem and biodiversity is the greatest non-economic loss and damage (NELD) impact of concern among Okavango Delta communities (see image to the left and extract below):

8 Moses, O and Hambira, W L (2018) Effects of climate change on evapotranspiration over the Okavango Delta water resources. *Physics and Chemistry of the Earth* 105(March) 98–103. https://doi.org/10.1016/j.pce.2018.03.011

9 Quammen, D (2017) Inside the Ambitious Mission to Save Africa's Okavango Delta.

10 Francis, R, Bino, G, Inman, V, Brandis, K and Kingsford, R T (2021) The Okavango Delta's waterbirds – Trends and threatening processes. *Global Ecology and Conservation* 30 e01763.

11 Statistics Botswana (2022) Population and Housing Census Preliminary Results V2. www.statsbots.org.bw/sites/default/files/2022%20Population%20and%20Housing%20Census%20Preliminary%20Results.pdf

12 Darkoh M B K and Mbaiwa J E (2014) Okavango Delta – A Kalahari Oasis Under Environmental Threats. *Journal of Biodiversity and Endangered Species* 2(138). doi:10.4172/2332-2543.1000138.

13 Serdeczny, O, Waters, E, and Chan, S (2016) Non-economic loss and damage: addressing the forgotten side of climate change impacts. German Development Institute (DIE: Deutsches Institut für Entwicklungspolitik). DIE, Bonn.

> **MA11:** A mud puddle (called a xhobo in the local lingua) at the north-eastern side of Lake Ngami is all that is left of the vast lake. This must be the deepest side of the Lake Ngami and the puddle is receding very fast. A strong stench of death (of rotting fish mixed with decomposed meat) hangs thick in the air and it can be smelt from miles away. There are vultures circling around the mud pot. Marabou storks, the birds dubbed 'undertakers' have also congregated around … On the other side of the lake there is huge float of about 60 hippos. The competition for water has led to deadly fights and there are casualties belly up on the mud.

People in Botswana have long lived alongside wildlife and have largely depended on the country's diverse ecosystem services for sustenance and rural development. With the fate of biodiversity and local livelihoods entwined,[14] the loss of ecosystems and biodiversity negatively impacts traditional livelihood sources. This translates to a loss of quality of life, which emerged as the second area of concern in this study's analysis. The above findings were supported by the analysis of subsequent key informants' interview data (undertaken among 28 purposively sampled development stakeholders and inclusive of community-based tourism operators, such as polers, academics and conservationists).

Article MA5 highlights that "Botswana has, as a result of global warming as well as other climate changes, suffered extended droughts in the region. This [has] resulted in mass deaths of livestock, low crop production." This study found that such a loss of livestock and crops to droughts has forced many households to abandon their farms and depend on poling only: a source of income that has also become unreliable due to the perpetual drying of catchments such as Boro. In the words of key informant OKMCT2, "Boro has become a ghost poling station," due to the river now being cracked dry and deserted. Article PA3 details how, having been left with no crops, livestock, boat cruises and/or mokoro excursions, citizens were forced to compete with wildlife for food: a factor that increased human and wildlife conflicts in the country. "Farming is affected, elephants come and eat everything; there is nothing else we can do because of drought and elephants. Every year is worse. Its not getting any better at all," key informant PolerW3 divulged. Further, this study revealed that wildlife that hitherto did not venture into human territories was increasingly intruding in search of food and water (see pictures and article extract below):

Figure 3. Dry and abandoned Boro poling station.
Credit: Sharon Tshipa

Figure 4. Elephants grazing near Daunara village.
Credit: Sharon Tshipa

> **MA12:** Herds of elephants have repeatedly broken into the Khama Rhino Sanctuary, flattening its boundary fence in order to access food and water supplies, officials have revealed. In separate incidents in recent weeks, a group of 14 cows and calves broke into the 8,600-hectare sanctuary from the north, followed by five bulls, which reportedly returned a day later. Wildlife officials told Mmegi the incursions were most likely due to the drying up of water sources and loss of vegetation in areas away from the sanctuary frequented by the elephants.

14 Mbaiwa, J E, Stronza, A and Kreuter, U (2011) From Collaboration to Conservation: Insights From the Okavango Delta, Botswana. *Society & Natural Resources* 24:4 400–411. DOI: 10.1080/08941921003716745.

Community-based tourism operators largely felt the brunt of this shift in distribution/abundance of species. Many were forced to shut down or relocate in search of greener pastures:

> **MA2:** The animals migrated to waterholes further into the Okavango Delta, which meant even bushwalk safaris were not yielding any appealing sightings for tourists. That is when everyone left.

2. Loss of cultural heritage and identity

The cultural heritage and identity of the Okavango Delta communities is strongly linked to the wetland. This means if the Delta is threatened, not only is their quality of life affected, but their traditional ways of life are disrupted. Among Okavango Delta communities, the reality is that the following are impacted: i) artifacts creation (such as basket weaving), due to women depending on the raw materials they harvest along and within the Delta; ii) the use of mokoros (dugout canoes, mostly associated with female polers and a form of cultural identity); iii) swimming (known as shaora, which is strongly associated with Okavango Delta communities); and iv) cattle rearing and 'molapo farming' as traditional ways of life. See image to the left and key informants' quotes and article extract below.

Figure 5. Female dugout canoe poler. Credit: Sharon Tshipa

> **KITO6:** Our cultural lives have been affected in that people in the Okavango no longer collect reeds and veldt fruits from the wilderness.

> **KIDS3:** The ecosystem has changed a lot due to this drought, and it has caused a lot of lifestyle changes as people in this area depend on natural resources: from building materials, gathering of wild fruits, and even depending on rain water from the river for farming.

> **MA3:** During its heyday, Thamalakane River bustled with water sport activities. There were constant roaring engines of boats with ecstatic screams of passengers enjoying the rides. There would be silent mokoros gliding past the river's shallow sides, riding slow and smooth. There would be many at Matlapana beach doing the shaora — swimming. But everything is dead now.

Similar to the findings of the current study, a survey of 20 Delta settlements showed widespread use of veld products such as grass, river reed, the Mokola palm and wild fruits by at least two thirds of the local population.[15]

As this case study also found, Okavango Delta communities are not entirely oblivious to the cause of their misfortunes and consequent mental health problems — which were found prevalent among poler key informants, contradicting the results of the articles analysed: "Days and weeks can end without me poling. There is a queue since people came from other villages whose rivers have dried up. Our names are written in a list which we follow for our turn for poling. Sometimes a month or two passes without me getting a chance for poling as there are not enough tourists. When rivers dry up, we live in fear, knowing that there is nothing we will eat since the elephants would have eaten the available food, and there is no poling to resort to. We are thirsty and hungry," PolerW1 expounded. Sharing her sentiments, PolerW2 stressed that poling is unrewarding, as it is now congested. Citizens pointed to natural disasters as the cause of their challenges (see extract below), but the case study further explored whether respondents knew that climate

15 Arntzen, J (2005) Livelihoods and biodiversity in the Okavango Delta, Botswana. GEF project report 'Building local capacity for conservation and sustainable use of biodiversity in the Okavango Delta'. Centre for Applied Research, Gaborone.

change was worsening natural disasters: as MA1 put it, this "stoked fears that Botswana is witnessing the beginning of the end of the magic". However, results showed a strong need for climate change education among citizens:

> **MA3:** Many natives of Maun say it is their first time to experience such a terrible drought where the flood does not reach Thamalakane River. Omponye Mareje, a 43-year-old fisherman, remembers drought years where the river was dry, but the flood always arrived. Quizzed on why he thinks this is happening, the fisherman, who says he has spent all his life next to the river, believes the situation is the result of natural disasters.

Compounding risks/impacts created

This case study found that loss of ecosystem and biodiversity are acting as stress multipliers to the existing vulnerabilities faced by Okavango Delta communities. The Ngamiland District (where the Delta is located) has long ranked as the poorest region in the country. Recent statistics show that the incidence of multidimensional poverty in Ngamiland West, for example, stands at 60.82%.[16] This is an increase from the 33.4% that was recorded in 2018 by Statistics Botswana. Such a rise suggests compounding climate risks. Increased poverty is undoing government efforts to eradicate poverty in the district. It is also compelling the government, which has no drought budget, to divert national development funds to the crises as sources of livelihoods and jobs are lost:

> **DA1:** In view of the prolonged dry spell period, government has declared the 2018/19 financial year as a drought year with mitigation measures being a 35% subsidy on livestock feeds; emergency food baskets in the Kgalagadi, Okavango and the North East districts; and continuation of rations for children under the age of five and school feeding at primary schools.

The government is not the only entity whose budget is disrupted by drought. Key informant interviewee OKMCT2 revealed that when droughts occur, they end up exhausting funds they initially would have set aside for community development:

> **OKMCT2:** We help transport those migrating. Each week, we pick them up and bring them to Maun for medical checkups, grocery shopping and all those things. This affects us, unlike when they are staying in their homes. Our people's lives are tourism centred; when rivers dry up, they turn to us for everything, including ensuring their children are educated.

The study found education interference was a critical compounding risk. In a district with one of the lowest literacy rates in the country, slightly over 70%,[17] fears were that the rate will drop even further because of classes often being cancelled when there is no water in schools. Children had missed school because they had no bathing water and/or preferred not to go to school on empty stomachs. Key informant KIDS3 expounded that "the shortage of water in the river has led to more kids dropping out of school." On the other hand, Okavango Delta communities such as Maun have made headlines on countless occasions, due to the unsafe drinking water they were subjected to consuming because of dysfunctional water treatment plants. This study found that NELD impacts experienced in the area further hindered access to clean drinking water, as climate migrants were forced to drink unsafe river water — a problem highlighted by MA2:

16 Statistics Botswana (2021) National Multidimensional Poverty Index Report. www.statsbots.org.bw/sites/default/files/publications/Pilot%20National%20Multidimensional%20Poverty%20Index%20Report%202021.pdf

17 Statistics Botswana (2016) National Literacy Survey 2014. www.statsbots.org.bw/sites/default/files/publications/National%20Literacy%20Survey%202014.pdf

MA2: Ezekiel Keogotsitse, 36, originally from Xharaxau, has lived in Boro and now moved to Daunara. He spoke of the tough life at the new location. He said there is no borehole nearby, so they are just drinking unsafe river water. There are also no ablutions in the area and so the people face many health risks.

PA3: The drought also negatively affects water supply for human consumption in Maun and neighbouring villages, leading to the current acute shortage after Borolong Treatment plant suspended operations due to unavailability of surface water. WUC has set aside P3.4 million to rehabilitate and equip existing boreholes to address acute water shortage in the tourism town. Already, pump testing for water quality is ongoing in 12 boreholes. These boreholes will provide more that 200 cubic metres of water per hour which can supply the whole of Maun, a source said.

Numerous diarrhoea outbreaks in the area (for example, 48% (n=452) of the populations of Boro, Maun, Xobe, Samedupi, Chanoga and Motopi settlements) were attributed to the intake of faecal matter contaminated water by Tubatsi et al. (2015). The failure to treat river water before use was found to be a significant predictor of diarrhoea.[18] KIDS5 posited that contaminated water had claimed the lives of "children who were less than five years old … because they drank dirty water resulting in diarrhoea." Clean drinking water was not the only health concern found by this study. The government also harboured fears that citizens may fall sick due to the conditions leading to bad hygiene as "fishermen continued to fish in the lake … where many animals … had died. The minister called for the removal of carcasses at the lake..." Given the fact that subsistence fishing has socioeconomic, socio-cultural and food security values for the Delta's subsistence fishermen,[19] their desperate resolution was not surprising.

Another fear voiced by the community was that gender-based violence and human and wildlife conflicts would escalate in the country because of increased droughts. As forecast by article PA3, the analysis of key informants' interview data found human and wildlife conflicts to be on the rise: "Human and wildlife conflicts are on the increase; just this past Sunday we buried someone in Maun who was killed by an elephant," shared PolerW1. These deaths are further straining government and citizen relations, with communities stressing that the government moved them from their ancestral territories in the name of conservation. Yet the very wildlife they have sought to conserve is following them and killing them while the government does nothing, not even compensate them for the losses and damages suffered. The following quote shows just how unhappy some citizens are:

PolerW4: The government should kill its elephants. They are its elephants. I don't want to suffer as a poler; I want to go farm. So, the government should kill its elephants. I don't want the government to wait until the elephants kill me, and then they will come to compensate my family. I don't want to end up like that; the government should kill the elephants so I can plough.

Vulnerabilities/impacts by compounding risks

This study's analysis found out that recurrent droughts in the Okavango Delta have not discriminated between young or old, women or men. The analysis of key informant interviews also showed that, though the age bracket of polers interviewed was between 43 and 71 years, a good number of young people (below the age of 40) were also trying to make a living by poling:

18 Tubatsi, G, Bonyongo, M C and Gondwe, M (2015) Water use practices, water quality, and households' diarrheal encounters in communities along the Boro-Thamalakane-Boteti river system, Northern Botswana. *Journal of Health, Population and Nutrition* 33(21) https://doi.org/10.1186/s41043-015-0031-z.

19 Mmopelwa, G, Mosepele, K, Mosepele, B, Moleele, N and Ngwenya, B (2009) Environmental variability and the fishery dynamics of the Okavango Delta, Botswana: The case of subsistence fishing. *African Journal of Ecology* 47 119–127.

> **OKMCT2:** The education level of the youth is also low: some stopped at primary school, other[s] dropped out at junior high schools. In some of our poling stations, we have a high concentration of youth; they do nothing but poling and drinking alcohol. They can't even think of returning to school or opening [a] business.

Regarding gender, both were vulnerable, and the frequency of their struggles in the articles analysed was even. For men, the loss of the ecosystem and biodiversity during the 2018/2019 drought season resulted in unemployment. As highlighted by MA2, safari bushwalks — which are predominantly facilitated by men — had to stop, and some tourism businesses were forced to retrench their staff. To provide for their families, some men found themselves "… salvaging catfish from the mud … They were on a race against time to catch as much fish as possible before the lake completely dried up" (MA11).

While some women also lost their jobs, others, such as female polers, found themselves leaving their children and families behind to pursue livelihoods elsewhere. They migrated to distant rivers that still had water so they could continue making a living from the traditional canoes used for tourists' excursions. Among older women, the relocation was a tough experience, more so because they were not allowed to seek help from their husbands or sons:

> **MA2:** Over 250 OKMCT polers, all women, would wait at the Boro gate to welcome these tourists for the famed Mokoro Trails into the Okavango Delta. These brave women eked [out] a living by poling tourists on small mokoro (dugout canoes) made of fibreglass through the hippo waterways … Most polers complain of a long wait to get guests, as there are now many polers stationed at Daunara. Fifty-seven-year-old Kesolofetse Sabokwa, who is one of the Boro women, said life is really tough for old timers at Daunara.

Though the 2019 drought is now history in the minds of many nationals, this study found that the number of polers at Daunara has since increased to 300, most of whom are women. Each poler can spend weeks and months without an excursion, as customers are scarce. Further, the customers must be shared among many polers, including many migrants from villages such as Xharaxao, Boro and Morotseng. These women can go up to three months without seeing their children and husbands. Some key informant respondents shared that, for a chance to give a mokoro ride and subsequently feed their families, they have been forced to turn a blind eye to their sick children and pregnant daughters. While awaiting their turn to surf the waters, and considering the limited number of tourists, some female polers resorted to basket weaving, using palm trees, but soon realised they had nowhere to sell their cultural artifacts, as there were no curio shops that could stock up their wares in their place of refuge.

Coping measures

The newspaper articles analysed in this study suggest that, to cope with the impacts, community-based tourism organisations and residents of the Okavango Delta were mostly concerned with preserving wildlife. This was possibly because of wildlife being largely linked to their culture and also being a main source of their eco-tourism livelihoods. A source quoted by MA3 divulged that, to reduce wildlife mortalities, communities availed food, inclusive of a "…daily supply of bales of hay to hippos", adding that "we use our money to buy this hay for the hippos to help their plight". Communities also ensured access to water:

SA1: He said the aim was to ensure that there are no mass mortalities. Decrying the unfortunate situation where animals are stuck in the mud in Lake Ngami and Okavango Delta in their hundreds, he said they managed to transfer some of them to where there was water.

The second predominant coping measure this case study found was a reliance on government safety nets — which are not very dependable. PolerW2 explained: "If things are really bad, I resort to Ipelegeng, but Ipelegeng is just like poling as you also have to wait for your turn to work. So, you raise children in a painful

way, especially children who are far away like mine, who is in Ghanzi. I live in pain, as there is nothing I can do to help the child. If all fails, I sit and do nothing, but God somehow provides, somehow: I bath; I eat." Also:

> **MA4:** Thousands of livestock in northern Botswana have been stricken by a crippling drought, while rural communities have been especially affected by the intensifying extreme weather conditions and are looking to the government for help.

Migration was the third most popular coping measure found among community-based tourism operators in the newspaper articles assessed: "Members of the OKMCT from … six villages ... migrated further north to the village of Daunara…" (see pictures and newspaper extract below):

Figure 6. MIgrant polers camping at Daunara.
Credit: Sharon Tshipa

Figure 7. Polers on duty at Daunara poling station.
Credit: Sharon Tshipa

> **MA2:** The Santandiba River at Daunara did not dry and all the tourist activities were never disturbed. Even this year's elusive floodwaters arrived in August. The lagoon near Daunara is the new Mokoro Trails capital and the polers have moved in.

The analysis of key informant interviews further showed that migration is a prevalent coping measure among polers. For example, PolerW11 highlighted that she migrated from Xharaxao in 2018, before moving to Boro and then, finally, Daunara, where she was currently camping. "If you go to Xharaxao you will find a ghost village because we have moved to this side, life compelled us to come here," PolerW4 also shared. Other coping measures that were dominant were the digging of boreholes, water harvesting, and the construction of pre-schools and boarding spaces by the OKMCT community trust, as outlined by OKMCT2 below:

> **OKMCT2:** … We have since started building preschools in all our settlements so that the smallest of the children can study closer to their parents. Our preschools are flexible; if a parent moves to Daunara, the child can also transfer. Another good development that is coming is that the government is building a primary school in Boro. What we have decided to do as a trust is to build a boarding house next to the school so that all our children (whose parents are part of the OKMCT villages) can start primary school in one place, so their parents can have a peace of mind, and visit their children twice or thrice a month. Once that happens, we can even provide transport to them, rotating parents from different poling stations so that they come and visit their children in the school.

Coping measures that were resorted to by the community included: i) stealing; and ii) starting wildfires to try to chase elephants away.

Figure 8. Pre-schools, a coping measure. Credit: Sharon Tshipa

Figure 9. Veldfires, a coping measure. Credit: Sharon Tshipa

Other measures supported by external agencies included: (i) charcoal production — as an economic diversification strategy supported by the Botswana government and intergovernmental stakeholders; and ii) conservation (even though the Delta's economic valuation amounts to millions or at least US$40/ha):[20]

> **PA3:** For the past two years the Trust has stopped fishing activities in the lake due to low water levels. The Trust has been forced to shift focus to charcoal production, estimated to last for the next 20 years.
>
> **MA14:** Speaking at the screening, managing director of Botswana Wild Bird Trust, Koketso Mookodi said the event is the organisation's "effort to start relevant conversations and collectively come up with solutions that will help contribute to the further protection of our beloved Okavango Delta".

Support needed in future

For community-based organisations and their villages to survive future climate shocks, be resilient and pursue sustainable development, the government needs to invest in water plants that can guarantee access to clean drinking water. This calls for funds to be invested in sound infrastructure development so that when rivers dry up, people can utilise underground water. This study's key informants stressed the need for boreholes, water harvesting and irrigation technologies. Also, since some tourism operators used their swimming pools as watering holes for hippos, constructing additional watering holes along the Delta will ultimately reduce human and wildlife conflicts during drought periods, as elephants (being the notorious species) will not enter human inhabited territories in search of water.

Key informants also suggested mending the Buffalo fence that runs between concessions NG32 and NG35 — or better yet, erecting an electric fence there — as elephants have damaged the existing one, creating paths that lead to their farms. PolerW9 revealed that elephants are not the only animals now using the passages: "… Our cattle cross over into NG32, when we close the opening using branches and shrubs, the elephants come and remove it again, and come into our homes." Key informant OKMCT2 revealed that, since the government has done nothing about the fence for a long time, some of their polers have even asked them to erect electric fences to protect their farms. On the other hand, scholars have argued that veterinary fences are a blessing and a curse: a blessing in the sense that veterinary fences protected the Delta from human encroachment (achieving conservation), and a curse in that they have sealed off vital wildlife habitat and terminated cross-border migrations (a critical factor in the maintenance of the Delta's wildlife diversity and population numbers).[21] This study posits that fencing individual farms may be a viable solution: a win-win.

20 Gagoitseope, M (2006) The value of the Okavango Delta: A natural resource accounting approach. Faculty of Natural and Agricultural Sciences Department of Agricultural Economics, Extension and Rural Development University of Pretoria.

21 Darkoh M B K and Mbaiwa J E (2014) Okavango Delta – A Kalahari Oasis Under Environmental Threats. *Journal of Biodiversity and Endangered Species* 2(138). doi:10.4172/2332-2543.1000138.

Figure 10. Veterinary fence damaged by elephants.
Credit: Sharon Tshipa

Figure 11. A damaged fence allows cattle to cross into NG32.
Credit: Sharon Tshipa

There is also an acute need to diversify sources of income among the Okavango Delta communities. This means upskilling and equipping citizens with new ways of making a living that do not include livestock production; some key informants decried the killing of their livestock by predators such as lions, hyenas, wild dogs, cheetahs and crocodiles, consequently fuelling human and wildlife conflicts.[22] Communities should not mainly depend on the Delta for sustenance. To end the dependency, residents — especially young people — need to be supported in every way possible.

Lessons learned

When it comes to developing strategies to adapt to climate change-induced NELD, drought preparedness was cited by various key informants, such as KIDS1, as crucial. KITO4 said that, to effectively prepare, the community had learned about the "need to collect data and use it for planning". In agreement, KITO3 stressed the "need to work with researchers in order to achieve solutions to the losses and damages brought about by climate change". Another important lesson was concerned with people's low awareness levels of climate change. Key informant interviews thus emphasised the need to raise awareness on climate change: its causes, effects and possible solutions, without which resilience and food security will be impossible, meaning citizens will be fighting a losing battle, as the status quo implies.

Synopsis

This case study examined how climate change loss and damage affects Okavango Delta-dependent communities. To ensure rigour when addressing the research objective, analysis and the eventual discussion of the public discourse was triangulated with 28 key informants' (purposively sampled) interview data. Overall, results showed that loss of ecosystems and biodiversity, loss of quality of life, and loss of cultural heritage to be the top three NELD impacts of greatest concern among Okavango Delta communities. As it stands, these communities are fighting what is clearly a losing battle against climate change. However, should sources of livelihoods become diverse (with reduced dependence on natural resources) and climate change education be made imperative, communities will become more resilient and food security will be possible.

22 Mbaiwa, J E (2018) Human-Wildlife conflicts in the Okavango Delta, Botswana: what are sustainable management options? *PULA: Botswana Journal of African Studies* 32(1) 22–35.

Loss of ecosystems and biodiversity

Secondary categories: loss of cultural heritage; loss of quality of life (shelter, food, health, skills, education)

Ode to the Benahaj River: how a climate-fuelled landslide and subsequent ecosystem loss forced an Indigenous tribe in Vanuatu to relocate

Christopher Bartlett, Head of Climate Diplomacy, Government of Vanuatu

With expert contributions from Susan Balmet, Roy Peter, Allan Taman, Donakle Bune and Seule Kamilo, who are all local experts of the Santo Sunset Environment Network

Location	Molpoi Village, Santo Island, Vanuatu, Pacific Islands
Climate hazards	Unseasonal rainfall; landslides
Non-economic loss and damage	Destruction of ecosystems, social sites, food plantations, water sources and infrastructure; forced migration
Coping measures	Community Disaster and Climate Change Committee to coordinate resilience planning and carry out adaptation activities

Context

Western Santo, Vanuatu

The Republic of Vanuatu is an island archipelago, in the South Pacific, that graduated from Least Developed Country (LDC) status in 2020. Located between Australia and Fiji, the majority of Vanuatu's ~325,000 people live in small coastal villages spread over 80 islands, and are commonly underserved by health, education and government extension services.

Espiritu Santo is the largest island in Vanuatu, with a total land mass of only 423,897 hectares (the approximate size of Rhode Island, USA). Santo has a population of just over 40,000, who speak 37 of Vanuatu's more than 120 Indigenous languages. Around 40% of the island's land area is covered with tropical forests.

The western side of Espiritu Santo is one of the most remote and inaccessible parts of the nation, requiring residents and government officials to walk, ride horses or take small outboard boats to reach villages across hilly terrain or rough seas. The total population of the Western Santo Area, including under the jurisdiction of two area councils, is 4,965, who live in 1,008 households in 42 villages.

As there are no roads in the area, with minimal mobile phone network coverage, the people of Western Santo live a subsistence lifestyle under traditional systems of governance headed by a chief. Village families grow taro, banana, yam, kava, peanut and sweet potato, as well as using traditional canoes for hook and line fishing. There is no grid electricity or water supply to the area.

Climate impacts in Western Santo

Vanuatu's people make negligible contributions to global greenhouse gas emissions (0.0016%), and according to the UN's Multidimensional Vulnerability Index preliminary scores, Vanuatu ranks tenth in the world for lack of Economic, Environmental and Social resilience.[1] Poverty is high: the World Bank recorded GDP per capita in Vanuatu at just over $US3,000 in 2022,[2] and the penetration of insurance of any type is extremely low there, with around 5% of the population holding some kind of coverage.[3]

Yet, climate impacts are intensifying daily, including from hazards like stronger tropical cyclones, prolonged droughts, ocean acidification and sea-level rise,[4] which are destroying livelihoods, undermining fundamental human rights and costing lives. Compounding and exacerbating these climate impacts is that Vanuatu sits directly on the Pacific Ring of Fire with nine active volcanoes,[5] regular earthquakes, and resulting tsunamis and landslides.

Vanuatu has been shown to have a highly circular economy, relying on secondary or renewable materials and energy sources for 59% of the materials it uses for domestic consumption.[6] Vanuatu has also submitted one of the most ambitious Nationally Determined Contributions (NDCs) in the world and is committed to achieving 100% renewable energy in the electricity generation sector by 2030.[7]

1 www.un.org/ohrlls/content/mvi-preliminary-country-scores

2 https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=VU

3 https://link.springer.com/article/10.1007/s11027-022-10002-z

4 www.pacificclimatechangescience.org/wp-content/uploads/2014/07/PACCSAP_CountryReports2014_Ch16Vanuatu_WEB_140710.pdf

5 www.vmgd.gov.vu/vmgd/index.php/geohazards/volcano/our-active-volcanos

6 www.nab.vu/document/circular-economy-opportunities-vanuatu-concise-metabolic-analysis-report

7 www.VanuatuICJ.com/NDC

Further impacts

The world faced a rare multi-year La Niña event from 2021 to 2023[8] (nicknamed a 'triple dip La Niña').[9,10] In Vanuatu, this manifested as above normal rainfall, and was associated with elevated flooding, coastal inundation, infrastructure degradation and landslide risks.[11]

Western Santo villages experienced a series of extreme rainfall events in the first two months of 2022, dumping nearly one metre of rain on an already soggy rainy-season landscape. Then, beginning on 23 February 2022, Western Santo villagers experienced three strong earthquakes, each over M 4.6.

