Comprehensive Climate Impact Quantification (C-CIQ)

An approach to co-developing policy and programmatic responses for climate risk management

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Across the world, climate impacts such as extreme heat and floods are destroying lives, livestock and property. Loss and damage (L&D) occurs when the capacities of affected communities and countries are compromised to the extent that they can no longer absorb the effects of climate impacts or adapt to climate risks. Climate-related L&D has consequences beyond the economic; these impacts are often referred to as non-economic loss and damage, such as the loss of cultural heritage. We urgently need to develop new ways to manage L&D risks, and to do this we need to understand and measure the full range of L&D. But current methodologies for understanding and measuring climate-related L&D have significant gaps.

This toolkit offers a comprehensive step-by-step guide to quantifying and valuing economic and non-economic L&D, and co-developing policy and programmatic responses to manage climate risks. We have sought to demystify complex analytical methods and make them straightforward, easy to understand and versatile enough to be applied in diverse geographic and social contexts.

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Acronyms list

3Ps	Predisposing, precipitating and protective factors
CBR	Cost-benefit ratio
C-CIQ	Comprehensive Climate Impact Quantification
CSOs	Civil society organisations
DRR	Disaster risk reduction
IPCAs	Inclusive and participatory community assessments
IPCC	Intergovernmental Panel on Climate Change
L&D	Loss and damage
LDCs	Least Developed Countries
LGBTQI+	Lesbian, gay, bisexual, transgender, queer/questioning, intersex, and other sexual or gender identities
MCDM	Multi-criteria decision-making
NDCs	Nationally determined contributions
NELD	Non-economic loss and damage
NGOs	Non-governmental organisations
SIDS	Small Island Developing States
SNLD	Santiago Network for Loss and Damage
UNFCCC	United Nations Framework Convention on Climate Change
WIM	Warsaw International Mechanism
WTP	Willingness to pay

Summary

Across the world, rising sea levels have submerged coastal areas, extreme heat is threatening health, and floods and droughts are destroying lives, livestock and property. As climate change continues, many of these impacts are already locked in and unavoidable, threatening widespread losses and damages.

Loss and damage (L&D) occurs when the capacities of affected communities and countries are compromised to the extent that they can no longer absorb the effects of climate impacts or adapt to climate risks.

Climate-related L&D has consequences beyond the direct loss of livelihoods, assets and infrastructure. These impacts are often referred to as non-economic loss and damage (NELD): impacts that are hard to quantify and frequently go unnoticed by the outside world, such as the loss of traditional ways of living, social networks and cultural heritage.

We urgently need to develop new ways to manage the L&D risks that countries and communities face, and to do this we need to understand and measure the full range of economic and non-economic L&D affecting communities.

Assessing and quantifying L&D presents many challenges. First, losses and damages are hugely varied. They encompass short- and long-term economic impacts that can be readily quantified, such as damage to infrastructure or gradual loss of productivity; they also include effects that cannot be expressed in monetary terms, such as loss of heritage, psychological health or identity.

L&D is also highly contextual. Some countries may be vulnerable to lower-intensity climate stress, and their resilience levels may be lower than other countries because of variations in infrastructure, socioeconomic development and fiscal capacity.

Assessing the risk of L&D across widely varying geographies, economies and societies requires an approach that can offer a clear picture of who is affected, how and to what extent. This detailed understanding and quantifying of the full spectrum of L&D is key for developing policy and programmatic measures tailored to the needs of those most at risk.

Current methodologies for understanding and measuring climate-related L&D have significant gaps. Most research on L&D focuses on economic perspectives rather than exploring the multidimensional nature of climate risk and quantifying non-economic L&D. Although there is a welcome shift in discussions towards non-economic aspects of L&D, there is still a lack of attention on this, leaving a critical gap in international efforts.

Additionally, there is limited multidisciplinary and coordinated work on the conceptualisation, design and implementation of interdisciplinary research. L&D research is primarily conducted by a handful of experts who largely operate in silos; there is also not enough evidence originating from the global South.

Governments, non-governmental organisations (NGOs), civil society organisations (CSOs), and those involved in national and international climate policy discourses and negotiations need to adopt a multidimensional approach to L&D. This approach needs to include a grounded understanding of how losses and damages are impacting communities, especially in Least Developed Countries (LDCs) and Small Island Developing States (SIDS).

The Comprehensive Climate Impact Quantification (C-CIQ) toolkit offers a comprehensive framework to assess, measure and understand economic and non-economic L&D.

The toolkit addresses the inherent complexity of valuation techniques with a carefully structured process accompanied by detailed working examples. We aim to make it a useful resource for local organisations, think tanks, researchers and national and international policymakers. We have sought to demystify complex analytical methods and make them straightforward, easy to understand and versatile enough to be applied in diverse geographic and social contexts.

The toolkit provides a comprehensive step-by-step guide on quantifying and valuing economic and non-economic L&D and co-developing policy and programmatic responses to manage climate risks.

How the toolkit is structured

Step 1 sets out how to carry out community-level assessments using inclusive and participatory approaches.

A commitment to inclusion and participation underpins the whole toolkit. Inclusive and participatory community assessments (IPCAs) aim to incorporate the perspectives of all the people directly affected by climate change. Inclusion ensures that marginalised groups within a community — such as women, children, sexual minorities, older people and disabled people — are actively involved and their inputs are valued.

By incorporating the perspectives of affected communities, grassroots organisations, policymakers and researchers, the C-CIQ approach ensures that assessments are well-rounded and representative of diverse experiences and knowledge bases.

Step 2 details how to organise information gathered from the community into the 3P framework of predisposing, precipitating and protective factors. Predisposing factors make certain areas, communities or sectors inherently more susceptible to climate impacts. They include demographic context, geographical location, socioeconomic conditions, political factors and pre-existing vulnerabilities, such as poverty or lack of access to resources. Precipitating factors are the triggers causing L&D and may range from acute events such as floods to more gradual events such as desertification. Protective factors refer to elements that contribute to resilience against climate change impacts.

The 3P framework provides policymakers, researchers and practitioners with a systematic way to assess risk and develop interventions that account for a full spectrum of vulnerabilities and coping capacities.

Step 3 details how to categorise different climate impacts into economic and non-economic L&D across tangible, intangible, functional, intrinsic, spatial and temporal domains. Tangibility differentiates between what can be physically measured and what cannot, such as cultural losses. The intrinsic-functional spectrum looks at whether the value of something lost is intrinsic, meaning it has value in and of itself, or functional, meaning it serves a purpose towards an end goal. Different cultures may assign varying levels of value to these losses, which is why it is essential to recognise this spectrum when assessing L&D.

The temporal dimension captures how climate impacts are experienced over time, while the spatial dimension examines the geographic distribution of climate impacts, recognising that these are not evenly spread across landscapes or populations; the spatial dimension is vital for creating localised adaptation strategies.

Step 4: The next step is to use an index-based approach for quantifying and valuing economic and non-economic L&D using a combination of methods: economic valuation, multi-criteria decision-making (MCDM) analysis and semi-quantitative and qualitative analysis.

First, an index-based valuation approach creates a set of indices, sub-indices and indicators. The indices and subindices should be easy to replicate, ensuring that the same method can be applied in different contexts and produce comparable results. The indicators under each sub-index are assessed using a combination of methodologies:

- Economic valuation is essential in understanding the full cost of climate change, acknowledging that every negative impact, whether on traded goods and services or on non-economic aspects such as health and cultural heritage, results in significant losses. The toolkit integrates various valuation methods to provide a holistic understanding of climate change's economic and non-economic implications.
- The toolkit uses multi-criteria decision-making analysis to evaluate the factors that influence community decision making.
- The composite risk index synthesises various dimensions of climate risk into a single, comprehensive metric. This index measures the collective impact of economic and non-economic L&D, the effectiveness of adaptation and mitigation efforts, and broader environmental and social change. The index uses a range of data sources, including empirical studies, community surveys and expert analyses. The data is normalised to ensure comparability across different metrics and weighted to adjust the influence of each risk factor according to its importance in the context being assessed.
- Finally, semi-quantitative and qualitative approaches use scoring systems or rankings to quantify perceptions and qualitative observations. This data is particularly valuable for assessing variables that are challenging to quantify directly, such as the social impacts of climate change.

Step 5: The final section of the toolkit describes how to use the analysis to co-develop context-specific resilience strategies with communities and other stakeholders using participatory and inclusive engagement approaches.

Using a co-development approach helps ensure that resilience strategies are tailored to the needs and priorities of vulnerable populations and are culturally appropriate and inclusive.

The toolkit prepares communities, local governments and civil society organisations (CSOs) for effective disaster management by enhancing their response and recovery capacities. It ensures inclusivity, giving special attention to the needs of the most vulnerable populations and providing them with the necessary support to cope with climate impacts. This solution pathway not only addresses current impacts but also strengthens community preparedness for future challenges.

Overall, the C-CIQ toolkit provides a robust basis for co-developing practical approaches to assess and address L&D and strengthen existing adaptation strategies.

1 Introduction

Across the world, rising sea levels have submerged coastal areas, floods are increasing in magnitude, breaching barriers and destroying lives, livestock and property, and communities are battered by more intense cyclones. As global temperatures increase, many of these impacts are already locked in and unavoidable – driving loss and damage.

Loss and damage occurs when the capacity of affected communities and countries are compromised to such an extent that they can no longer absorb the effects of climate risks or adapt to climate impacts (Bharadwaj and Shakya, 2021). For example, in 2017, the Caribbean region experienced three Category 5 hurricanes – an unprecedented event in which the damage exceeded the annual gross domestic product of many countries (Heinrich Böll Stiftung, 2021). The 2022 floods in Pakistan impacted a third of the country and caused over US$30 billion in economic losses (World Bank, 2022). Such overwhelming impacts compromise the ability of communities to either adapt or effectively manage escalating risks, leading to loss and damage of lives, livelihoods and infrastructure.

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 rising sea levels, and this is disrupting the transmission of traditional language and cultural practices from one generation to the next. In the Lake Chad Basin, climate change is having far-reaching social impacts, such as increased inequality, social conflict and a reduced sense of social cohesion and cultural identity. These losses can erode the social fabric and further undermine the resilience of communities (Bharadwaj and Shakya, 2021). 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 (Bharadwaj et al., 2022). Recurring impacts, 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.

As L&D is happening now and these impacts are expected to worsen, we urgently need to develop new approaches or build on existing ones to manage the more diverse climate risks countries and communities are facing, as well as those they expect to face in the future.

1.1 Why understanding and quantifying the range of economic and non-economic L&D is important

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 to lower-intensity climate stress, and their limits to withstand climate impacts may be breached earlier than other countries because of variations in infrastructure, socioeconomic development, fiscal capacity and so on. Similarly, L&D impacts also manifest differently for different people (such as women, children, disabled people and Indigenous and marginalised people); regions (small islands, land-locked areas and coastal regions); and countries (different fiscal capacities, political structures, infrastructure and institutions).

Addressing the risk of L&D across the wide range of national and local contexts where it occurs needs an approach that acknowledges the vast range of L&D, from tangible economic losses, such as damaged infrastructure and lost livelihoods, to less visible non-economic L&D, including cultural erosion, loss of biodiversity and mental health issues. For instance, in coastal communities threatened by sea-level rise, policies must consider both the economic implications of lost homes and businesses and non-economic impacts, such as displacement from ancestral lands and the resulting loss of cultural identity. Understanding and quantifying the range of economic impacts and non-economic L&D is not just a matter of academic and research interest but a necessity for developing effective policies and programmes that can unpack both tangible and often overlooked, less visible impacts of climate change, especially for the most vulnerable populations.

The quantification of these impacts can also help understand the real-world consequences of climate change and natural disasters, offering a clear picture of who is affected, how and to what extent. This detailed understanding is

important for developing policy and programmatic measures tailored to the needs of those most at risk. For instance, in the agricultural sectors of developing countries, quantifying losses not only in terms of crop yields (economic L&D) but also in terms of loss of biodiversity, community displacement and loss of quality of life (non-economic L&D), provides a comprehensive picture of the risks involved. It highlights the need for policies that not only compensate farmers for economic losses but also support them in adapting to changing climatic conditions, preserving local biodiversity and maintaining community structures.

Further, quantifying these impacts helps in the creation of appropriate delivery and financing mechanisms. For example, in SIDS, where rising sea levels pose existential threats, understanding the economic cost of lost infrastructure and non-economic losses such as cultural heritage and ancestral lands can guide the development of financial instruments and social protection programmes specifically designed for climate adaptation and relocation efforts.

Invisible impacts, such as mental health issues arising from climate-induced stress and displacement, often escape the attention of policymakers. Quantifying these alongside more visible impacts provides a more holistic understanding of climate change impacts and can assist with the development of comprehensive support systems. These could include mental health services integrated into disaster response initiatives, ensuring that communities receive both the material and psychological support needed to recover and rebuild.

Quantification also underpins the design of insurance products and social protection schemes that reflect the multifaceted nature of climate impacts. For example, index-based insurance, which pays out when a predetermined climate index (such as rainfall levels) is met, offers a way to mitigate the economic losses from droughts, while community-based insurance schemes can offer a safety net to those whose livelihoods are disrupted by environmental changes.

Thus, adequately quantifying the full spectrum of climate change impacts — both economic and non-economic — can better equip policymakers to address the complex realities of those most at risk, ensuring that no one is left behind as we navigate the challenges of an increasingly uncertain future.

1.2 What are the challenges in quantifying economic and non-economic loss and damage?

1.2.1 Methodologies are not available or inadequate

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

- **Research is lacking multidimensionality:** most of the research on L&D connected to extreme events induced by climate change focus on economic perspectives rather than understanding the multidimensional nature of climate risk, the non-economic L&D it creates and measuring the impacts thereof.
- **Paucity of multidisciplinary and coordinated approaches:** L&D created by climate risks is often complex and highly contextual. Addressing L&D from climate risks requires a multidisciplinary and coordinated approach. This involves conceptualising, designing and implementing interdisciplinary research and methodologies to assess L&D effectively at the grassroots level. As L&D intersects with multiple academic fields and human rights issues, the lack of multidisciplinary approaches results in a fragmented understanding and ineffective solutions.
- **Limited exchange of expertise and capacities:** even though there is expertise available in national think tanks and 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.
- **Not enough evidence originating from the global South:** there is a need for stronger peer-to-peer quality-control mechanisms and enhanced 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, policymaking or international negotiations as much as it should.

1.2.2 Issues in the application of methodologies

There has been more emphasis to date on the traditional and economically quantifiable aspects of L&D, which takes a narrow view and overshadows non-economic dimensions such as cultural heritage, social cohesion and mental wellbeing. Even though there is a welcome shift in recent discussions towards non-economic aspects of L&D, the investment of resources and attention on this issue remain insufficient, leaving an important gap in international efforts. To broaden multidisciplinary approaches in the measurement of L&D, several elements must be addressed:

- **Wider range of contexts and losses and damages:** the economic dimension of L&D is, to a certain extent, universal and methodologies can easily be tailored to the regional or country contexts. Non-economic aspects of the L&D are highly contextual, and generalisation cannot work in all circumstances. What non-economic L&D means for one community, its cultural or social ramifications, may not mirror other communities, regions or countries. Non-economic L&D requires a flexible and adaptable methodology, which can cater to the needs of diverse contexts.
- **Capacities of local organisations/think tanks:** local institutions and think tanks play a pivotal role in undertaking quantitative and qualitative assessments at the grassroots level and in developing response strategies that are relevant to local contexts and priorities. However, their contributions are currently absent from national and international discourse. These organisations need better tools, approaches and frameworks to capture the factors contributing to community vulnerabilities, categorise loss and damage of both economic and non-economic nature, and measure the severity of L&D in a more systematic manner.
- **Community perspectives are important:** the top-down approach commonly employed by international bodies often excludes grassroots perspectives, which are critical for addressing non-economic L&D. We require more inclusive and participatory approaches in quantification, so that L&D can be co-identified with communities, and we can evolve locally relevant policy and programmatic interventions to support vulnerable communities.

In effect, despite the existence of comprehensive international mechanisms and research, there remain substantial inadequacies in addressing the complexities of climate change-related L&D, particularly non-economic impacts. These shortcomings call for more inclusive, interdisciplinary, bottom-up approaches that are sensitive to the unique challenges posed by non-economic L&D.

1.3 A multidimensional 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 requires better understanding in the following areas from governments, non-governmental organisations (NGOs), civil society organisations (CSOs), and those who engage in national and international policy discourses and negotiations on L&D:

- **A grounded understanding of how loss and damage is currently impacting communities is crucial,** especially in 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 such as 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 focus particularly on non-economic losses. Are traditional risk-transfer mechanisms such as 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 such as the Warsaw International Mechanism (WIM) and Santiago Network for Loss and Damage (SNLD) in designing their support structures and potentially inform climate negotiations on the options available.
- **Finding out what resources (technology, finance and capacity) will be needed to adequately respond to the range of L&D 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 range of resource needs becomes essential. This includes understanding non-economic dimensions that require specialised resources such as 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.

1.4 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 non-economic L&D, which has been largely overlooked in national and international processes to date. 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 and non-economic aspects of L&D but also the adaptation efforts needed to support communities. Only by addressing these gaps can national governments and international frameworks such as the United Nations Framework Convention on Climate Change (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 this critical knowledge gap.

2 The Comprehensive Climate Impact Quantification (C-CIQ) toolkit: an overview

2.1 What is the C-CIQ toolkit?

The C-CIQ toolkit is a comprehensive framework developed to assess, measure and understand the wide range of impacts caused by climate change, including both economic and non-economic L&D. It is particularly tailored to address the intricacies of climate risk management at the community level, recognising that local communities often do not distinguish between adaptation measures and the concept of loss and damage. To them, both are responses to the spectrum of risks posed by climate impacts — some risks are manageable or adaptable within their capacity, while others exceed their capacity to cope and result in significant L&D. Additionally, it is important to note that L&D can also occur when adaptation efforts are not optimally implemented.

In constructing the C-CIQ methodology, we put a primary focus on quantifying non-economic L&D alongside economic L&D, using participatory methods, composite indices and various valuation methodologies, ensuring that the toolkit is straightforward, easy to understand and simple to compute. The toolkit uses community value-based judgments to assess and quantify non-economic aspects of these impacts, such as loss of cultural heritage, mental health issues and disruptions in social cohesion. By integrating qualitative insights from community experiences with quantitative data analysis, the toolkit not only gathers precise data but also reflects the diverse and real-world impacts of climate change. This design principle also ensures that the toolkit can be effectively used by practitioners and policymakers alike, facilitating its application across diverse contexts.

Beyond impact assessment, the toolkit supports co-development of well-informed and inclusive solutions and strategies with affected communities and stakeholders. This allows for the solutions to be tailored according to the unique needs and priorities of vulnerable populations, making the toolkit a versatile tool for assessing and addressing climate risks comprehensively. This participatory approach ensures that resilience strategies developed are not only effective but also culturally appropriate and inclusive.

Moreover, the toolkit aims to bridge the learning and implementation gaps in national and international frameworks such as the UNFCCC, WIM and SNLD. By enhancing the understanding of both economic and, critically, non-economic aspects of climate impacts, the C-CIQ toolkit empowers international frameworks to become truly effective in serving the communities they aim to support. Consequently, it facilitates the development of holistic response strategies that are crucial for safeguarding at-risk populations, ensuring that the strategies are not only effective but also equitable and inclusive.

2.2 What does the C-CIQ toolkit cover?

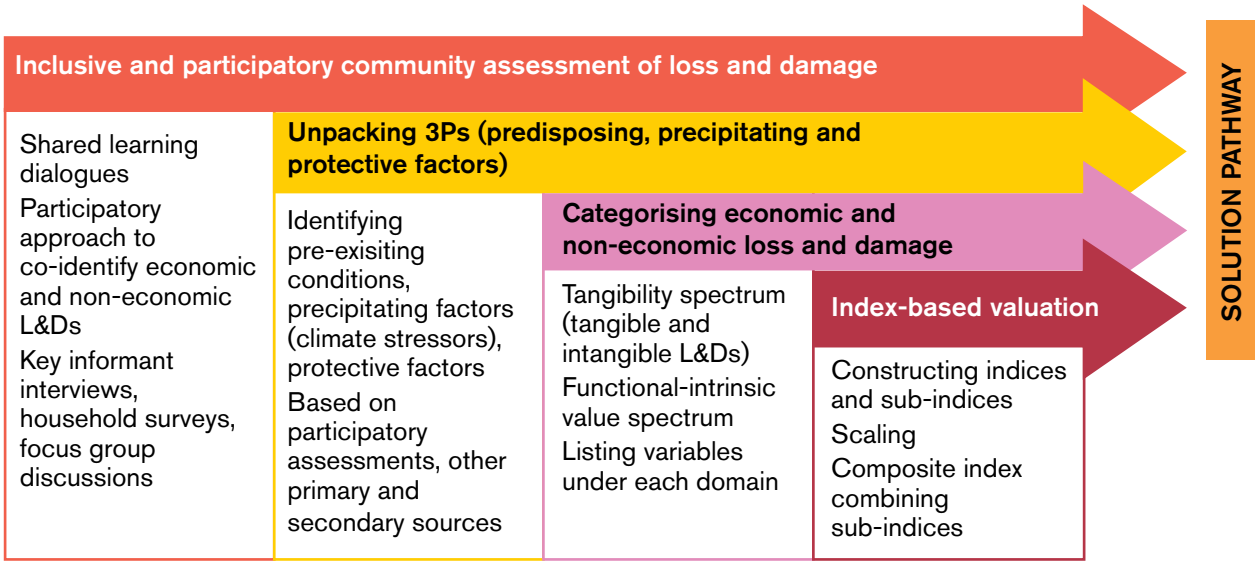
The C-CIQ toolkit is designed to address the multifaceted challenges posed by climate change:

- **Economic L&D assessment:** the C-CIQ toolkit evaluates the direct financial damages of climate change on infrastructure, agriculture and the broader economy, including disruptions to livelihoods and the associated reduction in crop and livestock productivity. It also accounts for the less visible, indirect economic effects, such as the long-term decline in economic growth potential and the additional healthcare burdens on society — helping quantify the immediate costs as well as secondary economic consequences that may erode economic stability over time.
- **Non-economic L&D assessment:** the scope of C-CIQ extends to non-economic losses and damages, which are crucial yet challenging to quantify. The approach looks at the human cost, assessing the impact on life, health and wellbeing. It considers the erosion of cultural heritage, the loss of biodiversity, and the disruption of social cohesion and community networks. Furthermore, the framework recognises the psychological toll of climate change, evaluating the mental health issues and emotional distress that arise from climatic disturbances and the uncertainty they bring.
- **Assessment of adaptation effort:** the C-CIQ toolkit is designed to also assess the effectiveness of existing adaptation strategies. By analysing how communities anticipate, withstand and recover from climate-related events, the toolkit highlights strategies that can strengthen ongoing adaptation measures. This ensures that risks that are potentially avoidable are addressed through proactive and effective adaptation responses. In doing so, C-CIQ supports the development of comprehensive strategies that enhance resilience against future climate impacts and reduce the incidence of severe L&D.
- **Cross-sectional assessments:** the C-CIQ toolkit looks at the different types of losses caused by climate change, including both economic losses (such as damage to property and loss of income) and non-economic losses (such as health impacts and loss of cultural heritage). It explores how these losses are connected and can make each other worse. For example, losing a home can lead to health problems, and health issues can make it harder to work and earn money. The toolkit also examines how climate change affects essential aspects of daily life, such as access to clean air and safe water, having enough food, and stable housing. Additionally, it assesses how well communities can cope with and adapt to these changes. Communities with better resources and strategies to deal with climate impacts are less affected, while those with fewer resources may experience greater losses and damages.
- **Methodological integration:** employing a variety of assessment techniques, C-CIQ combines empirical data collection, econometric models and qualitative assessment methods. This transdisciplinary approach ensures a full-spectrum evaluation of climate impacts drawing from each other. Underpinning the C-CIQ framework is a strong commitment to participatory assessment involving a wide range of stakeholders. By incorporating the perspectives of affected communities, policymakers, researchers and grassroots organisations, the approach ensures that the assessments are well-rounded and representative of a diverse set of experiences and knowledge bases.