At 6pm on 9 March 2022, as a result of rain-drenched topsoil and the destabilising effects of the earthquakes over the previous weeks, the entire mountainside of the Indigenous village of Molpoi collapsed, sending topsoil, rock and debris more than 300m wide and 30m deep barrelling down the valley, over 2km to the ocean. In less than one hour, the community of Molpoi had lost its coconut plantations (3,000 trees), cacao groves (3500 trees), water taro gardens, kava cash cropping sites, fruit orchards, livestock pastures and subsistence food plots. Thick mud blanketed the village, destroying homes, the community meeting hall, a local kindergarten and the village cemetery.

Figures 1, 2 and 3. Multiple landslides have destroyed buildings and land crucial to the community's subsistence lifestyle.
Credit: Santo Sunset Environment Network

Less than one year later, in the early dawn hours of 21 January 2023 — again preceded by a deadly combination of extreme rainfall and a series of earthquakes — the remaining hillside of Molpoi slid down to the ocean, this time smothering the entire coral reef and knocking down the last trees and standing structures in the village.

Haphazard relocation has been the result. Local negotiation with neighbouring communities has secured allocation of a small parcel of land, with no running water nor access to education or health services. Local non-governmental organisations (NGOs), such as the Indigenous Santo Sunset Environment Network, have provided basic support. This has included food, tools and a rainwater tank, but meeting the costs of reconstruction of houses, gardens and livelihoods has fallen entirely on the shoulders of the Indigenous people of Molpoi.

8 https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php

9 https://public.wmo.int/en/media/press-release/triple-dip-la-ni%C3%B1a-persists-prolonging-drought-and-flooding

10 https://earthobservatory.nasa.gov/images/150691/la-nina-times-three

11 https://reliefweb.int/report/world/la-nina-impacts-felt-throughout-pacific

One consequence of this fossil-fuel driven loss and damage event was the stripping of the Mol Hin Boi Community Conservation Area of more than 600 hectares, which was established hundreds of years ago under Indigenous customary governance, and formalised as a protected area in 2016.

Designated by the IUCN and the Government of Vanuatu as part of a Key Biodiversity Area within the Eastern Melanesian Biodiversity Hotspot, the Molpoi Conservation Area is home to bird and mammal species found nowhere else in the world, including endangered and endemic ones like the Santo Mountain Starling (*Aplonis santovestris*) and the Santa Cruz Ground Dove (*Pampusana sanctaecrucis*). A global biodiversity expedition in 2006 found that West Coast Santo contained hundreds of previously undescribed species of flora and fauna.[12]

There is currently no way to quantify the value of the loss of these species, nor their spiritual and cultural importance to the people of Molpoi, who have for hundreds of years placed stewardship of their ancestral land and ecosystems as a core principle of being in a tribe.

One of the greatest and most irreplaceable losses experienced by the people of Molpoi was the heart of the conservation area, and the spiritual centre of the community: the Benahaj and Or Rivers and the community's drinking water source.

Using ecosystem service valuation methodologies,[13] it is possible to estimate the value of drinking water now unavailable, as well as the riverine fish biomass forfeited and the timber and food production lost. But the existence value of the Mol Hin Boi Conservation Area and Benahaj River for baptisms, recreation, ceremonial use and Indigenous identity is priceless.

In this study, Roy Peter, the traditional medicine man of Molpoi, explained how an ancient village called OrLav, previously located within the area, was destroyed by the landslide. The site included the burial ground of the community's ancestors, as well as key cultural sites. One of the most important sites lost was that of the Su Stones, a table of stones with one large flat rock sitting atop between three and four smaller stones.

In order to claim a new chiefly title, men were required to kill the number of pigs equivalent to the rank they aspired to. As soon as the pigs were killed, the ascending chief stood atop the Su Stones and called out his new rank, chiefly name and land claim for all to witness. This ceremony, on these sacred Su Stones, has played a critical role in the hereditary titles of the men of Molpoi as well as certifying land rights. Without this step, the assumption of customary chiefly titles is not possible. Both the main Su Stone and site and a secondary Su formation were lost forever in the landslide.

Figure 4. Su Stones. Credit: Santo Sunset Environment Network

Another example of non-economic loss involves a special kind of flower used by the people of Molpoi in their taro gardens. This flower, known in the local Vanlao Indigenous language as Napau and Nasas, was cultivated to give extra productivity to the taro tubers, as well as making a powerful traditional medicine. The pink, red and purple flowers, set off by long round leaves, are not found in other sites in Western Santo, and have possibly now been lost entirely.

12 www.researchgate.net/publication/281400628_The_Santo_2006_global_biodiversity_survey_An_attempt_to_reconcile_the_pace_of_taxonomy_and_conservation

13 Vanuatu NELD valuation after Cyclone Harold: PDNA Environmental Cross Sectoral Report. De Groot et al. (2012) Global ecosystem values: www.sciencedirect.com/science/article/pii/S2212041612000101 Mackey et al. (2017) Vanuatu ecosystem valuation: https://vanuatu-data.sprep.org/dataset/ecosystem-and-socio-economic-resilience-analysis-and-mapping-vanuatu/resource/a12ff881-f5e9 Pascal et al. (2015) Vanuatu marine valuation: http://macbio-pacific.info/wp-content/uploads/2017/08/Vanuatu-MESV-Digital-LowRes.pdf

Figure 5. Multiple landslides have destroyed buildings and land crucial to the community's subsistence lifestyle. Credit: Santo Sunset Environment Network

The paramount chiefs and customary authorities of Molpoi had a special pool in the Benahaj River, reserved for bathing on the nights of the new moon, to perform customary magic and encourage good growth of food crops. Only custom chiefs were allowed to access this pool, and it played a critical role in the agricultural calendars of the tribe. This piece of important cultural heritage of the tribe is no longer in existence after the landslide.

The community is now grieving the loss of special flora and fauna within their long stewarded Mol Hin Boi Conservation Area. Freshwater prawns (*Caridina gueryi*, locally called Ur), the red-headed Vanuatu flying fox (*Pteropus anetianus*, locally called Tavut) and the black-headed Pacific flying fox (*Pteropus tonganus*, locally called Koroe) are particularly valuable to the tribe as totems.

The huge and long-lived Santo Kauri — *Agathis silbae* — and the Pacific Kauri — *Agathis macrophylla* — (both known locally as Koe) were smashed like matchsticks during the landslide, and are now found in pieces along the coastline. The Koe tree is traditionally used for custom torches during night-time pig hunts, due to its highly flammable and long-burning sap. It is a well taught lesson to the young men in the tribe that, to prevent bushfire, they must never light cooking fires near the Koe tree. Today, one lone Koe tree is left standing at the very top of the mountain, just above the area where the land broke and fell away.

Compounding risks: an unjust confluence with vulnerabilities and impacts

The people of Molpoi, and indeed those of Vanuatu and other Pacific small island developing states, suffer from an interaction of simultaneous and successive multiple risks that combine to produce extreme disasters that are now generating widespread losses. The Intergovernmental Panel on Climate Change (IPCC) finds that compound disasters occur when compounding processes play out extensively to generate multiple events that eventually lead to a loss of lives or assets, indicating a tipping point for the risk.[14]

Moreover, the losses and damages now being experienced in Vanuatu result from the interactions of climate-related hazards, exposure and vulnerability, as well as systemic, cascading and compound risks.[15] This was most recently evidenced by two category 4 cyclones striking Vanuatu within 72 hours and described in submissions to the Loss & Damage Transitional Committee by Vanuatu[16] and Australia.[17]

Earthquakes can and do cause landslides on their own, but in the case of the people of Molpoi, the climate influenced triple dip La Niña, extreme localised rainfall, and a lack of early warning or technical support have combined. These events have led to the permanent displacement of an Indigenous community and incalculable non-economic loss and damage to its people.

14 www.cambridge.org/core/books/abs/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/national-systems-for-managing-the-risks-from-climate-extremes-and-disasters/BBEEF8006AD1FE91666F18F4ABB2A550

15 www.sciencedirect.com/science/article/pii/S2590061723000121

16 https://unfccc.int/documents/628229

17 https://unfccc.int/documents/627999

Vulnerabilities/impacts of compounding risks

Existential vulnerabilities pre- and post-event

The nature of the landslide, which effectively razed the earth down to the bedrock, eliminated any potential to build back better or to utilise traditional materials and resources for recovery. Without access to their traditional medicines, the coral reef or ceremonial sites, the people of Molpoi now face an existential stress multiplier, dramatically increasing the pre-existing vulnerabilities faced by the most remote Indigenous communities in small island developing states. This impacts on geographic locations at low latitudes, as well as levels of development and economic diversification, making reliance on external and costly supply chains more likely.

Indeed, the IPCC finds that the most common climatic drivers for migration and displacement are drought, tropical storms and hurricanes, and heavy rains and floods (with high confidence for this finding, in terms of replication in future studies). It also finds that small island states in the South Pacific are disproportionately affected relative to their small population size (high confidence).[18]

Within the population in Western Santo — including Molpoi — certain communities face greater risks and exposure, due to factors such as socioeconomic status, gender, race, age, disability, income or class identities.[19,20] None of the children from birth to five years old in Molpoi are now attending kindergarten because the teacher, like her colleagues, lost her home and livelihood. The relocation site has no school building, teaching materials, or access to water and sanitation.

This has generated conditions for an upcoming climate event to trigger further disasters in the community. It is not a matter of if, but when the next set of systemic, cascading and compound risks will affect this and other underprivileged communities in Vanuatu.

Coping measures

Practical solutions to scale up locally-led action

Due to the systemic, cascading and compounding nature of impacts, solutions will require context-specific approaches that are grounded in the everyday realities of families and tailored to the vulnerabilities of different people and places.[21]

The Santo Sunset Environment Network (SSEN) is an Indigenous-led organisation based in remote Western Santo. Established in 2017, it is active in all aspects of the sustainable development affairs of Western Santo.[22]

Immediately after the first landslide, SSEN was the first organisation on the scene. It supported the Molpoi Community Disaster and Climate Change Committee to undertake initial disaster assessments, including on non-economic impacts, to channel through the official Ministry of Climate Change and National Disaster Management Office institutional arrangements.[23]

18 TS.B.6.1 www.ipcc.ch/report/ar6/wg2/

19 TS.B.6.1 www.ipcc.ch/report/ar6/wg2/

20 www.sciencedirect.com/science/article/pii/S0305750X20305118?via%3Dihub

21 www.iied.org/21291iied

22 www.SantoSunset.org

23 https://openrepository.aut.ac.nz/items/a1287767-ac3f-4fa1-8a43-4e983d6cf267

Beyond the immediate humanitarian work, SSEN has continued to engage with Molpoi to address the non-economic impacts of the landslide. For example, in July 2022, the network convened a traditional agricultural festival. This brought together chiefs, elders, farmers, women and young people to discuss practices, crops and coping mechanisms. The documentation of this traditional knowledge, which is at risk of being lost forever, has been included in a forthcoming book about the custom agriculture of Western Santo. This solution is an example of a NELD solution known as memorialisation (or remembrance).[24]

To address non-economic losses to biodiversity, the SSEN facilitated discussions with the Molpoi chiefs and community conservation area committee in 2022. There were follow-ups in May 2023 to prepare a management plan with concrete activities. These included documentation of biodiversity in the Vanlao language, a historical timeline of conservation action, ecological surveys alongside the landslide area, reforestation along the edges of the landslide and the removal of the now invasive vines and snails. These were all examples of locally determined ecosystem restoration focused loss and damage solutions.

To address the lack of pre-school education, and to ensure that the community has immediate access to technical assistance required for implementing its loss and damage solutions, the SSEN worked through local telecom and renewable energy suppliers to set up a solar-powered satellite internet receiver in the village, for the first time connecting all households to high-speed internet. The internet is now used by people with smartphones to get information from agricultural extension agents based in the capital, about planting crops in new areas and for diversifying into new productive sector opportunities. The people of Molpoi are now able to access climate early warning bulletins, as well as financial access training from private sector stakeholders, as the community navigates its reestablishment in the relocation site.

Support needed in future

Finance urgently required to address non-economic loss and damage

First and foremost, families in Molpoi, Indigenous enabling organisations like the Santo Sunset Environment Network and developing countries like Vanuatu must receive the finance and support required to address loss and damage in a nationally determined and locally led way. This should be offered by countries and industries that have not met commitments or legal obligations commensurate with their historical emissions and responsibilities.[25]

Vanuatu and other island nations are currently subjected to unequal resilience resource sharing at the global level, receiving seven times less than LDCs.[26] The communities on remote Western Santo and others like them experience even more limited climate finance flows, as they are difficult to access geographically and therefore have extremely high transactional costs to serve. They also do not have access to capital-based civil servants tasked with allocating climate finance, and are thus not written into the time-bound projects of externally based implementing entities.

Moreover, humanitarian and adaptation systems do not concretise non-economic losses and damages,[27] thereby commonly omitting them from solution suggestions, projects and programmes.

24 www.aosis.org/aosis-pushes-progress-on-loss-and-damage-finance-facility

25 www.lossanddamagecollaboration.org/publication/the-loss-and-damage-finance-landscape

26 https://odi.org/en/publications/a-fair-share-of-resilience-finance/

27 www.tandfonline.com/doi/abs/10.1080/14693062.2019.1640105?journalCode=tcpo20

Across the Pacific Islands, climate impacts are superseding the limits and thresholds of adaptation, and are now resulting in severe security risks, loss and damage.[28] Included here are those related to human mobility and the kind of internal displacement suffered by the people of Molpoi.[29]

Vanuatu was one of the first countries in the world to include a Loss and Damage section in its revised and enhanced NDC towards meeting the goals of the Paris Agreement.[30] The country has identified and fully costed 12 tangible and locally led loss and damage solutions, which it commits to implement by 2030, conditional on international support.

For example, in the NDCs' Loss and Damage (LnD) Commitment #4, costed to just under US$2 million, Vanuatu aims to improve LnD assessment methodologies that build on what local committees and provincial authorities are already using in villages like Molpoi, with new non-economic loss and damage indicators related to food security, cultural impacts and ecosystem services.

Vanuatu is also spearheading the initiative for an Advisory Opinion from the United Nations International Court of Justice[31] to clarify the obligations of States to climate change action, and the legal consequences associated with breach of these obligations in respect to vulnerable nations and future generations.

Lessons learned

Parties at COP27 agreed to establish a Fund for responding to loss and damage, with a mandate that includes a focus on addressing loss and damage.[32]

From the lessons learned by Molpoi's experiences, the new Fund and funding arrangements must enable nationally defined systems that are premised on a whole of society approach, and institutionalise the roles of community and non-government stakeholders.

Considering the systemic, cascading and compound nature of loss and damage in Vanuatu, top down, one-size fits all or projectised modalities of funding are not appropriate. Governments have the legal mandate for delivering services to their people, and a formal role to ensure coordination and complementarity with existing funding arrangements. Governments have decentralised structures (such as provincial and island councils, and links to community disaster and climate change committees) as well as the historical understanding required to address loss and damage in a responsive, flexible and culturally appropriate manner. Funding should be delivered to locally and nationally developed solutions that adhere to national policies, laws, regulations, and monitoring and evaluation parameters, not externally imposed project development guidelines and timeframes.

The case of Molpoi suggests that funding needs to be predicable as the community navigates its livelihood transformation after relocation, evolving over time as contexts and solutions shift. The experience of Western Santo is that there is, even within two remote Area Councils, a range of loss and damage scenarios facing Indigenous communities. This means the area requires funding and technical assistance that can be tailored, ideally under the leadership of the national and subnational government, to meet the local mosaic of needs and solutions.

28 www.iom.int/sites/g/files/tmzbdl486/files/documents/2023-06/limits-to-adaptaiton-in-the-context-of-the-pacific-2023.pdf

29 https://publications.iom.int/books/navigating-human-security-and-climate-mobility-pacific-sea-islands

30 https://unfccc.int/documents/578782

31 www.VanuatuICJ.com

32 2/CP.27 https://unfccc.int/sites/default/files/resource/decision%202%20CP%2027.pdf

Communities, NGOs, private sector partners, humanitarian actors and scientific experts should be empowered by international cooperative mechanisms like the LnD Fund to continue work under a government-led comprehensive risk management framework that has been set up to address a range of complex climate and non-climate risks. As experienced by the people of Molpoi, overcoming the siloed approach is existential, and requires a much more holistic and temporal consideration of solutions to address non-economic loss and damage.

Synopsis

Systemic, cascading and compound risks and climate hazards have converged to cause two devastating landslides on the Indigenous tribal lands of the Molpoi community in the remote island archipelago of Vanuatu. Buried forever under more than 18 million m^3 of topsoil is the community's spiritual centre: the Benahaj River, along with hundreds of sacred sites and endemic plants and animals. While the replacement value is incalculable, and relocation has been the only viable course of action for the village, this case study details concrete actions taken by local champions to address non-economic loss and damage. It outlines opportunities for new and additional LnD finance to utilise nationally defined systems that are premised on a whole of society approach, and which institutionalise community and non-government stakeholders for effective, programmatic, long-term, flexible and culturally appropriate action.

Loss of ecosystems and biodiversity

Secondary categories: loss of quality of life (shelter, food, health, skills, education); social disruption (migration and displacement)

The ripple effect of lost ecosystems and biodiversity in the Volta River Estuary, a Ramsar site in Ghana

By Sylvanus S.P. Doe, Research Fellow, Earth System Governance Project, Utrech University, The Netherlands

Location	Volta River estuary, Ghana
Climate hazards	Large-scale sea-level rises; extreme erosion of the estuary and coastlines; localised extinction and/or death of oysters; storm flooding of livestock, tree/food crops and biodiversity assets; formation of hardpan soils, desert-like conditions and salinity on mangrove rangelands
Non-economic loss and damage	Over 4,000 marginalised rural households destroyed by tidal waves; reduced oyster picking causing livelihood loss and financial insecurity; basic schools submerged in storm floods displacing both school children and teachers; lost food crop farming and fish smoking activities exacerbating social exclusion, food insecurity and acute poverty conditions; biocultural and ecological heritage loss along with sacred groves declining
Coping measures	Migration to less risky upstream communities to personally resettle or pick oysters; depositing or aquaculturing 'seed oysters' in an anticipation of bumper harvest; establishing 'closed season' that restricts picking of oysters within the months of November to February each year; diversification of landscape-level income and livelihood sources

Context

The natural ecosystem base of the Volta River substantially drives sustainable development progress. It makes positive socio-environmental contributions that inextricably align to the AU Agenda 2063, Ramsar Convention, UN Convention on Biological Diversity, Paris Agreement, and UN Sustainable Development Goals (SDGs). Geographically, the Volta River and its tributaries interconnect the food, water, livelihood, hydroenergy, security, transportation and environmental heritage needs of nearly 120 million people co-inhabiting six nations on the western coast of Africa: Ghana, Togo, Benin, Ivory Coast, Mali and Burkina Faso (Mul et al., 2015, Doe, 2023; Clément and Chazot, 2022). The estuary of the Volta River is recognised as a Ramsar site (Willoughby et al., 2001), positioning it as bioecologically significant asset and of international climate policy interests. This transboundary river and the Atlantic Ocean meet between Azizanya and Fuveme (Figure 1) to create geopolitical island interfaces that are administratively managed by Ada East, Anloga and South Tongu Districts of the Republic of Ghana collectively, a home to almost 284,420 people (Ghana Statistical Service, 2021).

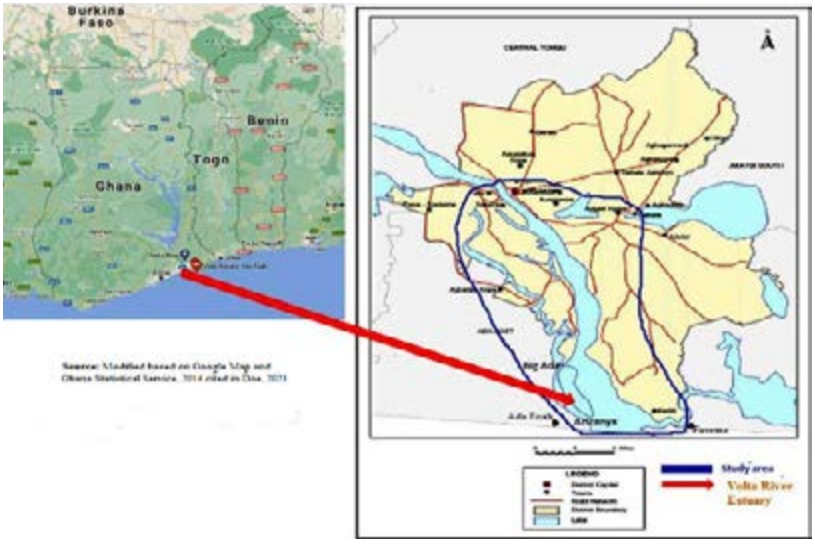


Figure 1. Location of the study area. Source: modified based on content from Google Maps and Ghana Statistical Service (Doe, 2021)

The Volta River Estuary (VRE) distinctively exhibits mixed relics of coastal savannas, wetland/dryland ecosystems and low-patched canopy forests, comprising multispecies of mangroves, bamboos, baobabs (*Adansonia digitata*), palmyra palm (*Borassus* sp), date palm (*Phoenix dactylifera*), mango (*Mangifera indica*), Kapok (*Ceiba pentandra*), neem (*Azadirachta indica*), coconut (*Cocos nucifera*) and oil palm (*Elaeis guineensis*). Oysters are harvested alongside fishes like tilapia, crabs and shrimps from freshwater lagoons, streams and tributaries in the VRE. All kinds of birds, reptiles and insects are spotted on the mangrove swamps. The river landscapes serve as grasslands for grazing livestock. The coastal temperature ranges from 25 to 31°C.

As the global mean temperature keeps rising towards 1.5°C (Atwoli et al., 2021; Miranda et al., 2023; IPCC, 2018; Rahmstorf et al., 2017) and triggering irreversibly large-scale risks in the planetary boundaries (Richardson et al., 2023), including abruptly uncharacteristic oscillation of both the Atlantic Ocean and the Volta River waters, the local communities closest to the estuary are constantly confronted with recurrent sea-level rises, seaheat, coastal erosion and storm floods that are causing widespread non-economic loss and damage (NELD) to human lives, eco-properties and the coastal Earth systems of the VRE (BBC, 2021; Doe, 2023; AFP, 2021). Today, the climate-induced NELDs in the VRE are manifesting in many (in)visible

Figure 2. Eroded coastline showing coconut roots exposed by tidal waves, illustrating an approximate rate of coastal erosion at 2.2m per year faster than previously estimated at Fuveme Island. Credit: Sylvanus S.P. Doe

Figure 3. Massively damaged rural household structures and dead coconut trees showing seaweed debris under the trees after tidal wave havocs at Fuveme. Credit: Sylvanus S.P. Doe

forms, intensities and scales, the impacts of which are devastatingly cascading across coastscapes (Figures 2, 4 and 6), aquatic systems and societal groups, most acutely affecting the aged, vulnerable women, persons with disabilities and girls. Children in Fuveme are daily suffering from sea-triggered violence. The future and sustainability of the socio-ecological systems and biodiversity underlying coastal Ramsar sites and the VRE at large remains unclear, uncertain and threatening due to rapidly growing species depletion, land degradation, desertification and deforestation, especially excessive tidal surges (Boafo, 2018; Doe, 2021; Boateng, 2012).

Against this background, this case study on NELDs was conducted within 25km of the VRE in the south-eastern zone of Ghana, approximately 150km from the capital city, Accra. A cluster of communities visited during this study were Azizanya, Dalive, Big Ada, Ada Junction, Ada Foah, Amedorme, Akalove, Havui, Sogakope, Agorta, Gamenu, Gamenu-Kedzi, Adidokpo and Fuveme.

Human-environments, communities and NELD impacts

The intense circulation of the Atlantic Ocean unpredictably triggers a rise in sea level, causing ingress of seawater ('saltwater') of up to 0.5km in the Volta River, disrupting freshwater regimes, killing and downsizing oysters towards extinction by 2100 (Doe, 2021). The highly concentrated seawater does not only cause deformities ('climate shock') to oyster shells but also kills oysters in their microscopic larvae, egg and premature ('young') stages (Doe, 2021). The unprecedented rate of seawater flows into oyster habitats and farmlands is crucially undermining the ways of life in the oyster-producing communities.

Each time the deadly sea surge coincides with the West African monsoon, it forces the Volta River to flood the *Red Oval Belt (ROB)* of the estuary. Here, the NELDs are extremely devastating. The death of domestic tourists or fishermen returning from sea mostly occurs within the ROB (that is, the death-trap-belt between Fuveme and Azizanya), stretching 0.25km into the sea and 0.25km into the river. The unequal flow velocity of seawater and riverwater reproduces resultant gravitational pressure that stirs the blackish water to cause boats to capsize, killing fishermen or islanders.[1]

Widespread coastal erosion, which is the combined result of the ocean circulation and Volta river storm flooding, destabilises coastal biosphere with significant impacts on communities connected to the VRE and the adjoining Songor and Keta Lagoon Complex Ramsar Sites (Figures 4, 5, 6 and 8). In 2017, about 80 homes and 300 residents were harshly affected by ocean-related disasters (Appeaning, 2021). Previous studies confirmed an increased frequency of floods in the estuary and then estimated the degree of coastal erosion linked to flooding at 2 metres per year (Appeaning et al., 2020; NASA, 2020). During this study, it was visibly observed that climate-induced sea-level rises caused irreversible coastal erosions and slight mudslides at Azizanya and Fuveme (Figure 5), which is consistent with the latest scientific findings of the Intergovernmental Panel on Climate Change (IPCC) (2023). The caveat from IPCC's scientists is that sea-level rises will continue even beyond the year 2100 (IPCC, 2018).

1 The public media outlets frequently published boat disasters and human deaths linked to the bad weather events in the Red Oval Belt in the region, Ghana News Agency (https://gna.org.gh/2023/03/canoe-accident-on-volta-river-claims-six-lives/) and also reported by the Daily Graphic (www.graphic.com.gh/news/general-news/ada-boat-disaster.html). This week the Ghanaian Times reported that two fishermen died at Ada East and that only their decomposed bodies were found (www.ghanaiantimes.com.gh/2-die-in-ada-canoe-accident/).

At the moment, the eroding estuary boundary attributed to the sea is causing localised oyster extinction and/or oyster deaths in coastal communities like Agorta (Doe, 2021; Doe, 2022). Scientific studies elsewhere reiterated that the "imbalance of both biotic and abiotic parameters such as species density, seawater, feed, sea heat, rainfall and wind are responsible for oyster growth, survival or mortality" (Fleury et al., 2020; Rybovich et al., 2016). Apart from oysters, some sea turtle and whale skeletons were found on Fuveme's sandbars during this study, confirming tipping point evidence of a rising biodiversity loss (Figure 7).

The recurring adverse ocean, weather and monsoon events are having major physical and social impacts in the VRE, affecting human settlements, food system security, hydromobility,[2] subsistence livelihoods and biodiversity assets like coconut groves (Figures 4 and 8). Climate extremes are rewriting heritage stories of the VRE, altering its geographical images and shifting socio-ecological data to influence day-to-day decisions and actions taken by islanders.