2.3 How does C-CIQ assess climate risks to develop comprehensive solutions?

The C-CIQ toolkit adopts a four-dimensional strategy (see Figure 1) to develop comprehensive solution pathways.

Figure 1. The four-dimensional approach of C-CIQ



The different aspects of assessment and broad approach used under each of these dimensions are as follows:

2.3.1 Inclusive and participatory community assessments of loss and damage

The inclusive and participatory community assessment (IPCA) is designed to incorporate the perspectives of those directly affected by climate change. In the assessment process, 'inclusion' ensures that marginalised groups within the community — such as women, children, sexual minorities, individuals with disabilities and older people — are actively involved and their inputs are valued. 'Participation' goes a step further by empowering these individuals to take a leading role in the assessment. This approach leverages the deep, generational knowledge and wisdom these community members hold, particularly as they have lived in close proximity to the effects of climate disasters.

Utilising methodologies that echo the principles of participatory rural appraisal,[1] this approach aims to gather experiences and information about the community's vulnerabilities to climate change. It documents pre-existing conditions that render communities more susceptible to climate impacts, recognising that not all community members or households have the same level of access to resources or decision-making in village-level institutions. Some households may have a small landholding, poor irrigation facilities, or may be landless and as a result may have fewer savings to tide them over a crisis, compared to households with better landholdings. Similarly, some households or communities may be traditionally marginalised and have poor representation or voice in decision-making, and, as a result, resilience strategies may not take their needs into consideration. It is important to unpack these diverse vulnerabilities, so that policy and programmes are responsive to the needs of different communities and groups.

Under C-CIQ, communities engage in a self-assessment process to understand the depth of their vulnerabilities and the robustness of their resilience strategies. They are encouraged to recount their experiences of extreme weather events and of gradual climate shifts, such as sea-level rise. This recounting helps in exploring how climatic factors lead to L&D and contextualises the impacts on different vulnerable groups within a community.

The assessment aids in documenting the community's past and existing coping mechanisms and adaptation strategies, alongside their needs and aspirations for future support, resources and capacity-building to better prepare, cope and recover from climate events. By documenting these, the toolkit facilitates more accurate policy responses and interventions from both governmental and non-governmental entities in understanding what policy and programmatic response mechanisms might work for different vulnerable groups within a community.

1 Participatory rural appraisal (explained in more detail in Step 1) is a community-based approach that involves local people in gathering and analysing information about their conditions and resources. This method empowers communities to identify problems, prioritise issues and develop action plans for sustainable development.

Additionally, the participatory assessment enables communities to articulate their experiences of non-economic L&D — because quite often, even if the community suffers such impacts, they are not able to express them. The assessment includes a thorough exploration of the psychological impacts and the significance of these losses to their social, cultural and religious identity. The approach also pays attention to the ways in which climate impacts have changed over years, observing seasonal patterns, trends and the historical occurrence of climate events. It covers how a community is experiencing visible changes in their surroundings over time, such as ecological changes, wildlife and marine habitat shifts, land-use patterns and migration issues stemming from climate events.

2.3.2 Unpacking the 3Ps — predisposing, precipitating and protective factors

Climate change does not occur in isolation and often intensifies pre-existing vulnerabilities, including poverty, inequality and social exclusion. Based on the insights received from the community, it is important to systematically unpack how L&D is currently being experienced and what form losses and damages are likely to take, who is likely to be impacted and how, so that responses can be designed to address the specific vulnerabilities of the different regions, communities and households most at risk.

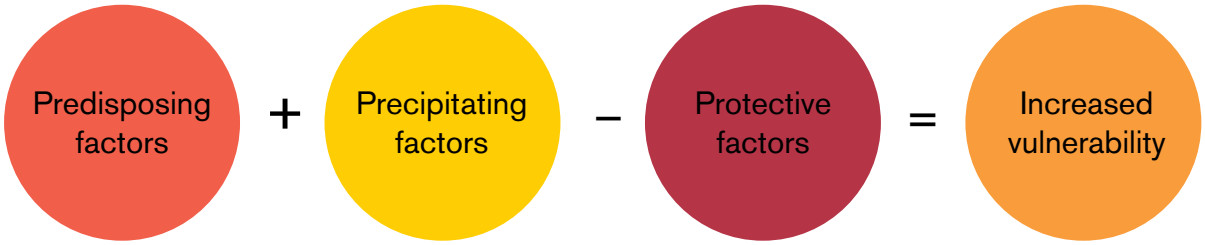
C-CIQ uses the 3P framework (predisposing, precipitating and protective factors) to thoroughly explore the interconnections and dynamics between underlying vulnerability, climate-attributable economic and non-economic L&D, and policy and programme responses. **Predisposing factors** encompasses elements that make certain areas, communities or sectors inherently more susceptible to climate impacts. This includes demographic context, geographical location, socioeconomic conditions, political factors and pre-existing vulnerabilities, such as poverty or lack of access to resources. By identifying these predisposing factors, interventions can be designed to address the inherent risks they pose.

Precipitating factors are the triggers causing loss and damage. These could range from acute events such as floods and heatwaves to more gradual events such as drought or desertification. Understanding these factors is crucial for real-time response and recovery efforts. For example, knowing the precipitating factors for a water crisis in a particular region can inform emergency preparedness for the future through water conservation efforts and immediate strategies for ensuring water security.

Protective factors refers to elements that contribute to resilience against climate change impacts. These include assessments of current social protection and disaster risk management mechanisms, such as food security, community preparedness programmes and healthcare systems. Protective factors typically enhance the coping capacities of vulnerable groups and reduce L&D when a climate crisis occurs, while a lack of the same pushes communities to adopt negative coping strategies.

Together, the 3P framework provides a holistic understanding of climate change-related L&D (see Figure 2). By unpacking the factors across these domains, we intend to provide policymakers, researchers and practitioners with a framework for a more systematic assessment of risks to help them develop tailored interventions that account for a full spectrum of vulnerabilities and coping capacities.

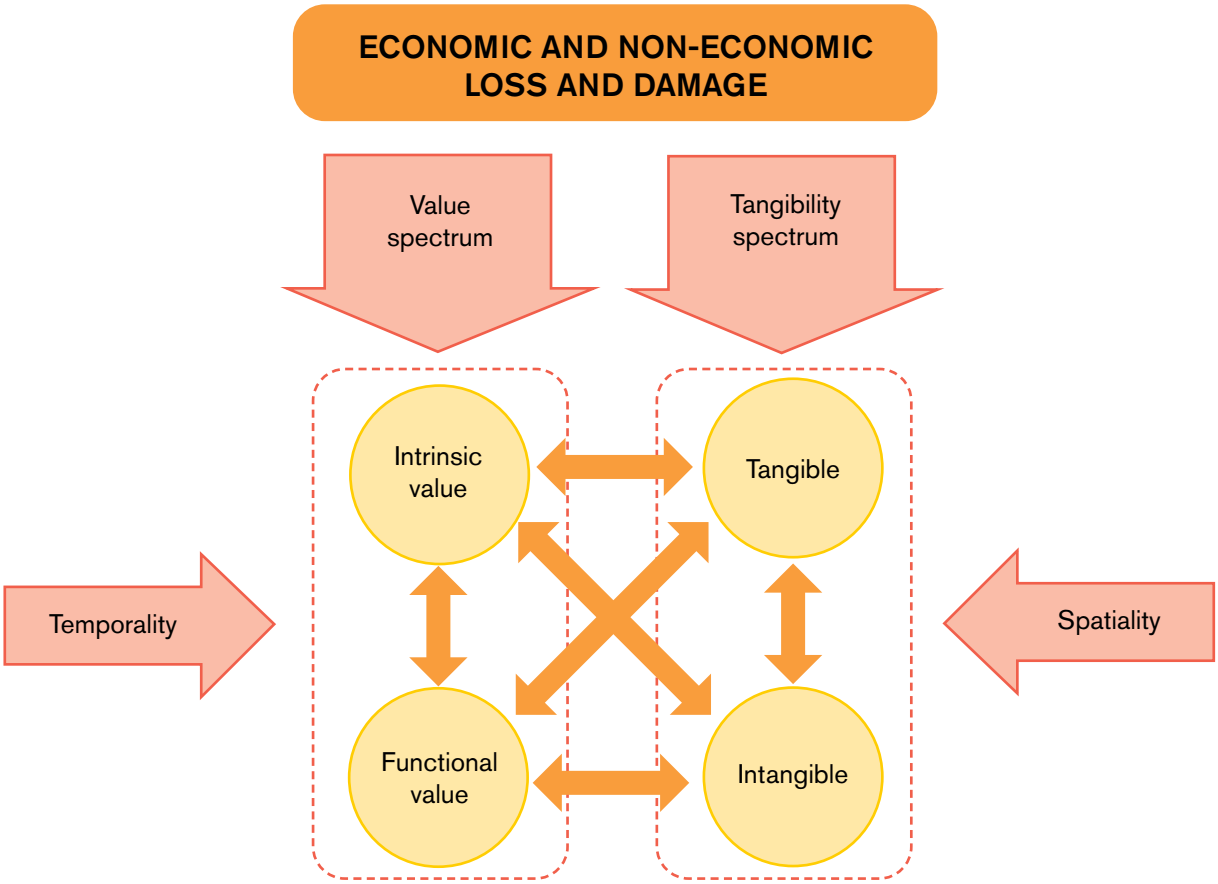
Figure 2. Interaction of predisposing, precipitating and protective factors



2.3.3 Categorising economic and non-economic loss and damage

Once all the underlying vulnerabilities and risks are identified, the categorisation of economic and non-economic L&D using the C-CIQ framework can help develop a complete understanding of the range of climate impacts being suffered by a community. C-CIQ helps unpack these across four dimensions, namely tangibility, intrinsic-functional, temporality and spatiality.

Figure 3. Domains of economic and non-economic loss and damage impacts



Tangibility

This dimension differentiates between what can be physically measured, such as crop-yield losses or reduced livestock production, and what cannot, such as mental health issues or cultural losses. While tangible impacts are directly observable, intangible impacts, such as the emotional distress caused by losing a home or the breakdown of community structures due to displacement, may be just as significant. Although these two types of impacts may seem separate, they are often closely linked: tangible changes in the environment can deeply affect intangible aspects of people's lives, for example, the loss of crops may create emotional distress.

Intrinsic-functional spectrum

The value of something lost can be viewed from two perspectives: intrinsic, meaning it has value in and of itself, or functional, meaning it serves a purpose towards an end goal. For instance, the loss of a community gathering place has intrinsic value because of its importance to a community's cultural identity, while the functional value of an ecosystem might relate to its role in supporting livelihoods. Different cultures may assign varying levels of value to these losses, which is why it is essential to recognise this spectrum when assessing L&D.

Temporality

The concept of temporality in the C-CIQ framework captures how the impacts of climate change are experienced over time. This includes immediate effects, such as job losses following a natural disaster, as well as issues that develop slowly, such as the gradual degradation of natural resources. Temporality also involves the consideration of future risks, including the potential for long-term changes in weather patterns that could affect generations to come. For example, a community might face a sudden loss of homes due to flooding, but the long-term consequences could include a decline in mental health or community cohesion. By considering the timing and duration of these impacts, the C-CIQ framework helps to understand the full lifecycle of climate change impacts — from immediate to delayed events and from one-off shocks to recurring events.

Spatiality

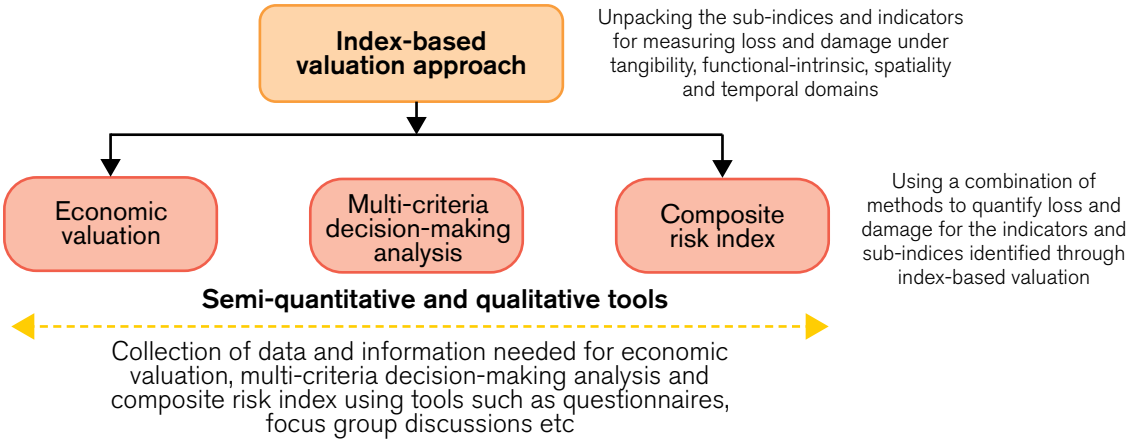
The spatial dimension of the C-CIQ framework refers to the geographic distribution of climate impacts. It recognises that the effects of climate change are not evenly spread across landscapes or populations. Some areas may be more prone to certain types of climate events, for example, coastal regions facing sea-level rise or urban areas experiencing heat islands. Spatiality looks at how physical location influences the degree and type of L&D encountered by communities. For instance, rural areas may experience loss of agricultural productivity due to drought, while urban areas might grapple with the health effects of heatwaves. Additionally, the movement of people from affected regions, whether through migration or displacement, introduces new dynamics as individuals and communities adapt to different environments and challenges. Understanding these spatial nuances is vital for creating localised adaptation strategies that address the specific needs and conditions of each area affected by climate change.

By examining these four dimensions, C-CIQ provides a complete picture of climate impacts that can inform targeted and effective solutions. For example, understanding the spatiality of impacts can guide where to focus resilience-building efforts, while insights from the temporal dimension can influence long-term planning and emergency response strategies.

2.3.4 Index-based valuation approaches

The C-CIQ toolkit utilises a blend of methodologies (see Figure 4) to quantify and value economic and non-economic L&D, measuring the impacts of climate change as felt by individuals, households, societies and nature. It is useful in analysing and quantifying how the tangible and intangible, intrinsic and functional dimensions of climate impacts interplay across various spatial and temporal scales. This is achieved using an index-based valuation approach, which creates a set of indices and indicators that are direct and easy to calculate, allowing for consistent application across various settings and contexts.

Figure 4. Methodological framework used for quantification of climate impacts under C-CIQ



In developing these indices, the C-CIQ methodology adheres to principles of simplicity, ensuring that the indices are not only easy to compute but also easy to replicate. This replicability is vital because it means that the same method can be applied in different contexts, producing comparable results. Clarity is also a cornerstone of the index-based approach: the indices must be clear and easily interpreted so that practitioners and policymakers can readily understand and utilise them in their decision-making processes.

These indices are constructed along two dimensions (see Figure 5): tangibility and the intrinsic-functional spectrum. Temporal and spatial aspects are further overlaid to ensure that the indices account for changes over time and variations across locations, providing a comprehensive picture of L&D impacts.

Figure 5. Scope of different indices constructed under C-CIQ using the index-based valuation approach

The measurement of indicators under each sub-index that forms an index is done by using a combination of methodologies:

Economic valuation

Economic valuation is important in understanding the full cost of climate change for communities and regions, acknowledging that every negative impact, whether on traded goods and services or on non-economic aspects such as health and cultural heritage, results in significant losses. The methods used for economic valuation include:

- **Quantifying economic loss and damage:** economic losses are typically calculated for market-traded goods and services. These are direct losses that can be measured by the cost of goods no longer produced, services no longer provided, or assets that are destroyed.
- **Valuing non-economic loss and damage:** non-economic losses encompass health impacts, cultural heritage and social capital. These are less tangible and often overlooked in traditional assessments. The C-CIQ framework addresses this by implementing various valuation methods. The 'revealed preference method' uses market behaviours to estimate the value of environmental goods and services. When market prices are absent, the 'stated preference method' relies on how much individuals are willing to pay for specific non-market goods and services. For goods and services with a market value, price-based valuation is used, and contingent valuation methods are applied to determine the willingness to pay for non-market impacts.
- **Assessment of direct and indirect costs:** direct costs refer to expenses related directly to the use of goods and services, while indirect costs are associated with non-use values, such as biodiversity loss. The framework employs cost-benefit analysis to weigh these costs against potential benefits, incorporating social and environmental considerations to provide a comprehensive valuation.
- **Evaluating environmental degradation:** to address environmental degradation, the C-CIQ toolkit uses replacement cost methods, which estimate the cost of restoring damaged ecosystems or infrastructure. Additionally, prevention costs are calculated to determine the necessary investment to avert future losses, such as expenditures on disaster risk reduction (DRR) strategies. This approach helps stakeholders understand the financial implications of environmental degradation and the value of preventative measures.
- **Opportunity costs:** this approach considers the cost of losing alternative opportunities, for example, if a coastal community has to relocate due to erosion, the opportunity costs include not only the direct expenses of moving but also the financial impact of leaving behind potential income sources, such as fishing or tourism, that they can no longer access in their new location.

By integrating these various valuation methods, the C-CIQ framework provides a more holistic understanding of the economic and non-economic implications of climate change. This comprehensive valuation is crucial for creating policies that not only aim to rebuild and compensate for losses but also work to protect and improve the overall wellbeing and stability of society. It will help in facilitating development of new or strengthening of existing policies to address immediate needs while also supporting long-term resilience and quality of life for affected communities.

Multi-criteria decision-making analysis

The C-CIQ toolkit employs multi-criteria decision-making (MCDM) analysis to evaluate the factors that influence decision-making at the community level, particularly in contexts where different factors exist. This methodology is instrumental in understanding how communities prioritise different strategies or responses to climate impacts based on a range of measurable and experiential factors.

In the application of MCDM within the C-CIQ framework, the process starts by thoroughly understanding the specific climate challenges and the socioeconomic backdrop of the community through detailed data collection and stakeholder engagement. It then identifies actions taken by the community to cope with the impacts or potential interventions that could address these impacts. The toolkit establishes clear objectives and criteria based on the community's priorities and goals for these interventions. These criteria serve as benchmarks to evaluate and compare the potential effectiveness and suitability of each option, ensuring that the chosen strategies align with the community's needs and preferences.

Community involvement is crucial in this process. Members participate in scoring each option against these criteria based on their direct experiences and insights, ensuring that the evaluation authentically represents the community's perspectives and priorities. Additionally, the criteria are weighted to reflect their relative importance to the community's overall wellbeing and specific objectives, acknowledging the subjective nature of decision-making.

The scores and weights provided by the community are then aggregated to calculate an overall value for each option, which highlights the options or strategies that best align with community preferences. This comprehensive value helps in highlighting the most effective and suitable strategies from the community's perspective. The process concludes with a review of these insights to ensure they are consistent with community expectations and the practical realities of their situation, followed by the selection of adaptation strategies for implementation based on the outcomes of the MCDM analysis.

By integrating MCDM, the C-CIQ toolkit makes the assessment structured, transparent and deeply rooted in the values and experiences of the community.

Composite risk index

The composite risk index synthesises various dimensions of climate risk into a single, comprehensive metric. This index measures the collective impact of economic and non-economic L&D, the effectiveness of current adaptation and mitigation efforts, and broader environmental and social changes. It captures direct financial impacts, such as damage to infrastructure and agriculture, as well as indirect effects, such as economic instability and loss of livelihoods. Additionally, it assesses non-economically quantifiable impacts on areas such as health, cultural heritage and social cohesion.

To develop this index, data from diverse sources — including empirical studies, community surveys and expert analyses — are normalised and weighted. Normalisation ensures comparability across different metrics, while weighting adjusts the influence of each risk factor according to its importance in the specific context being assessed. This structured aggregation makes the composite risk index a versatile tool for assessing climate risk, enabling comparative analyses across regions or over time.

The 'scaling' of indices within the toolkit involves assigning values to different dimensions of L&D to gauge the relative scale of impacts. The toolkit employs the maximum value scaling method, which normalises each index by the highest value observed in the dataset. This approach sets a clear reference point, with a maximum score of 100 indicating the most severe observed loss, and a score of zero indicating no loss. This method simplifies interpretation and enhances transparency, making it easier to convey the extent of loss and damage.

Additionally, by setting fixed minimum and maximum values, similar to methods used in indices such as the Human Development Index, the C-CIQ facilitates temporal comparisons. This feature adds a layer of utility for ongoing assessment and strategic planning.

With this approach, the C-CIQ framework can help identify high-risk areas, help prioritise resource allocation, and guide the development of effective adaptation strategies. By considering all relevant factors, this index can support informed, effective and sustainable climate risk-management policies.

Semi-quantitative and qualitative approaches

In the C-CIQ toolkit, semi-quantitative and qualitative approaches help in capturing the necessary data and information for economic valuation, MCDM analysis and the composite risk index.

Semi-quantitative approaches combine elements of quantitative and qualitative data collection, using scoring systems or rankings to quantify perceptions and qualitative observations. Tools such as Likert scales (used to represent people's attitudes to a topic), checklists and decision matrices translate complex qualitative judgments into actionable data. This data is particularly valuable for assessing variables that are challenging to quantify directly, such as the social impacts of climate change or the effectiveness of community adaptation strategies.

Qualitative approaches focus on gathering narrative data through methods such as focus group discussions, key informant interviews and participatory rural appraisals. These techniques provide contextual insights into how communities experience and respond to climate risks, offering a depth to the data that quantitative methods may overlook.

By leveraging both semi-quantitative and qualitative data, the C-CIQ toolkit enhances its analytical capabilities, ensuring that assessments are both robust and reflective of the complex realities faced by communities dealing with climate change.

2.3.5 A solution pathway approach to co-develop practical ways of tackling L&D

The index-based valuation approach provides a way for capturing the multidimensionality of climate impacts, providing a robust basis for action. A critical focus of C-CIQ is to build on this analysis for co-developing practical approaches to address L&D and strengthen existing adaptation strategies that can help communities manage climate risks comprehensively.

Once different forms of economic and non-economic L&D and those most vulnerable to such impacts have been identified, the C-CIQ toolkit can be used to understand how vulnerable communities can be supported to prepare, cope and recover. The C-CIQ allows this information to be taken back to the community using a participatory and inclusive community engagement approach to co-develop context-specific solutions.

The C-CIQ toolkit uses a range of participatory tools for engaging with communities, local NGOs, local government and other relevant actors. These tools include community risk and vulnerability mapping, resource and livelihood mapping, matrix ranking, social mapping, perception mapping and institutional mapping. The purpose of these tools is to carry out participatory assessments of all existing social protection, development and humanitarian assistance programmes that act as safety nets during a crisis. The assessment also considers other sectoral and adaptation programmes already being implemented. With this approach, the toolkit seeks to understand the following:

- Whether the benefits reach the neediest individuals and households in a **timely and effective manner** and in a form that they can use to meet their needs for coping with climate impacts. It is also important to understand whether the support is provided in an anticipatory way so that communities can better prepare for an impending crisis.
- Whether the existing programmes **cover different vulnerable groups** in their eligibility criteria or whether certain groups are excluded.
- Assessment of the **delivery mechanisms** for these programmes and whether there are existing local institutions capable of delivering these programmes to those eligible in a timely and effective manner.
- The safety net provided by social protection programmes during times of crisis can be of different types, such as cash transfer, food aid, cash for work, food for work or insurance coverage for loss and damage suffered. It will be important to assess what **type of support** is provided and whether it is suitable to enable communities to tide over the crisis.
- Assessing **targeting** will be useful to understand the extent to which the most vulnerable groups or households are covered. Similarly **benefit incidence** will help understand the extent to which non-poor or less vulnerable households or groups are excluded by the programmes.
- **Benefit adequacy** and **average per capita transfer** represent the size and the nature of the transfer benefits or support provided to the target population. Often, non-economic L&D remains invisible and is not covered in the support package provided to the community to tide it over during a crisis.

Using the information gathered, the C-CIQ framework then helps to close knowledge and practice gaps by encouraging stakeholders to collaborate to identify effective programmes, strategies, systems, delivery mechanisms and financing approaches. This collaboration aims to provide a comprehensive safety net, improve preparedness, minimise impacts and enable robust recovery. This involves co-developing strategies for improvements in the existing policies and programmes or evolving newer ones to guide the development of resilience capacities. These resilience capacities are categorised into absorptive, adaptive and transformative capacities. They are vital for enabling communities to prepare for, respond to and recover from climate-induced impacts effectively:

- **Absorptive capacity** allows communities to manage and withstand the effects of climate shocks by reducing immediate damages and maintaining functionality during crises.
- **Adaptive capacity** focuses on adjustments in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change.
- **Transformative capacity** involves creating systemic and long-term changes that fundamentally enhance the capabilities of communities to face climate change.

By following a co-development approach, C-CIQ also supports the development of measures that boost community agency, self-confidence and connections — key components for effective recovery. It encourages collaborative action, promoting partnerships with communities to develop inclusive disaster-management policies and programmes that are community focused and well supported.

The toolkit also prepares communities, local governments and CSOs for effective disaster management by enhancing their response and recovery capacities. It backs community-led efforts ranging from immediate relief to long-term strategies such as livelihood diversification and ecosystem restoration. Furthermore, it ensures inclusivity, giving special attention to the needs of the most vulnerable populations and providing them with the necessary support to cope with climate impacts. This solution pathway approach not only addresses current impacts but also strengthens community preparedness for future challenges.

2.4 A pathway to delivering resilience through the C-CIQ framework

The theory of change that underpins the C-CIQ framework outlines the sequential steps from assessment to intervention which form a pathway to resilience (see Figure 6). This pathway is operationalised through collaborative action involving all stakeholders — from affected communities to policymakers — ensuring that resilience strategies are not only comprehensive but also context specific.

The process begins with a detailed assessment of predisposing factors such as environmental, economic, demographic and sociopolitical elements that shape the vulnerabilities within a community. These factors are crucial as they establish the initial context for identifying specific risks and needs.

Following this, the framework assesses both economic and non-economic loss and damage. This includes direct financial impacts such as infrastructure and agricultural damages, and indirect effects such as disruptions in social cohesion and mental health challenges. These assessments are categorised based on their tangibility (tangible vs intangible) and value spectrum (intrinsic vs functional), further refined by their temporality and spatiality. This categorisation helps tailor interventions more accurately to the needs identified at the community level.

Incorporating protective factors is the next critical step. The framework evaluates existing institutional strengths, social capital and economic stability to gauge the community's current resilience levels. Understanding these protective factors helps in pinpointing resilience gaps and leveraging existing capacities for adaptation.

The interventions are strategically designed across three levels: micro, meso and macro. The micro level includes immediate relief and support that can be provided to individuals and families directly impacted by climate events. The meso level focuses on community and regional programmes that aim at recovery and building short- to medium-term resilience. At the macro level, interventions involve the implementation of national policies and programmes that promote long-term restoration and resilience building.

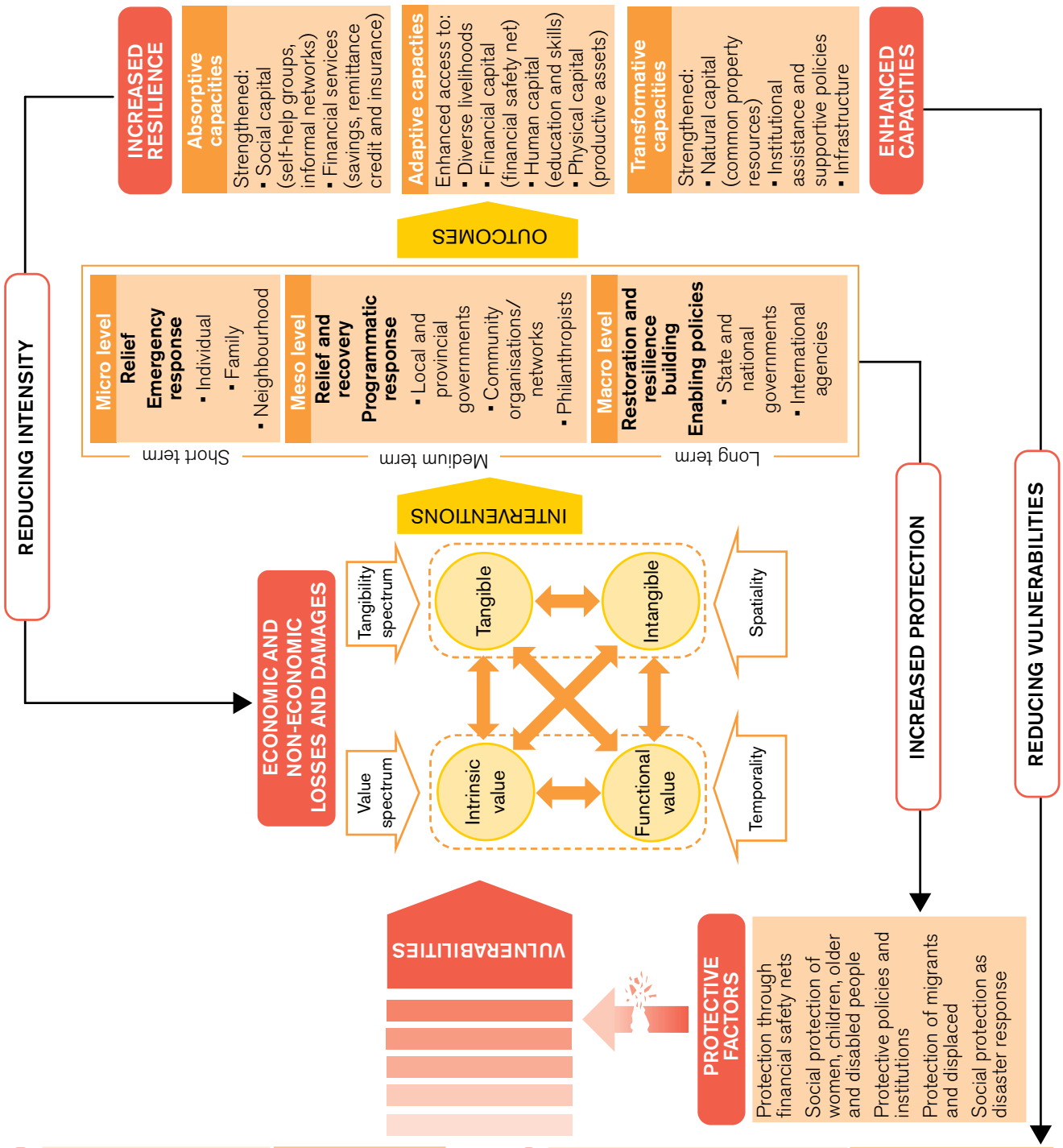


Figure 6. Pathway to delivering resilience through the C-CIQ framework

These interventions aim to enhance various capacities within the community: absorptive capacities are strengthened through enhanced community networks and safety nets, adaptive capacities are boosted by improving access to resources and services, and transformative capacities are developed by implementing enabling policies and infrastructural improvements. These strategies are continuously monitored and adjusted based on feedback, ensuring they remain effective against the dynamic backdrop of climate risks and community needs.

By adopting this thorough, structured approach, the C-CIQ framework not only addresses the immediate impacts of climate change but also strengthens the long-term resilience of communities, enabling them to adapt to and recover from adverse climate events more effectively.

This theory of change underscores the transformative potential of integrating scientific assessment with community-led adaptation strategies, fostering a resilient future for the most vulnerable populations.

2.5 Who should use C-CIQ and how it can help them

The C-CIQ toolkit can provide funding agencies, policymakers, researchers and practitioners with the information and evidence needed to develop well-rounded climate action and financing strategies. The following sections outline some of the ways in which C-CIQ can be used by different stakeholder groups.

2.5.1 Supporting the Loss and Damage Fund and the Green Climate Fund with fund disbursement

The C-CIQ toolkit can equip funding agencies with a detailed, data-driven foundation for resource allocation, enabling them to prioritise investments that are likely to have the greatest impact on addressing loss and damage, fostering resilience and supporting Sustainable Development Goals. This can be particularly relevant to guide funding decisions for entities managing climate finance, such as the Loss and Damage Fund and the Green Climate Fund.

The toolkit's data-driven approach can allow strategic allocation of resources. By quantifying the extent of L&D through various indices, funds can identify which communities or ecosystems are experiencing the most significant climate impacts.

The C-CIQ toolkit provides a method for making evidence-based decisions which consider both economic and non-economic factors. This can ensure that funds not only support projects that show tangible results, such as the reconstruction of physical infrastructure, but also those that address less visible impacts, such as the loss of Indigenous knowledge or community displacement. This holistic perspective ensures a well-rounded approach to climate financing.

Climate funds can use the temporal and spatial analytics of the toolkit to plan for long-term resilience. This involves both immediate disaster response and the development of infrastructure and community capacity that can withstand future climate impacts. For instance, the toolkit can guide investments in sustainable agricultural practices that bolster food security against the backdrop of changing climate conditions.

For the Green Climate Fund, which invests in projects aimed at enhancing resilience, the toolkit can serve as a monitoring and evaluation tool. By establishing baseline indicators and tracking progress, the fund can assess the effectiveness of its investments over time and adapt its strategies accordingly. The toolkit enables this by using participatory tools and multi-criteria decision-making analysis to provide detailed metrics and insights into community needs and impacts. It can help identify gaps in existing programmes and suggest improvements, ensuring that interventions are both effective and responsive to local conditions. This can allow the fund to operate with greater transparency and accountability. It can justify funding decisions based on stakeholders' needs and demonstrate effective targeting.

The participatory aspects of the toolkit align with the principles of equity and inclusiveness that are central to climate finance. By incorporating local stakeholder input, including from those most vulnerable to climate change, the funds can ensure that their initiatives are sensitive to the needs and priorities of those they aim to support.

2.5.2 Providing evidence for bodies such as the Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) relies on rigorous, peer-reviewed scientific data to inform its assessment reports, which in turn guide global climate action. National think tanks using the C-CIQ toolkit can contribute valuable data and insights to the IPCC. By conducting nationally focused research that quantifies climate impacts, think tanks can provide the IPCC with nuanced, localised data that enriches its global assessments.

For example, if a think tank identifies significant non-economic losses among Indigenous communities due to climate change — such as loss of cultural heritage, traditional knowledge, and social cohesion — this data can be incorporated into IPCC assessments. This detailed information can then shape more comprehensive recommendations, ensuring that the unique vulnerabilities and needs of Indigenous communities are adequately addressed in global climate policies.

Furthermore, the toolkit's emphasis on a multidimensional approach to quantifying loss and damage can help in the development of IPCC guidelines and methodologies for assessing climate impacts, offering a model that balances quantitative rigour with the qualitative richness of local experiences and knowledge.

2.5.3 Supporting national think tanks in policy advocacy

National think tanks play a critical role in shaping policy through research, analysis, and advocacy. The C-CIQ toolkit can provide these institutions with a robust framework for assessing climate-related loss and damage, offering a detailed, evidence-based foundation to influence both national and international policy discussions.

National think tanks can leverage the C-CIQ toolkit to conduct in-depth analyses of climate impacts within their countries. By quantifying both economic and non-economic losses, these institutions can provide policymakers with clear, compelling data that underscores the urgency and scale of climate action required. For example, a think tank could use the toolkit to demonstrate the potential economic impact of sea-level rise on coastal infrastructure, advocating for increased investment in climate resilience and adaptation measures.

The toolkit's comprehensive approach also allows think tanks to highlight the often-overlooked non-economic impacts of climate change, such as cultural loss or mental health impacts. Presenting this data can enrich national policy debates, ensuring that a broader spectrum of climate impacts is considered when developing policies and programmes.

At international forums, national think tanks can use evidence generated with the C-CIQ toolkit to advocate for global climate action that reflects the specific needs and challenges of their countries. This is particularly relevant in forums such as the UNFCCC negotiations, where detailed, country-specific data can provide data and evidence for nationally determined contributions (NDCs) and bolster a nation's arguments for more significant support, fairer climate finance distribution, or more ambitious emissions-reduction targets.

Think tanks can also highlight disparities in climate impacts between regions, advocating for equity-based approaches to international climate finance and support mechanisms. For instance, data showing disproportionate impacts on vulnerable populations can support calls for enhanced support through the Loss and Damage Fund.

2.5.4 Supporting development practitioners and local NGOs

Development practitioners, who support translation of climate-resilience strategies into action, can harness the C-CIQ toolkit to quantify the specific climate change impacts within the communities they serve. For instance, when implementing a new agricultural project, practitioners can use the toolkit to measure how changing rainfall patterns affect local crop yields. This data can be useful for designing interventions, such as introducing drought-resistant seeds or water-saving irrigation techniques. The toolkit's indices can also monitor and evaluate the progress and effectiveness of development projects over time, ensuring that they adapt to evolving climate realities and continue to meet community needs. Additionally, practitioners can leverage quantified L&D data to strengthen their advocacy for increased funding or policy support from governments and international bodies.

Local NGOs deeply rooted in communities can use the C-CIQ toolkit for participatory community engagement, ensuring climate action is informed by those most affected. For example, an NGO focused on coastal conservation might use the toolkit to assess how rising sea levels are impacting local fishing practices and then mobilise community-led conservation efforts. The data derived can also influence local policies, such as advocating for the construction of sea barriers or the development of alternative livelihood programmes for fishermen. These organisations can use the toolkit to strategically direct resources to support the most vulnerable or to restore damaged ecosystems.

In these roles, the C-CIQ toolkit acts as a bridge between data and decision-making, between community experiences and broader policy implications, helping to shape strategies better designed to respond to the challenges posed by climate change.

2.5.5 Supporting policymakers in developing targeted policy interventions

Policymakers at various levels of government can utilise the toolkit to better understand the real impact of climate change on their constituencies and to develop policies that are both responsive and forward looking.

When policymakers are faced with decisions on allocating funds for climate adaptation and mitigation, the C-CIQ toolkit can provide a structured approach to identify the areas of greatest need. For example, a policymaker in a coastal state might use the toolkit to quantify the potential losses from sea-level rise and prioritise investments in coastal defences or in the relocation of vulnerable communities.

The C-CIQ toolkit also equips policymakers with the ability to assess the effectiveness of existing policies and programmes. By examining the indices and engaging with community feedback, they can identify shortcomings in current responses to climate impacts and adjust their strategies accordingly. For instance, if an area is repeatedly affected by floods, the toolkit could help reveal which existing water-management policies need to be revised or which infrastructure needs to be updated to better withstand extreme weather events.

The toolkit's ability to factor in temporal and spatial dimensions means that policymakers can plan not only for the short-term but also for the changing dynamics of climate impacts in the future. This could involve long-term urban planning to make cities more resilient to heatwaves or developing agricultural policies that account for the projected impacts of climate change on local food systems.

At the international level, policymakers can leverage the data and insights from the C-CIQ toolkit for updating their NDCs, negotiations for climate finance and collaborations on climate action. Quantitative assessments of loss and damage can serve as powerful evidence in advocating for global agreements or in securing funding from international bodies for climate initiatives.

In essence, the C-CIQ toolkit can help policymakers across all levels to design and implement policies that are grounded in a deep understanding of climate risks and are shaped by the needs and experiences of those most affected by climate change.

3 Using the C-CIQ toolkit

In the sections outlining steps 1 to 5 in this document, we provide a comprehensive step-by-step guide on how to use the C-CIQ toolkit. This guide is designed to support users throughout the toolkit's process — from initial data collection to the application of evidence in developing targeted solutions for different vulnerable groups.

3.1 How the toolkit is structured

- **Step 1. Inclusive and participatory community assessment to co-identify loss and damage:** in this first step, the focus is on understanding the community's vulnerabilities and needs. It begins by initiating an inclusive and participatory assessment with the community, followed by the co-identification of predisposing, precipitating and protective factors. The process concludes with summing up and reporting back to the community. The principles of inclusive and participatory community assessment ensure that all community members are actively involved, making the assessment comprehensive and representative.
- **Step 2. Unpacking predisposing, precipitating and protective factors (3Ps) and understanding their interaction:** this step involves unpacking the predisposing, precipitating and protective factors using a taxonomical approach to understand their interactions and how they lead to various climate impacts. The assessment covers: understanding the predisposing factors that create vulnerability, assessing the precipitating factors that act as stress multipliers causing loss and damage, and understanding the protective factors that offer safety nets during times of crisis. An integrated assessment of these factors helps to comprehensively evaluate the community's vulnerability to loss and damage.
- **Step 3. Categorising impacts of economic and non-economic loss and damage:** in Step 3, the toolkit explains how to categorise different climate impacts into economic and non-economic loss and damage across various domains such as tangible, intangible, functional, intrinsic, spatial and temporal. This step includes practical examples for categorisation, covering aspects such as loss of quality of life, ecosystems and biodiversity, cultural heritage, social disruption (including migration and displacement), and mental and physical health impacts. Understanding the interaction between these different domains is crucial for a holistic analysis of climate impacts.
- **Step 4. Index-based valuation of economic and non-economic loss and damage impacts:** Step 4 outlines how to use an index-based approach for the quantification and valuation of economic and non-economic loss and damage. This involves methodologies such as economic valuation, multi-criteria decision-making analysis, and semi-quantitative and qualitative approaches. The process includes constructing indices and sub-indices, employing robust sampling approaches to capture data, and integrating these metrics to provide a comprehensive valuation. This step ensures that both quantitative and qualitative aspects of loss and damage are accurately measured and valued.
- **Step 5. Solution pathway — co-developing practical ways of tackling loss and damage:** in the final step, the toolkit focuses on co-developing practical solutions for addressing economic and non-economic loss and damage. This involves sharing the outcomes of the valuation with communities and other stakeholders, mapping existing resources and identifying gaps, and assessing current programmes for adaptation, DRR and resilience building. The process culminates in the development of a solution matrix through a participatory process, ensuring that the strategies developed are practical, effective and tailored to the community's specific needs.

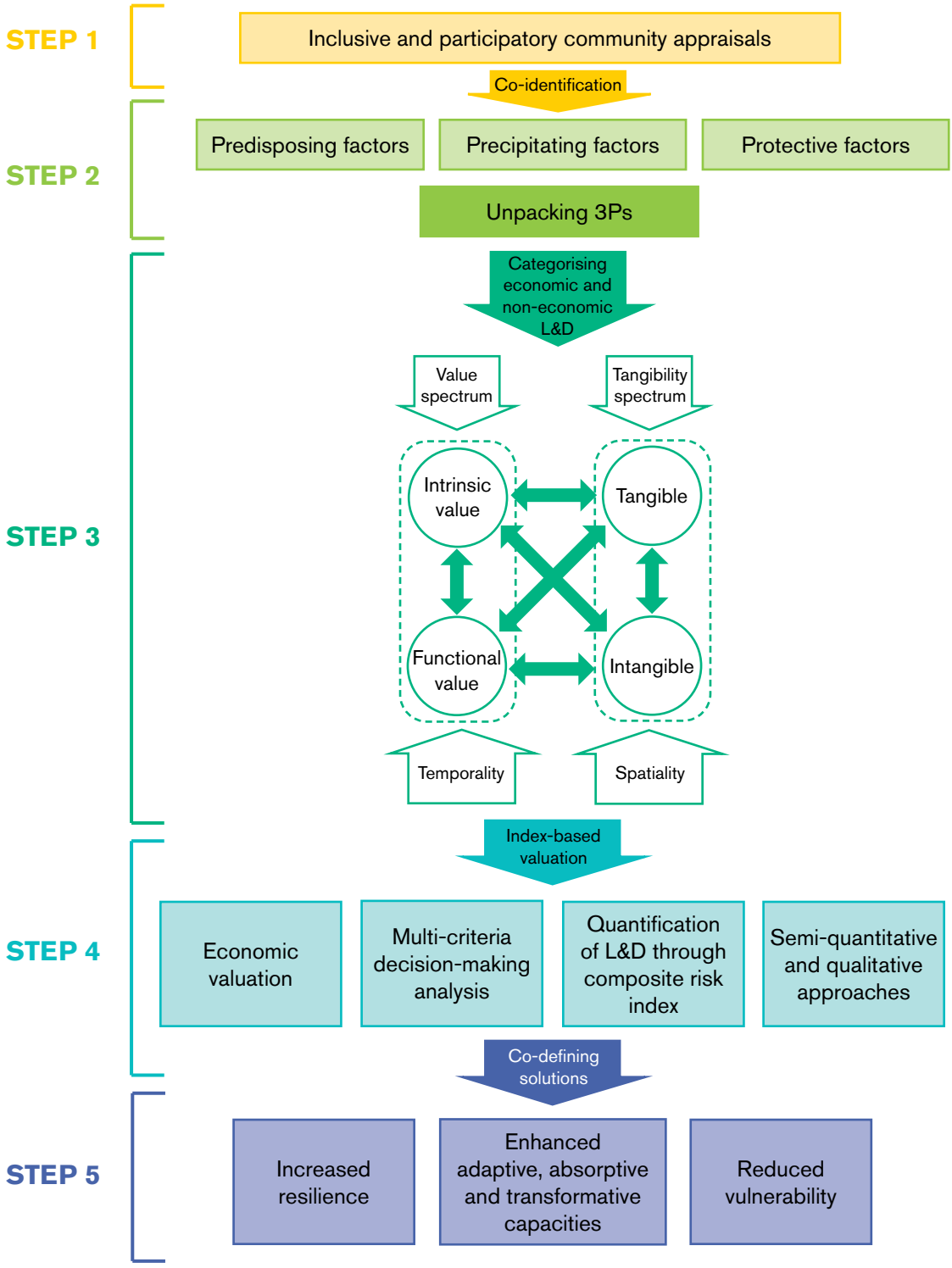
This step-by-step approach is depicted in Figure 7.