More significantly, four Indigenous villages namely Wutikordzi, Zodanukordzi, Dzaflagbey and Anlokordzi/Atorkordzi have been totally lost from the Fuveme Island due to heated ocean effects. The fifth community, Agorkedzi, is presently being battered by repeated tidal waves (Figures 4, 5 and 6). In turn, the rich Indigenous knowledge, values, bioculture and ecological heritage associated with the damaged villages have been permanently shifted or lost. The intergenerational capital in the form of social networks, friendships and marriages are alienated due to lost income sources and sleeping places to tides or floods. "The deadly tidal waves forced many people living here, including myself to relocate from Fuveme/Agorkedzi. Now, I live at Atiteti, which is a nearby community where I currently teach", remarked Godwin Atatsi.

Figures 4, 5 and 6. Households destroyed (4), buried in sea sands above window level (5) and abandoned by occupants (6) after tidal waves at Agorkedzi. Credit: Sylvanus S.P. Doe

On the coastal fringes, running seawater moves 'sandbars', microplastics and seaweeds downstream while the storm flooding, usually reactivated by the West African Monsoon, tends to carry different riverweeds (for example, water lily, water hyacinth, water lettuce) from the opposite direction, making it difficult for fishing boats or canoes to freely navigate on the rivers and lagoons. Microplastics are littering seascapes or surroundings to pose complex setbacks for greener domestic ecotourism, water quality, soil health and biodiversity. This instigates the idea of Ramsar site reclassification or remediation. Generally, the displaced riverweeds end up becoming invasive species in distant wilderness, sometimes up to 50km away.
The riverweeds at times impede artisanal fishing practices and therein endanger local fish-smoking or processing, which is the commonest employment activity of many vulnerable women who depend on it to survive climate shocks. Furthermore, the flood forcefully flows until the river waters turn muddy, preventing people who are fishing from clearly seeing during diving. The divers will normally choose not to go fishing in muddy rivers. In addition to oysters, fish catch is by and large reduced, leading to ecojob losses.

2 Hydromobility — means the practice of using boat (manual or engine-powered) to navigate the rivers from one community to the other with the purpose of transporting people, items or searching for oysters to pick or to simply escape chaotic climate conditions. Hydro-mobile activities like 'migration' also happen among aquatic and non-aquatic species such as oysters in the VRE. Shifting of sandbars by tidal waves tends to block movements of boats in certain locations of the river in the VRE, for example, between Muvetorkor and Kporkporkordzi (on Fuveme Island). Thus, the impact of climate on hydromobility affects livelihood, fishing and rural business activities.

Figure 7. A dead Sea Turtle washed off the seashore at Kporkporkordzi near Fuveme. Credit: Sylvanus S.P. Doe

Figure 8. Cocos nucifera, Borassus sp and Phoenix dactylifera trees are dead or dying alongside medicinal herbs at an alarming rate, with negative ramifications for human-environment security, health, resilience and livelihoods at Fuveme. Credit: Sylvanus S.P. Doe

Figure 9. The status of a rural household after a storm flooding disaster at Amedorme. Credit: Sylvanus S.P. Doe

One of the biggest tidal waves that hit the estuary in November 2021 exposed over 4,000 people to polycrises of shelter deficit, hunger, poverty and mosquito bites among the Indigenous Anlo, Ada and Agave tribes within the VRE (Figures 9 and 10). People had no place to sleep at night. The tidal events have impacted coastlands, larger ecosystems and human society. Drawing attention to the ever-deepening gravity of tidal situations plaguing the people of Fuveme and, for that matter, extreme climate changes in the entire estuary, Kwadzo Kwaduadze passionately warned us that "if policy action is not taken to immediately halt ocean aggressions, the sea will engulf over 200 communities along the Atlantic coast to reach as far as Dabala. The consequences will be very catastrophic, especially for the poor."[3] His view was strongly re-echoed by Gladys Ameley De-Tada, who runs a mini-rest spot for visitors at Havui and on the beach at Fuveme.[4]

Figure 10. An abandoned cottage distillery, there were broken pots, a concrete tank and 20 bags of damaged cement after storm flooding at Amedorme. Credit: Sylvanus S.P. Doe

Figure 11. A footpath and an artisanal bridge, linking Havui and Adidokpo, with mangrove forests on each side. Also at the sides are coconut stems placed to reduce the erosion of sand from the footpath. Credit: Sylvanus S.P. Doe

Figure 12. A rural household during flooding at Havui. Credit: Sylvanus S.P. Doe

The combined effects of the West African monsoon and river overflows have destroyed livestock, foodstuffs, tree crops and biodiversity assets. Thousands of coconut trees are dead/dried, uprooted or dying at Havui, Azizanya and Fuveme (Figures 2, 6 and 8). For aged farmers not receiving state-sponsored climate insurance or pension benefits, such a loss is harmful to their survival, self-reliance, security and dignity.

3 Dabala is a vibrant rural trading community in the South Tongu District and is about 27km from Fuveme Island.

4 Havui is about a ten-minute boat ride from Fuveme. It is located on the northern part of the island.

Ecosystem destructions, human society, eco-conflicts and compounding inequalities

Human society is a major driver of the destructions of the coastal Earth systems fuelling the NELDs. Nearly 80% of the rural population in the lower river basin depends on natural ecosystem resources through smallholder food cropping, mat weaving, charcoal production, livestock rearing and fishing, along with the gathering of biomaterials from the coastal forests, lagoons and grasslands for various uses such as fuelwood, fodder, fruit, herbs and food (Figure 15). All these landscape level livelihoods and income-generating activities depend on or tightly connect to the Earth's climate stability. The crucial issue is that when climate heating or unpredictable patterns of dry weather occur in locations like Gamenu, the supply of certain biomaterials and the productivity of ecosystem services tend to greatly diminish, which in turn increases social inequalities and poverty.

In oyster ecosystems, oysters feed on decayed micro-debris in the form of algae derived from the by-products of phytospecies,[5] for example, the wool dispersed by *Ceiba pentandra*. Nowadays, climate impacts on river landscapes have drastically reduced the *Ceiba pentandra* population, thereby putting the diet of oysters in danger. The scarce diet affects oyster nutrition to the extent that oysters may grow very big — up to 12cm in size — but may end up having very little raw meat. This lowers market value of oyster products, decreasing the income of the oyster farmers and confidence in oyster trading among locals.

Climate change has depopulated oysters in certain estuarine communities, compelling divers to migrate to other communities in search of bigger or mature oysters to pick. In the process, interrelationships are bruised and traditional codes violated. Also, mistrust regarding safety of seeded 'oyster beds' emerges among migrant divers and their hosts. This makes migrant divers prone to hostile actions of their counterparts in the receiving oyster-producing communities. For example, the nomadic tendencies of the divers have sparked fierce eco-conflicts and tribal tensions in Sogakope and Big Ada, causing insecurity at both individual and community levels.

Moreover, limited oyster availability and increased competition for diving spaces has motivated collection of immature oysters and other fish. A new practice of spawning 'seed oysters' for the purpose of harvesting during the next fishing seasons has begun. The spawning causes unhealthy rivalry for diving spaces, leading to conflicting interests and struggles to own oyster beds under the Volta River.

From an ecological angle, oysters are important biospecies in ensuring resilient and healthier aquatic ecosystems and the food-web and, as such, any climate impact on them is felt further along the chain. For example, as the oyster population declines (Doe, 2021), Nile Tilapia (*Oreochromis niloticus*) find it difficult to feed because oyster eyes and meat are part of their diet. Once acidic seawater damages river ecosystems, it impacts oysters as a source of nourishment for aquatic bio-subsystems. This constrains the achievement of some of the global goals, specifically SDG13, SDG14 and SDG15. The spillage of seawater negatively distorts coastal ecosystem health and biodiversity services necessary for rebuilding social cohesion and resilience. The current state of the coastal ecosystems at VRE is not sustainable.

Growing climate risks have immensely damaged the relationships between the natural coasts and human society as exemplified at Korgbor Shrine situated near Big Ada. The phytospecies at the shrine has almost disappeared. The sacred trees presently at the shrine are countable in tens. According to a reliable storyline by an oyster diver who retired from diving after 35 years, a giant crocodile measuring more than 4.5m used to crawl to the hitherto popular shrine, carrying a pot of ancient herbs on its head to signal the commencement of an oyster harvesting season. But, due to climate disturbances compounded by human residential activities this natural creature has not visited for some time. Thus, climate impacts altered the biocultural relations and social characteristics of the VRE, with incidences of fading eco-cultural

5 The term 'phytospecies' refers to species related to flora or vegetation.

heritage that encourages people to convert the shrine's peripheral lands into dwelling homes. Appeaning (2021) found the UNESCO World Heritage Sites like Fort Kongensten, which was built by the Danish in 1783 at Ada, completely eroded, robbing the central government and local people of its cultural heritage significance.

The Fuveme Star of the Sea R.C. Basic School (FSSRC Basic School), located less than 120m from the Atlantic Ocean, has become unsafe for holding classes. This is due to increased sea-level rises accompanied by tidal waves that are continually bombarding the only school in the community (Figures 17 and 18). The insecure schooling situation is depriving over 160 children of their rights to basic education.

According to community members of Fuveme, including the Headmaster of the FSSRC Basic School, Mr Saviour Gokah, the school was previously built at one of the four Indigenous communities that were destroyed by the sea. To avoid coastal erosion and to safeguard school children, the school's physical infrastructure was relocated twice. Currently, as the sea-level rise worsens tidal waves and erosion of the school's lands with each passing day, the choices for both students and teachers reduce. The Headmaster of the FSSRC Basic School in addition to some citizens subsequently suggested urgent relocation of the school from the existing risky premises to a new area that is safer and conducive for quality education (SDG4).

The dynamics of vulnerability to climate extremes

The majority of the local population that suffered from the 2021 tidal waves in the estuary are yet to fully recover from the severe social cost of the NELD. The plight of women, especially those in their old age, is particularly hard and dehumanising. Many are now homeless, jobless or have taken residence in congested family homes or temporal structures. Some are landless too. This has created pathetic social hardships and adversely affected their emotional, spiritual and mental health. With no strength and clear idea of how to revive their lives and reconstruct the damaged homes, they feel rejected, dispossessed, anxious and helpless.

As previously indicated, when increased seawater enters the river, it terminates the life cycle of a huge proportion of immature oysters nearer to Azizanya. This consequently limits oyster picking by men and hence curtails supply of fresh oysters to women involved in the processing for markets. Oyster-processing is a form of full-time work for less educated women who are not employed in the formal or organised informal sectors of the local economy. As a result, climate-induced decline in the oyster population causes livelihood loss and joblessness to compound already entrenched poverty and vulnerability conditions among divers, women who process oysters, and girls who retail processed oysters. Also, the rivalry arising out of spawning seed oysters as stated earlier has dislodged women[6] divers from diving spaces, leading to depression, child malnutrition and irregular incomes.

Women are heavily paying for the price of ecojob losses attributable to climate disasters and hazards. One of the women at Big Ada frankly said, "I have no job and no formal education. Without the oysters, I do not know what I would be doing today."[7] Hundreds of girls also rely on selling oyster products at roadsides. Those from deprived households are dropping out of basic schools as families battle to meet expenses due to reduce oyster catch (Doe 2021; Doe, 2022).

The tidal waves are often unpredictable and getting more frequent and intense. They may strike anytime of the day. This makes it difficult for divers, farmers and fishermen, including women traders to predict and

6 It is important to note that in the 1970s almost 100% of picking oysters was done by women who did not use manual or motorized boats to navigate the rivers. They just walk into the nearby riversides to pick oysters with their hands for domestic consumption. At the time, men focused on catching other fish species. Nowadays, oyster harvesting is completely taken from the hands of women.

7 Per communication by Mary Apeyesi (Doe, 2021).

strategically plan their movements and activities. Fuveme residents are riskily living in fear with no evidence of when the recurrent sea surges will cease. The schoolchildren and teachers of the only basic school in the community, in particular, are vulnerable to regular displacement from tidal invasions or flooding. The ill-protected schooling conditions are compounded by the fact that roads leading to some schools are not motorable (Figure 11). Next, not every family owns a boat. A lack of safe boat or good road has exacerbated child absenteeism in schools during rainy days (Doe, 2023), which in the long run has led to severely impacted schools like the FSSRC Basic School being temporarily closed.

The closure of such basic schools exposes adolescent girls to social risks, unplanned migration to cities and, in some cases, sexual activity leading to teenage pregnancy. The menace of child labour resurfaces. To date, over 1,500 dropout girls, divers and vulnerable women have lost access to arable lands, biomaterials drying grounds, reeds and fish-smoking activities due to storm flooding, bushfires and soil salinity, thereby aggravating social exclusion, hunger/food insecurity, unemployment and extreme poverty issues that do not favour or advance the SDGs but rather complicate vulnerability to NELDs. The seasonal calendar for food cropping and fishing changes as the climate changes, affecting agricultural and pastoral choices in the estuary. For example, as soon as the rainy season ends, extremely dry land conditions set in to discourage local youth from engaging in agrobiodiversity production (Figure 21). Those who try to cultivate depleted soils under extreme weather to grow consumable foods tend to harvest low yields from their fields. This is deepening food shortage in poorer families, stimulating wood-cutting for charcoal production and consequently causing deforestation.

In addition to food security, the recurrent coastal flooding also disrupts supply of safe and clean water at the household level as nearby freshwater lagoons get contaminated. While some communities have access to potable water provided by the central government, there is a lack of drinking water in Havui, Adidokpo and Fuveme, forcing women/residents to spend an extra three hours fetching 'pure' water.

Besides that, a bigger rural market for trading green commodities and exchange of biocultural products like bushmeat, oysters, crafts, baskets and services is not readily available at Fuveme, Havui or Akalove unless a person travels 25-30km to Dabala, Sogakope or Ada. But during the floods, access to long distant markets is severed. Petty traders may not travel to markets on consecutive days, resulting in inability to repay microloans and so plunging into debt. In fact, during the fieldwork for this case study, it was impossible to reach Havui on a second visit due to a flooded footpath. The flooding issue is even worse for people with complicated health problems as they end up being unable to timely access hospitals or clinics. Along with this, the situation for pregnant women becomes terribly precarious.

On Fuveme Island, large areas of shrubs and cover grasses beneath the coconut groves, which are supposed to serve as natural barriers against minor erosions and floods, have been removed through anthropogenic activities. The vegetative cover loss makes it easier for tidal waves, floods or torrential rainfalls to wash away the top-soil. Repeated surface weathering, mudslide or soil erosion reduces the island's topographical height below normal sea level (Figure 2). Thus, the flat land surface created by human walkways, constructions and wood-cutting makes the island more susceptible to ocean effects, which are frequently being felt by the islanders. Although human activities could improve socio-economic development, they helped to compound NELD on estuarine environments (Lawson et al., 2021).

Figure 13. Some residential buildings are eco-friendly and cost-effective but they cannot withstand climate extremes, necessitating a new eco-design for infrastructural development at Fuveme. Credit: Sylvanus S.P. Doe

Figure 14. A shrimp farming facility collapsed by flooding, leading to unemployment in Agorkedzi. Credit: Sylvanus S.P. Doe

Over 60% of residential buildings in Fuveme or Agorkedzi are eco-friendly, cost-effective and skilfully constructed (Figure 13). But the buildings are not climate defensive and, as such, prone to damage by minor rainfall, winds and sea tides. As the domestic refuse dump sites attached to the buildings are open and close to low-grounds, flood waters usually flow through them. The running floods then dissolve or carry different kinds of 'domestic' wastes into lagoons and streams, causing water/chemical pollution, sanitation and environmental health concerns. Flooding has also destroyed a shrimp farming facility at Agorkedzi (Figure 14), reportedly funded by an investor from Vietnam (Brinks, 2017).

Coping and adapting to NELD crises

The local people have formulated various interventions to either cope with or adapt to different climate impacts. As specified earlier, for example, to cope with extinction of oysters, some divers have started migrating to nearby oyster-producing communities to gain access to bigger oysters. There is another group of divers who do not migrate but use motorised boats that enable them to navigate the rivers to harvest oysters and then return home on the same day.

Another mechanism being adopted to lessen climate shocks on oyster ecosystems is the establishment of a community-imposed norm of 'closed season'. During the closed season, picking of oysters is banned from the months of November to February each year. Along with these strategies, few women-headed households are raising a limited quantity of domestic poultry, ducks (Figure 16) and small ruminants (for example, sheep and goats) on free range, to cushion food and financial adversities inflicted by both the 'closed season' directives and the real climate crisis.

Additionally, local people have diversified landscape-level sources of livelihoods, incomes and foods. For example, they cultivate riverbanks to grow maize, vegetables, cassava, onion, sugarcane and groundnut using mixed farming principles. While fewer farmers at Adidokpo still organically enrich croplands, the practice of using unregulated agrochemicals has become rampant in other coastal communities. The overutilisation of non-recommended agrochemicals on farms may speed degradation of coastlands and soils, and ultimately, deepen the NELDs. This means that some of the diversified coping mechanisms are not entirely effective or eco-friendly to support thriving ecosystems for human health and sustainability. For example, contrary to the Indigenous smallholder cropping that has negligible land-use distortions, the intensification of land clearing for commercial monoculture of rice resurfaced at Fievie/Sogakope and Larve/Kpenu. Brinks (2017) identified cutting of mangrove forests to pave way for a commercial shrimp farm at Agorkedzi as a threat to the future of the Ramsar site's biodiversity. Protected or cultivated mangrove plots are starting to emerge at Sota community.

Other considerations in relation to coping mechanisms include:

- The individuals or 'royal' families that inherited mangrove forests normally lease or cut the trees and tie them into bundles for sale as firewood
- Some elderly men and women are involved in weaving mat, rope and basket using biomaterials gathered from the coastal ecosystems (Figure 15)
- Only few families can purchase 'polytank' to store water for drinking and domestic uses when climate disaster strikes. Others who own boats navigate the rivers to safer points to fetch 'pure' water

- To cope with lack of shelter caused by tidal surges, some residents are using about 90% of local biomaterials to reconstruct damaged homes. The reconstructed buildings (Figure 13) are very eco-friendly but not climate resilient due to reduced availability of stronger, taller and adaptive biomaterials like the *Borassus* sp and *Phoenix dactylifera* (Figure 8).

Figure 15. Finished rope made from the leaves of Phoenix dactylifera is kept in a wooden basket at Amedorme. Credit: Sylvanus S.P. Doe

Figure 16. Some families in Agorkedzi keep ducks in a free-range system as a coping measure. Credit: Sylvanus S.P. Doe

Tipping interventions, policies and NELD futures

Achieving sustainability, carbon-neutrality and a greener future in (non-)coastal regions depends on localising social tipping interventions (STIs) to realise the SDGs and the Paris Agreement (IPCC, 2023; IPPC, 2018; Otto et al., 2020; Independent Group of Scientists appointed by the Secretary-General, 2023). In the deprived coasts of the VRE, adequate support is urgently needed in terms of gender-responsive technology, policy and finance for minimising NELD impacts to advance the SDGs, including safeguarding biodiversity and enhanced human-environments.

In Fuveme, sea-level rises are intensely worsening life crises. Living conditions are deteriorating every day for vulnerable citizens due to ocean heating and its multiplier effects of tidal waves that are hindering the smooth modes of schooling, fishing, farming, health and trading. Greener support for socio-technological transformations and nature-based solutions (NbS) informed by eco-entrepreneurial model, green-blue ethics and estuary science is required to charter a short to long-term roadmap for redressing the NELD issues for moving towards sustainable futures (Doe, 2022; Doe, 2023). A new eco-entrepreneurial mindset will be needed to manage multi-dimensional approaches that bridge a wide gap between technology, finance and Earth system governance. These should also allow for tackling complex transitional inequalities linked to gender, poverty and education, scientifically recognising that NELD issues in the VRE are nonlinear and systemic. In Fuveme and other coastal settlements, Indigenous knowledge exists about green infrastructure, different ecosystems and eco-wise housing. This means that, in the short term, a greener support is needed to mobilise and effectively integrate Indigenous and scientific tools for biodiversity conservation to restore depleted mangrove forests, capacity building in NELD actions and increasing women's access to microclimate insurance rather than microfinance.

Co-creating a national NbS policy that promotes locally-led adaptation, nature-based residential buildings, renewables and collaborative reforestation of coastal mangrove forests could combat flooding effects, remediate eroded coastlands and improve opportunities for sustainable local livelihoods (Doe, 2023). Critical drivers of the NELD, like sea-level rises in the VRE, are global in character. As such, a new transnational research to scientifically re-examine NELD indicators and attributions to understand actual levels, needs and options for climate finance and partnerships for sustainably managing different kinds of ecosystems should be supported. A multi-stakeholder dialogue and cooperation should take various

dimensions regarding mitigation, adaptation and resilience building into account (IPCC, 2023), because large-scale NELD impacts caused by the sea are beyond individuals' capacities. Table 1 summarises five key STIs that demand short to long-term supports for delivering high impact to eliminate NELDs.

Table 1. Socio-ecological tipping elements and interventions

Tipping elements	Tipping interventions
Sustainable finance	▪ Investing in low-carbon emission boats and safe hydromobility services ▪ Investing in efficient product certifying, processing and packaging ▪ Investing in climate action, NELD/SDG education, microinsurance and infrastructure.
Partnership	▪ Promoting transnational cooperation and NELD/SDG partnerships ▪ Co-researching innovation to inform interdisciplinary climate solutions ▪ Advanced skills training in ecological, estuary and sustainability sciences.
Ecological policy and technology	▪ Deploying renewable energy to decarbonise land-use systems and oyster economy ▪ Digitalising, greening and professionalising the oyster/fishing value chain ▪ Facilitating gender breakthroughs in accessing diving and fishing spaces.
Entrepreneurship and eco-innovation	▪ Promoting participatory socio-ecological monitoring of climate change events ▪ Creating an oyster reserve as an alternative to the closed season ▪ Enhancing product efficiency, circularity and sustainability.
Traditional ecological knowledge and leadership	▪ Facilitating the networking of divers, women and young people for learning and exercising Earth system stewardship ▪ Decentralising climate information and awareness raising through local/village authorities ▪ Streamlining village civil societies and Indigenous women's groups to localise NELD/SDGs.

Credit: modified from Doe, 2021

Key lessons for future dialogue and research engagements

Increased NELDs are differently felt by households, individuals and communities in the VRE. The main driver of the real NELD impacts is the Atlantic Ocean circulation, attributable to global warming (IPCC, 2023; IPCC, 2018; Doe, 2021). This means the NELDs in the VRE should not only be conceived as a local problem but also as a global and subregional issue. Some lessons to organically inform collective rethinking of policies, solutions and future research are summarised below and should be considered in line with the actions listed in Table 1:

- The **development of inclusive policies and regulations** is needed to stop discriminative attitudes toward women divers and to **rebuild sustainable ecopeace** (SDG16) in the VRE. Adequately empowering Indigenous young people and women to access digital eco-business skills, renewable energy, and low-carbon livelihoods will enable them to regain power, voice and financial capacity to actively participate in local climate governance, mangrove restoration and sustainable management of diverse ecosystems, for example wetlands, drylands, coral reefs and so on.
- Fuveme is one of the most vulnerable island communities experiencing dangerous climate crisis that must be amplified to reach the attention of policymakers, scientists and donors. **Here, the NELD impacts on children under 13 years old should be remedied as a priority.** Children from poorer families are at high-risk because their parents cannot afford to quickly resettle when climate disaster

suddenly occurs. As such, working with the local government, NGOs and Indigenous authorities, parents should be mentored and financially empowered to **consider the long-term options of resettling from risky parts of the island.**

- **Relocating or greenly upgrading facilities at the FSSRC Basic School is recommended.** The damaging impacts of sea rises every day do not favour learning. Co-creating a learning and teaching environment that is greener, resilient and sustainable for over 160 students and their teachers should have the utmost focus. A success story like this could offer exemplary international lessons for basic schools trapped in a similar climate emergency in the (non-)Commonwealth Small Island Developing States.
- **Healthy partnerships** (SDG17) should be nurtured to mobilise business-science-policy actors to imbed NELD mechanisms and technologies that 'leave no one behind'. For example, strategies could be planned for **designing and embedding indigenous NbS into coastal resource management, regulation and environmental planning** to help return the degraded coasts to virgin-like mangrove forests.
- The VRE is a high-risk zone of complex NELDs. Yet there are also abundant opportunities for scientific research, biodiversity, ecotourism and greener revenue creation for empowering coastal communities to prepare and respond better to climate change events and NELDs.
- **Innovative green technology could help turn some of the climate impacts into opportunities for the countryside population to minimise NELDs for prosperity, security and sustainability.** For example, **recycling riverweeds into biocompost could boost sustainable food production locally while helping keep waterways uncluttered for improved fishing activities and hydromobility.**
- Finally, **a similar study should ideally take place in the future** around November to March to understand how the systems of NELDs interact with each of the 17 SDGs in local contexts.

Figure 17. A classroom in the FSSRC Basic School. Credit: Sylvanus S.P. Doe

Figure 18. Seaweeds are gathered daily from the premises of the FSSRC Basic School. Credit: Sylvanus S.P. Doe

Figures 19 and 20. The river boundary margins (zero to 120m), which are covered by mangrove forests (19), bamboo forests (20) or Sporobolus pyramidalis, usually serve as nature-based protections to reduce the negative effects of surface erosion and flooding. Credit: Sylvanus S.P. Doe

Figure 21. Abnormally dried mangrove rangelands depicting weather extremes near Gamenu. Credit: Sylvanus S.P. Doe

Synopsis

- **Recurrent sea-level rises** triggered by randomly large-scale circulation of the Atlantic Ocean at an abrupt speed release or intense sea heat, burning the phytospecies closest to the shorelines, or highly acidic seawater ('saltwater'), contaminating top-soil and disrupting hydroregimes and biosystems in the estuary.
- **Irreversible coastal erosion** in the delta caused by repeated tidal waves or storm floods is alarmingly expanding above 2.2 m/yr to deplete coconut groves, mangroves and other coastal biodiversity assets, including Ramsar sites, thereby putting human lives and settlements at high risk.
- **Localised oyster extinction** and a frightening rate of oyster deaths/mortality is sparking eco-conflicts and ethnic tensions among divers competing for limited diving spaces.
- **Uncontrollable storm flooding** submerges livestock, tree/food/arable crops and biodiversity assets to increase the vulnerability of deprived rural households to polycrises of acute poverty, hunger and unemployment.
- **Atlantic Ocean effect is causing fast-spreading climate-induced NELDs** in the VRE, especially causing human displacements at Fuveme and Azizanya. The FSSRC Basic School is a deprived school in a climate emergency that deserves urgent greening, public educational policy attention and actionable philanthropic interventions.

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Loss of ecosystems and biodiversity

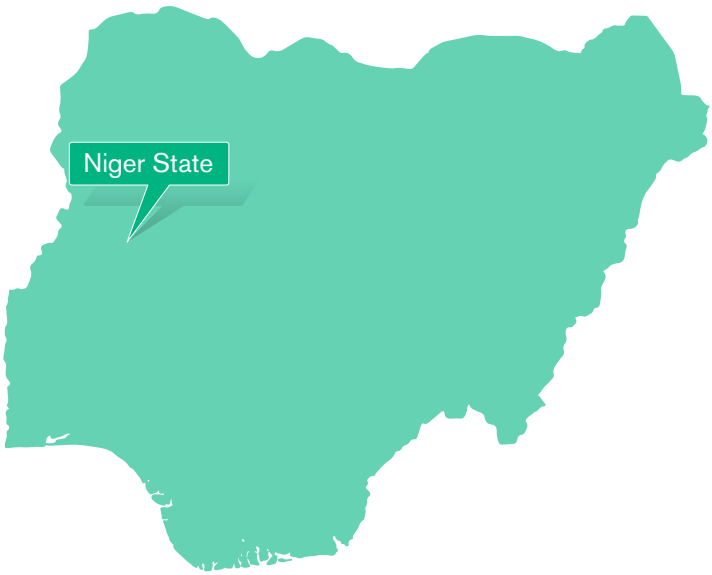
Secondary categories: loss of quality of life (shelter, food, health, skills, education); social disruption (migration and displacement)

A glimpse of climate change: Azhi Garam's struggle for biodiversity

VIDEO CONTENT

This case study is presented as a short video, accessible via the QR code below or www.youtube.com/watch?v=WRVFNKmxUP4&ab_channel=IIED (running time: 6 mins 21 secs).

Abdullateef Mobolaji, Michael Ogar, Habiba Alih and Mujidah Ajibola



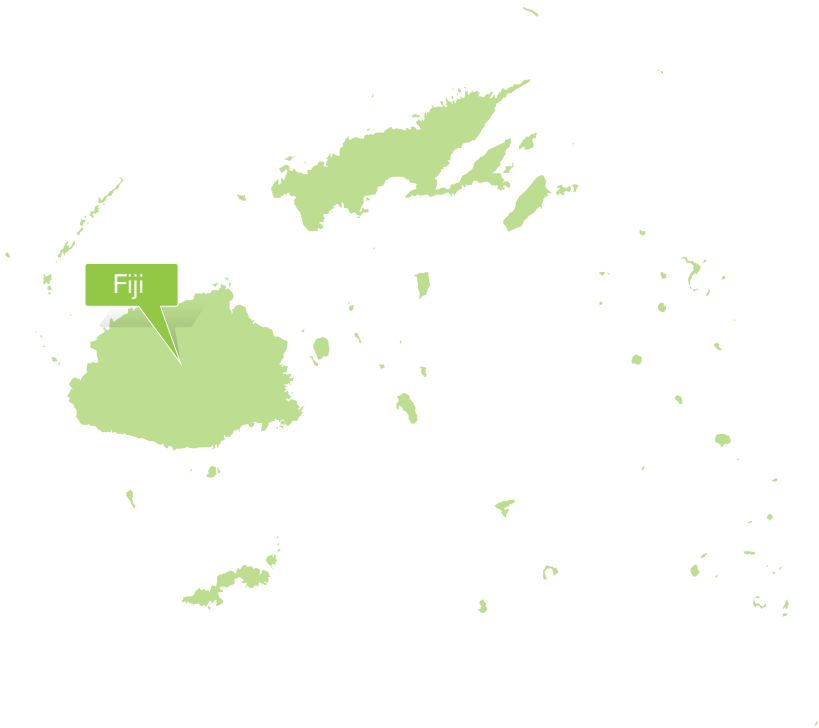
Location	Azhi Garam community, Niger State, Nigeria
Climate hazards	Rising temperatures; less and more uneven rainfall; desertification
Non-economic loss and damage	Loss of traditional remedies; malnourishment (especially women and children); limited access to adaptation info or resources (as a low-income Indigenous community)
Coping measures	Reliance on chemical fertilisers

Loss of cultural heritage

Secondary category: mental and physical health impacts

Lost to the waves: climate impacts on sacred places in three coastal communities in Fiji

Merewalesi Yee and Karen E McNamara, School of the Environment, The University of Queensland, Brisbane, Australia



Location	Togoru settlement (Viti Levu), Sese village (Vanua Levu) and Vunisavisavi village (Vanua Levu), Fiji Islands
Climate hazards	Sea-level rise; coastal inundation
Non-economic loss and damage	Burial grounds and foundation stones destroyed or damaged; impact on people's ability to maintain traditions, spirituality, family connections, sense of place, wellbeing and identity
Coping measures	Relocating burial sites

Context

Climate-driven loss and damage is a reality in the Pacific Islands. Communities throughout the region have experienced — and will continue to experience — loss and damage to the following: health and wellbeing, current and future ways of being, cultural sites and sacred places, Indigenous knowledge, life sustaining tools, biodiversity and ecosystem services, and the connection to land and sea (McNamara et al., 2021). There is extensive evidence of climate change impacts across the region due to escalating temperatures, sea-level rise, increasing intensity of storms and cyclones, ocean acidification, changes in rainfall patterns, and changes in inter-annual climate variability (Barnett and Campbell, 2010; Portner et al., 2022). All emission projections show that climate change impacts will increase over the next century (Ibid., 2022). Studies on the impacts of climate change on biophysical and economic systems in the region have been extensive. However, there has been less focus on how communities experience impacts in their everyday lives and how they respond through adaptation, including the use of traditional knowledge (Granderson, 2017).

This study has therefore been guided by the following research question: What are people's everyday experiences of climate change impacts, including non-economic loss and damage, and how can we respond? We focus on Fiji, which comprises over 300 islands in the Pacific Ocean, of which 90 are inhabited (Korovulavula et al., 2020). Sea level is likely to rise in Fiji over the next few decades, leading to the possible relocation of hundreds of rural/peripheral coastal settlements to less-vulnerable (upslope/inland) locations before the end of this century (Janif et al., 2016). Fijian communities also face other impacts such as groundwater salinisation, flooding, vector-borne diseases, exacerbated water scarcity, depletion of fisheries and increased severity of tropical cyclones (Gibson et al., 2022; Igbal et al., 2022).

Figure 1. Map of three study sites, all located in Fiji. Credit: Chandra Jayasuriya

We conducted this study in 2023 in three coastal communities: Togoru settlement, Sese village and Vunisavisavi village (left). Togoru is situated on the floodplain of the Navua river on the southern coast of Viti Levu, the largest island in Fiji. It is a low-lying non-Indigenous (non-iTaukei) coastal settlement, inhabited for over 200 years. The village of Sese is situated in Vanua Levu Island, in the Cakaudrove Province's district of Saqani, on the western shore of Natewa Bay, the largest bay in Fiji. Vunisavisavi village is positioned only a few metres from the ocean on the south-east coast of Vanua Levu, in the same province as Sese village. With the encroachment of seawater into the village boundaries, there is little to no vegetation or trees growing in this once rich ecosystem.

Impacts

Across the three study sites, notable stressors included sea-level rise, tidal inundation, coastal erosion and saltwater intrusion. In Togoru, locals were most exposed to the latter two stressors, along with flooding from high tide events becoming more frequent (see Figure 2). Impacts from these have included loss of the community burial ground, flooding of the settlement's access road, damage to property and homes, unfavourable soil for agriculture, contamination of the groundwater source, and altered fish stocks.

Figure 2. Saltwater intrusion and coastal erosion has led some Togoru locals to abandon their homes. Credit: Merewalesi Yee

Figures 3 and 4. Coastal erosion and encroaching seawater into the village have become commonplace in Sese village. Credit: Merewalesi Yee

In Sese, the impacts of climate change have been evident due to events and stressors such as frequent flooding events, coastal erosion and encroaching seawater into the village (Figures 3 and 4). The retreating shoreline has significantly reduced the size of the village, impacting on children's play spaces. Other impacts have included crop failure, devastation of mangrove forests and the loss of some medicinal plants and associated traditional knowledge.

In Vunisavisavi, the land displays clear signs of erosion, sea-level rise and coastal inundation (see Figure 5): "We have been experiencing issues of recurrent flooding for the last three decades, but recently flooding events have intensified in frequency" (Participant #1, Vunisavisavi village). Due to these impacts, it is difficult to cultivate crops, resulting in several houses being abandoned.

Figure 5. Rising sea levels and coastal inundation are prevalent in Vunisavisavi village. Credit: Merewalesi Yee

Compounding risks

Climate change impacts have compounded the existing hardships faced by these communities. For example, the access road to all three study sites gets flooded during king tides that come twice a month, affecting mobility. These can prevent children going to school, also impacting people who need medical care (for example, due to pregnancy or illness).

In Togoru, locals face challenges in earning an income from fishing, due to dwindling fish stocks and an inability to pay for fishing licences. They also experience a range of challenges, including poor access to transport, water and electricity. There is no bus service and locals are dependent on expensive taxis for their transportation. Locals previously used wells to access water. However, due to saltwater intrusion,

the water is no longer safe for human consumption. Locals instead rely on two 10,000 litre water tanks that they share collectively. The energy and water companies have declined to provide piped water and electricity to the settlement due to the sandy, unstable ground foundation. Along with this, a lack of electricity affects the everyday lives of locals. For example, children are falling behind at school (Yee et al., 2022). While the current government is aware of the plight of locals, financial assistance and developmental initiatives have been minimal.

In Sese, climate change weakens cultural practices and community life in various ways. Declining fish stocks have meant that locals purchase canned fish, while traditional cooking methods for fresh fish are no longer used. Therefore, the knowledge of local recipes is being forgotten and not passed on to the younger generation. This growing dependency on canned and processed food raises the risk of non-communicable diseases and affects the diet of the next generation. Reduced fish stocks mean more hours spent in the sea catching less fish. When fisherfolk return home after a long day, the cooking and cleaning still needs to be done. This can lead to clashes within the family unit. Locals' long hours of exposure to the sea makes their clothes wet, causing discomfort and, sometimes, illness.

In Vunisavisavi, the recurrent issue of flooding has been prevalent for the past 30 years and has recently intensified. This has led to some changes in traditional governance systems and decision making. The paramount chief has told community members that they must remain in the village. Despite this, younger couples have been building homes on higher ground, but within the customary land. Four families have been relocated due to their home being in the red zone, an area prone to sea-level rise. While the relocated families are now safer from the sea, they face other risks such as landslides and other challenges such as houses that are smaller, hotter and poorly designed. Growing crops for subsistence and sale at the market has also become difficult for locals due to saltwater intrusion. Locals have noted changes in fish stocks, which they attribute to warming ocean temperatures. Compared with the situation ten years ago, fishing now takes an entire day rather than a few hours.

Coping measures

Communities in all three study sites have used a diverse range of coping and adaptation measures to respond to climate change impacts (see Figures 6, 7 and 8).

Faced with adversity, families in Togoru share whatever limited resources they have, including foods such as vegetables and fruits. To control coastal erosion, locals have been using sandbags and creating a tyre wall along the foreshore. Although inexpensive, these structures are not durable and last only eight months or so. Locals have also established a new burial ground after the original site was submerged due to sea-level rise. However, the seawater continues to reach this new burial ground. Compounding the problem is the fact that locals in Togoru are not customary landowners (that is, non-Indigenous) and do not have suitable land where they can establish their new burial ground and/or relocate.

In Sese, several strategies for coping with climate risk were observed in our study. These included investing in strong social networks, such as encouraging women's groups to engage in diverse livelihood activities like mat weaving and coconut oil production. Another planned strategy was to pay for physical work to transport big stones for a sea wall, but this was not possible because the waves had continued to inundate the village. In addition, there were initiatives to plant mangroves, but these also proved futile due to the strong waves. Given that the ancestral burial ground was lost to the sea, our study found that locals established a new burial ground at the top of a hill. While a few families have exhumed and removed the remains of their loved ones and laid them to rest in the new burial ground, there are still a few graves at the old site, but these are at risk of being washed away.

In Vunisavisavi, adaptation responses have included creating sandbag walls, which have only served as a short-term solution as the bags have a limited lifespan. Saltwater intrusion has affected the local water source, but following assistance from the national government in January 2023, the community can now access clean water from a bore hole.

Figures 6, 7 and 8. Adaptation measures to respond to climate impacts across the three study sites. Credit: Merewalesi Yee

Intolerable losses

Burial grounds hold immense importance in Fiji, playing a crucial role in the cultural, social and spiritual fabric of communities (Vave et al., 2023). Typically, when someone in the community has died, comfort is offered to their family and friends with the thought that the deceased person has "gone on to a better place" (Participant #3, Togoru settlement). However, according to locals, this no longer provides solace to them as the burial grounds have been lost to the encroaching sea (see Figures 9, 10 and 11):

> Our loved ones who have passed away — when we bury them, we say "sili vakarua" ("bath twice") because one is the bath before they are put into the coffin, and they bath again after they are buried as the waves come in and enter the new burial site. This is just traumatising for us but what can we do — we need a new burial ground that needs to be purchased — what you see here is the only land left in Togoru — we move that side it's the ocean, that side mangroves, that side is private land.
>
> Participant #1, Togoru settlement

Figures 9, 10 and 11. The affected burial grounds in Togoru settlement and Sese village. Credit: Merewalesi Yee

Loss of burial grounds have triggered an array of other cascading impacts, including on people's mental and emotional wellbeing, cultural traditions, practices and heritage, and social and family cohesion. This has particularly been the case for people in Togoru and Sese, where the desecration or disturbance of ancestral resting places can cause grief, trauma and a sense of loss:

> One of our relatives dug up the bones of their father and took it to their land to bury him again. It was such a disturbing and heartbreaking process to watch. Even the dead are not at peace.
>
> Participant #12, Sese village

Grave sites and other artefacts provide insights into the lineage, histories and stories of past generations. They serve as repositories of cultural heritage and contribute to the preservation of Indigenous knowledge and oral traditions, so their loss is felt greatly:

> How will I explain to my grandchildren that this is the sacred burial site for our ancestors when they have been lost to the waves?
>
> Participant #7, Sese village

Burial grounds are also important, sacred places for communities to gather for communal reflection, remembrance and healing:

> Families and friends come together to pay respects, share stories and support one another during times of loss.
>
> Participant #3, Sese village

These gatherings contribute to community cohesion, resilience and social support networks. However, this important cultural practice is no longer possible:

> With the waves encroaching our burial site, we can't even have a proper remembrance gathering, as it won't be safe. We just stand from a distance and look out and see the graveyard underwater and just the tip of its headstone visible. [It] brings tears to my eyes.
>
> Participant #2, Togoru settlement

Vunisavisavi village is known to be the original residence of the first "Tui Cakau", the paramount chief of Cakaudrove province. Lalagavesi is the Fijian term referring to the foundation stones — 'yavu' — of the first Tui Cakau's chiefly residence. These foundation stones are extremely significant and sacred in Fijian culture, as they provide a connection to their first paramount chief. However, they have been devastated by coastal inundation (see Figures 12, 13 and 14):

> The term Lalagavesi is used in Fijian protocols in addressing the people from the province of Cakaudrove and its current paramount chief. If we lose the Lalagavesi [sacred place] to the waves, we also lose our identity and Fijian protocols.
>
> Participant #3, Vunisavisavi village

A loss of sense of place due to the destruction of the foundation stones was further noted:

> [It is] disconnecting us [from] perform[ing] our ancestral duty to look after this place where the first paramount chief of Cakaudrove province was installed, [had] lived and [was] buried.
>
> Participant #20, Vunisavisavi village

Figures 12, 13 and 14. Fragmentations of the Lalagavesi sacred site, due to tidal inundation in Vunisavisavi village.
Credit: Merewalesi Yee

Loss and damage to these important cultural sites has affected people's wellbeing, ancestral connections, cultural practices and community bonds. The presence of ancestors in burial grounds and sacred spaces fosters a sense of stewardship of place, belonging, identity and continuity within Fijian cultures.

Climate change not only directly alters the natural environment (through erosion and sea-level rise), it also changes an environment's meaning, identity and emotional connection (Reser et al., 2011; Raisele and Lagi, 2023). Burial grounds and foundation stones hold immense importance in Fiji and elsewhere in the Pacific. Preserving and respecting these sacred places is vital for maintaining cultural heritage, promoting wellbeing and upholding the cultural identity of Fijian communities.

Support needed in future

Burial grounds and foundation stones serve as a physical link between the past and present, connecting communities to their ancestors and chiefs. They provide a tangible representation of lineage, heritage and familial ties. Financial support and other resources are needed for communities to protect these sacred places.

This protection could be undertaken in two ways. The first would be to relocate the burial grounds. This is the case for Togoru, where coastal inundation has caused the "loss of graveyards as a result of the sea drowning our ancestors' resting places" (Participant #5, Togoru settlement). The community members we spoke to in this study made it very clear that the purchasing of land was necessary for the burial grounds of their ancestors to be relocated and therefore protected, allowing locals to bury their loved ones "properly, so they may rest in peace" (Participant #3, Togoru settlement). As part of this support, the community requested assistance of the Provincial Office and Fiji Correctional Service (who oversee burials in Fiji) to help identify an appropriate burial site and advise on the proper protocols for transferring bodies/bones to a new site. Additionally, culturally appropriate burial relocation procedures are urgently needed, in collaboration with the Ministry of iTaukei Affairs, along with assistance in identifying favourable locations for transferring burial sites to protect present and future generations' spiritual connection to their ancestors. If the currently available land is not conducive for burial grounds, then assistance is also required from the government to purchase land for a new site. As one local aptly remarked: "In this changing climate, we are not only relocating the living but also the dead" (Participant #3, Sese village).

Burial grounds provide solace and peace of mind, assuring families that their loved ones have been laid to rest in a place that is considered sacred and meaningful. Like those in Togoru, the locals of Sese village who we spoke to suggested engaging relevant technical experts to assist in transferring the burial sites to an alternative location and to ensure that remains are handled in a safe and respectful way.

The second method of protecting these sacred places would be through physical structures to ensure the integrity of the site. This was the emphasis for locals in Vunisavisavi in their aim to protect the foundation stones and burial grounds:

> Even though the waves are regularly flooding our sacred site (Lalagavesi) and ancestral burial grounds, we will not relocate, but protect and guard them. These two heritage sites are not only identities for us in the village but the entire province of Cakaudrove. That is how we honour and remember our past and present paramount chief and our people.
>
> Participant #2, Vunisavisavi village

Assistance is needed to preserve the sites, as the foundation stones cannot be relocated as per cultural protocol, even in the face of severe climate impacts. To do this, the locals of Vunisavisavi have suggested earthworks be carried out to protect the village, especially the foundation stones.

Lessons learned

While critically important to local communities, the loss of cultural heritage, such as sacred places, is not often a major narrative in global policy discourses on loss and damage. Through these three study sites, we have highlighted the experiences and concerns of local communities in Fiji due to the loss of their cultural heritage through sea-level rise and coastal inundation, and the cascading effects this has on their wellbeing, sense of place and identity. Participants identified two key approaches for addressing these losses: through relocation and on-site physical protection. Policymakers should take note of these locally identified solutions and integrate them into discussions on the newly established global fund on loss and damage, to ensure that ways of addressing non-economic loss and damage are included in the fund.

Synopsis

- In the three study sites in Fiji, burial grounds (Togoru settlement and Sese village in particular) and foundation stones (Vunisavisavi village) have been devastated by sea-level rise and coastal inundation: "the sea has drowned the graves of our forefathers" (Participant #2, Togoru settlement).
- These sacred places are critically important for people's wellbeing, the maintenance of cultural practices, families and traditions, and social cohesion, as they provide a connection to ancestors and their former chiefs.
- The losses to these sacred places have affected people's spirituality, sense of place and identity.
- Participants in all three study locations deem these cultural sites critically important, and consider it essential to protect them. One community is building a new burial site within the community boundary, but the seawater continues to reach it as there is limited land in the village that is not affected by sea-level rise.
- Future funding to address these losses is needed to protect these sacred places through either relocation or protection through physical structures, depending on the wishes of the local community.

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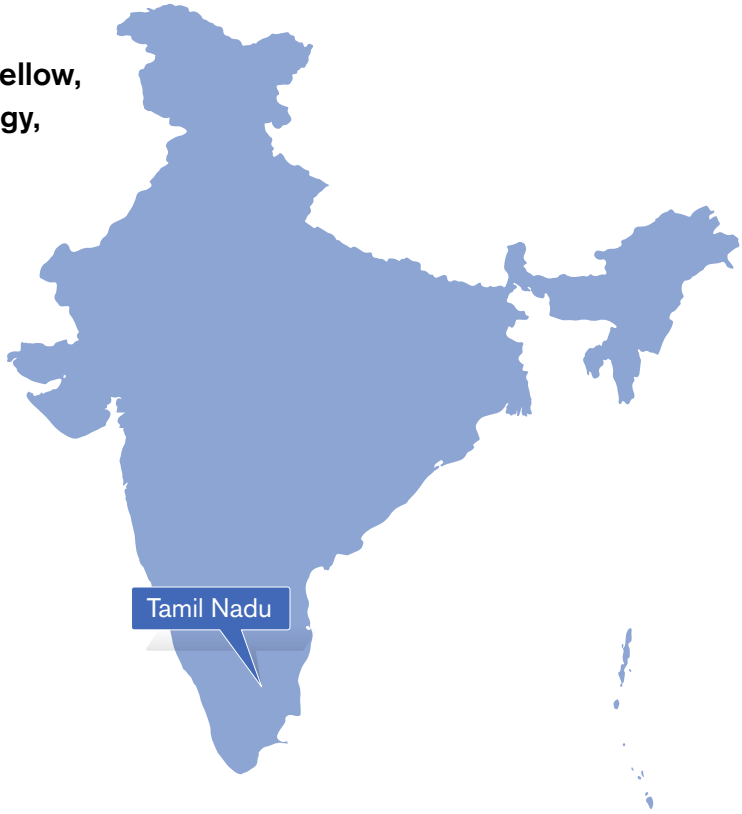
Social disruption (migration and displacement)

Climate migration's growing threat to marginalised people in Tamil Nadu, India

C. M. Pratheepa, Post Doctoral Research Fellow, and R. Rengalakhmi, Director, Ecotechnology, M S Swaminathan Reasearch Foundation (MSSRF), Chennai



Location	Tamil Nadu state, India
Climate hazards	Land degradation due to fast onset events (tsunami, cyclones) and slow onset events (increased soil and groundwater salinity)
Non-economic loss and damage	Declining food production and changing land use increasing migration of male workers; deeper gender divides and social inequality; increased vulnerability for women (gender-based violence and other), landless people and Dalit community; the 'feminisation' of farming, with women's work less valued and lower paid
Coping measures	Converting some land to aquaculture, leaving the land fallow or changing to high-value crops; leasing land from landed farmers; small income-generating activities

Context

Migration has been considered a climate risk management strategy in the form of adaptation, causing both economic and non-economic gains and losses. Given the importance of non-economic loss and damage (NELD), this case study explores the ground reality of climate migration and the incidence of NELD on individuals, society and the environment in the coastal agro-ecosystem of Tamil Nadu state, India.

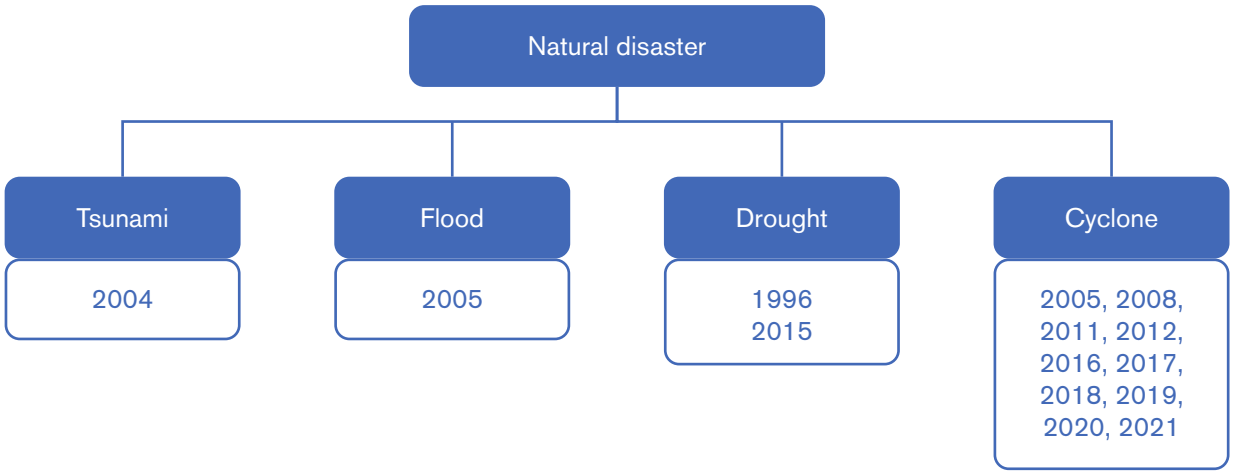
The study area is a coastal village in Sirkazhi block, which is in the Mayiladuthurai district in the state of Tamil Nadu in India. Both fishing and agriculture are the primary livelihoods of the local communities. Because it was once part of Kaveripattinam, popularly known as "Puhar" and the main port of the Chola dynasty (9th to 13th century), it is a region of archaeological significance. The village covers a l geographical area of 801 ha and has a population of 6,853 (Census of India, 2011). There are 416 agricultural labourers (who are landless and dependent on agricultural work) and 152 cultivators (of which more than 70% are smallholders). However, in the recent past, there has been a changing trend, with farming now becoming a seasonal and secondary occupation. This change has been driven by increasing climate risks coupled with anthropogenic factors. The village comprises seven hamlets; the study was carried out in only five, where farming remains an important means of livelihood, while the other two largely depend on fishing and aquaculture.

As the study area is located on the Coromandel coast (Figure 1), it is highly vulnerable to several natural hazards: cyclones, seasonal floods and droughts, sea surges, extreme events and tsunamis. These climatic hazards are rising in intensity and frequency, and the climate crisis is emerging as an important pull factor in development. Infrastructure, waterways, water bodies, wetlands, common lands and agriculture have regularly been exposed to extensive damage as a result of these catastrophes. In addition, it has been reported that sea-level rise is a critical climate risk that adversely impacts agroecosystems (Ramachandran et al., 2017 and Kankara, 2023). The exposure of farming systems to the above-mentioned climate risks and the associated reduction of environmental co-benefits, such as groundwater, vegetation, soil nutrient cycles and pest regulation, are deeply impacting livelihoods by aggravating the vulnerability of smallholders.

Figure 1. Location of the study area. Source: GIS lab, MSSRF

The Indian Ocean Tsunami devastated the area in 2004, mirroring the catastrophic waters that devoured the prestigious port city of 'Puhar' — as chronicled in ancient Sangam Tamil literature — and the study area was one of the worst-hit villages located next to Puhar. At the time of Tsunami, the extended stagnation of seawater and mud in the agriculture fields meant that both the water and soil became salinised. Even after more than 15 years of tsunamis, the Indian Ocean event's adverse impact on soil and water continues to deeply influence farming and has been more complex and challenging to farmers. These increasing exposures to climate risks result in a range of sensitivity factors: a reduction in the net sown area, changes in the cropping systems, declining soil health, and increasing soil and water salinisation. These conditions compound the vulnerability and reduce local communities' adaptive capacities.

Figure 2. The impact of natural disasters on agriculture in Sirkazhi villages during the 1992–2021 period. Source: Primary data, MSSRF



Impacts (social disruption and migration)

Climate change and other anthropogenic factors have combined to become the main driver of migration as an adaptation strategy for households, in their efforts to reduce vulnerabilities due to the fall in agricultural production. This has a gender dimension that, with other intersectional factors, mediates between social relations, socioeconomic changes and climate adaptation strategies. This has significant implications for gender roles, traditional gender norms, women's workloads and their health.