3.2 How to use the toolkit

- **Following the step-by-step process:** the document outlines a sequential process that users can follow, from setting up their study to deploying the toolkit's findings in real-world scenarios.
- **Customisation:** users will be equipped with the knowledge of how to adapt the toolkit's application to their specific needs and contexts, ensuring that the assessment process is both relevant and impactful.
- **Engagement strategies:** guidance on how to engage stakeholders throughout the process will ensure that the assessment is inclusive and reflective of diverse perspectives, particularly those of vulnerable populations.
- **Evidence to action:** tips on converting the data and insights gained into persuasive narratives for policy advocacy, funding proposals and community mobilisation efforts.

Our aim is to equip users with the knowledge and skills needed to effectively use the toolkit to understand and address the multifaceted challenges posed by climate change.

Figure 7. Stepped approach under C-CIQ toolkit



STEP 1

Inclusive and participatory community assessment to co-identify losses and damages

Different communities within a region may be impacted differently by climate change due to differences in their exposure, sensitivity to the climate events, and their capacity to cope and bounce back from the ensuing loss and damage. Therefore, solutions need to recognise the impact on different vulnerable groups within these communities though community value-based judgements, which entails inclusion of perspectives, needs and priorities of communities in the process of assessing and developing responses for L&D caused by climate impacts.

The first step in the toolkit is the inclusive and participatory community assessment (IPCA). This is the underlying approach that forms the basis for the information and data needed for all the subsequent steps for analysis and quantification undertaken through the toolkit, and therefore the most important.

The first underlying element is 'inclusion': aiming to involve marginalised groups such as women, children, sexual minorities, people with disabilities and older people in the assessment and valuation process. The second element is 'participation': this encourages communities to lead the assessment using their local knowledge and historical wisdom.

Users of the toolkit should focus on both inclusion and participation because:

- **It is crucial to hear from all parts of the community:** creating an inclusive framework helps ensure that economic and non-economic losses are accurately valued, leading to greater community ownership of the outcomes and resilience strategies.
- **It is important to respect the values that different communities place on loss and damage:** some losses may hold intrinsic value for a community, while others have functional value. These perspectives are essential for properly valuing and quantifying the losses.
- **Often, communities are not fully aware of how climate change affects them:** educating them about their vulnerabilities, preparedness and adaptive capacities, as well as recognising both felt and unfelt losses, is vital. This awareness helps prioritise their needs and aspirations.
- **Shared learning dialogues are crucial for addressing intangible and intrinsic issues,** such as emotional and mental wellbeing, self-esteem and the spiritual and cultural values communities cherish. These dialogues help communities articulate and address these often-overlooked aspects.

Implementing an inclusive and participatory assessment will require commitment and the complete reversal of conventional assessment approaches. It will need engagement processes and methods that require listening to community voices and engaging in dialogue with multiple stakeholders. The participatory methods and approaches included in C-CIQ are rooted in the participatory rural appraisals that evolved in the late 1980s and early 1990s (Chambers, 1994) by social science researchers and development practitioners intended for listening to the voices and priorities of the people. Since the assessment and quantification of economic and non-economic L&D speak of lived experiences of the people affected by extreme climate events, it is therefore relevant and important to deploy time-tested participatory methodologies to assess these impacts and co-develop solutions based on methodologies that help bring in community perspectives.

What Step 1 achieves

Step 1 will enhance the understanding of the underlying vulnerabilities of different groups within the community, current coping mechanisms, and how these can be strengthened or supported to better equip communities to build resilience against climate change. The process will be particularly helpful in:

- Identifying the pre-existing conditions within communities that make them particularly vulnerable to the impacts of climate change, especially marginalised and excluded groups. The community engagement approach will help unpack the demographic, social, economic and political factors that exacerbate their vulnerabilities and deepen their development deficits, which we have categorised as **predisposing factors**.
- Allowing the community to **self-assess where these vulnerabilities exist**, within which groups they are most entrenched, and develop targeted strategies to enhance their collective resilience against climate impacts.
- Helping communities recall and document both historic and current trends of sudden extreme weather events, such as cyclones and floods, as well as slow-onset events such as sea-level rise, salination and desertification. Analysing these climate change trends that act as **precipitating factors** is crucial for understanding what triggers loss and damage due to climate change, especially when considered in the context of predisposing factors among different vulnerable groups.
- Evaluating the current state of **protective factors**, including social and financial safety nets, and existing programmes and strategies aimed at enhancing resilience, reducing vulnerabilities, and disaster risk management.
- Enabling communities to assess their own solutions for coping with L&D, and their adaptive capacities and resilience. By documenting community responses and adaptation strategies during extreme climate events, as well as their needs and aspirations for building collective capacities to face future disasters, we can facilitate policy responses and interventions from both governmental and non-governmental actors.
- The IPCA methodology will assist communities in expressing their **shared experiences of both economic and non-economic L&D** incurred during disasters, validating and categorising those experiences based on their **tangibility and functionality**. This also includes exploring the psychological aspects of the losses and damages and how **intrinsic** these are to their cultural and religious structures and processes, as well as community perceptions, beliefs and responses.
- The IPCA supports assessment of the **temporal aspect** of L&D through participatory assessment of seasonality, trends and historic occurrences of extreme climate events, and how communities have been coping with the impacts of such events over generations. This will also help in documenting the changes in climate they have witnessed over the years, the immediate and chronic impacts these changes have created in their ecosystems, and the strategies communities have used to adapt to these changes and their effects on their lives and livelihoods.
- The IPCA supports assessing the **spatial aspect** of loss and damage with changes in immediate and neighbouring ecosystems, wildlife and marine habitats, changes in land-use patterns, mobility and migration patterns, and issues at source locations and destinations as a result of displacement and migration due to extreme climate events.

By focusing on these areas, this IPCA process will ensure comprehensive engagement and effective targeting of interventions to help communities better manage and recover from the impacts of climate change.

The principles of inclusive and participatory community assessment

The IPCA methodology draws its strength from participatory rural appraisal, which is a set of flexible methods designed to let people lead the appraisal process, while facilitators engage in co-learning about problems, potential solutions, and the evaluation of these solutions' impacts. Responsibility lies with the local communities, who own the information generated from these appraisals. Participatory rural appraisal incorporates a variety of participatory methods, including mapping and modelling, transect walks, matrix ranking, seasonality calendars, trend and change analysis, wellbeing and wealth ranking, and perception mapping. Here it is important to highlight that while various participatory appraisal methodologies utilise common tools, they would require adaptation to local contexts and to address specific concerns.

The principles that users will need to adhere to while undertaking assessment are:

- Reversing the learning process by valuing people's knowledge and learning from and with them
- Respecting the diversity of expressions and opinions
- Avoiding blueprints or quick-fix solutions, instead being led by the process
- Being flexible enough to adapt and innovate methods according to local contexts
- Accommodating verbal, non-verbal and visual expressions
- Using triangulation with more than one method to verify information
- Facilitating rapid and progressive learning experiences
- Shifting from merely extracting information to empowering people to assess, plan and evaluate outcomes on their own, and
- Transitioning from an individual-centric to a group-centric approach.

Having been widely used for several decades, especially in poverty assessments, such participatory approaches have triggered extensive debates about their advantages and limitations. In the context of climate change, a community-level participatory approach can provide unique insights into the impacts of severe weather or climate-related hazards on socially and economically disadvantaged communities based on their experiences. This enables these communities to assess vulnerabilities and co-develop practical solutions that work for them.

Unlike traditional methods such as individual or household questionnaires, inclusive and participatory community assessment methodologies attempt to draw representatives from different community groups. This helps in gathering feedback from different members of the community in terms of age, gender, ethnicity, social and economic stratification and culturally specific factors. Since their inception several decades ago, participatory methodologies have been widely used by social science researchers and development practitioners.

While all participatory appraisal methodologies share common tools and techniques to address various social, economic and environmental issues, we have combined selected IPCA tools into a framework specifically designed for C-CIQ. This will offer insights into how vulnerable communities experience extreme weather events and other climate-related hazards they face. It allows excluded and marginalised sections of communities to assess their vulnerabilities, needs and opportunities. Also, it offers scope for identifying interventions that align with community perspectives.

How to undertake an inclusive and participatory community appraisal

1. Initiating an inclusive and participatory assessment with a community

Before initiating the assessment with the community, the facilitator should prepare by creating an environment that is conducive for effective engagement. Some essential steps include:

- **Understand the community context and local sensitivities:** the facilitator should begin by conducting comprehensive research on the community's demographic, cultural and socioeconomic background. This involves understanding local norms, values, power dynamics and historical conflicts to tailor the IPCA approach appropriately. Knowledge of local languages, customs and key issues facing the community is crucial for effective communication and engagement.
- **Establish clear objectives:** defining clear, achievable goals for the IPCA is essential. The facilitator should determine what the assessment aims to discover or achieve and ensure these objectives align with both the community's needs and the broader goals of the research. Clear objectives help in structuring the assessment process and guide the selection of specific participatory tools and methods.
- **Engage local leaders and stakeholders:** early engagement with local leaders, influential figures and stakeholders is critical. This helps in gaining their support and trust, which can facilitate easier entry into the community and greater participation from community members. It also helps in understanding any potential resistance or sensitivity around the issues to be addressed.

- **Identify and train community-level volunteers who can support the facilitation process:** identifying and training local individuals to assist in facilitating the IPCA can enhance trust and communication between the facilitator and the community. A team of local volunteers can offer insights into community dynamics and help manage logistics and language barriers.
- **Select appropriate participatory tools:** choosing the right tools is crucial for the success of an IPCA. This involves judging the most appropriate tool based on the community's literacy levels, cultural appropriateness, and the specific objectives of the assessment. Tools might include surveys, focus groups, mapping, storytelling and more, depending on what is most effective for engaging the community and gathering the needed information.
- **Plan logistics carefully:** organise all logistical aspects of the IPCA, including the scheduling of meetings and activities, locations for gatherings that are accessible to all community members, and any necessary materials or equipment. Consider timing (for example, avoid harvest times in farming communities, avoid religious festivals, choose times that make it easier for women to participate). Also consider transportation and any compensation for participants' time, if appropriate.
- **Establish ethical guidelines:** the facilitator should ensure that all activities respect the rights and dignity of community members. This includes obtaining informed consent, ensuring confidentiality where necessary, and being transparent about how the information gathered will be used. The facilitator should also be prepared to address any ethical dilemmas that arise during the assessment.
- **Communicate the purpose and process of the appraisal:** before the assessment begins, the facilitator should clearly communicate the purpose, process and potential benefits of the IPCA to community members. This should be done in a way that sets realistic expectations and builds trust. Providing clear information about the IPCA will help minimise misunderstandings and encourage active participation.
- **Be prepared to be flexible:** finally, while it is important to plan, the facilitator should also be prepared to adapt an approach that is based on ongoing feedback and the evolving dynamics within the community. Flexibility can be crucial in responding to unforeseen challenges or opportunities that arise during the assessment process.

This approach can help the facilitator lay a strong foundation for carrying out the process that engages the community effectively and ethically, leading to meaningful outcomes.

2. Co-identification of predisposing factors

The assessment process will start by understanding and defining climate-induced loss and damage through the lens of community perceptions and value judgments. Therefore, the local context should guide the selection of appropriate tools to understand the pre-existing conditions of the community that contribute to the heightened vulnerabilities to climate change. Exploring these factors with the community will help understand how these vulnerabilities can inhibit the capacity to prepare, cope and recover from climate impacts. For instance, economic deficiencies, such as high levels of poverty and debt, can constrain local capacities to invest in adaptation measures or disaster recovery. Similarly, social factors such as gender disparities may restrict women's access to information and resources, making them more vulnerable during climate disasters.

Understanding different factors, such as population growth, age distribution, urbanisation and migration patterns, allows for an assessment of the scale and complexity of climate-induced loss and damage.

- **Population size, density and distribution:** densely populated coastal areas and slums that have expanded rapidly due to urbanisation — often without appropriate infrastructure — can exacerbate flood risks. Similarly, areas with a high dependency ratio may struggle with evacuation and disaster recovery efforts.
- **Population mobility:** migration, driven by both push and pull factors, can positively or negatively influence the lives of people, affecting how they respond to and recover from climate impacts.
- **Social marginalisation:** people in the lower strata of society are particularly vulnerable due to their limited access to resources.
- **Economic deprivation:** economically deprived individuals, including those without savings, assets or homes, are more vulnerable to climate impacts.
- **Age:** children and older people are more vulnerable due to their specific needs and lower capacity for self-sufficiency during disasters.

- **Gender:** women often face greater vulnerabilities than men due to socioeconomic and cultural factors that limit their access to resources and decision-making.
- **Disability:** people with disabilities are disproportionately affected during disasters due to accessibility and mobility challenges, as well as a lack of tailored emergency response measures.

By cataloguing these factors, we can develop interventions that are more demographically sensitive, ensuring that the most vulnerable population segments such as children and older people are adequately protected.

The following tools can be used.

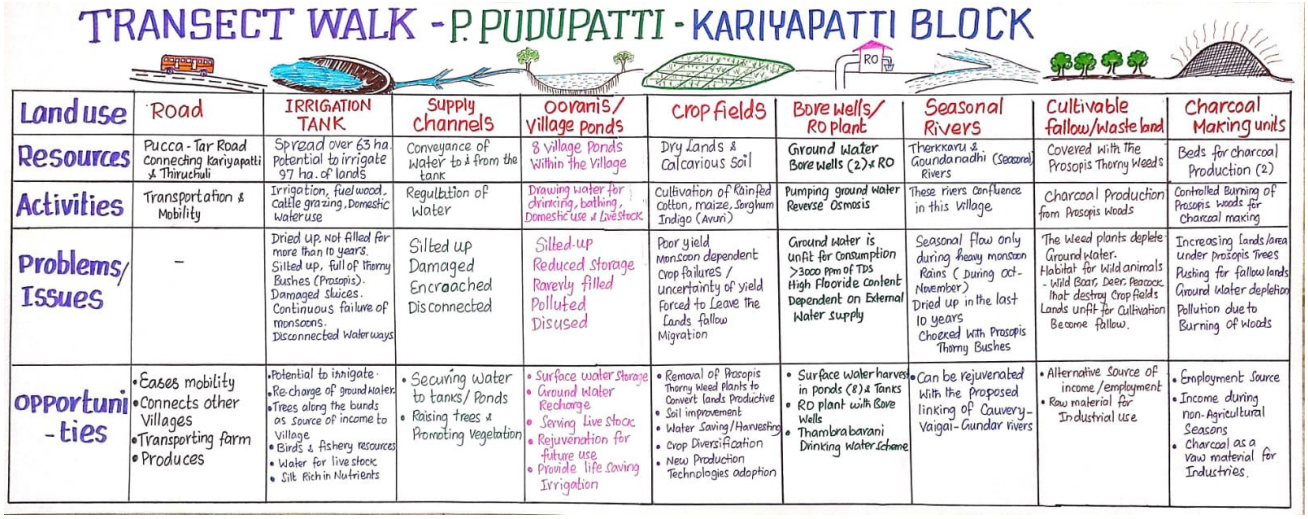
Transect walk

Transect walks can be conducted across affected or risk-prone villages or settlements with the local community to explore various issues and opportunities related to climate risks. This exploration involves listening, observing, asking questions and clarifying details with participants while walking through the village or urban settlement. It is important to stop for a while at key junctures or locations to have detailed discussions. During or towards the end of the transect walk, engage the co-walkers in discussions to create a transect map that incorporates the notes prepared during the walk.

The transect map could cover social factors such as the caste and ethnicity of the settlement inhabitants, access to and control over village resources, and gender-related dimensions, in addition to the geographical characteristics of the village. These geographical characteristics include topography, land type and usage, ownership and access, soil type and fertility, vegetation and crops. Depending on the purpose of the exercise, the map may also detail geographical vulnerabilities, such as areas prone to flooding, landslides, coastal erosion, and issues related to water and sanitation.

We have provided a sample resource map in Figure 8, which was developed based on transect mapping. The transect walk analysis shows village land-use patterns and was co-generated with the community. Depending on the context, the facilitators can undertake a similar resource-mapping exercise (covered later) before or after starting the transect walk. Such an exercise will generate many ideas and exploratory questions to be discussed during or after the transect walk. This process will also help in the triangulation of information, enhancing the accuracy and depth of insights gathered.

Figure 8. Transect walk analysis showing land-use patterns in P Pudupatti, Kariyapatti, Virudhunagar, India. Credit: Nageswari Ramasamy



Land use	Road	IRRIGATION TANK	Supply Channels	Oorani's/ Village Ponds	Crop fields	Bore Wells/ RO plant	Seasonal Rivers	Cultivable fallow/Waste land	Charcoal Making units
Resources	Pucca - Tar Road connecting Kariyapatti & Thiruchuli	Spread over 63 ha. Potential to irrigate 97 ha. of lands	Conveyance of water to & from the tank	8 Village Ponds within the Village	Dry Lands & Calcarious Soil	Ground Water Bore Wells (2) & RO	Therkkaru & Gounda nadhi (Seasonal) Rivers	Covered with The Prosopis Thorny Weeds	Beds for charcoal Production (2)
Activities	Transportation & Mobility	Irrigation, fuel wood, Cattle grazing, Domestic water use	Regulation of Water	Drawing water for drinking, bathing, Domestic use & Livestock	Cultivation of Rainfed cotton, maize, Sorghum Indigo (Avuri)	Pumping ground water Reverse Osmosis	These rivers confluence in this village	Charcoal Production from Prosopis Woods	Controlled Burning of Prosopis woods for Charcoal making
Problems/ Issues	-	Dried up, Not filled for more than 10 years. Silted up, full of Thorny Bushes (Prosopis). Damaged Sluices. Continuous failure of monsoons. Disconnected Waterways	Silted up Damaged Encroached Disconnected	Silted-up Reduced Storage Rarely filled Polluted Disused	Poor yield Monsoon dependent Crop failures / uncertainty of yield Forced to Leave the Lands fallow Migration	Ground water is unfit for Consumption >3000 ppm of TDS High Flouride content Dependent on External Water supply	Seasonal flow only during heavy monsoon Rains (During Oct-November) Dried up in the last 10 years Choked with Prosopis Thorny Bushes	The Weed plants deplete Ground water. Habitat for Wild animals - Wild Boar, Deer, Peacock that destroy Crop fields Lands unfit for Cultivation Become fallow.	Increasing lands/area under prosopis Trees Pushing for fallow lands Ground water depletion Pollution due to Burning of Woods
Opportuni-ties	• Eases mobility • Connects other Villages • Transporting farm Produces	• Potential to irrigate • Re-charge of ground water • Trees along the bunds as source of income to village • Birds & fishery resources • Water for live stock • Silt Rich in Nutrients	• Securing water to tanks/ Ponds • Raising trees & Promoting Vegetation	• Surface water Storage • Ground water Recharge • Serving Live Stock • Rejuvenation for future use • Provide life saving Irrigation	• Removal of Prosopis Thorny Weed Plants to Convert lands Productive • Soil improvement • Water Saving/Harvesting • Crop Diversification • New Production Technologies adoption	• Surface water harvest in ponds (8) & Tanks • RO plant with Bore Wells • Thambrabarani Drinking Water Scheme	• Can be rejuvenated With the Proposed linking of Cauvery-Vaigai-Gundar rivers	• Alternative source of income / employment • Raw material for Industrial use	• Employment Source • Income during non-Agricultural Seasons • Charcoal as a raw material for Industries.

Social mapping

Social mapping is a popular participatory method that has been used extensively for social and development studies, planning and evaluations. Using this approach helps in understanding the demographic characteristics of the settlement by mapping the pattern and distribution of people according to prevailing social and economic inequalities, access to and control over resources within the village boundary (including biodiversity and ecosystem services), vulnerability of households due to exposure to various hazards and risks of disasters, and the opportunities they have for coping with loss and damage, as well as social networks and exchanges.

The approach to be followed includes:

- The preparation of the social map led and supported by local people and facilitated by the researcher.
- People creating a physical map of the village using locally available materials such as seeds, leaves and stones. This map can later be reproduced on a chart or paper for further use. People will draw village infrastructures such as schools, health centres, places of worship, community gathering places, public utilities and government buildings.
- The map will also show roads, pathways and houses, differentiated by size, type, wellbeing criteria (rich and poor), and whether they are headed by males or females, distinguishing between landless inhabitants and landholders, migrants and non-migrants and noting people with disabilities.
- Discussions held during and after the creation of the social map will help to identify and understand the social dynamics and interconnections within the community, and the support structures and processes for exchanges and mutual support during and after disasters.

The social map is unique in several ways. First, it is prepared by local people, not by experts or outsiders, which means it fully reflects the perceptions of the people and is an authentic representation of the community's reality. Since the map is drawn not to scale, it represents people's perceptions of relative importance (see Figure 9 for a sample social map carried out by a community).