Since the 2004 Tsunami, the soil salinity level has been increasing. With an electrical conductivity of 3 to 4.98 millimhos/cm in soil, along with moderate runoff and slow infiltration, the soil has become unsuitable for the cultivation of food crops (Pratheepa et al., 2022). The increasing salinity after 2004 compelled some farmers to shift to shrimp farming; this transition was only possible for prosperous men farmers, due to being capital-intensive and requiring the support of external institutions for input and output markets. This led many small farmers to cultivate crops just once a year, without leaving land fallow. Foreseeing the increasing salinity, most of the smallholders from the Dalit or Scheduled Caste (SC[1]) community, along with some members of the Most Backward Class (MBC) community, sold their land to a private company. These changes in land ownership deepened their vulnerabilities, as SC households were compelled to work on the land they had sold to private companies without a land title (land number in their name), making them unable to get crop insurance in case of disaster. Approximately 35% of the decline in the cultivable land has been recorded from the 1991–2011 period, with a decline from 284.1 ha (census of India) to 211.58 ha in 2019-20 (according to records from the village administrative office in 2020).

The primary change has been the shift from growing three crops per year to simply one: a reduction in the cropping intensity alongside changing the cropping systems. Paddy, a primary food crop for smallholding farm households has been replaced by cotton, due to changes in the rainfall pattern, increasing soil salinisation and a reduction in surface water. In the past, households cultivated different traditional varieties of paddy with salinity tolerance, millets and groundnuts. Besides the decline in crop diversity in the main fields, the drylands were degraded, which negatively impacted the tree crops, such as the coconut and mango orchards. A rise in the cultivation of other cash crops in the paddy/millet fields led to a significant impact on women's role in ensuring household food security, due to a substantial reduction in paddy cultivation and production in favour of more chemical-intensive, and therefore expensive, cotton cropping.

1 The Scheduled Caste (SC) is an officially designated group in India that comprises people from the lowest castes, who are considered 'untouchable' in orthodox Hindu scriptures and practice, and officially regarded as socially disadvantaged.

> Salinity is the main reason only our cropping pattern and crops have changed. We have never planted cotton before [in the previous decade] ... Only after the salinity in farmlands [have] we adapted to cultivate cotton. We used to cultivate paddy in all three seasons [for two decades], but now we cultivate paddy only in [the] second season. Some have started horticultural crops.
>
> Focus group discussion (FGD) with women farmers

These changes in agriculture are adding to the mental stress of women and men as they are increasingly falling back on informal sources for credit with higher interest rates. It has also impacted local employment; men have shifted to non-farm sectors with semi-skilled and regular employment with higher wages, while women have stayed back to manage the farming along with caring for children and aged parents in their families.

Figure 3. Farmland converted for shrimp cultivation. Source: MSSRF

Until 2000, migration as a strategy to overcome distress in farming was rare among the coastal farming community. However, the situation has changed since the Indian Ocean Tsunami in 2004. After this event, the rate of migration increased as there was less scope for agriculture due to seawater entry into agricultural land, which increased the soil salinity (Primary data, 2020). Subsequently, the frequent cyclones and coastal surges further compounded the risk of soil salinity, rendering the fertile agricultural land less productive. The migration pattern was gendered: mostly men migrated outside the village to the non-farm sector while women stayed in the village and were forced to continue the agriculture. A migrant temple construction worker shared: "It is difficult to stay in the village with salinity-affected land, and farming in this land is less profitable to run a family of six … Migration is inevitable in such a situation."

Figure 4. Cultivation of cotton in paddy field. Source: MSSRF

Although it was evident that men's migration had a positive impact on ensuring the financial assets of the households, the women respondents also talked about gendered dimensions of loss and damage in the FGD, highlighting their increasing vulnerability: "Our land is drying and dying now, and we don't have scope for good income and food from our land. Migration of our men is the only option to sustain our lives and family."

The decline in agricultural production has forced men and women to diversify or take up alternative employment in the non-farm sector, outside or within the village respectively, to sustain their families. Here, existing social inequalities, especially caste hierarchy and land ownership (class) have decided the type of employment rather than gender. In addition, education has shaped these inequalities further. Among these, caste has played a major role in securing well-paid jobs among migrants. In this case study, there were 344 migrants in the village including 250 inter-state migrants, 28 intra-state migrants and 66 overseas migrants (Table 1).

Table 1. Nature of work, gender, caste and destination.

Type of work	Gender	Number of persons migrated	Caste and landholding status	Location (state/ district)	Wage per day (INR)
Mason	Male	105	MBC, landed and landless	Intra district and inter state	1000
Temple construction	Male	90	MBC, landed and landless	Andhra Pradesh, Telangana and Karnataka (inter-state)	1500
Helper to mason	Male	55	SC, landless	Coimbatore, Tamil Nadu (intra-state)	750
Spinning mill	Female	28	Mostly SC, very few from MBC landless households	Tirupur, Tamil Nadu (intra-state)	800
Overseas migrants	Male	66	MBC and SC, mostly landholders	Arab countries (outside the country)	2000

Source: primary data from the field

Migrants belonging to the MBC community are usually employed in skilled work like construction (mason work and temple construction) or as drivers and office assistants in overseas employment. In contrast, those from the SC community occupy mainly unskilled positions such as assistants of masons (100%) and other unskilled work in overseas employment. Along with this, some young girls have migrated to spinning mills in Tamil Nadu for better wages. Most of these girls are from SC households, with only a few from landless MBC households recently taking this work to support their families (which is not permitted among landed MBC households).

A gradual shift in livelihoods has also been observed in farming, where individuals with lower education levels tend to take unskilled work with lower wages, but more moneyed individuals are able to seek better paid employment. Climate migration has also made a remarkable change in gender relations and thus created more challenges for women in society.

As mentioned above, the migration of men has forced women to take up more agricultural tasks. However, among the women who have been left behind, the magnitude and type of work has differed according to their social position. The households that are in the socially middle position of the caste hierarchy (MBC) mostly own land, and a much smaller number are landless. But the reverse is true in households in the lower rung of the social system (SC), where only a small proportion of the households own land, and most are landless agricultural workers. Due to a reduction in local employment opportunities in agriculture production, SC women have leased land from higher caste households and started farming. Thus, SC women, who were earlier agricultural workers, now take an active role as 'farmers' on the leased land, mainly producing paddy for subsistence, with a smaller proportion being sold in the market. Similarly, both landless and land holding MBC women's participation in agriculture has increased after their husbands' migration. In affluent households, women have not engaged in any agricultural tasks, even after migration.

Similarly, this inequality has continued in non-farm small enterprises/income generating work undertaken by women within the village. Women from SC households take up unskilled work, and MBC households take up skilled and semi-skilled work. However, women from both landless MBC and SC households have been engaging in income-generating activities like tailoring, basket weaving and doll making, which only take place within the house. But food processing — namely selling batter and curd — and running eateries or tea and coffee shops are areas that have been taken up by women from MBC households within the village. However, the women from the SC community never get involved in these types of work due to the social stigma of untouchability prevailing in their society.

The Mahatma Gandhi National Rural Employment Guarantee Scheme of the Government of India grants all women 100 days of employment within the village. This is the only national programme where work is allocated to women, though it is mostly middle-aged and older women who are participating. However, this is done in two batches: separately for women from MBC and SC households, reiterating caste-based marginalisation and segregation in society.

Compounding risks

The existing risks of soil salinity due to sea surges, inadequate rainfall, increasing seasonal flooding and cyclones are compounded by current structural inequalities, especially in terms of land and caste. These existing vulnerabilities and exposures are further deepened by increasingly frequent hazards, which in turn further intensify the risks and make the community more vulnerable. These climate impacts mean women agricultural workers are losing their employment opportunities within the village, where the land-use is changing to shrimp farming. The increasing soil salinity is making small holding farmers from the SC community landless, as they have been forced to sell the land due to its declining quality for cultivation. Conversely, when women take a lead role in agriculture, the prevalence of existing social norms in care and responsibility in household food security means that crop choices and farming strategies are not aimed towards profit, tending to continue the use of land for cultivation without leaving fallow. This keeps women in livelihoods that are underpaid and undervalued, which is further compounded when salinity is increasing due to climatic events.

Vulnerabilities/impacts of compounding risks

Women's work burden and health: in terms of changes in household labour availability, the absence of men leads women (both landless MBC and SC) to take agricultural daily wage work in addition to household work. This increases their work burden and adversely impacts health. For example, they tend to skip breakfast and have tea and snacks provided at work, as they don't find time to cook and eat. In addition to productive work pressures, responsibilities for other household maintenance have also increased and become more demanding of women's time, especially in terms of the following: paying bills such as school fees and maintaining payment receipts such as for tax or EB, attending school meetings, caring for children and in-laws when they are sick and admitted to hospitals, and looking after the overall savings and expenditure. In addition, the daily fetching of water is a hurdle, as accessing drinking water is challenging due to the increasing salinity of groundwater: women spend two hours each day engaged in this task, which also physically exhausts their energy.

Figure 5. Women spent more time collecting potable water. Source: MSSRF

Women's agency in productive work: this case study has shown that, at the societal level, women's (gender) role in agriculture has diversified and increased in multiple folds, but with no comparative increase in their agency. Existing inequalities such as gendered wage disparity and discrimination still prevail, which further increases women's exposure. This is because of the dominant social norm of considering women 'farm labourers' and not 'farmers'. Historically, women from the landed MBC household were only engaged in preparing and providing tea and snacks to labourers, as a support role to their husbands, but a reduction in the household labour force means they are now involved in the farm work.

This feminisation of the agricultural labour force makes women more vulnerable and marginalised, as their share of labour shoots up drastically. This has both positive and negative implications for women's agency, meaning their gains and losses need to be analysed carefully. This phenomenon in farming is not associated with changing women's access to productive resources and services such as technology, knowledge, institutional links and credit input/output markets. Instead, it deepens their vulnerability, and is linked with low agricultural productivity, low earnings, poor job security and growing food insecurity.

Gender-based violence: climate migration exacerbates gender-based violence against women with limited access to and control over productive resources. With increasing natural hazards, they frequently face food insecurity and declining labour opportunities within the village due to a reduction in the net sown area, crop productivity and farm income. Consequently, women access credit to run their households from informal sources at higher interest rates, or depend on land owners for labour opportunities within the village. This dependency makes them vulnerable and the creditors/land owners berate them, even demanding sexual favours in some cases: "There are times when men ask us to work behind the field alone, claiming that they need assistance. But it is always for making sexual advances. It affects us psychologically as if we were slaves."

Even though these interactions are typically framed as consensual, the reality is that the women engage in them because they have no other options. Lack of sufficient, timely and regular support from their husbands regarding remittances to meet food and other household expenses pushes women to agree to such favours. The landlords take advantage of their vulnerable conditions and exploit them physically and mentally. Of significance here is that there has also been an increase in orphans and young widows due to men's overconsumption of alcohol, with those men dying early or giving up their care-giving responsibilities, making the women and children in their families more vulnerable. Such circumstances have profound psychological effects on families, with declining mental health and wellbeing, which can in extreme cases lead to suicide.

Coping measures

The coping/adapting strategies observed in this case study have been diverse and gendered, with largely competitive outcomes that negatively impact more vulnerable sections of the community. This is mainly due to existing social and economic inequalities, and exposure to climate impacts. The adaptive strategies of women left behind in the village intersect with other social, economic and demographic variables, namely caste, class and age. Adaptation strategies at the local level are shaped and deepened by class and caste discrimination, which is further intensified by socioeconomic inequalities. To cope with and adapt to increasing soil salinity, the households with large land holdings have undertaken a range of actions. These include: converting a portion of land to aquaculture, leaving the land fallow or changing to high-value crops (tree/cotton). But the change in the land use to shrimp farming further deepens the environmental and social vulnerabilities of the landless, as well as small holding farmers, by increasing salinity (Pratheepa et al., 2022). Conversely, some women from landless households have strengthened their livelihoods by leasing the land from landed farmers, with the associated risks in crop production. Also, irrespective of caste, landless women have been trying to diversify their livelihoods by undertaking small income-generating activities, but landed women, who were previously engaged in supportive roles, are either now involved in managerial roles or remain in domestic and care work. Again, these outcomes have been shaped by the class and remittances these women receive from their husbands. Despite there being diverse categories of women, migration is impacting them by increasing their workloads, and changing gender roles and decision making in farming. Some of the women in this case study have started adopting eco-friendly farming practices, but this has largely been mediated by the existing social norms associated with household work, as well as women's limited mobility and lack of access to productive resources.

Support needed in future

The kind of support needed here is to engage in action research to understand the potential pathways that reduce women's vulnerability and decrease environmental degradation. This should involve specific support in the form of capacity building for designing the study, data collection and analysis of the pathways for improving adaptive capacities. Specifically, technical support is needed to link and synthesise the field level learnings into theoretical frameworks and pathways.

Although there has been an effort to improve the salinity management of public land by leveraging existing government schemes, financial support is still necessary to facilitate the whole process in a co-management approach to ensure their participation and ownership. In addition, there is a need to improve women farmers and workers' access to productive resources by harnessing and promoting their collective power. This needs to be closely promoted at the field level.

Based on the emerging field evidence, technical support and guidance is needed to convert the learning to potentially influence policies, both at the state and national levels.

Lessons learned

Women from poor and marginalised households have less adaptive capacities due to limited access to assets and resources such as land and credit, as well as lesser access to local employment, technology, institutional links, decision-making processes and the market during climate change-induced events and disasters. Increasing climate risks exacerbate existing social and gender-related inequalities and vulnerabilities of poor people and women-managed households. Such adverse impacts are shaped by the fact that women and other disadvantaged groups are already marginalised in their resource access and ownership. It is evident from this case study that increased climate-induced environmental degradation, along with the degree of that exposure, increases gender-based violence. Despite a substantial increase in workload and changing gender roles and relations, gendered discrimination in terms of lower wages and the undervaluing of women's labour remains. Strategies to improve marginalised people's adaptive capacity to withstand increasing climate risks (co-evolved from women and men farmers) include:

a. Strengthen women's access to productive resources and services where collective power and social capital need attention, in areas such as land, credit, salinity management technologies, new institutional linkages, and inputs including farm machinery and markets.

b. Build evidence to comprehend nuanced patterns of changes, with an intersectional lens to account for different sections of the community.

c. Develop analytical frameworks and collect data to understand how these changes are impacting both the paid and unpaid work of women at the household level as well as women's agency in productive work.

d. Reduce the intensity of environmental degradation by investing in common and individual land to reduce soil and water salinity.

e. Build awareness and facilitate necessary institutional arrangements like women's collectives and agencies that support/facilitate women's access to land, credit and marketing at the village level, to address gender-based violence due to agricultural distress (aggravated due to climate risks).

f. Offer differential support with consideration of the intersectional elements that shape people's vulnerabilities and adaptive capacities. The women belonging to the landed MBC group were better able to cope than those in the landless MBC and SC groups, and this was because of the former's improved access to wealth and skills. Hence, skill development and appropriate training for vulnerable groups should be given top priority as these benefits could provide opportunities for a better living.

g. Address access to credit: informal credit being used as a last resort by women to sustain their families can lead to gender-based violence; when such debts are not re-paid, there is an opportunity for moneylenders to demand sexual favours. Therefore, women need better access to formal financial and credit services so they don't depend on these informal sources.

h. Increase the value of women's time: fetching water takes a long time, leaving women with less for productive work. Measures are needed to provide safe and regular access to both drinking and domestic water needs.

Synopsis

This paper discusses how climatic factors are deepening the vulnerabilities of small farmers and agricultural workers, pushing men's migration to the non-farm sector. These changes exacerbate pre-existing gender divides and social inequality, thereby intensifying the vulnerability of those left behind: mainly women, landless people and the socially marginalised (Dalit) community. Appropriate strategies need to be identified, to assess intersectional micro-level NELD. Regional level need-based policies should also be developed and effectively implemented, to prevent salinity-induced land degradation. This means vulnerability could be minimised, with changes in the pattern of men's migration. In addition, women's collective power could be harnessed by empowering them to act independently via formal credit and adequate backward and forward linkages to ensure their sustainable livelihood.

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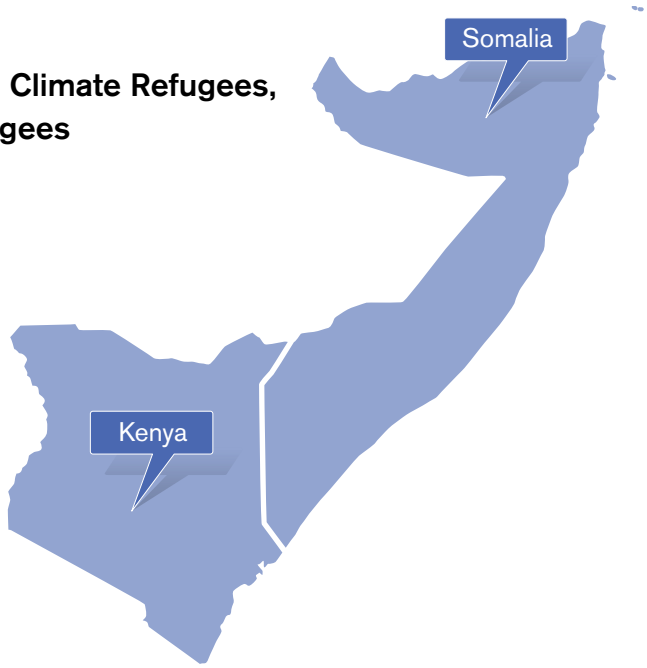
Social disruption (migration and displacement)

Secondary categories: loss of cultural heritage; loss of quality of life; mental and physical health impacts

"Climate change is controlling everything — let them compensate us": addressing the climate displacement of Indigenous, marginalised populations in Kenya

Amali Tower, Founder and Executive Director, Climate Refugees, and Ryan Plano, Project Officer, Climate Refugees



Location	IDP camps and locations in Kenya; IDP camps in Hargeisa, Somaliland and Mandera, Somalia
Climate hazards	Rising water levels; flash floods; drought
Non-economic loss and damage	Particularly affected groups include: women and girls (poor access to maternal healthcare; gender-based violence and FGM in IDP camps); Indigenous Peoples (cultural loss; displacement); and children (loss of education)
Coping measures	Increasing dependence on external support or humanitarian services

Context

Kenya's Great Rift Valley stretches from the border with Ethiopia and South Sudan in the north to Tanzania in the south. It is home to over 12 million people, making it the most populous region of Kenya.[1] The natural environment is the area's primary source of livelihoods and economic activity, but climate change is profoundly affecting the region, notably the onset of severe drought and devastating lake-rise flooding.

The Horn of Africa at large is experiencing an unprecedented drought, the worst to strike in 40 years.[2] There have been five failed rainy seasons since 2020 in parts of Ethiopia, Kenya and Somalia. Researchers contend this phenomenon would not have happened without human-induced climate change.[3] Elsewhere, the opposite problem is occurring: significantly increased rainfall since 2010, as a result of climate change, is primarily responsible for the rise and expansion of the Rift Valley lakes.[4] As the climate crisis continues, it is expected that the region will continue to experience these catastrophic extremes, which have produced their own impacts while also exacerbating and intersecting with existing inequalities and vulnerabilities.

This case study, which highlights impacts on Indigenous and ethnic minority communities and households, is based on research visits to ten locations, some of which are expounded upon: Kiwanja Ndege internally displaced persons (IDPs) camp (Marigat, Baringo County), Kokwa Island (Lake Baringo, Baringo County), Rugus (Lake Baringo, Baringo County), Lake Bogoria (Baringo County), Loya Village (Turkana County), Lokiriama (Turkana County), Lorengippi (Loima sub-County, Turkana County), Kakuma Refugee Camp, (Turkana County) and Kibera informal settlement (Nairobi).

These locations differ widely in their geographic features and climatic conditions — from arid and semi-arid (ASAL) to sub-tropical — but all are experiencing climate change impacts, which are in turn driving loss and damage, notably non-economic loss and damage (NELD).

Impacts

Local communities tell us that increasingly unpredictable climate shocks and extreme weather events are creating "cascading effects of climate change" from which they "cannot recover". This is resulting in situations of forced displacement, as well as a loss of quality of life and cultural heritage for millions of people.

The prolonged and severe drought, which has left 23.8 million people in hunger in the Horn of Africa,[5] is driving food insecurity in Kenya's ASAL areas, affecting 4.4 million people across 23 counties.[6] Northern counties like Turkana are expected to reach emergency levels of food insecurity (IPC4), while particularly vulnerable agro-pastoralists and IDPs remain at risk of famine (IPC 5) if assistance fails to reach them.[7] In addition to food insecurity, the drought has forcibly displaced people across the region, with the United

1 Nyawira, L (4 November 2019) Census 2019: Rift Valley most populous region. *The Star.* www.the-star.co.ke/news/2019-11-04-census-2019-rift-valley-most-populous-region/

2 World Meteorological Organization (30 May 2022) Meteorological and Humanitarian Agencies Sound Alert on East Africa. https://public.wmo.int/en/media/news/meteorological-and-humanitarian-agencies-sound-alert-east-africa#:~:text=Meteorological%20agencies%2C%20including%20WMO%2C%20and,the%20%E2%80%9Cshort%20rains%20season.%E2%80%9D

3 World Weather Attribution (27 April 2023) Human-Induced Climate Change Increased Drought Severity in Horn of Africa. www.worldweatherattribution.org/human-induced-climate-change-increased-drought-severity-in-southern-horn-of-africa

4 Herrnegger, M, Stecher, G, Schwatke, C, Olang, L (2021) Hydroclimatic analysis of rising water levels in the Great rift Valley Lakes of Kenya. *Journal of Hydrology: Regional Studies* 36(1) 23–24. https://doi.org/10.1016/j.ejrh.2021.100857; Hernegger, M (16 January 2023) Kenya's Rift Valley Lakes are Rising, Putting Thousands at Risk – We Now Know Why. The Conversation. https://theconversation.com/kenyas-rift-valley-lakes-are-rising-putting-thousands-at-risk-we-now-know-why-194541

5 Oxfam (22 May 2023) NGOs Call Out Climate Injustice and Urge Global Donors to Fully Fund the Humanitarian Response in the Horn of Africa Now. www.oxfam.org/en/press-releases/joint-statement-ngos-call-out-climate-injustice-and-urge-global-donors-fully-fund

6 National Drought Management Authority (2023) National Drought Early Warning Bulletin – May 2023 (pp. 2). http://knowledgeweb.ndma.go.ke/Public/Resources/ResourceDetails.aspx?doc=8bd256e5-146b-4918-ac6b-07822ec1351

7 Danish Refugee Council (2023) Horn of Africa Drought Situation Report #8: 1 March to April 30 2023. [via reliefweb] https://reliefweb.int/report/ethiopia/horn-africa-drought-situation-report-8-1-march-april-30-2023

Nations High Commissioner for Refugees (UNHCR) reporting that nearly 200,000 people have crossed the border from Somalia and South Sudan into drought-stricken refugee camps in Kenya and Ethiopia.[8] Region-wide, in 2022 more than 5 million IDPs lived in drought-affected areas, with more than 2 million displaced by drought and over a half million forced to move between drought-affected areas,[9] highlighting how limited the options are for many in this region. A third major impact of drought in the region has been loss of livelihoods, notably pastoralism. With nearly 10 million livestock dead, including 2.5 million in Kenya, more than $US1.5 billion of economic losses were inflicted on the region. In addition to making food insecurity worse, loss of livestock has forced some to abandon pastoralism altogether — a livelihood that is rooted in cultural heritage — either because they have lost their entire herd in the current drought or because they simply cannot afford to wait the five years it generally takes to rebuild herds after a drought event.[10]

Water scarcity from drought has had devastating consequences for communities throughout the Rift Valley, but most acutely in the ASAL regions. The advance of climate change has been so swift here that residents have seen the environmental changes occur within their own lifetimes. One man explained: "Here, droughts are almost inevitable because rain is becoming so irregular, and when they do come, they are short rains that do not penetrate the soil. But we have never seen a drought like this before."[11] In Loya village, nearly all livestock have died, destroying the livelihoods of pastoralists and contributing to widespread food insecurity.[12] In Lokiriama, one nomadic pastoralist described the twin effects of the drought and locust infestation on crop yields in the 2019–2022 period as "missiles sent from the skies".[13] Due to this increasingly untenable situation, some households have migrated elsewhere, with no guarantee that water will be easier to find on arrival. Pastoralists are having a particularly difficult time given their reliance on accessible grazing land and adequate water supplies to maintain their herds.

The flooding of lakes in Kenya's Great Rift Valley since 2010 has resulted in dramatic consequences. With each flooding event, freshwater Lake Baringo is moving closer to saltwater Lake Bogoria, threatening an ecological disaster, a loss of lake-based livelihoods and displacement. Communities say the lakes are now just six miles apart, which is similar to reports in the media.[14] The risks posed by rising waters continue to threaten ever-larger populations in an immediate way. Indeed, Baringo has doubled in size in the last decade, with a water-level rise of 12 metres.[15]

The islands of Lake Baringo are a veritable ground-zero for the loss and damage caused by flooding. One of these islands, Kokwa, is home to around 2,000 minority-group residents of the Ilchamus tribe, as well as the Tugen and Turkana people. Due to lake level rise, communities here live right at the water's edge, deeply impacted by both flooding and drought. With pastoralism less viable on the island, residents have become reliant on fishing, but say "the fish can't be found anymore". Residents could historically rely on the local tourism industry for their main economic security, but the lake rise has submerged several hotels, taking away a critical source of income for many Kokwa islanders.

8 United Nations High Commissioner for Refugees (UNHCR) (28 February 2023) The Horn of Africa Drought Appeal (January – December 2023). [via reliefweb] https://reliefweb.int/report/ethiopia/horn-africa-drought-situation-appeal-january-december-2023#:~:text=The%20Horn%20of%20Africa%20region,raise%20livestock%20and%20buy%20food

9 International Organization for Migration (IOM) (2022) Horn of Africa Drought 2022: Human Mobility Snapshot (January – December 2022). [via reliefweb] https://reliefweb.int/report/ethiopia/horn-africa-drought-2022-human-mobility-snapshot-january-december-2022

10 United Nations Office for the Coordination of Humanitarian Affairs (OCHA) (2022) Horn of Africa Drought: Regional Humanitarian Overview & Call to Action (Revised 28 November 2022). [via reliefweb] https://reliefweb.int/report/ethiopia/horn-africa-drought-regional-humanitarian-overview-call-action-revised-28-november-2022

11 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

12 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

13 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

14 Baraka, C (17 March 2022) A Drowning World, Kenya's Quiet Slide Underwater. *The Guardian.* www.theguardian.com/world/2022/mar/17/kenya-quiet-slide-underwater-great-rift-valley-lakes-east-africa-flooding

15 Baker, A (22 April 2021) Environmental Crises Are Forcing Millions into Cities. Can Countries Turn Climate Migrants Into an Asset? *Time.* https://time.com/5953402/climate-migrants-kenya-floods

According to a 2021 Kenyan government report, the flooding of Lake Baringo has severely impacted over 3,000 households,[16] with many forced to abandon their homes despite having strong cultural or ancestral ties to the land. On Kokwa and surrounding regions of Lake Baringo, some residents have been dealing with displacement since 2008, when conflicts with local Pokot tribes forced them to seek safety away from the mainland, and are now being displaced due to the impacts of climate change. As the lake has risen, it has submerged homes and land owned by residents. Islanders with resources have moved to higher ground on Kokwa or to surrounding islands, with some even leaving the region altogether.

The losses and damages faced by Kokwa residents are seen elsewhere in the region. For example, in Kiwanja Ndege IDP camp in Baringo County, residents identified themselves to us as 100% climate-displaced.[17] We spoke to the former residents of ten villages surrounding the lake that were submerged in 2020 when water levels rose, and when we asked them what had displaced them, they replied with one simple word: "water".

Residents in one area of the lakeshore region, Rugus, are being impacted by both flooding and drought. They are increasingly trapped between an expanding lake on one side and conflict with cattle raiders on the other, which is being exacerbated by the prolonged drought and resultant conflict over resources.[18]

In addition to the loss of homes, land and livelihoods, some communities are facing devastating and permanent losses to their culture and heritage. In Turkana County, the El Molo community has seen hundreds of its homesteads submerged, including family burial sites. This is in addition to water-borne illnesses[19] and acute food insecurity, the latter being reported by some 2,500 residents.[20]

Compounding risks/impacts created

The impacts of drought and flooding in Kenya interact with and exacerbate existing issues, such as underdevelopment, marginalisation and poverty.

Drought and resultant water scarcity are making existing issues worse in many areas. Pastoralists in Kenya have long struggled to access the best grazing lands due to the colonial legacies of land tenure. Particularly in Laikipia and Baringo countries, British rule saw large tracts of fertile land reserved for settlers, private land ownership and conservancies, while pastoralists were forcibly pushed onto non-arable lands.[21] The inherent conflict for resources created by such a system is now greatly magnified in the face of climate change. In Turkana and Baringo counties, migration internally and across borders to Uganda in search of water and better land is increasingly being met with resistance from other tribes, due to resource scarcity. This in turn further contributes to the pastoralists' food insecurity: many residents told us they had not eaten for days.[22]

16 Ministry of Environment and Forestry (2021) Rising Water Levels in Kenya's Rift Valley Lakes, Turkwel Gorge Dam and Lake Victoria: A Scoping Report (pp. 26). Republic of Kenya and UN Development Programme (UNDP), Nairobi and New York. https://ir-library.ku.ac.ke/bitstream/handle/123456789/22851/Rising%20Water%20Levels%20in%20Kenya%e2%80%99s%20Rift%20Valley%20Lakes%2c%20Turkwel%20.....pdf?sequence=1&isAllowed=y

17 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

18 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

19 Rwothungeyo, B (6 September 2022) Climate-linked lake rise frustrates indigenous Endorois health volunteers. Minority Rights Group International, London. https://minorityrights.org/2022/09/06/climate-endorois

20 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

21 Odhiambo Makoloo, M (2005) Kenya: Minorities, Indigenous Peoples and Ethnic Diversity (pp. 27). Minority Rights Group International, London. https://minorityrights.org/publications/kenya-minorities-indigenous-peoples-and-ethnic-diversity-april-2005

22 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

In the Turkana village of Lorengippi, residents shared alarming details of several community members who had died in recent years at community water holes, showing how climate change, underdevelopment and poverty can have deadly consequences, especially in one of Kenya's poorest counties.[23]

Extreme drought and temperature increases have forced residents to dig new and deeper water holes so that water can be retrieved for daily use. For many, this is their only source of water. This activity has progressively required an increasing number of people, as water must be passed from source to surface in an assembly line. During these collections, several water holes have collapsed, killing multiple people. At Nakanjakal water point, three people died in 2021 when the water hole collapsed on them. Kapesa water hole collapsed in 2020, killing eight people. At Lowsobani water hole, two people were killed in 2014. These deaths even inform the name of the village. In the Turkana language, community members told us, "Lorengippi" literally translates as "red water." As water scarcity worsens, the deaths continue. This tragic situation is the outcome of underdevelopment, namely a lack of infrastructure to bring potable water to the community, but also its intersection with climate change-driven drought and water scarcity.

Increased rainfall and flooding are exacerbating the existing situations of vulnerability and inequality in many areas. Lake Baringo's once highly lucrative tourism industry is now devastated by climate-driven flooding and lake expansion. In 2021, Baringo County suffered tourism and infrastructure-related losses of 95 million shillings (nearly $US700,000) largely due to flooding.[24]

Communities who depend on the tourism industry are now facing loss of income and financial security as flooding turns hotels into a submerged wildlife habitat.[25] The impacts are most severe on the poorest residents. In Kokwa, some lack the financial means to migrate or relocate, even if they want to. As the lake creeps closer, they are increasingly vulnerable to wildlife attacks and other dangers because they have been rendered immobile by poverty. This is a phenomenon that is gaining attention from scholars and practitioners alike.[26] It shows how discussing climate displacement as only a form of migration leaves out entire households and communities who simply cannot move.

Flooding has also made transport, pursuit of livelihoods, and access to education and healthcare more challenging for Kokwa islanders, especially for the poorest households. Swelling lakes have inundated educational institutions, forcing schools on the island to shut down for over two years. The small locally-made balsa wood boats, on which poor communities have long relied, are no longer adequate in rising waters. This makes fishing more difficult and therefore less remunerative. It also means that residents who must travel to the mainland for healthcare – where the nearest hospital is – are often unable to do so.

Elsewhere, flooding has placed entire communities in fragile situations with limited access to support. At the Kiwanja Ndege camp, the flood-displaced residents have been made more vulnerable by a lack of humanitarian services and protection programming, both from the government and outside groups. Given the trend of increased rainfall and continued lake level rise, it is likely their situation of marginalisation and displacement will become protracted.

23 Otieno, R (2014) Report lists counties with highest levels of poverty. *The Standard*. www.standardmedia.co.ke/article/2000110595/report-lists-counties-with-highest-levels-of-poverty; Data Science Limited, Poverty Levels in Kenya: How does it correlate with Election-related Matters? www.datascience.co.ke/poverty-levels-in-kenya-how-does-it-correlate-with-election-related-matters/#:~:text=Poverty%20level%20per%20county%20in%20Kenya&text=The%20counties%20with%20the%20highest,%2C%20and%20Bungoma%20(643316)

24 Cherono, C (11 August 2021) Baringo Lost Sh95 Million Revenue Due to Floods. *Kenya News Agency*. www.kenyanews.go.ke/baringo-lost-sh95-million-revenue-due-to-floods

25 Baker, A (22 April 2021) Environmental Crises Are Forcing Millions into Cities. Can Countries Turn Climate Migrants Into an Asset? Time. https://time.com/5953402/climate-migrants-kenya-floods

26 Rikani, A, Otto, C, Levermann, A and Schewe , J (2023) More People Too Poor to Move: Divergent Effects of Climate Change on Global Migration Patterns. *Environmental Research Letters* 18 no. 024006. https://doi.org/10.1088/1748-9326/aca6fe; Balasundaram, R and Plano, R (20 February 2023) Climate Change and Immobility: New Study Highlights Some Too Poor to Migrate. *Spotlight*: Climate Displacement in the News, Climate Refugees. www.climate-refugees.org/spotlight/2023/2/20/climatetraps

Vulnerabilities/impacts by compounding risks

Certain groups of people are disproportionately affected by the above events. These inequities in turn fuel a vicious cycle of vulnerability during subsequent instances of climate impacts.

Women and children

Women and girls often bear the brunt of drought and flood impacts, as well as the existing issues they exacerbate. In Kiwanja Ndege camp, the needs among women and girls are acute, with gender-based violence (GBV) being a key concern. Additionally, with displacement, women leaders have reported that previously curbed practices of female genital mutilation (FGM) are returning. This unfortunately tracks with what humanitarian agencies and UN bodies have observed in displacement contexts,[27] but Kiwanja's lack of support means the women and girls there are largely left to fend for themselves.

For Kokwa Island's women, the flooding of Lake Baringo is having serious impacts on their access to healthcare. As the traditional balsa wood boats are ineffective in high waters, it has become exceedingly difficult to reach the healthcare facilities on the mainland for receiving appropriate maternal health services. One woman we talked to recounted her harrowing experience of having to give birth on one of these boats in the middle of the night after it became clear that a crossing would not be possible.[28]

In Rugus, which is being impacted by lake rise and drought, women are seeing their economic prospects literally dry up, with grazing land hard to come by and fishing becoming increasingly difficult, reducing their portion of the daily catch. Girls are having to travel further in search of potable water, a cruel irony as the lake creeps closer with each heavy rainfall. This search is causing some to forgo schooling, and is exposing them to GBV along the way. Some women have been widowed by the drought-exacerbated conflicts with neighboring cattle raiders or the capsizing of boats as many men switch to fishing. Others have lost husbands to deadly contact with wildlife as it encroaches with lake level rise. With no man at the head of household, in a mostly patrilineal system, these women are left to fend for themselves and their families, all in an environment of shrinking livelihood options.[29]

In Turkana County, drought is particularly impacting women and girls, but also children in general. In Loya, where drought has made keeping livestock alive a nearly impossible task, households are facing malnutrition — with obvious implications for child development — as well as difficulties in ensuring their children are educated. It is common for communities to sell livestock to pay school fees, but this is no longer possible. Instead, children are forced to forage for berries and travel further for water.

Children are also dealing with challenges due to climate change in Lorengippi. The collection of water from community-dug water holes is often done by children, especially girls. One of the water holes is even named "Akinpipu" or "girls", so named because the water point is used by many young girls who come to fetch water for their families, some of whom have lost their lives in the process.

As drought and flooding continue to impact these communities, it is clear that an entire generation of children, especially girls, are suffering major development setbacks and losses due to climate change.

27 United Nations High Commissioner for Refugees (UNHCR) (n.d.) Gender-based violence. www.unhcr.org/what-we-do/protect-human-rights/protection/gender-based-violence

28 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

29 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

Indigenous Peoples and marginalised communities

Indigenous Peoples and other minority groups are often some of the most marginalised in societies across the world, given their lack of access to political power and exclusion from service provision.[30]

All the climate displaced communities we spoke to are Indigenous, marginalised populations. At Kiwanja Ndege camp, the residents — who were displaced due to flooding — are ethnically marginalised Ilchamus people, an Indigenous group that likely accounts for why the camp receives so little government attention and support. This traps them in a vulnerable position during subsequent climate shocks.

The Indigenous Endorois people in Bogoria County have a similar story. Forcibly dispossessed of their land in the 1970s,[31] the community is now facing displacement due to flooding of Lake Bogoria. In addition to generalised impacts like increased wildlife contact, the Endorois told us about the difficulty they have faced in pursuing compensation claims for lost homes, farms and cultural assets, no doubt largely due to their status as Indigenous Peoples.

Repeatedly, Indigenous and other minority groups in the region face further marginalisation in the wake of climate change. Support from the government, as well as external aid groups, are slow to reach these historically marginalised communities, leaving them in progressively vulnerable situations as flooding and drought continue to wreak havoc.

Coping measures

In the face of these climate impacts and intertwined challenges, the people and communities we visited have employed various coping strategies. While these measures vary in efficacy, taken together they provide a clear message that climate-impacted communities are struggling to survive, let alone thrive. Many affected communities are grossly overlooked outside a declared humanitarian emergency or disaster context, and are consequently left to fend for themselves. There is a concerning lack of agency demonstrated by many of these coping measures — where individuals and households are essentially left with no other choice but to adopt what can be called enforced resilience — which only further marginalises these often-forgotten communities.

Despite their pastoralist roots, many Endorois pastoralists in Lake Bogoria have had to switch to farming, an imperfect solution in the face of water scarcity and risk of inundation. For the farms that are able to still operate, communities are planting drought-resistant crops and tubers to conserve water while addressing food security concerns. Unfortunately, some coping measures taken as last-resort mechanisms are exacerbating social disruption, such as the rise in sex work, early marriage and family break-up.

Communities around Lake Baringo have similarly limited options. With the collapse of the local tourism industry due to lake expansion, locals have attempted to fill the gap with subsistence fishing, but are forced to depend on the kindness of donated nets and fishing hooks to survive. One leader on Kokwa Island said that as fishing becomes more difficult, he is encouraging a switch to farming, but that this requires the capacity to obtain seeds, generators, water pumps and other costly items.

Unfortunately, as climate change impacts worsen, the limits of local and long-standing coping measures will be tested. One common strategy among pastoralist communities is resource sharing during dry spells and lean periods, where wealthier families share with poorer ones. But as was described to us during one

30 United Nations High Commissioner for Refugees (UNHCR) (n.d.) Minorities and indigenous peoples. www.unhcr.org/what-we-do/protect-human-rights/protection/gender-based-violence

31 Kiburo, C (2 March 2022) Impacts of Climate Change Among the Endorois Peoples in Kenya," *Cultural Survival*. www.culturalsurvival.org/publications/cultural-survival-quarterly/impacts-climate-change-among-endorois-peoples-kenya

visit, "with climate change, our entire community is affected all at the same time … Everyone is poor at the same time and none of us have anything to share with one another."[32]

Support needed in future

As is the case in all situations of loss and damage from climate change, support and solutions will need to be realised at multiple levels and be sustainable for years to come, especially given that individuals are using last-resort coping measures.

While some solutions are difficult — particularly the operationalisation of adequate climate finance — we should not overlook the fact that some solutions are quite simple. For Kokwa islanders who are unable to leave the island and are increasingly finding their handmade balsa wood boats ineffective, small external grants can quickly provide adequate vessels in the short-term while ensuring community members have the materials to maintain them in the longer-term. Better vessels will not solve everything, but would allow residents to build resilience more effectively in the face of flooding and rising lakes by improving transport, with positive effects on healthcare access and livelihood options.

Investment in early-warning systems is crucial when providing useful and potentially life-saving information regarding droughts, high tides, polluted waters and other issues related to climate impacts.[33] This mirrors the request of many developing countries during multilateral climate talks, providing an area of synergy between local actors and national authorities, if financing is made available.

In drought-affected Turkana County, the climate-conflict-migration nexus is a complex issue, but there are possible ways forward. The Kenyan government could focus on facilitating internal migration agreements between pastoralists, herders and landowners,[34] rather than taking a reactive approach to conflicts when they arise. Thankfully, policymakers already have a regional model to draw upon: the 2020 Intergovernmental Authority on Development (IGAD) Protocol on Free Movement was signed by several states in the region to facilitate temporary and circular migration, including in the context of climate change.[35]

There is an urgent need for the Kenyan government to provide water tankers in Turkana County and elsewhere as a short-term measure, while working with international partners to invest in water security through the installation and massive scaling of climate-resilient boreholes and solar-powered water systems. The international community must meet its obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations (UN) Sustainable Development Goals and international human rights law by granting adequate climate finance to address the gross losses and damages that marginalised Kenyan communities are suffering in the climate crisis.

As options dwindle and climate-vulnerable countries like Kenya struggle to maintain development gains in the wake of climate impacts, the COVID-19 pandemic and global inflation, there is an urgent and substantial need for developed countries to operationalise the loss and damage fund to which they agreed at COP27 in Sharm-el-Sheik.[36] Critically, this fund must be new and additional to existing commitments, administered via the UNFCCC, and in line with the principle of "common but differentiated responsibilities

32 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

33 Field visit. "Climate Change is Controlling Everything, Let Them Compensate Us": Stories of Loss and Damage in Kenya climate-refugees.org"

34 International Crisis Group (2023) Absorbing Climate Shocks and Easing Conflict in Kenya's Rift Valley (pp. 1). International Crisis Group, Nairobi/Brussels. https://icg-prod.s3.amazonaws.com/s3fs-public/2023-04/b189-kenya-climate-shocks_1.pdf

35 Intergovernmental Authority on Development (IGAD) (26 February 2020) Protocol on Free Movement in the IGAD Region. IGAD, Djibouti. https://environmentalmigration.iom.int/sites/g/files/tmzbdl1411/files/event/file/Final%20IGAD%20PROTOCOL%20ENDORSED%20BY%20IGAD%20Ambassadors%20and%20Ministers%20of%20Interior%20and%20Labour%20Khartoum%2026%20Feb%202020.pdf

36 United Nations Framework Convention on Climate Change (UNFCCC) (20 November 2022) COP27 Reaches Breakthrough Agreement on New 'Loss and Damage' Fund for Vulnerable Countries. UNFCCC, Rio de Janeiro and New York. https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries

and respective capabilities" (CBDR-RC).[37,38] There must also be mechanisms that can be accessed at the local level, such as within communities in Kenya's Great Rift Valley, who continue to suffer losses and damage as a result of climate change.

Lessons learned

Our visits to these climate-impacted communities provide a few key lessons when it comes to addressing climate-induced NELD and related effects.

Perhaps the most important is the need to speak with impacted communities. This not only allows us to better understand their reality; it also provides more useful information to the discussion on localised solutions than those that often come from actors at higher levels. Turkana pastoralists have significant experience in dealing with heavy rainfall and dry spells. Negotiators in the UNFCCC will never address the NELD of climate-impacted communities if they do not meaningfully engage and listen to local solutions. Despite recent greater attention to this issue, some of the individuals we talked to during our visits told us it was the first time any external actor had asked them how climate change was affecting them.

This case study also shows the importance of designing locally specific solutions to address the needs of the most vulnerable within impacted communities, notably women and children, Indigenous Peoples and other marginalised groups. One-size-fits-all approaches will only serve to maintain existing inequities, at best.

Finally, it is important to recognise that solutions to NELD as a result of climate change must be innovative and targeted if we are to truly prevent widespread development setbacks and contribute to climate justice. Communities should not have to rely on humanitarian aid, which is channelled irregularly and often at levels too high to be effective in climate-impacted and vulnerable communities.

Synopsis

A record-breaking prolonged drought and catastrophic flooding — especially of lakes — is driving severe losses and damages, especially those that are non-economic, as a result of climate change in Kenya's Great Rift Valley. Beyond the more obvious impacts, such as inundation and crop failure, these increasingly severe weather-related events are exacerbating existing inequities and marginalisation, which have plagued frontline communities throughout the region for decades. The result is a myriad of negative impacts, including loss of livelihoods, displacement, immobility and various development setbacks. Support is needed at all levels and must be designed and implemented in a way that addresses existing inequities and meaningfully includes impacted populations.

37 CBDR-RC refers to a principle within the UNFCCC — enshrined in the 1992 treaty — that recognises the different capabilities and differing responsibilities of countries to address climate change and its impacts.

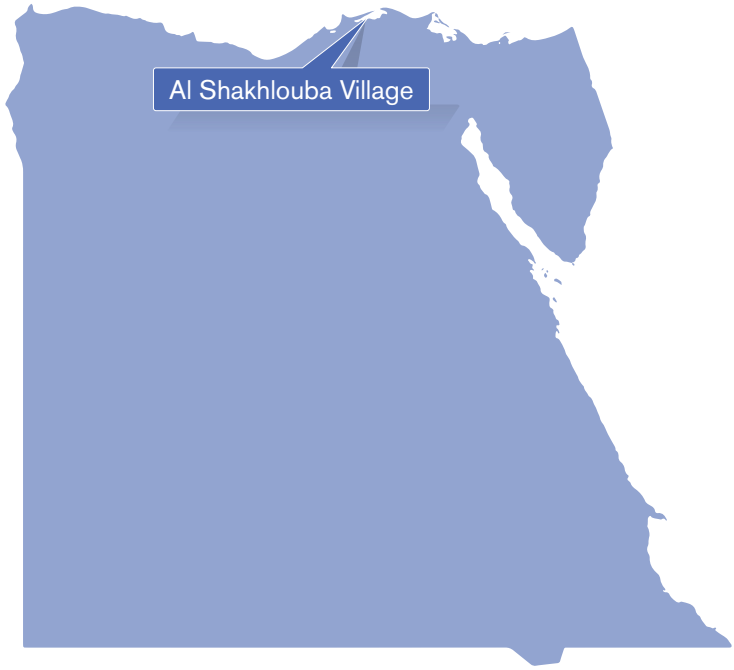
38 climatenexus (n.d.) Common but differentiated responsibilities and respective capabilities (CBDR-RC). https://climatenexus.org/climate-change-news/common-but-differentiated-responsibilities-and-respective-capabilities-cbdr-rc

Social disruption (migration and displacement)

Secondary categories: loss of quality of life; mental and physical health impacts

A lake to remember: human-made loss disrupting lives in Al Shakhlouba Village, Egypt

Abd El Hamid Sherief



Location	El Shakhlouba, Egypt
Climate hazards	Reduced rainfall; rising sea levels; groundwater salination
Non-economic loss and damage	Forced migration due to loss of subsistence opportunities; loss of traditional occupations and oral traditions related to fishing; increased inequity; loss of life due to resource competition and violent conflict; loss of land to degradation, infrastructure governance issues and fish yield reduction (in coastal communities); scarcity of freshwater
Coping measures	Community-based philanthropy, charity and resource sharing; eco-tourism to supplement income; local clergy playing a significant role in stabilising the community; internal temporary migration for work in the construction sector; when husbands are temporarily relocated to cities for work, women often move back with their immediate families for security and protections; digging wells in areas affected by water shortage; the 'youth spirit' has been seen as a driving coping spirit to cultivate hope when hope is scarce

Context

Figure 1. Map showing El Burullus Lake and the surrounding area. Source: Google Maps

Al Shakhlouba is a village situated at El Burullus Lake (Figure 1). As with other lakes in the northern Nile Delta area, its ecosystems are affected both by the Nile through its drainage system, both naturally and artificially (via irrigation and agricultural drainage streams) and the Mediterranean Sea, creating a unique blend of fresh and saltwater in the area. Other lakes, such as Maryut, Idku, Manzalah and Bardawil, differ in their 'brackish' conditions based on the feed from the Nile, or rainfall, but also in their unique hydrological connections to various openings on the Mediterranean Sea. Combined, these lakes represent a quarter of all Mediterranean wetlands by area size.[1] El Burullus is the second-largest natural lake in Egypt, as it spans 70,000 feddans (a local Egyptian area unit equivalent to 0.42 hectares).[2,3] The studied village of Al Shakhlouba is home to around 20,000 people, named after the presence of a prevalent fish species. The lake itself was designated as an "environmental protectorate" in May 1998 as per Law 102/1983.[4] This is akin to a 'national park'; a questionable designation, as economic activity, urban settlement and commercial operations persist in the area. The lake is home to 28 islands with some areas around it assigned significant archaeological importance, for example the Nestroh Archaeological Hill and Dushaymi Island, a short distance away. Both these places are entrenched within the marshy setting of aquatic plants that form a vegetation floating mat visible from space (see Figure 2).

The lake has recently gained additional economic significance with the inauguration of the Black Sands Mining Project in October 2022 to mine several commercially and industrially important elements and composites (like Zircon, Garnet, rutile, Monazite and Ilmenite) from the dunes surrounding the narrow strip that both connects and separates the lake from the Mediterranean Sea.[5] The full environmental impact of this project is not known, given that some black sand deposits contain a variety of radionuclides (nuclides that are unstable due to excess nuclear energy).[6]

Figure 2. The floating mat of vegetation seen from space. Source: Google Earth

Salinity levels within the lake outlet, Bughaz El Burullus, differ depending on the location, as seen in 1970s records where Chloride ions (as a parameter for NaCl) were measured at 0.4g per litre in the Western part (further from the inlet/outlet onto the Mediterranean), and reaching between 14 and 16g per litre around that opening; in addition, salinity has changed due to the freshwater feed that used to be

1 https://link.springer.com/article/10.1007/s12665-016-6136-x

2 https://link.springer.com/referenceworkentry/10.1007/978-1-4020-4410-6_239

3 www.dictionary.com/browse/feddan

4 https://rsis.ramsar.org/RISapp/files/RISrep/EG408RIS.pdf

5 www.sis.gov.eg/Story/176527/Black-Sand-Factory-in-Kafr-El-Sheikh?lang=en-us

6 www.tandfonline.com/doi/abs/10.1080/1526511003753961

supplied by the Rosetta branch of the Nile (via the Brimpal canal) being significantly reduced to only 5% of the freshwater feed, only to be replaced by agricultural drainage that is usually more saline.[7]

El Burullus is considered one of the important stations for migratory birds, with some staying during the winter and some using the area for breeding.

The lake has lost a substantial area because of land reclamation efforts for agricultural and aquaculture installations.

Climate change complexities in El Burullus Lake and Al Shakhlouba Village

For the local community, fish stocks and their abundance would constitute the main marker of a healthy ecosystem. The local community is aware of the impact of climate change on the daily catch and its variety.

Different climate-related effects have been hitting Al Shakhlouba Village's region (Lake Burullus and the Nile Delta). According to a paper on climate change impact on El Burullus Lake, published in the International Journal of Sediment Research in December 2021, the lake — as a 'coastal lagoon' — is set to experience a multitude of changes due to the rates of evaporation and seawater intrusion within adjacent aquifers, the rate of exchange with the open inlets and the changing rates of precipitation. These will all contribute to increasing the salinity of the lake: a matter that will affect those fish stocks that may have upper salinity tolerance levels beyond which they will witness a decline.[8]

While Al Shakhlouba is located at the south banks of El Burullus Lake, the Northern part is endangered by climate change because of the very narrow strip between the lake and the Mediterranean Sea, making it prone to sea-level rise. This area is affected by continuous land subsidence, seawater intrusion and coastal erosion, which occurs due to a steady sea-level rise that is no longer abated by the sedimentation and hydrological counterforce of the Nile. This is not only due to the High Dam of Aswan,[9] and the reduced flow rate due to climate change affecting rainfall levels upstream, but also damming, especially the Millennium Dam in Ethiopia that is still a subject of a much heated international political struggle even if Ethiopia has already announced the full completion of the dam's fourth filling.[10]

In a 2015 study of Al Manzalah, another of Egypt's northern lakes, El Shimy and Khadr concluded that climate change may increase the temperature, salinity of the water and depth of the lake. In their modelling of climate change scenario of RCP 2.6_I,[11] including sea-level rise by 0.24 metres, the observation station at Tanees would record a depth increase of 102% as a maximum value, with the average around 69%. For El Roda Station, the maximum depth increase would be at 98%, with the average at 48%.[12]

According to Shalby, El Shimy and Zeidan's 2021 modelling study, the following is expected to unfold for El Burullus Lake:

- Depth of the lake, on average, would increase by 13.5% by 2049 and 22.5% by 2050. In some areas, such as the western front (Brimbal station), this would grow to 18.9% in 2049 and 25% in 2050. At other parts, like in Khashaa station, the increases would be much less (8.8% in 2049 and

7 https://pubmed.ncbi.nlm.nih.gov/18240684/

8 www.sciencedirect.com/science/article/pii/S1001627919303087

9 https://bioone.org/journals/ambio-a-journal-of-the-human-environment/volume-36/issue-8/0044-7447(2007)36%5b677%3aLBOTND%5d2.0.CO%3b2/Lake-Borullus-of-the-Nile-Delta--A-Short-History/10.1579/0044-7447(2007)36[677:LBOTND]2.0.CO;2.short

10 www.aljazeera.com/news/2023/9/10/filling-of-grand-renaissance-dam-on-the-nile-complete-ethiopia-says

11 www.climatewatchdata.org/pathways/scenarios/198

12 www.researchgate.net/profile/Mohamed-Elshemy-4/publication/309160272_HYDRODYNAMIC_IMPACTS_OF_EGYPTIAN_COASTAL_LAKES_DUE_TO_CLIMATE_CHANGE_-EXAMPLE_MANZALA_LAKE/links/5802042a08ae23fd1b6702c6/HYDRODYNAMIC-IMPACTS-OF-EGYPTIAN-COASTAL-LAKES-DUE-TO-CLIMATE-CHANGE-EXAMPLE-MANZALA-LAKE.pdf

21.5% in 2050). The relative differences between the two years stem from model complexity and the meteorological cycles changing weather patterns from one year to the next.