Participatory social mapping, followed by shared learning dialogues with the community, will help understand the vulnerabilities of specific groups such as women, children, older people, disabled people, minorities and LGBTQI+ communities. Factors such as educational disparities, wage gaps and social discrimination directly influence these groups' capacity to prepare for and recover from climate disasters. Understanding these social realities allows for designing inclusive and targeted interventions that address the needs of specific vulnerable groups.

Figure 9. Social mapping carried out by the village community in Pottiuram, Thirumangalam, Madurai, India. Credit: Nageswari Ramasamy

Matrix ranking

Matrix ranking helps in prioritising problems and opportunities based on community perceptions. To understand the predisposing factors that contribute to people experiencing increased or decreased vulnerabilities to loss and damage, the community can list the factors in rows (see Figure 10 and these can then be ranked against criteria such as intensity, frequency and level of influence on their vulnerability (depicted in the columns). Community members fill in the boxes for each row with stones or seeds to score relative values based on their priorities. This will help in understanding the values attached by the community to the factors they consider most or least important in the context of disaster preparedness.

For the pair-ranking exercise, create a matrix on a flip chart with a comprehensive list of various economic and non-economic losses and damages identified during the focus group discussion exercise. List these problems both on the rows and columns of the matrix. The facilitator then asks community members to compare each pair of problems and select the most important one. This selection can be marked in the corresponding box on the matrix. Repeat this process until all possible comparisons have been made. Finally, the problems are scored by tallying how many times each problem has been ranked as the most important. The problem with the highest frequency of mentions in the matrix is assigned the top ranking, followed by others in descending order.

MATRIX RANKING: VeeraperumalPuram

PROBLEMS OF DROUGHT	Community Response	RANKING
Crop failure	★★★★★★★★★★★★★	1
Shortage of Cattle feed & Forage	★★★★★★★★	4
Distress Sale of Cattle	★★★★★★	6
Leaving Land fallow	★★★★★★★★★★★★	2
Sale of Land	★★★★	8
Migration	★★★★★	7
Shortage of food	★★	10
Drinking Water Scarcity	★★★	9
Increasing Debt Burden	★★★★★★★★★	3
Sale of liquidable Assets	★★★★★★★	5

Figure 10. Matrix ranking undertaken by the community in Veeraperumalpuram, Kallikudi, Madurai, India. Credit: Nageswari Ramasamy

This prioritisation process can be done with different groups of participants such as men, women, Indigenous groups and religious groups to gather perceptual differences among different categories of people in the community. The rankings can be combined to obtain a composite matrix ranking for the entire community.

Problem tree analysis of vulnerability

Problem tree analysis analyses a situation, its causes and effects. It is done in a small focus group of participants within the community. Depending on the purpose of the assessment, we can choose groups of participants based on their gender, age or livelihood categories. Like a tree, the roots represent causes, the trunk represents the main problem, and the leaves represent the effects in the form of economic or non-economic L&D.

- Using this problem tree analysis, the facilitator can keep vulnerability as the main problem and explore with participants the various causes such as poverty, indebtedness, social and economic deprivation, issues in farming, joblessness, access and affordability to financial services, and technology — including information and communication technologies.
- The participants can be asked to write the causes and consequences on cards or stickers. The crux of the exercise is promoting dialogue and debate around the issues, allowing people to reflect and discuss to come to a shared understanding of the causes and consequences of their vulnerabilities.

Constructing a problem tree depends on the skilful facilitation by the researcher, who promotes dialogue among the participants, focusing and refocusing them on the main issue and giving them examples and anecdotes.

Mobility mapping

The mobility map is an important tool for analysing the movements of individuals, groups and communities. In the context of economic and non-economic L&D measurement, we can assess the population movement triggered by extreme climate events. Demographic L&D in the context of climate change refers to the adverse impacts on human populations, particularly in terms of displacement and migration, changes in demography, and societal disruptions caused by climate change impacts. These impacts can result from rapid-onset extreme weather events and slow-onset changes such as sea-level rise, prolonged droughts, increased temperatures and other climate-related factors. Various push and pull factors will affect the migration decisions of a family or a community.

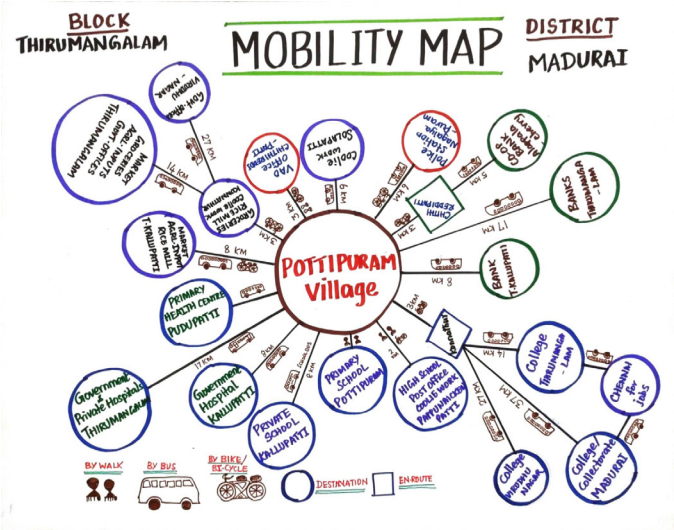


Figure 11. Mobility mapping carried out by the community in Pottiuram, Thirumangalam, Madurai, India. Credit: Nageswari Ramasamy

By working with a community to construct their mobility maps (see Figure 11 for a sample), we can obtain valuable insights into people's movements, whether temporary or semi-permanent, and whether under normal circumstances or distress situations. By studying factors such as migration frequency, distance travelled and the significance of destination sites, we can deepen our understanding of how people decide and move during and after disaster events. Like social and resource maps, the mobility map reflects a community's perceptions of their mobility patterns and sheds light on the motivations driving these patterns. It also helps us grasp the dynamics of local travel, including where people go and why they go there. Additionally, it can highlight gender disparities in mobility patterns, allowing a better understanding of men and women's different experiences. By expanding our knowledge of mobility patterns, we can widen our understanding of local communities and their interactions with the ecosystem and how they cope with the extreme events triggered by climate change by making a conscious choice of moving out permanently, temporarily or seasonally. It helps us pinpoint key social, economic and environmental factors that shape their movement.

3. Co-identification of precipitating factors

Precipitating factors include slow- and rapid-onset changes in the climate, such as temperature shifts, precipitation variability and new weather patterns. These factors go beyond climate change trends — they directly translate into real-world impacts such as sea-level rise, intensified droughts or erratic monsoons. Recognising these changes, such as increased frequency of cyclones, increased glacial melt or glacial lake outbursts, can help us anticipate what is coming next, especially in areas already struggling with developmental deficits. Community-level participatory assessment can be used to explore the community experiences over generations regarding these changing patterns and trends with respect to intensity, frequency and impact of such extreme events on different communities. We can co-identify changes such as:

- Trends of increasing or decreasing temperature
- Increasing frequency and intensity of droughts and desertification
- Trends in increasing or decreasing frequency and intensity of rainfall
- Increasing occurrence of cyclones, floods, heat aves or hailstorms
- Increasing incidences of glacial lake outbursts, and
- Increasing incidences of coastal floods, erosion, land subsidence or salination.

These precipitating factors create impacts on the people's lives, livelihoods and surrounding ecosystems in various forms of economic and non-economic L&D. The economic L&D includes amplifying debts, increasing economic deprivation, loss of livelihoods, loss of productive assets and employment, and so on. Non-economic L&D encompasses social issues such as increased hunger, water scarcity and violence against vulnerable groups. It also includes political tensions that arise from resource scarcity.

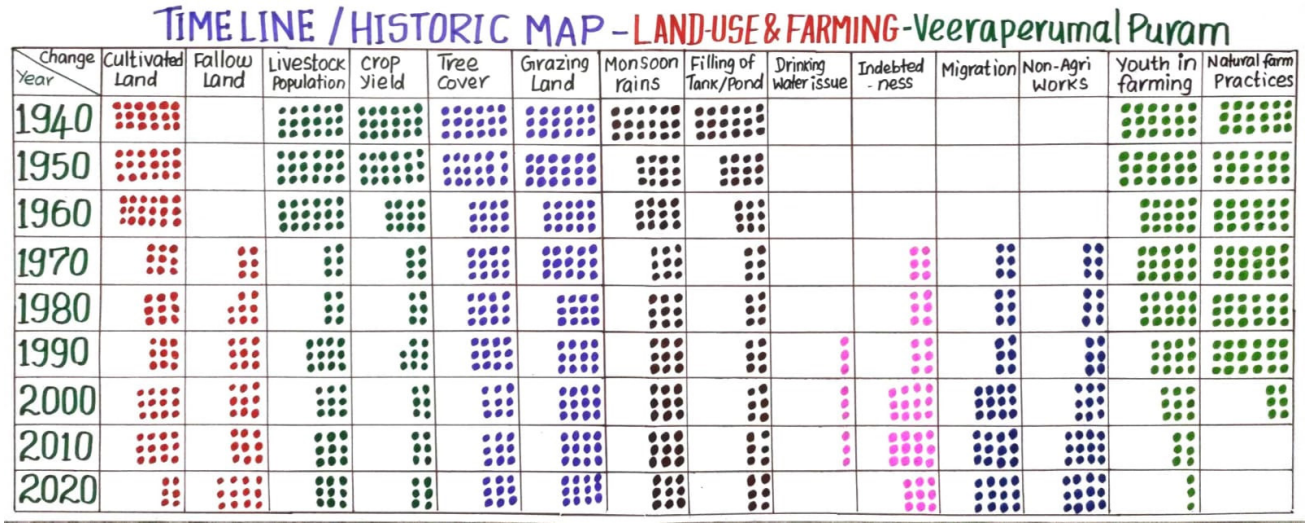
Participatory assessment of how climate change is increasing in a particular geography can be done based on people's experiences and their knowledge drawn from these experiences over generations. While the scientific data is relevant, the perceptions and experiential knowledge of communities, the history of changes in the climate and the impacts on the people's lives, transmitted across several generations through oral traditions, stories and songs are equally important and relevant. The impact of climate change encountered by communities, especially the non-economic aspect of L&D, can be very well-articulated through oral histories. Participatory community assessments are highly relevant to capture these nuanced experiences, which remain closer to people's hearts, and are mostly unheard and unrecognised by formal means of information gathering.

The following tools can be used to explore precipitating factors that influence L&D induced by climate change.

Timeline or historic mapping

The timeline is a participatory method that relies on people's experiences, their memories and information passed on from their ancestors (see Figure 12). It helps to establish rapport with villagers through an exploration of their past. It tries to capture the chronological sequence of events as remembered by individuals, serving as a historical reference for communities and institutions. However, it cannot be taken entirely as history: rather, it should be considered as the recollection of experiences by the community. By understanding the community's perception of significant climate events and related historical events, we can gain insights into their perspective on current issues, sparking discussions on the economic and non-economic impacts those events created, and especially, prompting them to talk about issues such as education, health and gender relations.

Figure 12. Timeline/historic mapping carried out by the community in Veeraperumalpuram, Kallikudi, Madurai, India. Credit: Nageswari Ramasamy



Seasonality mapping

Seasonality mapping, also known as a seasonality calendar or seasonality analysis, helps in understanding the seasons of the community and various activities undertaken by the community during these seasons. It focuses on community perceptions of seasonal variations in aspects of their lives, such as farming, fishing, cultural and social events, seasonal health issues or disease outbreaks, food security, and their mobility in response to seasonal changes. The seasonal diagrams (see Figure 13) created by a community can be triangulated with the secondary or primary sources to validate the information gathered. By quantifying and visually representing the intensity of different activities, seasonal diagrams provide valuable insights. Seasonality mapping assists in identifying livelihood patterns across the year, as well as periods of stress undergone by a community which may increase the need for interventions.

Figure 13. Sample seasonality mapping carried out by the community in Veeraperumalpuram, Kallikudi, Madurai, India. Credit: Nageswari Ramasamy

Trend analysis

Trend analysis involves participatory mapping of long-term changes in the availability, accessibility and quality of resources that contribute directly or indirectly to the livelihoods of the community. This can help capture both quantitative and qualitative changes in the resources upon which the community depends. It provides space for analysing a wide range of issues, including soil erosion, productivity, tree cover, water availability, livestock and human population changes, and rainfall patterns.

- Trend analysis starts with consulting a community to identify which resources they perceive as constraints, changes in the severity of L&D they encounter, changing trends in depletion of resources, and conflicts that arise out of resource sharing.
- People can share the changes they have been witnessing in various aspects of their village life, including cropping systems, production and productivity of crops, demographic changes, livelihood opportunities, land-use patterns, changes in water resources and biodiversity, natural calamities, damage caused by such calamities, and migration and adaptation measures adopted over the years.
- The analysis can also examine the causes and consequences of changes, losses and damages they have witnessed over the years. This will help understand the dynamics of change, and how the local communities perceive these changes, what interventions they have adopted to address those changes, what worked and what did not work, what changes they want to see and their aspirations.
- The facilitator can help community members create a map on the floor or on a chart with locally available materials. They can be asked to quantify the L&D using sticks, stones or seeds. It is important to note that the changes they try to quantify may not be precise: rather, they are indicative of people's relative perception of the intensity of the losses.

Hazard and resource mapping

Hazard and resource mapping is a participatory process wherein a community is facilitated to identify and assess the resources and risks of their village. Resource and hazard mapping can be done in combination or in isolation. The resource map helps to identify and plot all the natural and man-made resources in a village or across villages. It depicts the settlement of population, houses, public and private village institutions, soil, land resources (including cropped lands, common lands, grazing lands), water resources (rivers, tanks, ponds, wells), forests and common property resources.

For hazard mapping, people can map various natural and man-made resources that are exposed to hazards and features that pose potential threats to individuals, their assets, infrastructure and economic activities. It entails visually representing spatial variations in hazard events and depicting resources available to the community to cope in a disaster. Hazard mapping helps people generate valuable information about the perceived potential of climate events to cause L&D and possible measures they can take to minimise the impact of such events. The foundation of hazard mapping lies in gathering insights from a community that incorporate their Indigenous knowledge and understanding of hazards.

The resource map and hazard map can be superimposed upon each other to plot the potential risk zones, resources available to mitigate those risks, and settlements vulnerable to disasters due to their exposure and proximity to those disasters. With the information generated from these consultations and maps, we can study vulnerability, preparedness, adaptive capacities and resilience. The focus is not on creating precise maps, but on gathering valuable information regarding local perspectives about resources and hazards. These maps are developed collaboratively, leveraging a community's deep knowledge of the surrounding area and guided by what the community deems important.

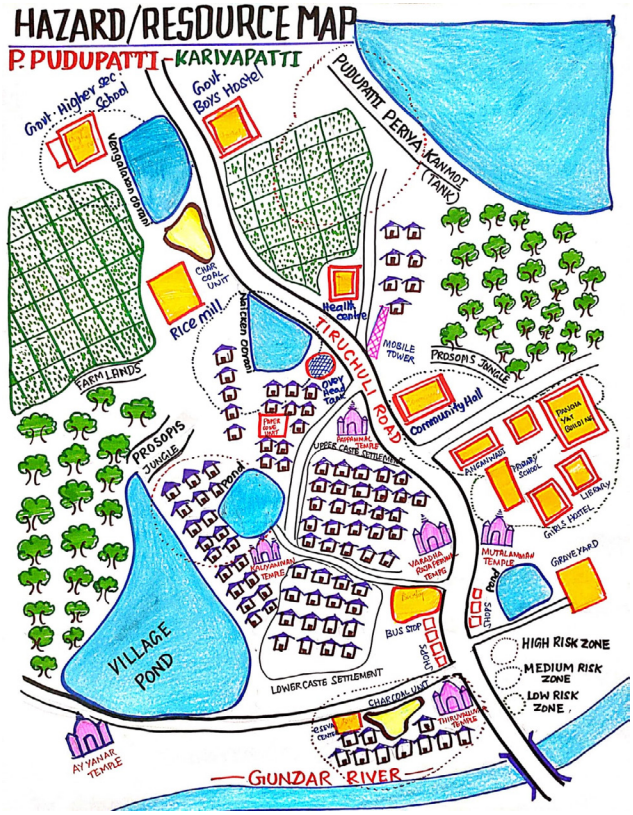


Figure 14. Hazard map developed with the community in Pottipuram, Thirumangalam, Madurai, India. Credit: Nageswari Ramasamy

4. Co-identification of protective factors

Protective factors encompass existing policies, programmes and strategies that aim to enhance preparation, reduce vulnerability and build resilience, especially in the areas of disaster risk management, health and human mobility. Some of the existing policy and programme responses to enable communities to absorb the shocks triggered by climate change-induced catastrophes include:

- **Cash transfers, skills development and employment assistance:** programmes that provide immediate financial aid and long-term skills training to bolster livelihood stability
- **Targeted poverty-reduction initiatives:** specific actions aimed at lifting vulnerable populations out of poverty, addressing both immediate needs and structural inequalities
- **Financial inclusion and support for alternative livelihoods:** efforts to increase access to financial services and promote sustainable economic activities
- **Health and social security programmes:** initiatives designed to provide healthcare access and financial security in times of illness or economic hardship
- **Unemployment protection:** safety nets for those who lose their jobs due to economic shifts or disasters
- **Welfare programmes for disabled people:** tailored support that addresses the unique challenges faced by disabled individuals
- **Disaster risk reduction and disaster-management programmes:** strategies and actions to minimise the impacts of natural disasters through preparedness and responsive measures
- **Programmes for protection and assistance to migrants:** support for individuals forced to move due to environmental changes or disasters.

Additionally, the following elements enhance comprehensive protective measures:

- **Awareness and capacity-building programmes:** initiatives that focus on raising awareness and empowering communities to better prepare and manage climate impacts
- **Infrastructure development:** upgrading and strengthening infrastructure to better withstand climate-related events
- **Technological innovations:** utilising advanced technology for better prediction and management of climate impacts and providing early warning and decision-making tools
- **Community engagement and capacity building:** enhancing community cohesion and collective problem-solving capacities through training and support
- **Legal and regulatory frameworks:** implementing robust environmental protections and rights-based access to social protection and other entitlements during crises
- **Mental health support:** integrating mental health services within social protection frameworks to address the psychological impacts of climate change.

However, sometimes, despite these enabling programmes and policies, their benefits do not reach the intended communities because of a range of issues or are not designed to meet the needs of vulnerable communities. Understanding existing protective measures and any challenges communities face with regard to access and adequacy of these programmes and strategies is crucial.

Participatory assessment of protective factors, along with predisposing and precipitating factors with a community can provide actionable insights on how the existing programmes can be strengthened or what new initiatives are needed and how their delivery should be designed.

Perception mapping of institutions and interventions

Effective governance structures, political stability and administrative capabilities are crucial for communities to successfully address climate-related risks. A lack of strong governance can impede the ability to respond to disasters and develop effective long-term climate adaptation strategies. Challenges such as corruption, inadequate law enforcement, and limited representation for marginalised communities in decision-making can further increase vulnerabilities.

Institutional interactions and levels of influence play a vital role in determining the collective capacity of a community to cope with L&D. In the context of climate change, these institutions include all groups within the community, such as public and private institutions, civil society, community groups, religious organisations and others that influence policies and programmes affecting the community. A community's efforts to enhance its adaptive capacity and resilience are significantly influenced by these institutions, whether they exist within or outside the community. A community can be facilitated to assess the significance of each institution and programme by listing and ranking institutions based on community perceptions and experiences. This ranking can then be visually represented using circles of different sizes, either cut out of paper or drawn on a floor or chalkboard. The circles can be positioned relative to a larger circle symbolising the community itself. The size of the circle, the distance between the circles and the size of the overlap

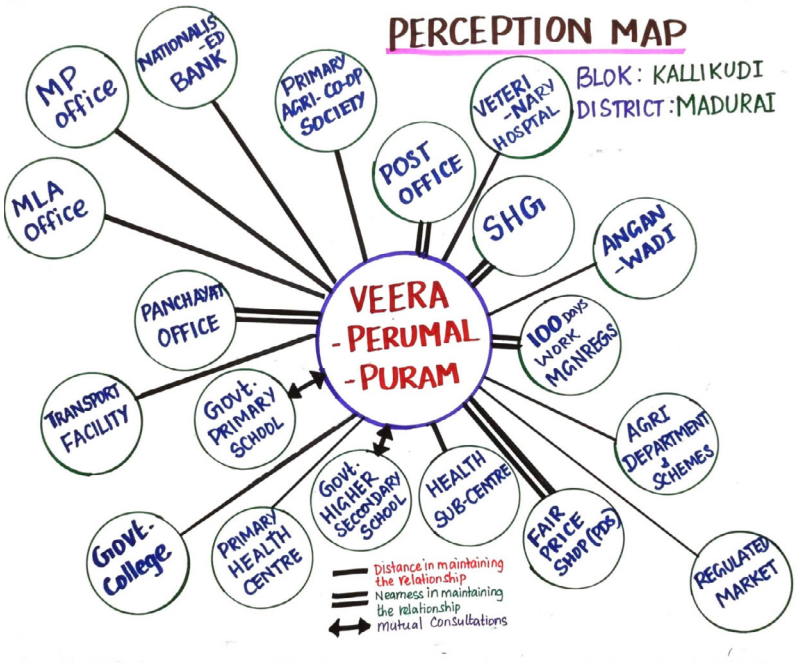


Figure 15. Sample perception mapping of institutions and interventions in Veeraperumalpuram, Kallikudi, Madurai, India. Credit: Nageswari Ramasamy

between circles can denote the importance, connectedness and collaboration between institutions. This process, facilitated by further community discussions, can help create an institutional interaction chart, similar to a Venn diagram due to its circular nature. This chart can provide a graphic depiction of the community's collaborative efforts aimed at improving their coping capacities. Also, it can show how much these communities are connected with institutions, and their perception of the impact, needs and attitudes towards various institutions or groups.

5. Summing up and reporting back to the community

At the end of the appraisal process, the facilitator should ensure that the gathered information is effectively synthesised, communicated and used for actionable change at the community level. Some guidelines on how a facilitator should conclude these processes include:

- **Summarising and validating the findings with the community:** the facilitator should summarise the key findings and insights gathered during the assessment process. This should be done in a community meeting where participants can validate the information. It is important that the summary captures the breadth of issues discussed, including the specific vulnerabilities, strengths and needs identified via participatory methods. The facilitator should encourage participants to clarify, correct or add to the summary, to ensure that it accurately reflects their views and experiences.
- **Explaining and discussing the next steps:** once the findings are validated, the facilitator should lead a discussion on next steps. This should ideally involve exploring potential solutions and interventions that can address identified issues. The facilitator should encourage community members to prioritise actions based on their urgency and feasibility. This stage should also include planning for resource allocation, setting timelines and assigning responsibilities to ensure that the community can move forward with implementing changes that they can introduce themselves and those they need to pursue with local authorities.
- **Documenting and reporting back to the community:** finally, the facilitator should document the entire process and the outcomes of the IPCA sessions. This documentation should include detailed descriptions of the participatory methods used, insights gained, decisions made and plans for future actions. The facilitator should prepare a comprehensive report that can be shared with community members, stakeholders and, where applicable, funding bodies or government agencies. This report serves not only as a record of what was achieved but also as a tool for securing support and resources for community-led initiatives.
- **Ensuring continuity and support:** the facilitator should ensure that there is continuity in the support and engagement with the community. This might involve scheduling follow-up meetings or establishing a local committee or group tasked with overseeing implementation of the interventions. The facilitator's role is to ensure that the momentum is maintained, and that the community feels supported and empowered through the process.

By effectively concluding the IPCA processes with these actions, the facilitator can help ensure that the community is well prepared to bring about sustainable changes and improvements based on their collective needs and priorities.

Unpacking predisposing, precipitating and protective factors (the 3Ps) and understanding their interaction

The losses and damages caused by extreme climate events are not solely the result of climate change. They result from a complex interplay of climate with various geographical, demographic, social, economic and political factors that influence the capacity of communities to withstand and recover from these impacts. Therefore, an assessment of L&D cannot be done in isolation.

Step 2 involves unpacking the predisposing, precipitating and protective factors using a taxonomical approach to understand their interactions and how they lead to various climate impacts. The assessment covers three domains: understanding the predisposing factors that create vulnerability, assessing the precipitating factors that act as stress multipliers causing loss and damage, and understanding the protective factors that offer safety nets during times of crisis. An integrated assessment of these factors helps to comprehensively evaluate the community's vulnerability to loss and damage.

To undertake this assessment, users will need to use the information and insights collected from participatory and inclusive community appraisals, data collected from the field and secondary sources of information to define and categorise the full spectrum of these 3P factors and create a taxonomy. This stage is crucial for identifying the specific mechanisms through which climate change exacerbates existing vulnerabilities and using that to co-design targeted interventions.

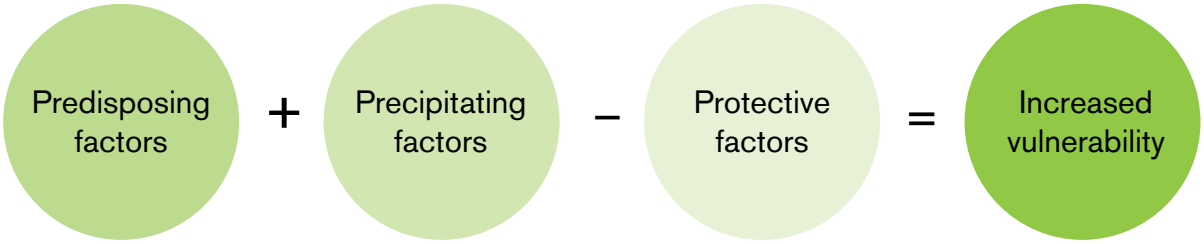
What are the three domains of assessment?

The **predisposing factors** domain encompasses elements that make certain areas, communities or sectors inherently more susceptible to loss and damage from climate change. This can include demographic context, geographical location, socioeconomic-cultural conditions, political factors and pre-existing vulnerabilities such as poverty, lack of access to resources or a fragmented and incoherent policy system. For instance, poor and marginalised communities along coasts may have lower capacities to cope and recover from climate impacts such as sea-level rise. By identifying these predisposing factors, interventions can be designed to mitigate the inherent risks they pose.

The **precipitating factors** domain focuses on the triggers causing loss and damage. These could range from acute events such as storms and heatwaves to more gradual processes such as sea-level rise or desertification. Understanding the intricacies between short-term weather events and long-term climate patterns (for example, a climate change-induced increase in sea surface temperatures can contribute to the intensity of storms, cyclones and hurricanes) is vital for devising effective solutions. Recognising the interplay between weather and climate is essential. Understanding these factors is crucial for real-time response and recovery efforts. For example, knowing the precipitating factors of forest fires in a particular region can inform emergency preparedness for future and immediate firefighting strategies.

Lastly, the **protective factors** domain covers elements that contribute to resilience against climate change impacts. These can include social protection and DRR mechanisms such as community preparedness programmes or robust healthcare systems. Protective factors aim to enhance the coping capacities of vulnerable groups and mitigate loss and damage when adverse events occur. For example, a community with a well-designed early warning system for cyclones can be better prepared and reduce loss of life.

Figure 16. Interaction of predisposing, precipitating and protective factors



Together, these domains provide a holistic framework for assessing and addressing climate change-related L&D (see Figure 16). They can enable policymakers and development practitioners to better understand the complexity of how different factors interplay to either exacerbate or mitigate loss and damage. This is especially important in diverse settings where generic solutions may not be effective. By categorising factors into these domains, policymakers, researchers and practitioners can more systematically evaluate risks and develop tailored interventions that account for a full spectrum of vulnerabilities and coping capacities.

Why unpacking the 3Ps using a taxonomical approach is important

Taxonomy (see Box 1) traditionally helps in organising and understanding the diversity of life on Earth, aiding in species identification, conservation efforts, evolutionary studies and biological research. The same approach to taxonomy can be used to understand climate-attributable loss and damage and serve as a valuable tool in climate research. A taxonomical approach will provide a standardised framework to the users for data collection, categorisation and analysis and offer a multifaceted framework to unpack vulnerabilities in diverse contexts and communities and work out viable solutions to address them.

Box 1. What is taxonomy?

Taxonomy is generally defined as "the science of classification according to a pre-determined system, with the resulting catalogue used to provide a conceptual framework for discussion, analysis, or information retrieval" (Thompson, 2018).

The Cambridge dictionary defines taxonomy as "a system for naming and organising things [...] into groups that share similar qualities" (Cambridge Dictionary).

Another definition of taxonomy, often cited in academic contexts, is: "the branch of science concerned with classification, especially of organisms; systematics" (Oxford English Dictionary).

Taxonomy can be applied across various fields, from biology (where it is commonly used to classify living organisms) to information science (where it is used to categorise and organise data or concepts).

A well-structured taxonomy can support prioritisation by identifying the most vulnerable areas, communities and sectors. Decisionmakers can identify the most pressing needs and most promising interventions, thereby directing funds and other resources to where they will have the greatest impact. Given the limited resources and the immediacy of climate threats in LDCs and SIDS, a framework to identify where interventions would be most needed is crucial for effective action.

Climate change impacts and the capacity to cope with them can vary widely between different communities and even within the same community. Understanding the interplay between different types of losses, damages and possible responses becomes more manageable with a taxonomy. Such a classification can reveal synergies and trade-offs among various adaptation and mitigation strategies, enabling policymakers to make informed decisions. A taxonomy can help in designing nuanced, context-specific solutions that take into account these local vulnerabilities and capacities. For instance, while seawalls might be effective in one coastal community, mangrove restoration could be more suitable for another. This alignment between on-the-ground realities and policy is often the key to successful implementation.

Systematic classifications of vulnerabilities and responses can be integrated into national and international frameworks based on taxonomy, making policy response more agile and responsive to real-world complexities.

How to unpack 3P factors influencing vulnerabilities to climate change impacts

1. Understanding the predisposing factors creating vulnerability for communities

To develop context-specific responses, it is important to understand the underlying drivers of vulnerability that make certain systems, sectors and populations more vulnerable to climate change impacts. Therefore, users should consider the analysis of predisposing factors as the foundational step in the process of assessing L&D. It will help identify where vulnerabilities exist and how deeply they are entrenched within communities. Analysis of predisposing factors will also enable users to highlight how these vulnerabilities can inhibit communities' capacity to prepare, cope and recover from climate impacts. For instance, economic deficiencies, such as high levels of poverty and debt, can constrain local capacities to invest in adaptation measures or disaster recovery. Similarly, social factors such as gender disparities may restrict women's access to information and resources, making them more vulnerable during climate disasters.

Using the taxonomical approach, the analysis can be carried out under four distinct domains — demographic, social, economic and political — to provide a comprehensive framework for understanding vulnerabilities. The following factors should be considered in each of the four domains.

Demographic factors

Understanding demographic factors such as population growth, age distribution, urbanisation and migration patterns permits an assessment of the scale and complexity of climate-induced L&D. For instance, rapid urbanisation without appropriate infrastructure could exacerbate flood risks, while areas with a high dependency ratio may struggle with evacuation and disaster recovery. By cataloguing these factors, we can develop interventions that are more demographic-sensitive, ensuring that the most vulnerable population segments, such as children and older people, are adequately protected.

Social factors

The social domain covers the varied vulnerabilities of social groups such as women, children, older people, disabled people, and minorities. Careful analysis is required to ensure inclusive, targeted interventions that address the needs of specific vulnerable groups. Some of the visible social realities to be considered include:

- Persistent gender inequality, with continuing challenges such as violence against women, child marriage and uneven access to reproductive healthcare
- Disparities in women's employment, education and political participation
- Communities at the bottom of social stratification hierarchies, such as people discriminated for their caste, race, beliefs and faiths
- Social disorganisation stemming from economic inequalities, political and religious polarisation, and the breakdown of social institutions
- Continuing social exclusion of marginalised groups, including women, children, minorities, disabled people and people facing discrimination for their sexual identities such as LGBTQI+
- People's voices are often not heard because of political differences and opposition to those in power. This leads to a lack of political participation, underrepresentation in decision-making, and exclusion due to their lack of power.

These social factors further heighten the vulnerabilities of people who are already disadvantaged making them more susceptible to climate impacts.

Economic factors

High incidences of poverty, economic inequalities and excessive dependence on primary sectors such as agriculture, fisheries and forest-based livelihoods increase the vulnerability of communities to extreme climate events. Identifying these economic factors helps to design more effective resource allocation and financial assistance programmes. Factors that may be considered include:

- Dependence on primary production, such as farming, fishing and forest-based livelihoods
- Indebtedness and increased spending on debt-servicing, which pushes people into debt traps and makes them vulnerable to financial shocks after a disaster
- Employment and income security, which determines the financial capacity of the community to cope with losses
- Limited access to financial services, including credit and insurance, which handicaps people who are already stressed financially
- Remittances from migrants, which signifies the capacity to cope and rebuild after disasters
- Access to and focus on science and technologies, which determine the capacity of disaster preparedness, capacity for recovery and resilience
- Access to and development of information and communication resources, which builds DRR capacity (any limitation on information is an impediment)
- Energy security and sufficiency, which determines the self-reliance of a community or a country.

Economic factors at the micro and macro level have a significant influence on the capacity of communities to cope with L&D. Assessment of these economic factors can help build various short, medium and long-term interventions aimed at enhancing resilience.

Political factors

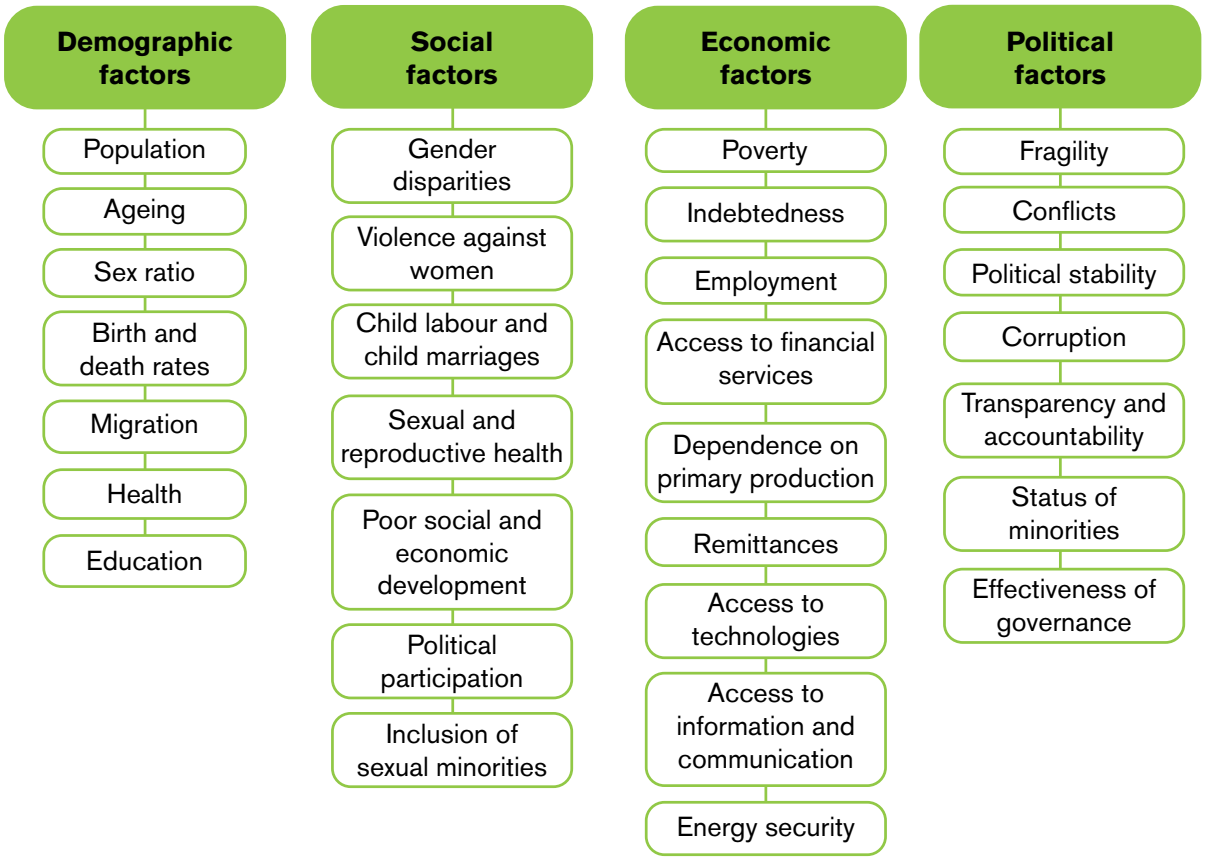
Governance structures, political stability and administrative capacities play a vital role in a community's ability to manage climate-related risks. Recognising these political factors enables the development of policies and programmes that are not only effective but also equitable and just. The following are some factors that may be considered in the analysis.

- Fragility of the state indicates weak governance and limited administrative capacities, as well as the presence of or potential for conflict and/or civil war, all of which affect people's capacity to respond to climate change and its impacts
- Conflicts increase humanitarian crises and lead to persistent violence and social tensions
- Political stability builds inherent capacity and commitment to climate action and supports building a culture of disaster preparedness
- Corruption deeply affects the ability to reach and deliver entitlements to poor and vulnerable people, especially after disasters
- Transparency and accountability are indicators of good governance and administration, which are crucial to channelling resources during relief, restoration and rebuilding
- The status of minorities is an indicator of inclusion and the just distribution of benefits and rights
- Effective governance is critical for efficiency in administering disaster responses, innovating new and workable solutions, and forging alliances for collective responses.

Good governance and democratic institutions provide stability and contribute to economic and social development, thereby supporting people's wellbeing. Good governance also provides a platform for multistakeholder coordination that is crucial for climate action.

Figure 17 summarises a possible set of factors that can be explored under these domains using a taxonomical approach. This list is indicative, and users can add or exclude factors depending on the local context or the specific research needs related to particular aspects of L&D.

Figure 17. Indicative list of factors for assessment under different domains of predisposing factors



Once the initial factors have been identified and organised under these domains based on the information and insights collected though IPCA (as explained in Step 1), additional steps are required to deepen the analysis:

- Additional data will need to be gathered from secondary sources such as local government records, academic studies, NGO reports, census data and community-level documents for **data enrichment and validation**. This step will provide a broader context and validate the collected data, ensuring it accurately and reliably reflects the community's situation.
- It will be important to **cross-verify** the trends emerging from the IPCA findings with secondary data to address any discrepancies and fill gaps. This process is crucial for constructing a reliable dataset that can accurately capture the predisposing factors affecting the community.
- Data from various sources will need to be **integrated and synthesised** to provide a comprehensive view that can show how demographic, social, economic and political factors interconnect and influence the community's vulnerability and resilience.

This structured approach will ensure that subsequent stages of research and intervention are well informed by a comprehensive understanding of the factors contributing to vulnerability. This will provide inputs for the next steps of the assessment (detailed in subsequent sections for Steps 3, 4 and 5). The input will be particularly useful for designing sampling plans focusing on specific households or groups identified as most vulnerable, and developing research tools such as questionnaires, focus group discussion guides and key informant interview protocols. These tools will be specifically designed to probe deeper into underlying issues and vulnerabilities identified through IPCA and 3Ps.

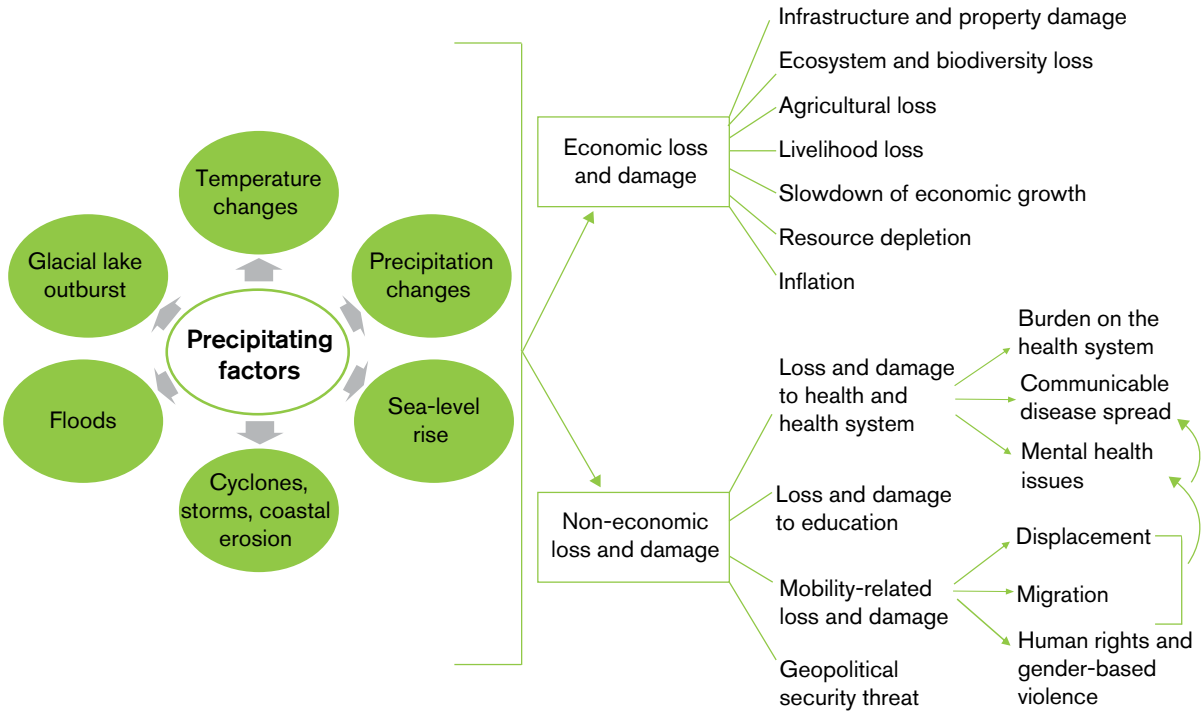
2. Assessing the precipitating factors acting as stress multipliers causing loss and damage

Precipitating factors in the context of climate change impact are triggers or events causing L&D. Analysis of precipitating factors is crucial in understanding the triggers of L&D due to climate change, particularly when placed in the context of predisposing factors among different vulnerable groups. Precipitating factors can range from sudden extreme weather events such as cyclones and floods to slow-onset processes such as sea-level rise, ocean acidification and desertification.

Users will need to follow a taxonomical approach to categorise and analyse precipitating factors, considering various types of climate change trends and the types of impacts, such as economic and non-economic L&D. Economic impacts typically include loss of property, assets and livelihoods, while non-economic impacts can span loss of life, loss of cultural heritage and identity, to psychological stress and other health-related issues.

Figure 18 illustrates the layered approach to unpacking the taxonomical domain of precipitating factors, while the following sections outline the two levels of analysis that will be needed.

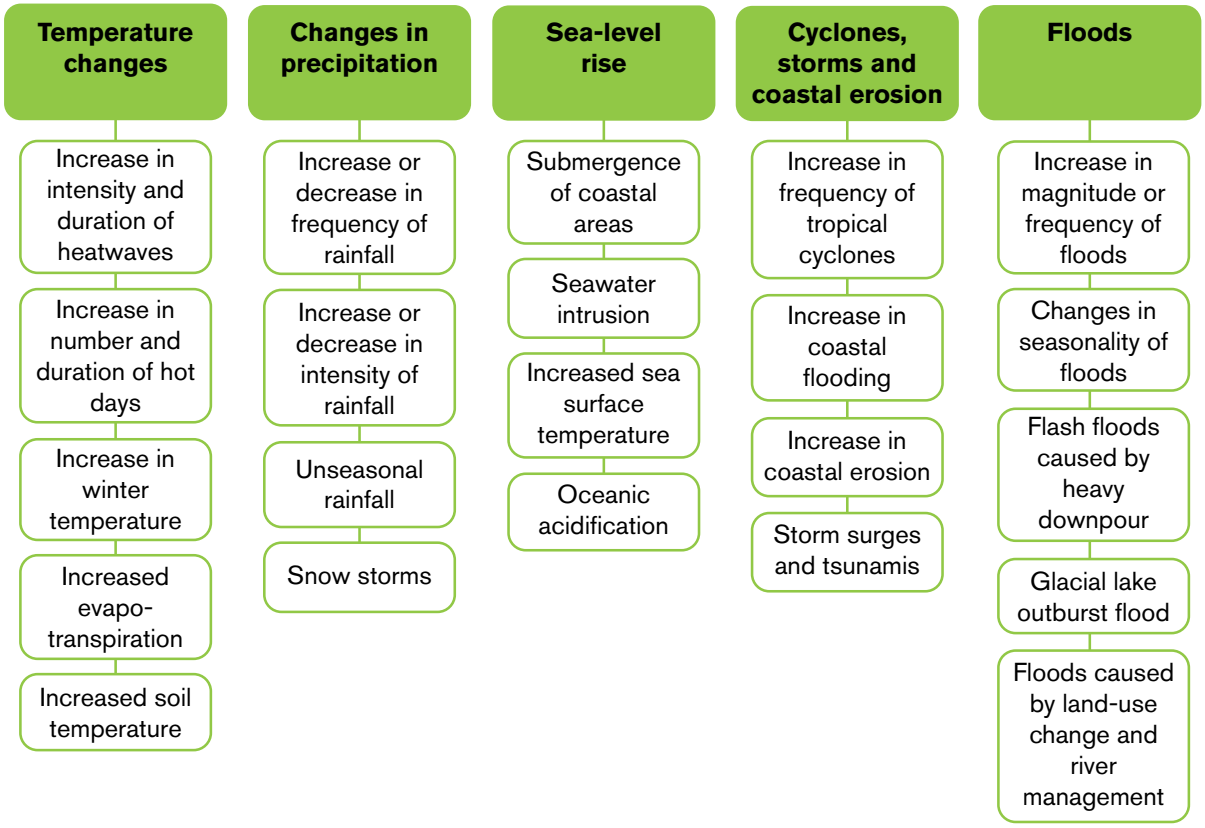
Figure 18. Taxonomical domains of analysis for precipitating factors



Climate change trends

Slow and rapid-onset changes in the climate, such as temperature shifts, precipitation variability and new weather patterns, directly translate into real-world impacts such as sea-level rise, intensified droughts and erratic monsoons. Recognising trends, such as increased frequency of cyclones, increased glacial melt or glacial lake outbursts, helps us understand what events are occurring, whether there is a change in their patterns, how fast the patterns are changing and the intensity of these changes. Any geographical area may be impacted by one or more events, and their trend patterns may be different. It is important to fully unpack them using a taxonomical approach, as explained in Figure 19. The five domains of climate change trends (temperature change, changes in precipitation, sea-level rise, cyclones, storms and coastal erosion and floods) and the factors within them are not exhaustive. There may be additional trends depending on context which may need to be added.