- Temperatures are expected to rise by 2.83 degrees Celsius in 2049 and around 4.15 degrees Celsius in 2050 (as averages). Areas furthest from the Mediterranean inlet/outlet openings would experience the highest temperature increase, especially the ones closer to incoming drains due to a higher thermal load at the end of the agricultural cycle, conserving the latent residual heat along the way in addition to being fresher in content, making it absorb solar radiation energy more than sea water due to having higher thermal capacity.

Increased heat reduces oxygenation levels due to decreasing oxygen solubility and increasing biological and chemical damads (BOD and COD, respectively). The spring and summer are the times when pollutant concentrations increase the most — via more application of pesticides, along with more municipal waste discharge — as well as being the seasons when heatwaves occur. This means aquatic fauna experience Toxicant-Induced Climate Change Sensitivity (TICS: a term mentioned in the Hooper et al. and Moe et al. 2013 studies.[13]) This compounded-stressor event of experiencing increased pollutant load and thermal stress would significantly affect fish stocks.

Climate change and the proliferation of invasive species

The locals believe that climate change isn't the only culprit to blame, but it is nonetheless a factor that has teamed up with other manmade phenomena like the proliferation of aquatic invasive plants such as *Eichhornia Crassipes* (known locally as 'ward el neel' or ورد النيل, literally translated to "the flower of the Nile"). This plant is fabled to have been introduced to Egypt by Mohamed Ali, the founder of the last Egyptian Kingdom prior to the 1952 Revolution, as an ornament for its flowers and aesthetic appeal. These plants thrive on nutrients offloaded in the lake from wastewater: municipal, agricultural or (sometimes) industrial. Aside from their eutrophication effects on the water bodies' ecosystem and water quality, they consume substantial amounts of water yearly, up to 7892.5 billion gallons of water yearly across the Nile water system.[14]

Figure 3. Map showing case study area with large swaths of *Eichhornia*. Source: Google Maps

Figure 4. Members of the local fishing community. Credit: Abd El Hamid Sherief

In the Google Maps picture (Figure 3), the dark green vegetation-like parts do not represent trees, but are large swaths of Eichhornia. With climate change-induced water scarcity and the overall increase in the water-budgeting requirements of crop cultivation, due to higher temperatures, irrigation authorities often resort to reusing and redirecting agricultural drainage water. This leads the agricultural wastewater reaching the lake to be highly concentrated in nutrients, resulting in more eutrophication, which further amplifies the effects of having high COD (chemical-oxygen demand) and BOD (biological-oxygen demand).

13 https://setac.onlinelibrary.wiley.com/doi/10.1002/etc.2045

14 www.al-monitor.com/originals/2016/09/egypt-nile-water-flower-hyacinth-invasive-species.html

The local fishing community say that such plants may offer a habitat for the fish and yet, within heatwaves, caused by climate change, the waters around such swaths of aquatic plants are described as "حامية" (pronounced as 'hamiya', meaning 'harsh' or 'hot'). Such conditions may cause mass mortality among the fish. In addition, not all fish species fare well within such thick mats of light-blocking vegetation; catfish species would outcompete other more prized preferable commercial catch, further reducing income from fishing. The potential for oxygen depletion in these floating plants is due to their green parts being above the water surface, shading other aquatic plants/phytoplankton that oxygenate the water column. The debris from their rapid growth decays and increases COD-BOD levels leading to more oxygen depletion below the water surface, releasing carbon dioxide and — in anoxic conditions — methane, which in turn increases the levels of soluble CO2 equivalent gases within the shallow water column. The increase of CO2 within the water column would increase the pH of the water (carbonic acid) and interact with the nitrogen compounds secreted as metabolic waste in fish and flushed out by their gills, further increasing the physiological stress with the production of NH4+ (ammonium).[15] In this sense, prolonged heatwave exposure from climate change accelerates the growth of Eichhornia Crassipes due to its tropical nature and as it is bundled with high levels of pollution, a reduction of the natural fishery yield of El Burullus Lake is imminent.

Figure 5. Lake Burullus December 1984. Source: Google Maps

Figure 6. Lake Burullus August 2023. Source: Google Maps

It is worth noting that the extent of the *Eichornia*'s growth has changed over time. With more pollutants and more area losses due to land reclamation for crop cultivation and aquaculture, the invasive species have become more prominent within the lake. Figures 5 and 6 show a comparison between 1984 and 2023, with 2023 visibly showcasing more growth.

The proliferation of *Eichhornia Crassipes* is not only tied to the lake, as it spreads across many irrigation canals in the agrarian belt of villages surrounding the fishing communities around the lakes. The plants consume a substantial amount of water due to their high water content and grow well in rising temperatures, further exacerbating the water losses behind the national water scarcity crisis that climate change has been a major contributor to.

As seen in Figure 7, these invasive aquatic plants have formed a 'floating reef/mat' around the shoreline/harbour of the village. These keep increasing with cumulative pollution concentrations and growing temperatures that stimulate the plants' metabolism and absorption of nutrients (from untreated wastewater) and biomass growth: outcompeting other aquatic grasses and reed-plants that are used as animal fodder.

Al Shakhlouba does not currently seem to be at risk of sea surges, or of being submerged, due to its position at the southern shores of the lake. But the same cannot be said about the lake overall, or Al Shakhlouba, in the long run. Projections show that the new generation of the village is poised to witness some critical changes if major shoreline engineering projects are not started ahead of time.

15 http://fisheries.tamu.edu/files/2013/09/SRAC-Publication-No.-464-Interactions-of-pH-Carbon-Dioxide-Alkalinity-and-Hardness-in-Fish-Ponds.pdf

Figure 7. Proliferation of plants in the area. Credit: Abd El Hamid Sherief

Figure 8. The 'floating reef/mat' formed by these invasive aquatic plants. Credit: Abd El Hamid Sherief

What seems like a green river between the two banks of the canal in Figures 9 and 10 is actually the same invasive aquatic plant, and these pictures have been taken on the road from Al Shakhlouba to Sidi Salem, a large provincial town an hour away from the village. The watershed system has carried the plant forward across most of the water bodies in the region.

Figures 9 and 10. The invasive aquatic plants filling the canal. Credit: Abd El Hamid Sherief

Going under scenarios: if not this century, then the next

On the face of it, the village may still seem to be 'marked as safe' from risks related to submerging and 'going under' as a result of climate change, as the lake itself may act as a buffer. Nonetheless, it should be noted that the lake is shallow, which may reduce its ability to absorb sea surges that may change its salinity levels. According to the Climate Coastal Risk website, the village is not entirely safe in the long term, as seen in the following timeline snapshots:

Figure 11. Year 2030 areas at risk of flooding close to Al Shakhlouba Village. Source: adapted from Google Maps

Figure 12. Year 2100 areas at risk of flooding close to Al Shakhlouba Village. Source: adapted from Google Maps

Figure 13. Year 2150 areas at risk of flooding, including Al Shakhlouba itself. Source: adapted from Google Maps

While we may think of the year 2100 as far away, it is only 77 years away. This means that children born within the community tomorrow who end up living in the village — whether willingly or involuntarily due to not having opportunities elsewhere — could live to see the unfolding of such scenarios. It is also worth mentioning that such projections may be quite conservative given that there are areas of critical climate change potential

that have not yet been considered within climate scenarios. Along with this, NOAA (National Oceanic and Atmospheric Administration, US) has predicted that sea-level rise within the next 30 years will be by the same magnitude of the sea-level rise that took place in the whole of the 20th century.[16]

Impact: NELD (non-economic loss and damages) due to climate change and environmental degradation

Fishing as a backbone of Al Shakhlouba: what would the village do without it?

The local community depends mainly on fishing for sustenance and income generation. This is in addition to services and crafts that support it, such as the manufacturing and maintenance of boats and trucks, weaving of the nets, fish sales, and fish market logistics, as well as community services like running shops and homemaking trades. That being said, the community laments that such a trade system is no longer enough to provide for the community due to the severe reduction of the catch and the fact that the lake has stopped being as abundant in fish over the years. Al Shakhlouba Village was once called "The Kuwait of fishing grounds", as the abundance of fish attracted many members of the fishing community and promised at least a good comfortable living. In addition, aquaculture was not as widespread previously as now, so price competition between wild-caught fish and raised aquaculture enclosures was not a contributing factor to such desperate resource competition and conflict. Within the community, the sense of 'doom and gloom' and uncertainty has begun to show in conversations and social settings.

Women in the community: fisherwomen and the reduced catch dilemma

While fishing is predominantly a man's profession, women have always been present within it, not only to support husbands, but also families where husbands died and the sons are too young to work, and there are cases of families having only daughters bringing them into the trade until they reach marrying age, as they transition and bring the fishing skillset to their husbands' households. Such circumstances have led to women fishing in the lake in small, but observable numbers. The more abundant the fish, the easier it has been for women to fish as yield abundance enabled them to get their target catch of the day very early on, a couple of hours after dawn, then go back home while their children were still sleeping and before being seen at the lake for a prolonged time. With ecosystem degradation reducing fish stocks, along with climate change effects and overfishing, these women must spend longer times at the lake, leading to further social and family pressures, as Al Shakhlouba community is still quite traditional and conservative.

The community has expressed drinking water distress, impacting both women and men. But as women have been undertaking most of the household chores — including cleaning, cooking, raising children and fetching drinking water — more maverick planning for managing water has been particularly required from them.

In addition, reduced fish catch has meant less income for households, adding budgetary stress for women, as they are the ones shopping for food ingredients: according to inflation reports, food prices surged to 61.8% in March 2023.[17] Many women have tried supplementing the family diet by raising chickens on rooftops or in coops in vacant spots between houses, but this has been heavily affected by soaring feed prices that have reached 24,000 EGP per tonne, or the equivalent to 775 USD, according to a Reuters report in March 2023.[18] While the crisis in Ukraine has contributed to the increased feed and cereal commodity prices, changing climatic conditions have negatively affected overall international markets where demand is outstripping supply.

16 www.nationalgeographic.com/environment/article/sea-level-rise-1#:~:text=13%20inches%20(3.2%20mm.),National%20Oceanic%20and%20Atmospheric%20Administration

17 www.zawya.com/en/economy/north-africa/egypts-food-inflation-surges-to-618-in-march-2023-world-bank-q0o3td0g

18 www.reuters.com/world/africa/egypts-poultry-sector-reels-currency-turmoil-driving-up-prices-2023-03-27

Desperate times call for desperate measures?

The 'Cattle Egret' white bird is known locally as "أبو قردان" (pronounced as 'Abu Qerdan). In another scene (pictured in Figure 14), during a boat ride, this bird was spotted ensnared by a bait placed within the thick mats of hyacinth plants. As the tour guide was releasing it, he said that some people in the local community have begun to trap these birds to complement their diet after the collapse of fish stocks. Unlike homesteaders in Western countries, the people of Al Shakhlouba Village do not have the necessary land acreage for artisanal gardening to supplement their nutritional intake, nor large game hunting grounds for expanding their pantry. While the species is abundant and classified as a 'Least Concern' bird species, it is worth noting that changing dietary behaviour during an environmental crisis is a sign of the decreased carrying capacity of the system and its conventional nutritional streams (fish in the case of Al Shakhlouba).

Figure 14. The ensnared bird. Credit: Abd El Hamid Sherief

Figure 15. The bird after it was safely released. Credit: Abd El Hamid Sherief

Rise of conflicts: resource depletion breeding violence

Damages to natural resources often result in conflict, and the local community in Al Shakhlouba have reported that fights between fishermen have indeed arisen over fishing territories. Overfishing offenders, such as those who don't abide by the ban on fishing with large motor-powered boats, have come into conflict with regulation-abiding fishermen. These fishing regulations have been put in place so that all those fishing the waters of the lake can be on an equal footing and to also give a chance for the remaining fish stocks to recover, but when it comes to the enforceability of such rules, another social issue emerges. The community is comprised of different families, yet is very intermingled due to intermarriage, so even with strict law and order in place, community-reporting from honest fishermen is frowned upon, as no one likes to be known as unable to manage their affairs on their own (relying on the police) or, worse, to be 'snitching' on a kin member. This leads to subtle tensions in the community and feelings of unease/fear, with each daily fishing trip.

Within each family, there are those who are law-abiding and those who don't follow the rules, making it hard to find perpetrators. An example of this can be seen in the العجايرة 'Al Agayra', a clan/extended family of fishermen who have been highlighted by the interviewed locals as using violent tactics when it comes to "carving up territories" within the lake. It has also been reported that the clan overfishes, using illegal means, such as poison-laced bait to bring fish to the surface and electric shocks while threatening to shoot those who object to them. Despite this, there are members of the same group who are peaceful and law-abiding, living within other fishing settlements and neighbourhoods. The locals seem to be aware of this much-needed distinction: a feature that helps "iron" or weed out social disruptions or conflicts. It has also been reported that such conflicts were less common in the past, as the stocks of prized fish were truly abundant: hence, no one had to resort to such desperate measures.

Traditional navigation and sailing

While almost all fishermen master the art of manual navigation and canoe steering with those valuable and quite versatile long sticks (seen in Figure 16), the advent of gas-fuelled motors may yet change the culture of navigation across the lake. A major economic reason why the traditional method persists is the removal of fuel subsidies and the high cost of motors and their maintenance. Hence, manual navigation is deemed a cheaper option and therefore more desirable, despite being physically exerting, especially considering how winters are becoming harsher and summers are now much hotter. The process is also aided by the relative shallowness of the lake, as the long sticks of wood hit its shallow bed against the body weight of the person steering the boat, until the canoe is pushed forward, or backwards, as that person plants their feet firmly onto their boat, transferring the kinetic energy from the stick, to their body and then to the boat. This slower means of marine transportation has helped limit fishing to the shorelines of the lake, a matter that deemed it as a part of the regulations decreed by the local authorities. Despite this, a "customary/informal" dispensation for the locals to use motor-powered boats has been given. It is unclear if such dispensation has been on a case-by-case basis or left up to community members/local authorities themselves. Traditional non-motor navigation and propelling is more environmentally friendly as it has no emissions, and gives fish stocks a chance to reproduce deeper within the lake. Dredging takes place with much larger boats at higher depths using larger motor-propelled boats. While there are still wind-propelled canoes with sails, large boats with sails are less commonly used, possibly due to reduced fish yields that no longer warrant using large sail-propelled barrages, but there is also a possibility that the prevalent wind patterns across the lakes have changed along with other occurring climate change effects.

Figure 16. Local guide, Arafa Sleem, steering a boat forward towards one of the sunken islands of the lake. On longer trips, the fishing crew alternate the steering work, as the heavier the boat (with more passengers, fish catch, nets, bait and other gear), the more physically demanding the steering is.
Credit: Abd El Hamid Sherief

Figure 17. Larger wind-propelled boats with sails are fewer and are often anchored within the lake itself, as the lake shoreline is too shallow due to sedimentation and debris. Credit: Abd El Hamid Sherief

Young people's uncertain future

Young people are a growing demographic that is overwhelmed by a lack of economic opportunities. In such a vulnerable economic context, environmental risks exacerbate the difficulties faced by the community. There is an overwhelming sense of being 'at the end of the line', not only for municipal and governmental basic services, but in terms of having 'something else to look forward to'.

For example, the community lacks drinking water, as well as the usual electricity outage due to loadshedding meant to relieve the national grid system, which is under extreme pressure from the ongoing heatwave. These impacts are not equally shared; marginalised communities like the one in Al Shakhlouba suffer more than others, especially regarding the 'end of the line' sentiment explicitly repeated and affirmed by Abu Suliman, a 40-year-old local fisherman; showcasing a sense of disenfranchisement and frustration about governmental attitudes. This comes at a time when the state — represented by

the Egyptian Prime Minister, Mostafa Madbouly — has declared that affluent resort towns around the North Coast and the Red Sea and Sinai will not experience the same loadshedding cuts, because the influx of tourism therein represents "a national source of income" and, as such, is deemed a priority.[19] This statement has later been diluted by an official at the Ministry of Electricity and Renewable Energy, indicating that such resort towns are often managed by real estate companies with dedicated facilities teams that operate their own electricity generation stations and grid: hence, they can afford to keep the electricity on at all times.[20] Aside from whether this is true, this thinking reflects a situation where a community's appraised worth is being measured by financial affluence. There is a running meme on Egyptian social media that there are 'two Egypts': one for the poor in villages (such as Al Shakhlouba) and one for the gated communities and resort towns where the rich live.

A growing number of boys and men have been leaving the fishing trade to find employment in the construction sector in the North Coast, where there has been an increase in new upscale tourism-oriented real estate development projects. Aside from internal temporary immigration for work that is often seasonal, informal or without job security, many young people take the risk of attempting to leave the country for better prospects, some legally with contracts for work in the GCC countries (Gulf Cooperation Council) and some others trying their luck on boats crossing the Mediterranean. In its 2016 report, the International Organization for Migration (IOM) considered illegal immigration from Egypt, not only for young adults, but also children. 'Uunaccompanied children migrants' represented 28% of all illegal migrants from Egypt in 2011, with an increase to 49% in 2014 and a jump to 66% in 2016. The report also revealed that 50.3% of migrant children who were caught unaccompanied showed determination to repeat the attempt to illegally migrate to Europe, with 68% of the migrant children surveyed saying they tried to leave Egypt, as it doesn't provide enough adequately-paid work opportunities for them to provide for their families.[21]

Military and police efforts to dismantle underground rinks of smugglers have resulted in a reduction in illegal migration, leaving many young men feeling "boxed-in"; unable to find opportunities locally and having the sea barricaded with Egyptian and European navies, with some still insisting to "gamble their lives away in a game of chance" in a desperate attempt to reach greener shores.

In 2016, a boat thought to be originating from Kafr El Sheikh — the same governorate to which Al Shakhlouba belongs — capsized near Alexandria while carrying 600 illegal migrants, killing at least 42.[22]

There is a problematic discussion to be had regarding the designation difference of 'climate refugees' versus 'climate migrants'. The latter group are still seen as 'economic migrants' by some, or may be seen as deserving of such status only if they were fleeing from rapidly occurring climate events of floods, hurricanes or wildfires, according to Dina Lonesco, the Head of Migration, Environment and Climate Change at IOM.[23] However it is worth noting that slow-onset climate change events can also be a cause for migration.[24] For example, Al Shakhlouba Village is experiencing such slow-onset events from heat increases in summers and colder weather in winters, along with water scarcity and reduced fish catch (in lieu of the added factors of pollution and manmade degradation). Hence, illegal migration from the village and other governorates experiencing the same effects needs to be addressed too, as a climate-related issue.

19 https://arabic.cnn.com/middle-east/article/2023/07/27/egyptian-pm-explains-why-power-not-cut-off-from-the-tourist-and-coastal-areas

20 www.elbalad.news/5854262

21 https://documents.aucegypt.edu/Docs/GAPP/Public%20Policy%20Hub%20Webpage/11-%20Children%20on%20The%20Move%20Policy%20Paper%20-%20En.pdf

22 https://egyptianstreets.com/2017/01/12/egypt-prevents-12192-from-illegally-migrating-in-2016

23 www.un.org/sustainabledevelopment/blog/2019/06/lets-talk-about-climate-migrants-not-climate-refugees

24 https://unfccc.int/files/adaptation/application/pdf/soe_synopsis.pdf

A father and a son: would climate change and environmental degradation put a stop to the traditional way of life?

Mahmoud Hegazy, nicknamed 'Abu Mohamed', is a local fisherman. He has spoken about the area's experience of a changing climate, with much harsher seasons. The colder winters pose more hardships to fishermen, who have been accustomed to milder winters. According to him, the magnitude of 'cold' in winter increased by around 'half' of what it used to be. Unlike their counterparts abroad, many poor fishermen do not have access to the high-quality insulated clothing required for work in a colder environment around open waters. With reduced fish catch, fishermen have to spend longer hours out on the lake, which increases exposure to the much hotter springs and summers. Mahmoud's son, 'Muhammad', said that he loves the lake but wants to leave when he gets older "as life around the lake is hard".

The longer hours required in such conditions to obtain a comparable catch means that sons would have to accompany their fathers for more hours on longer boat trips, affecting the remaining schooling time. This leaves families at a crossroads in terms of opportunity cost: they can either keep investing in education so that the new generation may have better prospects of future social mobility, or focus instead on immediate family survival by letting their children help their families.

Compounding effects

Pollution, eutrophication and neglect

Abu Sulaiman is a a 40-year-old fisherman in Al Shakhlouba village. In his house, opening his windows, even from that distance, comes with the risk of smelling the wastewater effluents discharged into the lake. As microbial activity increases with rising temperatures, this smell worsens during heatwaves in summertime. This is because there is often an increase in municipal water discharge, as the districts upstream, where there may still be running water, increase their consumption with an increase in showering, leading to more wastewater and a higher discharging rate. Being a dumping ground for liquid waste exacerbates the damage to the ecosystem that is slowly accumulating because of climate change.

Climate or pollution? Together apart, or hand in hand?

In his commentary, Abu Sulaiman said he used to be able to see fish popping up from within the glare of the sun onto the lake surface, as the lake had an abundance of fish and people didn't have to worry about food. In his mind, 'the lake would sort itself out' if manmade exploitation stopped immediately.

In summary, Abu Sulaiman's view was that talking about climate change is a 'luxury' that the community cannot afford as tackling pollution in the lake is the primary factor they need to address first. In his simple statement, he referred to what experts are increasingly defining as 'climate tunnel vision'. This describes how it can be a mistake to treat climate change in isolation from the environmental degradation caused by overexploitation of resources beyond rates of replenishment/recovery and contamination/pollution. Obliviousness about the relationship between climate change and pollution can end up exacerbating climate change's effects, as a degraded ecosystem loses its capacity for resilience in the face of external threats (of which climate change is one).

According to a study published in the Egyptian Journal of Aquatic Biology and Fisheries in 2019, Lake Burullus is classified as Hypereutrophic, with high ammonia levels as it represents 81% of dissolved inorganic nitrogen (DIN) and 44.86% of total nitrogen (TN). The toxicity of ammonia to fish stems from the fact that with higher concentrations of ammonia, fish find it difficult to get rid of their own ammonia waste via their gills, causing damage as their nervous system accumulates it, and in turn leading to the displacement of key ions of potassium while inducing an increase of calcium ions and, eventually, cell death

due to severe biochemical imbalance.[25] This is aside from the fact that ammonia breakdown from naturally occurring bacteria, through the nitrification process, is oxygen-demanding.[26] And, with less oxygenation in the lake — especially during heatwaves and high turbidity due to the high particulate count from wastewater and hindered photosynthesis of phytoplankton due to mats of water hyacinth — the nitrification process is slowed down and the ability of the lake to rid itself of the toxic ammonia is reduced.

Mahmoud Hegazy said fish are like humans: they need air to breathe. Dissolved levels of oxygen at the lake differ greatly according to the biological and chemical demand and the source of water replenishment, the sea or the watershed agricultural drains; in addition, oxygenation changes from one season to another depending on the agricultural cycle within the Nile Delta, the water temperature and the closure/opening of the inlet/outlet into the Mediterranean. For warmwater species of fish, some studies advise keeping minimum oxygenation levels at 6 to 8mg per litre of dissolved oxygen.[27] A 2023 study in El Burullus Lake, with seven different research station points for sample collection, revealed healthy dissolved oxygen levels in three locations at a range between 9.70 and 15.50mg per litre, finding lower values in the other four, with a low range between 4.58 and 6.90mg per litre.[28] This suggests that a couple of areas of the lake are either no longer oxygenated enough to support fish, or that they are bordering the lower thresholds.

Figure 18. One of the 'sunken islands' of Al Shakhlouba village. Credit: Abd El Hamid Sherief

Figure 18 is taken from one of the two famous "sunken islands" of Al Shakhlouba village: the one in question hosts the ruins of an old "fish market" that has been moved to the mainland for a while; some say this is because of water levels, while others suggest it is because the advent of refrigeration made it easier to trade the fish catch on the mainland. The sites have become something of an internet sensation due to their unique setting and aesthetics. Foam can occur naturally due to saponification of the oils released when plants die, which is decomposed (with water hyacinth having a high lipid content). This can also be due to the pollutants discharged into the lake, which may have particles that are both hydrophilic (attracted to water) and hydrophobic (rebelled by water), forming bubbles due to surface tension forces.[29] Given how common such a sight is around the lake, this seems to be a sign of prevalent pollution.

Climate change meeting the energy crisis

Figure 19 shows a spot for delivery of the daily catch. With increased heat, fishermen who have small canoes are pressured to bring their catch to the local fish market more quickly for cooling/refrigeration. This increases the physical strain on fishermen, who have to go back and forth to make sure their catch doesn't spoil. It also means facing the rising energy costs required for refrigeration. With more electricity outage, the local fish processing joints that rely on logs of ice may have to deploy their own generators in summer, to stay in operation. This is a small example of climate feedback loops:

Figure 19. A spot for delivery of the daily catch. Credit: Abd El Hamid Sherief

25 https://pubmed.ncbi.nlm.nih.gov/12398363/

26 https://edis.ifas.ufl.edu/publication/FA031

27 www.waterboards.ca.gov/water_issues/programs/swamp/docs/cwt/guidance/3110en.pdf

28 https://link.springer.com/article/10.1007/s11270-023-06351-3

29 www.in.gov/idem/files/factsheet_owq_nps_foam.pdf

fossil-fuel powered generators increase greenhouse gases (GHG) that lead to worse climate change outcomes requiring more use of energy for cooling and refrigeration. This is a clear indication that the drive of electrification should consider heatwave effects on vulnerable communities that may not afford the green transition, or fall between the cracks of poorly managed or inequitable governmental services. There is also a lost opportunity when it comes to the deployment of innovative cooling/heat insulation low-tech solutions that could be seen in pilot projects in some Sub-Saharan African countries.

Debilitated infrastructure and governance issues

Figures 20 and 21 showcase an excavator machine that has remained idle at the shoreline of the lake for a couple of months. The excavators were meant to help remove the accumulating sediments at the shoreline, as these often have high organic content trapped in by the debris of the invasive hyacinth plants. Within these plants, residue from incoming agricultural, industrial and municipal wastewater has settled. This causes bad smells and reduces the depth at the harbour, where the fishing boats and canoes come and go. When asked why the excavators are not working, a community member said: "They ran out of gas and the government-contracted company representatives said we cannot get fuel for them now." Fuel subsidies were significantly reduced by the government in a bid to reduce public expenditure and maximise revenues into its budget, but fuel is still available in the country, albeit more expensive. In addition, excavators are expensive to rent, either hourly or daily, making it hard to fathom how standing still for months may ever make sense economically even if fuel became more expensive. This may cast some "speculative shadows" on the service contracts and one community member suggested that the contractor may deliberately delay execution to maximise earnings by prolonging the service days. This suggests there may be a hint of collusion, corruption or — at best — bad management and neglect. The locals have urged local officials to order the excavators to resume the work, to no avail, indicating there is no adequate grievance or escalation process to navigate.


Figures 20 and 21. An excavator machine that has remained idle at the shoreline for a couple of months. Credit: Abd El Hamid Sherief.

In their own poignant way, Figures 20 and 21 symbolise the juxtaposition of a mechanical solution rendered ineffective due to lacking sound governance, follow up, or local agency/ownership. Natural forces contribute to this scene via the invasive water hyacinth: steady, relentless and able to steadily proliferate over time until it engulfs everything around it: a rogue biology in a perpetual tug of war with machinery out of fuel and desperate for spare parts.