Figure 19. Indicative list of factors and domains for assessment of climate change trends



Some of the factors that can be considered under each domain of climate change trends are:

Temperature changes

- Increasing intensity and duration of heatwaves cause morbidity and mortality in vulnerable populations, including children and older people
- Increased surface temperatures of land and oceans affect terrestrial and aquatic biodiversity, shifting geographical spread and hastening extinction
- The increase in the number and duration of hot days disrupts the timing of events that are important for plants and animals, such as budding, flower blooms, hibernation, egg-laying, hatching and migration
- Temperature increases will lead to increased numbers of pests, invasive species and microorganisms causing increased incidences of epidemics to crops, animals and humans
- Increasing winter temperatures lead to a reduction in glacier mass, reduced snow cover and precipitation (snowfall)
- Increasing evapotranspiration leads to heat stress and reduced productivity of crops
- Increased soil temperature alters the physical, chemical and biological properties of the soil, making it difficult for seed germination and growth, root development and microbial activity
- Increased temperatures fuel wildfires and consequent damage to wildlife and biodiversity, and
- Drought is a compounding impact caused by rising temperatures, deficit rainfall and increased evapotranspiration, affecting human and animal survival.

Changes in precipitation

- An increase or decrease in the frequency and intensity of rainfall affects the water cycle and water availability
- Increased intensity of precipitation leads to landslides
- Intense precipitation causes flash floods and coastal flooding
- Excessive stormwater runoff drains pollutants into water bodies, affecting aquatic ecosystems
- Unseasonal rainfall affects agricultural production, leading to food insecurity, and
- Despite a shrinking snow season and a decline in snowfall, snowstorms will become intense and frequent.

Sea-level rise

- Melting glaciers and ice sheets, compounded by ocean warming, will lead to rising sea levels
- Rising sea levels will lead to coastal erosion, coastal flooding, submerging of coastal areas and small islands, affecting the lives and livelihoods of the people dependent on them
- Sea-water intrusion will increase the salinity of fresh water in surface water bodies and aquifers, affecting agricultural production and the supply of drinking water
- This will affect biodiversity in coastal habitats, reducing coastal wetlands, birds, animals and mangroves, making coasts more vulnerable to storm surges
- Increased sea surface temperature will affect the survival of certain species of plants, animals and microbes, alter their migration and breeding patterns, and threaten sensitive ocean life such as corals, and
- Oceanic acidification, a slow-onset process caused by the uptake of atmospheric carbon dioxide, changes the ocean pH and mineral saturation and will impact marine ecosystems as a whole.

Cyclones, storms and coastal erosion

- The increased intensity of tropical cyclones (also termed hurricanes and typhoons, depending on their location), make people injured, homeless and displaced
- Cyclones also damage productive assets and sources of livelihoods and infrastructure such as schools, healthcare facilities, industries, roads, electricity and communication installations
- Flooding can increase water and vector-borne diseases, affecting peoples' health
- Cyclones and consequent flooding will displace wildlife and damage flora
- Tropical cyclones destroy crops and terrestrial and marine ecosystems, leading to food insecurity and pushing people into poverty
- Increasing coastal flooding and coastal erosion affects coastal wetlands, mangroves, coastal and marine resources and diversity of fauna and flora, and
- Storm surges, coastal erosion, flooding and mudslides cause significant damage to coastal ecosystems and the people dependent on them

Floods

- Floods increase in magnitude and frequency or there are changes in seasonality
- Flash floods are caused by heavy downpours in a short duration, especially in low-lying areas with poor drainage
- Glacial lake outburst floods occurring as a result of breaching, slope failure, overtopping or other failures of glacial lakes, which can lead to catastrophic flooding in the high mountains
- Intense precipitation, coupled with land-use change and poor river management, increases the incidences of river floods, affecting people living on riverbanks, and
- Significant health risks are brought about by floods through water and vector-borne diseases.

Information on climate change trends and types of impact for this assessment will be available from insights collected through IPCA using approaches described in Step 1.

After organising the initial findings from the IPCA under the respective climate change trend domains, it is imperative to supplement this data with empirical evidence from a variety of secondary sources. Data to support and cross-verify the findings can be obtained from scientific journals, climate monitoring organisations, local administrative offices and weather records. These sources provide vital data that complement and strengthen the IPCA findings, offering a broader understanding of the climate challenges that communities face. This step is important, as it will provide input for subsequent stages of research: for creating a sampling plan, designing questionnaires or qualitative research tools and specifically for understanding what aspects need further investigation.

Types of loss and damage

Climate change inflicts both economic and non-economic L&D. Economic impacts are quantifiable, affecting property, infrastructure and livelihoods, while non-economic impacts include losses that are difficult to quantify, such as effects on health, culture and ecosystems. Together, these impacts pose wide ranging challenges that significantly alter lives and communities and will need to be captured comprehensively.

Economic loss and damage

Economic L&D disproportionately affect countries, regions and communities that are already facing challenges related to poverty, growth, development and access to infrastructure and technology. Economic impacts span all sectors of the economy:

- In the primary sector, L&D can degrade natural resources such as land, water and biodiversity. This affects agricultural productivity and disrupts ecosystem services, leading to diminished employment and household incomes and jeopardising food security.
- In the secondary sector, including industry and trade, L&D can disrupt industrial production and supply chains, impact the value and distribution of goods, and damage transportation and trade infrastructure. These disruptions also reduce labour productivity in the sector.
- In the service sector, or tertiary sector, impacts can lead to the collapse of the tourism, travel and hospitality industries. Financial services suffer due to loss of savings, challenges in debt servicing and insurance claims. There is also an increased burden on resources due to spending on rescue and relief operations during catastrophes.
- For cities, the assessment of economic L&D may consider the infrastructural interdependencies and the potential for cascading failures. This includes evaluating the resilience of transportation networks, communication systems and utilities critical for maintaining urban life. Additionally, the assessment process could examine the ability of municipal governments to respond to and recover from economic disruptions.

The assessment will need to cover the extent of resource depletion, infrastructural damage, disruption of commercial activities, and the overall effect on livelihoods and economic stability (see Figure 20).

Figure 20. Suggested domains of economic loss and damage

Primary sectors	Industry and trade	Service
Natural resources — land, water and biodiversity	Disruption in industrial production	Collapse of tourism, travel and hospitality
Agricultural production and productivity	Disruption in value and supply chains	Disruption in financial services (loss of savings, debt servicing and insurance)
Disruption in ecosystem services	Disruption of transportation and trade	Spending on rescue and relief during catastrophes
Employment and household income	Damage to property and infrastructure	
Livelihoods and food security	Loss of labour and productivity	

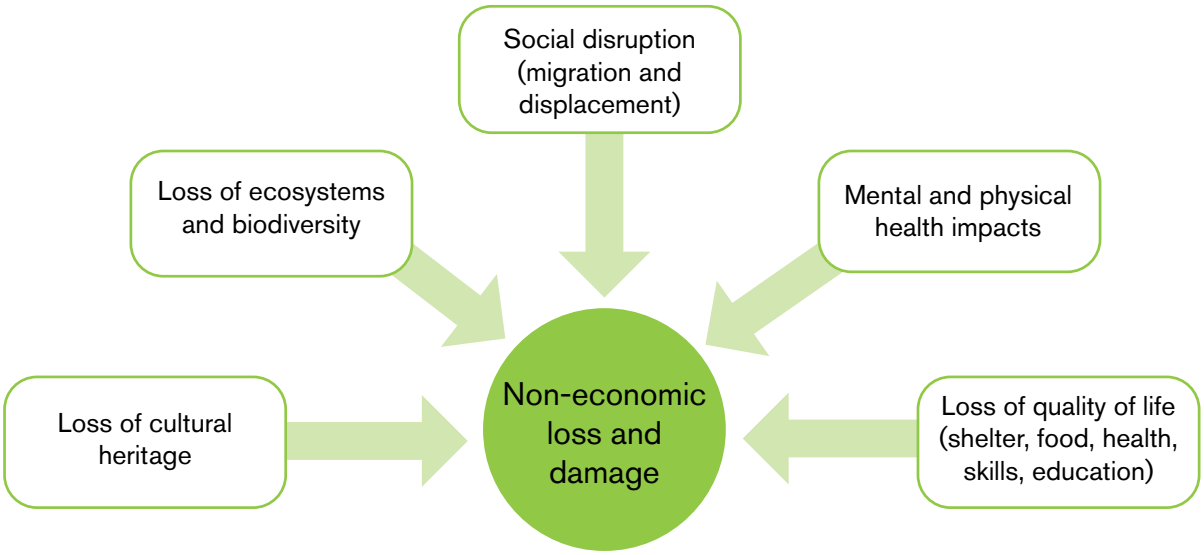
Non-economic loss and damage

Non-economic L&D occurs as a direct consequence of climate change impacts which go beyond monetary assessment, such as severe weather events and long-term ecological shifts. The interplay between non-economic L&D and economic L&D is intricate and often reciprocal. For instance, the loss of homes due to flooding has a clear economic cost, but it also leads to non-economic impacts such as the loss of ancestral lands and associated cultural identity. This can result in mental health issues such as anxiety and depression, which in turn may affect economic productivity. Similarly, the destruction of a coral reef might be assessed economically in terms of lost tourism revenue, but its non-economic value, including biodiversity and cultural significance to local communities, is immeasurable.

When economic supports such as livelihoods are damaged, the social and cultural fabric that relies on economic stability can also unravel, leading to non-economic impacts. In reverse, non-economic factors such as social cohesion can influence the economic recovery of a community post-disaster, demonstrating their interconnected nature. Understanding this interplay is crucial for a comprehensive assessment of L&D and for developing strategies for addressing it.

Non-economic L&D can be grouped into five taxonomical domains as follows: loss of ecosystem and biodiversity, loss of cultural heritage, social disruption caused by migration and displacement, loss of quality of life, and mental and health impacts caused by such losses (see Figure 21), as explained below:

Figure 21. Five domains of non-economic loss and damage



- **Loss of cultural heritage:** climate change can threaten the survival of traditional ways of life, including Indigenous cultures, and can lead to the loss of important cultural practices, artefacts and languages. This can have a significant impact on the cultural identity of affected communities. It can also lead to spiritual and cultural impacts where communities are not able to practise their religious/spiritual practices in the same way or lose their places of worship or burial grounds.
- **Loss of quality of life (shelter, food, health, skills, education):** climate change can impact traditional ways of life and impact communities' quality of life as the resources on which their lifestyle were dependent are either degraded or lost, or they are forced to move to other areas. For instance, food habits can be impacted as communities are no longer able to find the same ingredients or they do not find them in the new locations to which they move. This can impact their food security and nutritional status. Similarly, people may not have access to safe drinking water due to climate impacts or they may have to walk longer distances to get safe drinking water, increasing drudgery and potential risks to personal security.
- **Mental and physical health impacts:** climate change can have direct physical health impacts, such as increased heat-related illnesses, respiratory problems caused by air pollution and the spread of infectious diseases. The stresses and uncertainties associated with climate change can also have significant impacts on mental health, including anxiety, depression and post-traumatic stress disorder. There can also be a relationship

between a lack of mental health and psychological safety and issues such as lack of confidence, lack of risk taking, lack of generosity and sharing or lack of innovation and experimentation.

- **Social disruption (migration and displacement):** climate change can lead to social disruption due to forced displacement and distress migration, which can lead to loss of social support networks, traditional ways of life and cultural heritage, as well as create mental and physical health problems. It can expose communities moving in distress to trafficking and modern slavery. Migration to new areas can also lead to conflict with the host community.
- **Loss of ecosystem and biodiversity:** climate change can lead to the extinction of certain species and shifts in the distribution and abundance of other species. This can impact ecosystems and the services they provide, such as pollination and pest control. Similarly, many Indigenous communities treat many ailments with locally available medicinal plants.

The categorisation of types of economic and non-economic L&D through a taxonomical approach is crucial for climate impact assessment, as it will make complex information more understandable and actionable.

The information about economic L&D can be assessed based on participatory community assessments such as social mapping, transect mapping and resource mapping. For example, resource mapping can highlight agricultural areas, forests, water resources and infrastructure affected by climate impacts providing a picture of the extent of damage. When this is combined with social and mobility mapping it can help better identify who is impacted by L&D. This information can be further classified into categories such as direct damages to crops and indirect impacts such as indebtedness.

Non-economic L&D, while more challenging to quantify, can be categorised using participatory tools. For instance, mobility maps can track population displacement, providing details about social and cultural loss, while risk maps can indicate areas where community cohesion is threatened by recurrent climate stressors.

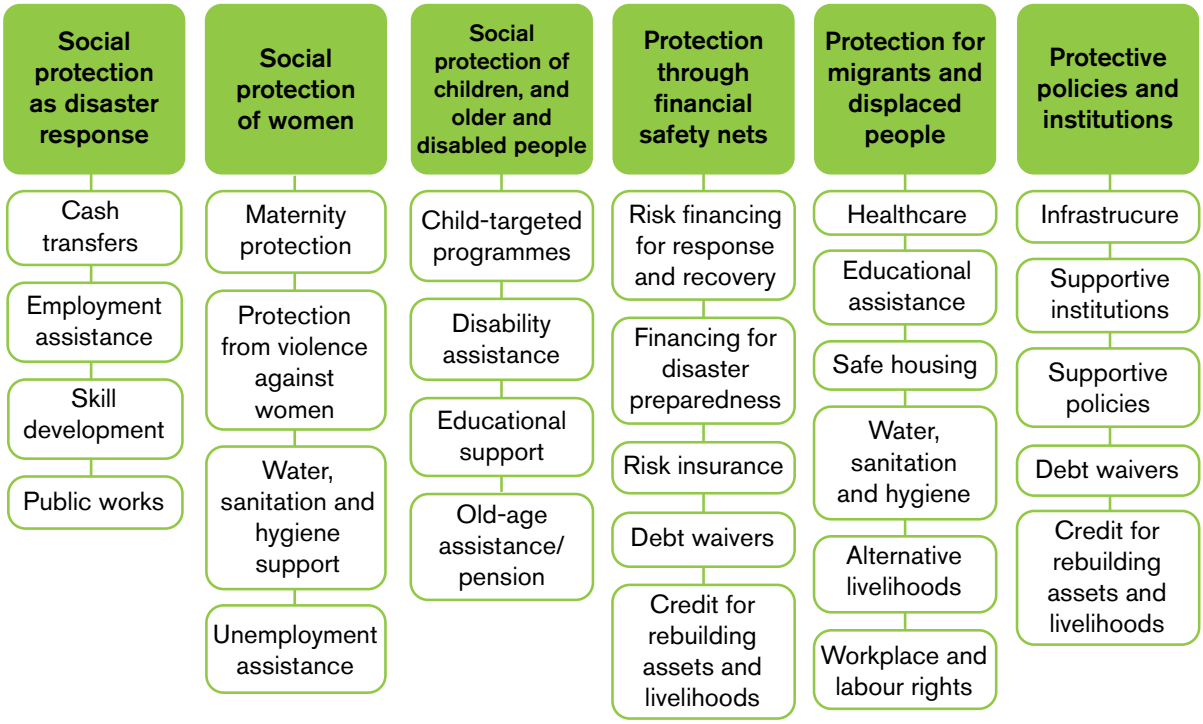
Taxonomical categorisation will enable the systematic assessment of each type of L&D and an understanding of their interactions. For example, it becomes clear how the economic loss of agricultural productivity can lead to non-economic consequences such as food insecurity and cultural disintegration, as agriculture may be an integral part of a community's cultural identity. This aspect of the assessment is important for several reasons. Firstly, it will allow for a holistic understanding of climate impacts that goes beyond immediate financial costs. Secondly, it can inform the development of targeted interventions by identifying which sectors, regions or community aspects are most vulnerable and require urgent attention. Finally, it ensures that adaptation efforts are comprehensive, considering both visible and less visible damages, and can thus be more effective in building climate resilience.

3. Analysing protective factors offering a safety net during times of crisis

Protective factors encompass both policy response and programmatic interventions that provide communities with a safety net during times of crisis. It is important to identify the variety of safety nets and support systems needed to address both economic and non-economic impacts of climate change, particularly for vulnerable groups.

The users will need to follow a taxonomical approach to categorising and understanding the current status of protective factors: the existing strategies, programmes and tools that aim for anticipatory action, vulnerability reduction and resiliency building, especially in the areas of disaster risk management, health and human mobility. Figure 22 presents the layered approach to unpacking the taxonomical domain of protective factors for the assessment. This list, however, is indicative. Users can add or exclude factors depending on the local context or the specific research needs related to particular aspects of loss and damage.

Figure 22. Suggested domains for assessment of protective factors



Social protection plays an important role in enhancing resilience and safeguarding wellbeing, particularly in the face of recurring climate-related crises that disproportionately affect impoverished communities. Governments worldwide utilise social protection programmes as a fundamental part of their development strategies to alleviate poverty and sustain economic growth and social development.

Social protection as a response to disasters

- Cash transfers encourage savings, asset building and income stability during severe climate impacts, particularly those that develop slowly over time.
- Employment guarantee schemes provide cash for work to help improve rural livelihoods and create infrastructure such as farm ponds, check dams and water recharge pits that can enhance resilience to climate impacts.
- Skill building helps people diversify their livelihoods or shift to alternative livelihoods that could enhance their coping capacities.

Social protection of women

- Women often bear the brunt of displacement and migration at both their place of origin and their destination, and need protection during pregnancy and childbirth — but prenatal and postnatal care can be affected during climate emergencies.
- Women who are displaced from their homes by disasters or conflict experience increased vulnerability to physical, emotional and sexual violence.

Social protection of children, and older and disabled people

- Old-age pensions are the most widespread form of social protection through contributory and non-contributory programmes.
- Disability assistance programmes in the form of assistive devices and cash transfers enhance disabled people's adaptive capacities.
- Programmes for children with physical and intellectual disabilities can help them to increase their cognitive capacities, build life skills and enhance their employability and productivity.
- Educational support is a critical need for children, who are often impacted by the loss or damage of educational infrastructure, which leads to loss of schooling and learning, the risk of dropping-out and being pushed into child labour.

Protection of migrant and displaced people

- Long-term contract workers and seasonal migrants require comprehensive healthcare schemes.
- Children, who often accompany migrant workers during seasonal, semi-permanent and permanent migration, need educational support at their destinations to continue their schooling.
- Accommodation and basic amenities are often compromised in the workplaces and destination sites of migrant workers which brings safety and health risks.
- Access to water, sanitation and hygiene facilities is a significant challenge for migrants, particularly vulnerable groups, and is more difficult in areas with inadequate services.
- Displaced people need new skills and opportunities to engage in alternative livelihoods, as their primary occupations may no longer be possible after a disaster.
- Migrant labourers should have access to decent work with adequate protection, in line with international labour treaties.

Protection through financial safety nets

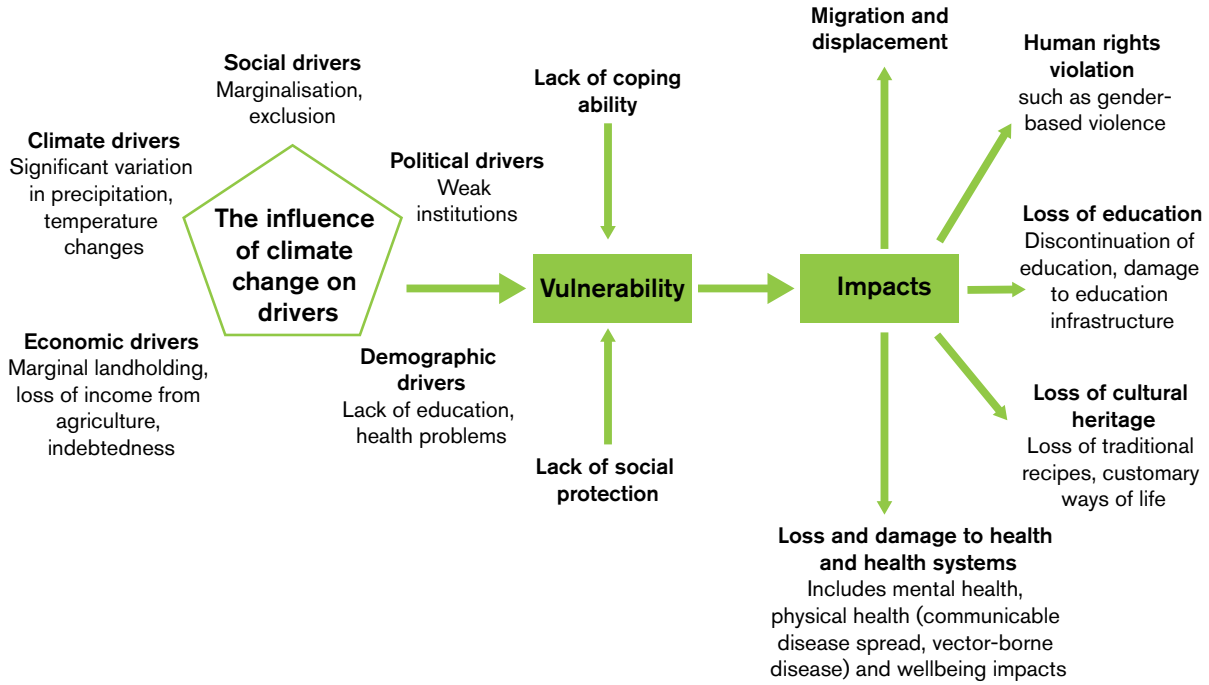
- People affected by extreme climate events need financial assistance, including credit for rebuilding their livelihoods and maintaining their consumption and insurance to cope with their losses.
- There is a need for investments directed towards rebuilding infrastructure, productive assets and livelihood support services to help people recover from L&D.
- Some governments have offered debt waivers as an immediate response to disasters, to lessen the financial burden for people affected by asset damage and crop and livestock losses.