Vulnerabilities

Health

With the increase in extreme temperatures during the longer summer months, there are more health complications to be expected, not only in the form of heatstrokes, but from communicable diseases. The locals at Al Shakhlouba have said the local hospital is "empty and devoid of doctors", who come only rarely

and when they do, it would be just to sign their names and leave. This pushes people to commute to the nearest hospital in Sidi Salem, which is around 40 minutes away. For a community that makes a living from the outdoor activity of fishing, where temperature extremes may cause health issues especially at the time when prolonged work outdoors is essential considering reduced fish yields, this higher risk of increasing occupational hazards would be more alarming in light of the absence of adequate healthcare.

During heatwaves, poor people do not have the comfort of air conditioning, so with electricity cuts and drinking water cuts (with the lake being too polluted for drinking), locals are very vulnerable to heat stress.

Hand-to-mouth existence

Since the steady decline of fishing yields, the ability of fishermen to raise enough capital to invest in equipment is minimal. Therefore, a substantial number of boats are rented or shared, thereby requiring a major cut from the catch in order to repay the owner of the boat. This further increases the vulnerability of households to decline of income indued by fish stock collapse.

Marital pressures

With reduced income from fishing, many fishermen either try to find another job to supplement their income and quit fishing altogether, or work an additional job; yet, due to unavailability of local job opportunities, they have to either migrate internally or go abroad (either legally or illegally). This creates much pressure on household dynamics. This is particularly worrying with the rise of divorce rates around the country. According to a 2020 study conducted by the Land Research Center for Human Rights, around 27% of fishermen migrate temporarily/seasonally to fish in other lakes due to the reduced catch at El Burullus.[30] This causes stress to the family structure, leading wives and children to worry greatly about their fathers, who aren't only in danger from environmental forces, but also from violence from rival fishermen at those lakes, who view them as "strangers who are there to steal their fish".

Coping mechanisms

Faith-based collective efforts

A major point of resilience for the Al Shakhlouba community is the anchoring point that faith offers. There is a renewed hope that God will provide and that God favours those who take care of others. This sense of philanthropy/charity, inspired by religion, can be seen in community efforts to build mosques within the village. These don't only serve a religious function: they provide a multitude of community services. Within the tour carried out during this study, a local fisherman pointed to the new extension of a mosque under construction, built on donated land that is currently being fundraised for. This building will provide classes to children, a clinic and a workshop for women to work on crafts, as well as serving other social and economic functions. Due to a rise in prices for construction materials, such as cement and steel, construction work for this project has been put on hold.

Traditional faith-based values also help the community during social disputes, especially considering the weak interventions of the government. Mosques therefore play a major role in managing the affairs of the community, as well as encouraging acceptance of hardship as the believers are called by God to be more resilient and adopt a stoic attitude towards life. Faith-based values encourage living within an extended family-house setting, to take care of the elderly: a matter that may cause problems for young newly married couples, but at least provides an 'insurance policy', or sense of security, for old age. One issue with this is that, as Al Shakhlouba is classified as a rural community, this may lead to a greater community desire for

30 https://jalexu.journals.ekb.eg/article_261283.html

begetting sons over daughters, as daughters traditionally marry young and leave the family to join another, but the sons are the ones who work and bring income to the household. That being said, because of increasing Malthusian-like pressure from the Egyptian government's policies of subsidy removal and the fact that it has not intervened to curb the hyperinflation striking the country for over two years, more families are delaying growth in number, despite longing for sons.

Philosophy of survival: one dawn at a time

The engraving of a Quranic verse on the ruins of one of the sunken islands (Al Baqara Chapter, Verse 156), seen in Figure 22, is a form of prayer that addresses the need to surrender oneself and accept God's fate and His decreed course of events, both those that have happened and those that are yet to come. It reflects the overall attitude and philosophy of the community. The verse is often quoted during times of loss, grief and suffering, as an affirmation that one can work hard, but that, ultimately, one must defer back to the higher power. The local fishermen in this study commented on the reduced catch due to a changing ecosystem, and an increase of fish prices, due to the overall inflationary wave hitting the country (doubling the prices of other sources of animal protein like meat and poultry), adding that such faith is the only thing keeping the community afloat. This is a testament of how systems can continue to operate profitably for a while, when there is an increased scarcity, prior to a total crash in the case where remediation is not applied. The phrase "God works in mysterious ways" has never been more true for a community whose 'stoic' attitude is like a trained muscle: disciplined and prepared to take on the challenges of each day, but one day at a time.

Figure 22. An engraving of a Quranic verse on the ruins of one of the sunken islands. Credit: Abd El Hamid Sherief

Cooperative organisation

Despite the fact that cooperatives in Egypt aren't as strong as those in other countries, they can still offer a form of self-management and self-regulation at a time when governmental presence is loose, sporadic and inconsistent, as described by the locals. According to a 2022 study authored by Eman Abdelsalam Khalifa, 55% of the 100 surveyed fishermen around El Burullus lake belong to a fishing cooperative that helps out with issuing fishing cards, which are necessary for licensing and formally registering fishermen.[31] These also help people register for the national social insurance scheme, though this offers a very small monthly amount that isn't enough to sustain a family, or even an elderly couple after their children have grown up and left the home.

One of the important actions of such cooperatives is to provide a front for representing the fishermen so they can voice their concerns to the government and help bring in support. This has been seen in a national initiative called Bar Aman (بر أمان, translated as Safe Shores). It has been financed by "Tahiya Masr (تحيا مصر", translated as Long Lived Egypt), a national developmental fund. The programme is in its second phase and has managed to support 7416 fishermen so far within three lakes, El Burullus included. The programme also had a focus on women as it supported 135 widowed women who have fishing licenses, but don't own boats, by giving them cooling boxes to place their catch. It has also provided fishing suits, gear,

31 https://journals.ekb.eg/article_261283_0.html

nets and boats to those who don't own any.[32] This initiative has also supported 900 fisherwomen who fish at the shorelines and canals without boats (using a technique that involves diving into the water in groups and forming a circle to trap the fish with their own hands; a very physically straining craft).

Being a member of a cooperative can help reduce anxiety about the future by providing a sense of community-based safety at times of crisis by pooling the little resources individuals may have. It may also ease isolation resulting from hardships caused by the changing ecosystem of the lake (with the motto that "It isn't just you; it is all of us facing the same danger").

Cooperatives may also serve an important role of representation in the future for communities filing claims of climate-induced 'loss and damages' since such future claims would require the involvement of civil society organisations to advocate for the rights of grassroots and vulnerable groups. While the Conference of Parties in its 27th iteration snatched a hard win by locking in an agreement, in principle, on the establishment of a Loss and Damages fund, it is unclear how such funding will be managed; but regardless, it is important to be ready with adequate representation just in case COP28 and the upcoming versions may address it.

Eco-tourism as a hopeful new start

Arafa Selim, a local tour guide, worked as a fisherman around two years ago then became a barber. He currently conducts local tours of the village, especially 'the sunken islands' and their ruins/lone houses. He indicated to us that the decline of income from fish means that diversifying the economy of the village is a must and that 'eco-tourism' is a possible stream for that. Arafa talked about the influx of YouTube and social media influencers and content creators, and how such a drive may not truly benefit the local economy unless the tours are organised by locals. This would also help make those tours and media coverage a vector for passing on the concerns of the community and raising the alarm about the environmental issues the community faces. This reflects the growing concern, worldwide, of travel bloggers and influencers focusing on the romantically-inclined shots: informed by notions of 'the good life' and leaving out the nitty-gritty details of the harsh work people in those areas do in order to survive. As expected, the proceeds from those monetised videos are not shared with the communities hosting those influencers.

Figures 23 and 24. The ruins of the old fish markets at the sunken islands, a major attraction and landmark of Al Shakhlouba. Credit: Abd El Hamid Sherief

32 www.youm7.com/story/2021/8/25/%D8%A7%D8%B7%D9%84%D8%A7%D9%82-%D8%A7%D9%84%D9%85%D8%B1%D8%AD%D9%84%D8%A9-%D8%A7%D9%84%D8%AB%D8%A7%D9%86%D9%8A%D8%A9-%D9%85%D9%86-%D9%85%D8%A8%D8%A7%D8%AF%D8%B1%D8%A9-%D8%A8%D8%B1-%D8%A3%D9%85%D8%A7%D9%86-%D8%B9%D9%84%D9%89-%D8%B6%D9%81%D8%A7%D9%81-%D8%A8%D8%AD%D9%8A%D8%B1%D8%A9/5437366

Figure 25. Graffiti at the ruins showcases messages of love, swearing, cursing and sometimes pride, as seen in engravings by friends and the occasional visitor. The ruins' value stems from being 'just' the way they are; if the water levels dropped or increased, they would be gone as symbols of the place and time. Credit: Abd El Hamid Sherief

Psychologically, a sense of being 'heard and seen' is needed, with the locals wanting to know that someone out there may be interested in the reality of their little corner of the world.

Arafa talked with pride about the foreign delegations he has received and the generated interest in his tours that has been **brought forth** via word of mouth, especially via social media. Eco-tourism has more potential for job creation, as seen in human-propelled canoes: a big motor-propelled boat may drive a ten-member group in a short time, but a small human-propelled canoe can often host three per trip, and take longer, meaning more 'ferry men' can be hired at zero carbon emissions.

Support needed

Green and climate financing

From a climate perspective, the lake, in its current condition, could contribute to both the climate crisis itself and also become a potential solution for it, should adequate investment be deployed. This wouldn't only look at the lake as a carbon-system from production and sequestration, but would look at the area from a socioeconomic perspective that could generate jobs and stabilise the community. This would require adequate resource mapping and opportunity identification studies.

For example, there have been studies indicating that water hyacinths (Figure 26) could sequester large quantities of carbon dioxide from the atmosphere, but can also offer a favourable setting for the production of methane, a potent greenhouse gas, due to their oxygen depletion potential manifested in the anoxic conditions they could create under water and the high BOD and COD parameters they contribute to via their debris.[33] A solution would be to have a business, or a whole circular economy extractive solution, near the lake that could continuously harvest and remove the biomass from it in a way that could lead to sustainable and high-income local jobs, but also generate enough revenue to be spent on lake rehabilitation. There are multiple pathways to create such biofuels, including pyrolysis and other methods that use chemical reactions or fermentation aided with enzymes.[34,35,36] As per the researched scientific and technical methodology, it has been proven possible to start a tangible energy operation with water hyacinth biomass acting as the input feedstock. The scaling-up of such projects could completely revitalise the community and while such mega-scale investment is beyond the financial, technical or organisational capacity of the community, a community public-private partnership where the local cooperative is partnered with startup investors may be possible.

Figure 26. Water hyacinths. Credit: Abd El Hamid Sherief

33 https://link.springer.com/article/10.1007/s10021-020-00564-x#:~:text=Water%20hyacinth%20is%20able%20to,of%20methane%20(CH4)

34 www.tandfonline.com/doi/abs/10.1080/17597269.2018.1558838?journalCode=tbfu20

35 https://link.springer.com/chapter/10.1007/978-981-99-2382-3_45

36 https://scialert.net/fulltext/?doi=ajsr.2012.285.289

Another green intervention is using the power of algae in the bioremediation of the incoming drain water where organic matter is metabolised and the algae biomass can later be valorised for energy, proteins, pigments or other high-value molecules (HVM). The model of fishermen acting as algae farmers is not far-fetched and has been seen in a couple of Sub-Saharan African countries. For example, in Tanzania, green solutions involving algae have provided enough income for many families to send their children to school, empowering the whole community and increasing its resilience against fish catch yield fluctuations.

Green and climate financing could also help address energy and water shortages that have been induced by climate change, via the installation of solar panels to form microgrids and the acquisition of innovative water treatment units like membrane bioreactors, which could help tackle quality issues in the lakes as well as improve drinking water parameters.[37] Such units could be produced at least partially in Egypt by organizations such as the Arab Organization for Industrialization (الهيئة العربية للتصنيع) benefiting from the rise of an ecosystem of water engineering technologies emerging in response to the persistent water scarcity crisis facing the country.

Supporting local storytellers

A major problem with climate impacts and the ensuing discussion on affected communities is that local communities are often aware of them, at least subconsciously on a collective level but cannot link the cause and effect within a defined narrative. In Al Shakhlouba village, the local fishermen can connect the reduction in the fish yield to pollution, overfishing offenders and lack of governance, but they find it difficult to associate the hardship they endure with climate change. This stems from the assumption that "climate change talk" is a luxury they cannot afford: too detached from daily reality, too elitist or — worse — a chance for outsiders to appropriate a local cause as their own in order to build a career off the back of a local population who rarely receive the recognition, or the funding pledged in climate meetings and conventions. Hence, there is a major need to hear the voices of the locals and to holistically understand the discourse being communicated to truly understand the communal subsistence-related anxiety and the persistent agony of having people stripped of agency to change their situation for the better. Local storytelling is therefore very important for anchoring climate change discussions and 'localising' the language, terms and conditions for subsequent action. It is also a means to preserve the oral history of a community that is under threat of erasure due to the pressure of ecosystem changes. Arafa Selim, the local guide who conducts eco-tourism tours, could be an example of such storytelling that needs to be supported and endorsed.

Mental and physical health

While fishing is considered a recreational sport, it becomes a physically and mentally taxing endeavour when it is required to sustain a whole family, nuclear or extended, with it. In many developing countries, mental health ailments, including anxiety, could be addressed via adequate insurance schemes and medical care, especially as many of the fishermen are in their 40s and possibly beginning to feel a physical toll at a time when the local hospital is unreliable and private medical costs are unaffordable. Upgrading the local healthcare facilities is a challenge because there is a nationwide shortage of doctors caused by the brain-drain of physicians and other highly educated professionals to the global North where salaries and living conditions are substantially better. One solution could be to train community health practitioners, who could provide basic medical and mental health support. Along with this, community leaders in mosques and fishing cooperatives could each serve as champions of this peer-to-peer support system.

37 www.sciencedirect.com/science/article/pii/S2666016421000311

Understanding the semi-urban context of Al Shakhlouba Village

While Al Shakhlouba is a fishing community, it is surrounded by an agricultural belt of farming villages to both the eastern and western sides of the south and the lake waters to the north. Within our field trip investigation, it seemed that the densely populated village lacked the trees to produce shade in an area small enough to be walkable but also overly exposed to the sun. There are not enough tall buildings to provide shade to help guard against the intensity of solar radiation during heatwaves. In Figure 27, it is clear how a congested urban batch of houses may benefit from more trees. Surveying empty plots of land within the village could help establish grounds for small community gardens for the cultivation of vegetables to improve food security and nutrition. This is especially crucial, as proximity to local farms no longer guarantees cheap vegetables or fruit, due to farmers tending to sell nowadays to wholesalers (or to big markets in cities), leading to greatly diminishing price advantages that could have been achieved in such circumstances. This could give the community a sense of vibrancy, hope and versatility that would surely reduce overall stress and worry about the food they need to put on the table.

Figure 27. Congested urban batches of houses may benefit from more trees. Source: Google Maps

Lessons learned

The Al Shakhlouba Village case demonstrates how slow-paced climate change effects can be demoralising and difficult to handle to an extent that is sadly often ignored in discussions about loss and damages occurring because of climate change, in favour of more disruptive sudden events. While it is understandable to prioritise climate change consequences in this way, such a focus diminishes the scope of climate change impact to 'a disaster control' issue, of major events like wildfires, hurricanes and storms. It ignores those communities 'off the beaten track', like Al Shakhlouba that don't make it to the news, either locally or internationally. Based on the discussions with the community, here is a summary of key points taken from this study:

1. It is important to listen carefully to local people and note their full range of grievances, as these could be connected within the same patterns or causes. Language may separate the issues covered, so it is important to 'connect the dots'.
2. An understanding of the country's political context is crucial: in Egypt, for example, people often fear criticising the state out of fear of persecution, or being considered political dissidents. This often affects how an interviewer collects field data. In one of the studies on the lake, cited earlier in this case study, the fishermen complained that the adjacent aquaculture installations belong to powerful families with connections to the police and judicial system, meaning environmental grievances against them often go unheard. Such a politically charged environment may affect how climate change cases, particularly those related to ecosystem degradation, are communicated and heard.
3. Al Shakhlouba represents a case of water-energy-food-ecology (WEFE) nexus where climate change hits all the buttons at once. Therefore, it would be wise to understand the non-economic loss and damages in terms of the anxiety and stress of these factors combined rather than in isolation. The climate/carbon-tunnel vision that treats climate change as a function of GHG and ignores how pollution reduces the resilience of ecosystems in the face of climate change's impacts, needs to be reevaluated and addressed in social assessments of climate impact, or in future forecasts of resource losses.

4. Social cohesion and peace are easily disrupted under economic and sustenance stress as demonstrated in the case of violent territorial disputes within fishing. It also applies to the rise in divorce rates under economic pressures prevalent in locations with degraded environments. While Kafr El Sheikh, the governorate encompassing Al Shakhlouba, has lower divorce rates than more urban regions around Egypt, it registers one case of divorce each hour and 13 minutes, according to the Central Agency for Public Mobilization And Statistics (CAPMAS).[38] This substantial increase in divorce rates can be partly attributed to deteriorating economic conditions. This connection creates a feedback loop connecting the social and environmental aspect of climate change, as a higher rate of divorce means more splitting properties and an increasing number of households, leading to an increase in the ecological footprint per person.[39]
5. Food access stress is a major mental health impact of climate change on a community. During our 3 August 2023 field trip, one of the fishermen said that six of their peers had been on their fishing round for the whole day and only got 10kg, meaning 1.6kg per fisherman even if they own the boat and no cuts would be allocated to paying the rent. When it comes to men's mental health, not being able to provide for one's spouse or family is traditionally considered to be failing to honour your duties as a man.
6. Climate change affects the reproductive cycles of fish in ecosystems like El Burullus, as it is home to some species that live partly in saltwater and partly in freshwater, with variant degrees of tolerance levels to prolonged life in "brackish" conditions. This may affect not only the diversity of catch, but also the local tradition. Mullet fish (known locally as السمك البوري, pronounced as 'Samak Burri') is among those species that alternate between saltwater and freshwater. This is a locally preferred fish, not only for eating as a grilled dish with rice, but also to be preserved and salted commercially for special occasions like 'Sham El Naseim': شم النسيم (an ancient feast of the advent of spring, which has been traditionally celebrated by Egyptians since Ancient Pharaonic times, often coinciding with the Coptic Church Easter Celebrations today). With Mediterranean stocks also affected by climate change, the rate of replenishment, or enrichment from the sea, for such valuable species has been reduced. Celebrating this tradition has become much more expensive that it affects the local industry built on it.
7. When it comes to green transition projects and climate adaptation, the term 'community-based green entrepreneurship' is often used with the good intention of maximising local ownership in such projects. However, entrepreneurship in Egypt has few funding opportunities, with these mainly going to startups of already affluent founders. It is also characterised by 'bootstrapping', implying that self-financing, via family and friends' investments, is often the way to go. Given that Al Shakhlouba village is a low-income community, aspiring youth groups may not have such an advantage, leading them to try to 'hustle up' any seasonal work they can get alongside their studies. But these temporary jobs don't provide income security, leaving young people in unpredictable financial situations. Those youth end up moving away from the village as it can no longer generate enough jobs for them. Socially, this has led to an increase in the average marriage age for men while the marriage age is still early for girls; higher than in the past, but still much lower than for men; further straining married life for the new generation.

Synopsis

Al Shakhlouba is a relatively small community (by Egyptian standards), with 20,000 inhabitants. Its context may not be unique in how it is affected by climate change, or in how its population struggle is now a daily endeavour and not an isolated seasonal occurrence. Yet it is a good example to showcase how communities in symbiotic existence with nature can fare if such a relationship has been broken by one party: humans in

38 www.youm7.com/story/2020/12/5/%D8%AC%D9%87%D8%A7%D8%B2-%D8%A7%D9%84%D8%A5%D8%AD%D8%B5%D8%A7%D8%A1-%D9%8A%D9%83%D8%B4%D9%81-%D8%AD%D8%A7%D9%84%D8%A9-%D8%B7%D9%84%D8%A7%D9%82-%D9%83%D9%84-%D8%AF%D9%82%D9%8A%D9%82%D8%AA%D9%8A%D9%86-%D9%8811-%D8%AB%D8%A7%D9%86%D9%8A%D8%A9-%D9%81%D9%89/5098648

39 www.reuters.com/article/environment-divorce-environment-dc-idUSN0343166320071203

this case. Nature — personified in the bounty provided by the ecosystem — becomes less able to give the same expected yield, as people ignore the signs of a downward spiral. The Al Shakhlouba community have been flagging this ecological degradation (amplified by climate change) for a long time, but have no self-governance or adequate political representation to manifest the change they need. This is due not to a lack of awareness, but economic and political disenfranchisement.

Hence, it is crucial to look at the subject of climate loss and damages beyond the sovereign negotiations at COP conferences and to demand that the communities themselves are adequately seated at the table, as they are the ones facing the burning of their rainforests in the Amazon, and they are the ones facing the collapse of the fish stocks in El Burrullus lake; same struggle, but different geographies.

Social disruption (migration and displacement)

Climate migration: the ripple effects of drought in Longido District, Tanzania

VIDEO CONTENT

This case study is presented as a short video, accessible via the QR code below or www.youtube.com/watch?v=awyCk69crto (running time: 6 mins 10 secs).

Fredrick Andrew Shija, Communication Officer, Sokoine Memorial Foundation

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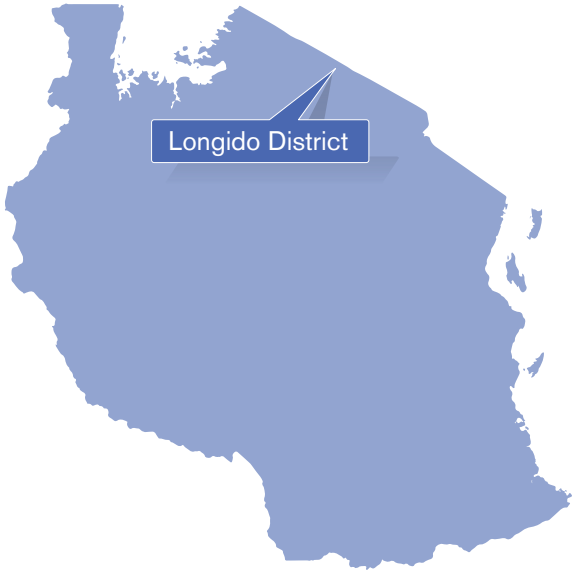
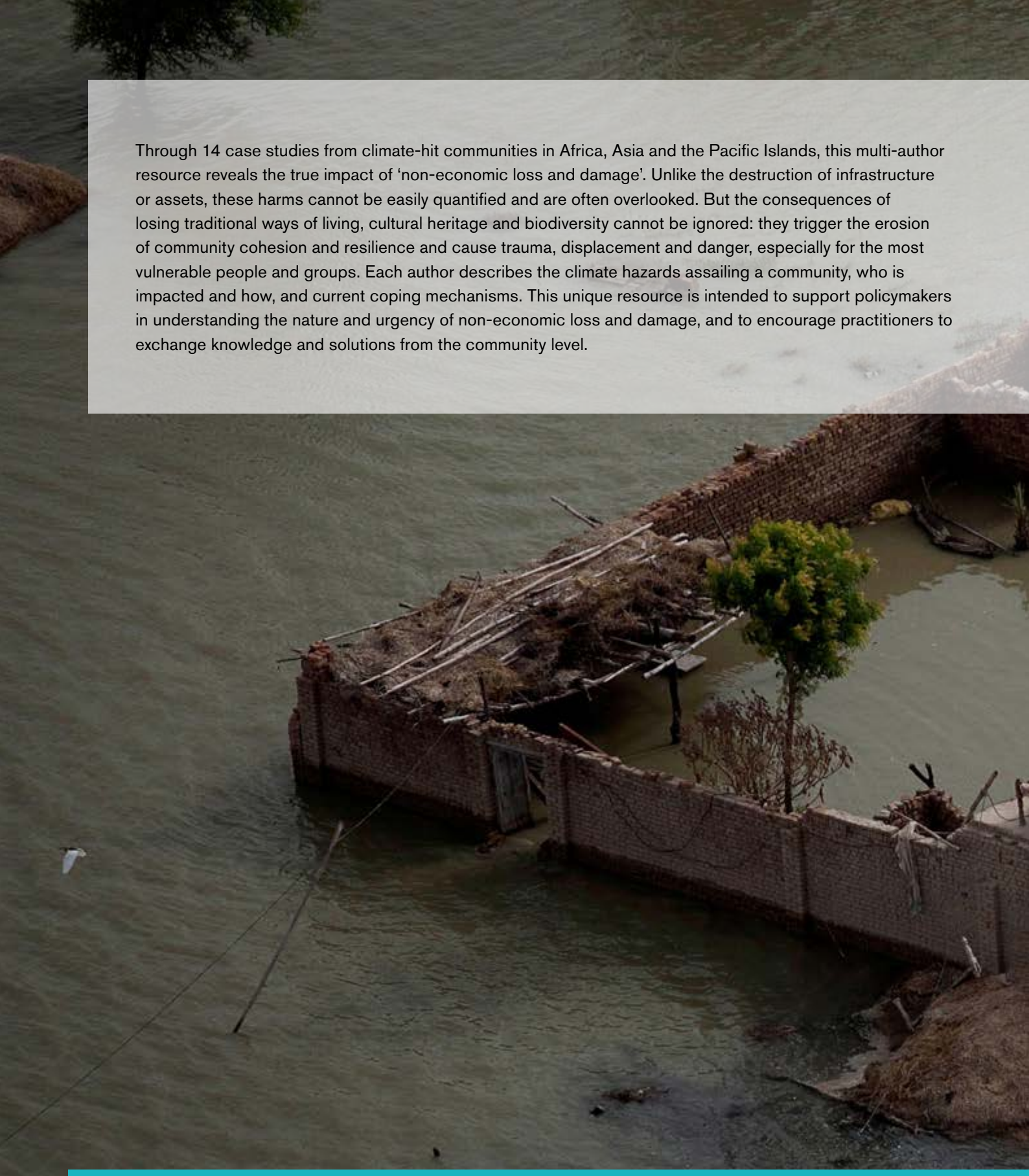


Location	Longido District, Arusha Regin, Tanzania
Climate hazards	Extreme dry spells cause drought and land degradation
Non-economic loss and damage	Loss of traditional pastoralist livelihoods; malnutrition (especially of children, affecting education); forced migration (especially of men and young people) disrupts community and family life, risks conflict and leaves those left behind vulnerable
Coping measures	Innovations at community and household level



Through 14 case studies from climate-hit communities in Africa, Asia and the Pacific Islands, this multi-author resource reveals the true impact of 'non-economic loss and damage'. Unlike the destruction of infrastructure or assets, these harms cannot be easily quantified and are often overlooked. But the consequences of losing traditional ways of living, cultural heritage and biodiversity cannot be ignored: they trigger the erosion of community cohesion and resilience and cause trauma, displacement and danger, especially for the most vulnerable people and groups. Each author describes the climate hazards assailing a community, who is impacted and how, and current coping mechanisms. This unique resource is intended to support policymakers in understanding the nature and urgency of non-economic loss and damage, and to encourage practitioners to exchange knowledge and solutions from the community level.

Knowledge Products

Case study collection

November 2023

Climate change

Keywords:
Loss and damage, climate resilience, livelihoods, forced displacement, food security, health

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