Categorisation and assessment of protective factors should be undertaken through community-led methods such as perception mapping of institutions and interventions, and resource mapping. These approaches will provide insights into people's current entitlements and the factors inhibiting their access to safety nets during crises for example, poor representation in decision-making. The information collected from the community will need to be strengthened and validated with data from local organisations and government offices. Combining on-the-ground knowledge with official data helps to identify information gaps and helps provide a well-rounded view of the support systems in place and how they are working.

4. Integrated assessment of vulnerability to loss and damage

To achieve a complete assessment of the range of economic and non-economic L&D that needs to be addressed, it will be necessary to layer the assessments, to ascertain how predisposing, precipitating and protective factors interconnect. Figure 23 explains how at how these elements come together.

Figure 23. Interaction between predisposing, precipitating and protective factors



The process of combining and cross-referencing these factors should start with a thorough community engagement process, utilising IPCA approaches such as social mapping to identify vulnerable demographics and hazard mapping to pinpoint imminent risks. Through a detailed analysis, users will be able to identify which economic and non-economic losses and damages are most pressing and require immediate attention. This might involve, for example, combining the knowledge of increased disease risk due to climate change (non-economic L&D) with the economic burden of healthcare costs. Or it could involve understanding the sociocultural impact of displacement on community cohesion (non-economic L&D), alongside the economic costs of rebuilding homes.

This comprehensive assessment will help in the next step of the assessment, which is explained in Step 3.

Categorising impacts of economic and non-economic loss and damage

The C-CIQ tool considers both economic and non-economic L&D to ensure a comprehensive approach to understanding the true impact of climate change. By acknowledging both tangible and intangible impacts, as well as intrinsic and functional effects, this framework captures the full breadth of climate change consequences.

This comprehensive focus is vital because climate change does not discriminate in its impacts. By considering both economic and non-economic aspects, the C-CIQ framework allows for a holistic assessment that is attuned to the nuanced realities faced by affected populations. It recognises that some losses may defy quantification yet hold deep value for individuals and communities. This approach ensures that the full spectrum of climate change impacts is addressed, paving the way for more effective and empathetic policy responses and adaptation strategies.

How to categorise economic and non-economic loss and damage impacts

Once the information collected through IPCA and secondary sources has been analysed using the taxonomical approach, users should use the C-CIQ framework to categorise the economic and non-economic L&D into tangible, intangible, intrinsic and functional domains. The following sections explain these domains of analysis.

1. Tangible

Tangible impacts refer to the physical or material aspects of loss and damage that, while they may not have been economically quantified, are visible and measurable in some form. For example, the number of houses destroyed in a flood, the acreage of forest lost to wildfires, or the miles of coastline eroded due to sea-level rise. These are concrete, material elements that can be directly observed, counted, or measured, even if their economic value is not calculated. Some types of tangible L&D are:

- **Agricultural loss:** loss of crops or agricultural land due to drought or other extreme weather events.
- **Human lives:** the loss of human life is tangible in the sense that it can be quantified (in other words, the number of lives lost).
- **Natural resources:** tangible loss also applies to natural resources such as land, water bodies and forests that are adversely impacted by climate events.
- **Physical infrastructure:** loss of buildings, roads and other physical structures that are visibly damaged or destroyed.

2. Intangible

Intangible aspects within non-economic L&D refer to the L&D that is not easily quantified in economic terms but has a significant impact on communities and ecosystems. This could be cultural, psychological or social in nature. It includes loss of social cohesion, psychological trauma from forced migration or disasters, or loss of cultural heritage and identity. Some types of intangible L&D are:

- **Cultural heritage:** if sea-level rise were to submerge a historic site, the loss would be non-tangible but substantial. People would lose a part of their collective memory and identity.
- **Social cohesion:** disasters such as floods might physically destroy communities but the non-tangible loss is much more pervasive. The displacement of residents and the disruption of social networks can lead to a breakdown of communal relationships and reciprocity. For example, after a flood, the forced relocation of families can separate neighbours and friends, making it difficult to maintain community ties. Additionally, the stress and trauma of the disaster can strain relationships and trust among community members, eroding the sense of safety and support that once existed. This disruption in social cohesion can have long-term negative impacts on the community's resilience and ability to recover.

- **Psychological wellbeing:** the trauma associated with losing one's home or being forced to migrate because of changing environmental conditions is another example of non-tangible non-economic L&D.
- **Ecosystem services:** while some ecosystem services can be economically quantified, others such as the aesthetic and spiritual benefits of a natural landscape are non-tangible.

3. Intrinsic

Intrinsic aspects refer to the inherent value of an entity, separate from any utilitarian or economic considerations. When discussing non-economic L&D, the term 'intrinsic' captures losses and damages that have a value in and of themselves, irrespective of their economic worth or usefulness to humans. For instance, the loss of biodiversity, cultural heritage or Indigenous knowledge systems are considered to have intrinsic value. Some types of intrinsic L&D are:

- **Cultural identity:** the loss of cultural sites, artifacts or practices that are central to the identity and heritage of a community.
- **Biodiversity:** the extinction of species that have an inherent right to exist or that are revered or culturally significant, regardless of their economic use.
- **Human life:** the intrinsic value of human life that is irreplaceable and valued beyond any economic measure.
- **Spiritual and religious significance:** the damage or loss of natural or man-made sites that hold spiritual or religious importance to a group of people.
- **Knowledge systems:** the disappearance of Indigenous or local knowledge that has been passed down through generations and is integral to the community's history and way of life.

4. Functional

Functional value in the context of non-economic L&D refers to the utility or role that a particular entity, whether it is a resource, practice or space, plays in the functioning of a system or community. Unlike intrinsic values, which have worth in and of themselves, functional values are understood in terms of their usefulness or purpose within a larger context. For example, a wetland might have functional value for flood regulation and water purification in a particular geographic location, irrespective of its economic worth. Some types of functional L&D are:

- **Ecosystem services:** the loss of natural functions such as pollination, flood regulation or carbon sequestration due to the destruction of ecosystems.
- **Infrastructure utility:** when structures such as dams, bridges or levees are compromised, their ability to provide essential services such as water supply, transportation or flood control is reduced or eliminated.
- **Health services:** damage to healthcare facilities or loss of medical personnel impairs the delivery of healthcare services to communities.
- **Food security:** the functionality of agricultural systems that provide sustenance. When damaged, the ability to grow or harvest food is diminished.
- **Livelihood functions:** the roles that various occupations or economic activities play in supporting the welfare of individuals and communities. When these are disrupted, the ability to earn a living and support family structures is affected.

Understanding the interaction between different domains of economic and non-economic loss and damage impacts

Understanding the interaction between different domains of economic and non-economic L&D is crucial to unpack the complex dependencies and influences that single-domain analyses might overlook.

The categorisation of L&D into tangible, intangible, intrinsic and functional domains will help systematise and clarify these interactions. By identifying and classifying the different types of impacts within these categories, users can better map out how one type of loss in one domain might trigger or exacerbate losses in another. This structured approach will allow for a holistic view of the cascading effects of climate change across a community or ecosystem. For instance, users can trace how the functional loss of ecosystem services (such as flood regulation by wetlands) directly leads to tangible economic impacts (such as increased flood damage to property) and intangible losses (such as stress and anxiety in affected populations).

This comprehensive understanding of interconnected impacts can enable decisionmakers to design interventions that address multiple layers of vulnerability simultaneously. For example, protecting a wetland might not only conserve biodiversity (an intrinsic value) but also enhance flood protection (a functional value) and reduce economic losses in adjacent areas. Thus, exploring the interactions between different loss and damage domains is a practical necessity for effective climate response planning.

The following sections outline interactions that users will need to consider for different domains of L&D impacts.

1. Tangibility

The tangible and intangible dimensions of L&D are intertwined. The primary impacts of climate change occur through alterations in the biophysical aspects of an ecosystem, such as loss of employment, reduction in crop yield and decline in livestock productivity. These physical impacts can lead to significant intangible L&D as indirect consequences of climate change. For example, the loss of crop yield may force individuals to take up jobs with exploitative working conditions to make ends meet, contributing to mental health problems and stress. Additionally, the scarcity of resources can lead to social issues such as increased domestic violence or the disruption of community bonds, which are intangible impacts that can deeply affect the wellbeing and resilience of communities.

These two types of losses are interlinked because the tangible impacts often serve as triggers for intangible consequences. Physical damages disrupt livelihoods and economic stability, which in turn can erode social structures, mental health and community cohesion. Conversely, strong social cohesion and mental wellbeing can enhance a community's capacity to cope with and recover from tangible losses, highlighting the cyclical and interconnected nature of these dimensions. Understanding this interconnection is crucial for developing comprehensive strategies to address both the immediate physical impacts and the longer-term socio-psychological effects of climate change.

2. Functional-intrinsic spectrum

The values of items suffering L&D exist on a spectrum between intrinsic and functional aspects. Functional values are those that are seen as a means to an end. They are useful because they help achieve a certain goal or outcome. For example, poor living conditions and forced labour might lead to severe health problems, which are considered functional because they result in significant outcomes.

Intrinsic values, on the other hand, are inherently worthwhile and valuable in their own right, regardless of any external goal or purpose. For instance, the loss of cultural heritage or traditional knowledge is an intrinsic value because these elements are seen as important and valuable in themselves, beyond any practical purpose they might serve.

The classification of L&D items as either functional or intrinsic can vary from one culture to another, as different cultures may place different levels of inherent worth, value or usefulness on items impacted by L&D. This framework does not aim to predetermine where L&D items belong on the spectrum. Instead, items are assigned to the functional value domain if they are recognised for serving a specific purpose, such as when ecosystem services are valued for supporting the wellbeing of communities.

3. Temporality

L&D is not static: it evolves and unfolds over time. The temporal dimension of L&D deals with time considerations in the experience, occurrence or aftermath of loss and damage caused by climate change or other environmental factors. It involves understanding how events unfold over time, including the duration, timing and sequencing of impacts. The temporal dimension considers the past, present and future aspects of L&D, examining the evolving nature of the loss and damage over different time periods. For example, the immediate displacement of communities due to flooding is a short-term and urgent event, while the gradual degradation of soil quality and long-term water scarcity are chronic issues that develop over time. Additionally, the psychological trauma from a disaster can have long-lasting effects, whereas temporary loss of income might be resolved more quickly. Understanding the temporal dimension helps to understand how loss and damage manifest, intensify or mitigate over different periods. This temporal perspective provides insights into the dynamics of the challenges faced. It is closely tied to other dimensions, such as spatiality and tangibility. Considering time helps in understanding the interconnectedness of these dimensions, providing a holistic view of the complexities associated with L&D.

4. Spatiality

The spatial dimension of non-economic L&D refers to the geographical or spatial aspects of the loss and damage caused by climate change. It involves understanding how these impacts vary across different locations, regions or ecosystems. The spatial dimension considers the distribution, extent and geographic patterns of L&D, providing insights into the localised nature of the challenges faced. This dimension is crucial for assessing the geographic disparities in vulnerability, exposure and adaptive capacity, and for developing targeted strategies to address spatially specific impacts.

Migration due to climate change introduces non-economic L&D at both source and destination sites. At destination sites, migrants may face non-economic L&D such as forced labour, poor living conditions and human rights violation. Meanwhile, at source villages, communities may experience significant losses due to climate-induced agricultural challenges, leading to reduced employment opportunities and increased burdens, such as the time and effort required to fetch water. Understanding these spatial dynamics is crucial for developing comprehensive strategies that address the multifaceted impacts of climate change throughout the entire process of displacement and migration.

Practical examples for categorising loss and damage impacts

To illustrate how categorisation can be done in a practical context, we provide here our assessment of five case studies, representing five categories of non-economic L&D, namely loss of ecosystems and biodiversity, loss of cultural heritage, social disruption caused by migration and displacement, loss of quality of life, and mental and health issues. This is for users to understand how the same framework can be used to categorise L&D impacts in different contexts.

1. Loss of quality of life

To explain how the identification and categorisation of different dimensions of loss and damage impacts can be done to uncover loss of quality of life, we present the analysis of the case study: *Climate change impacts on health and quality of life in the Makoko Community, Lagos, Nigeria*.[2]

The Makoko community is in the coastal region of Lagos state in Nigeria is comprised of more than 86,000 people living in abject poverty who are vulnerable to climate change impacts. Makoko community is an illegal settlement and has been under constant threat of eviction by the government and consequent neglect by the local authorities. The inhabitants are without basic facilities for sanitation and hygiene. Their situation is precarious due to increasing floods. While this community has already been living in poor conditions such as fragile housing, bad drainage, absence of proper garbage disposal and sanitary facilities, and lack of access to timely healthcare, extreme climate events such as floods and rising temperatures are adding to their problems. Disease outbreaks, maternal mortality and increasing mental health issues are some of the major fallouts of these challenges. The community is in desperate need of support to enhance their capacities to overcome these challenges.

2 For the full case study, see Bharadwaj and Mitchell (2023).

Tangible domain

- Loss of employment during floods (15 to 20 days per year)
- Deaths due to disease
- Maternal/infant mortality (every family has encountered the death of either a mother or child)
- Prolonged or frequent illness
- Loss of livelihoods (polluted water impacting the availability of fish)
- Loss of assets and properties
- Damage to houses that are already fragile.

Intangible domain

- Social and religious activities stalled, disrupting social and religious life
- Erosion of social capital due to displacement
- Disruption of education
- Mental health issues due to loss of infants and mothers
- Chronic morbidity due to unattended illness resulting in mental stress.

Functional domain

- Poor drainage, sanitation and hygiene
- Contaminated drinking water
- Increased breeding of disease vectors
- Long and unattended labour during childbirth due to inadequate healthcare facility and staff
- Disruption in schooling
- Lackadaisical governance
- Lack of support for disaster response (where people are left to cope alone, for example by resorting to blocking flood water with debris and rubbish, leading to further damage)
- Threat of displacement due to illegal settlement.

Intrinsic domain

- Difficulty in accessing emergency healthcare for pregnant women and children (having to kayak across lagoons for hours)
- Pregnant women fearing losing their lives and their babies' lives during childbirth
- Anguish of people losing their meagre savings and valuables to flooding
- Helplessness in the face of climate impacts, which drives people to accept suffering, leading to diminished mental health.

Temporal domain

The Makoko community has seen settlers arrive from other areas since the 18th century, eventually growing into a large waterfront slum settlement. Living amidst water and experiencing floods is common for the people here. However, over time, more frequent floods (three to four times a year) due to climate change is making it difficult for the residents to adapt. The communities receive limited support from local authorities, which has declared the settlement illegal. Some of the short-term and long-term impacts on the lives and livelihoods of the people are as follows:

Short term:

- Loss of assets and livelihoods
- Loss of income due to lack of employment
- Outbreak of epidemics due to vector/waterborne diseases
- Maternal and/or infant mortality, and
- Loss of schooling for children.

Long term:

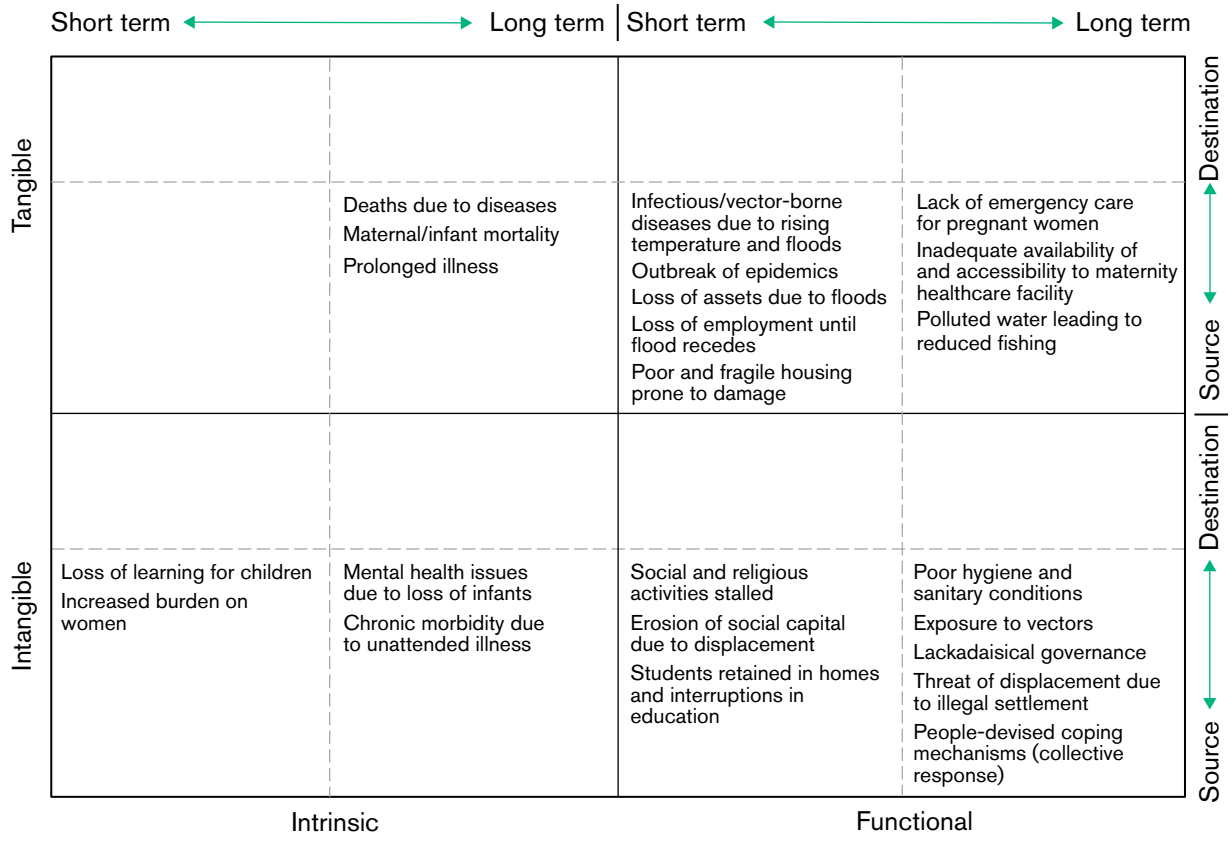
- Loss of lives due to floods and epidemics
- Mental health issues due to maternal or infant mortality, and
- Chronic diseases due to prolonged and unattended illness.

Spatial domain

The Makoko community is geographically situated in a low-lying coastal area, making it highly susceptible to the increasing risks of climate change, such as rising sea levels and frequent flooding. The encroaching waters and intensified storms not only threaten homes and infrastructure but also disrupt livelihoods, particularly for those dependent on fishing and other water-related activities. Additionally, the lack of proper urban planning and infrastructure support is expected to heighten the community's exposure to these climate hazards, further deepening their socioeconomic challenges.

The full extent of loss of quality of life in Makoko under different domains using the C-CIQ framework is presented in Figure 24.

Figure 24. Mapping of loss of quality of life in the Makoko urban slum community, Lagos, Nigeria using the C-CIQ framework



2. Loss of ecosystems and biodiversity

The analysis below explains how the identification and categorisation of different dimensions of loss and damage impacts can be done to uncover the loss of ecosystems and biodiversity. The analysis is based on a case study *Tracking ecosystem loss in nature-dependent Okavango Delta communities of Botswana*.[3]

Okavango Delta is a renowned World Heritage Site and a Ramsar Site located in the Ngamiland district of Botswana. It is home to diverse fauna and flora, including lions, elephants and cheetahs, a variety of birds and fish and a rich range of plant varieties. This delta benefits communities living in the Boro, Serongo and Khwai regions. The water flow in the Okavango River is reducing due to fewer rainy days, increased temperatures, wind speed and evapotranspiration. This is impacting wildlife and causing a decline in the tourism industry that depends on it, with a compounding effect on community livelihoods. The impact is significant: the tourism industry contributes 4.7% of Botswana's GDP and provides employment to 30,700 people. This, coupled with increasing human population and resultant competition for scarce resources, is driving people to migrate to distant parts of the river with water. Women, who are traditionally engaged in poling dugout canoes for tourists, are the main part of the community impacted by this problem and are experiencing significant mental stress as a result in both the sources and destinations.

Tangible domain

- Dwindling populations of 36 waterbird species in the delta, connected with irresponsible tourism
- Increased competition for limited wildlife resources due to the increase in human population
- Declining natural resources due to overextraction from land, water and wildlife
- Conflict among wildlife due to dwindling resources and deaths due to scarcity of food and water
- Reduced crop production and increased mortality of livestock due to drought, affecting livelihoods
- Loss of household food security due to loss of employment and income
- Closure of schools due to water scarcity
- Increase in waterborne diseases due to unsafe drinking water.

Intangible domain

- Erosion of artisanal skills (basket weaving) due to lack of availability of raw materials
- Declining cultural identity of female polers using '*mekoro*' (dugout canoes)
- Declining practice of molapo farming (farming in flood plains along the river)
- Human-wildlife conflicts due to loss of vegetation
- Living with the constant fear of the river drying up.

Intrinsic domain

- Women's dependence on tourism-based livelihoods pushes them to migrate, resulting in suffering at destination sites
- Women experience mental distress at destination sites because their children and expectant daughters lack medical attention and assistance in their native villages
- Changes in the way people view wild animals due to losses of crops and lives caused by human-wildlife conflicts
- People are resorting to illegally extracting wild resources and creating wildfires to deter elephants
- Young people dropping out of education and engaging in canoe poling and drinking alcohol.

3 For the full case study, see Bharadwaj and Mitchell (2023).

Functional domain

- The funds meant for development works are frequently diverted to provide urgent relief to communities suffering drought (such as provision of food aid or livestock feed). This reduces funds meant for development interventions related to healthcare, education and livelihoods
- People are dependent on the Ipelegeng Public Works Programme for poverty reduction and unemployment issues
- Women are leaving their children and families to migrate to distant rivers to find work running mekoro canoes
- Employment pressure is increasing due to growing numbers of migrant women polers
- Migrant women polers wait for months to get their turn to take tourists for excursions
- Groundwater is being exploited to get drinking water and save crops from drought
- People are shifting from fishing to charcoal production to cope with reduced river flows.

Temporal domain

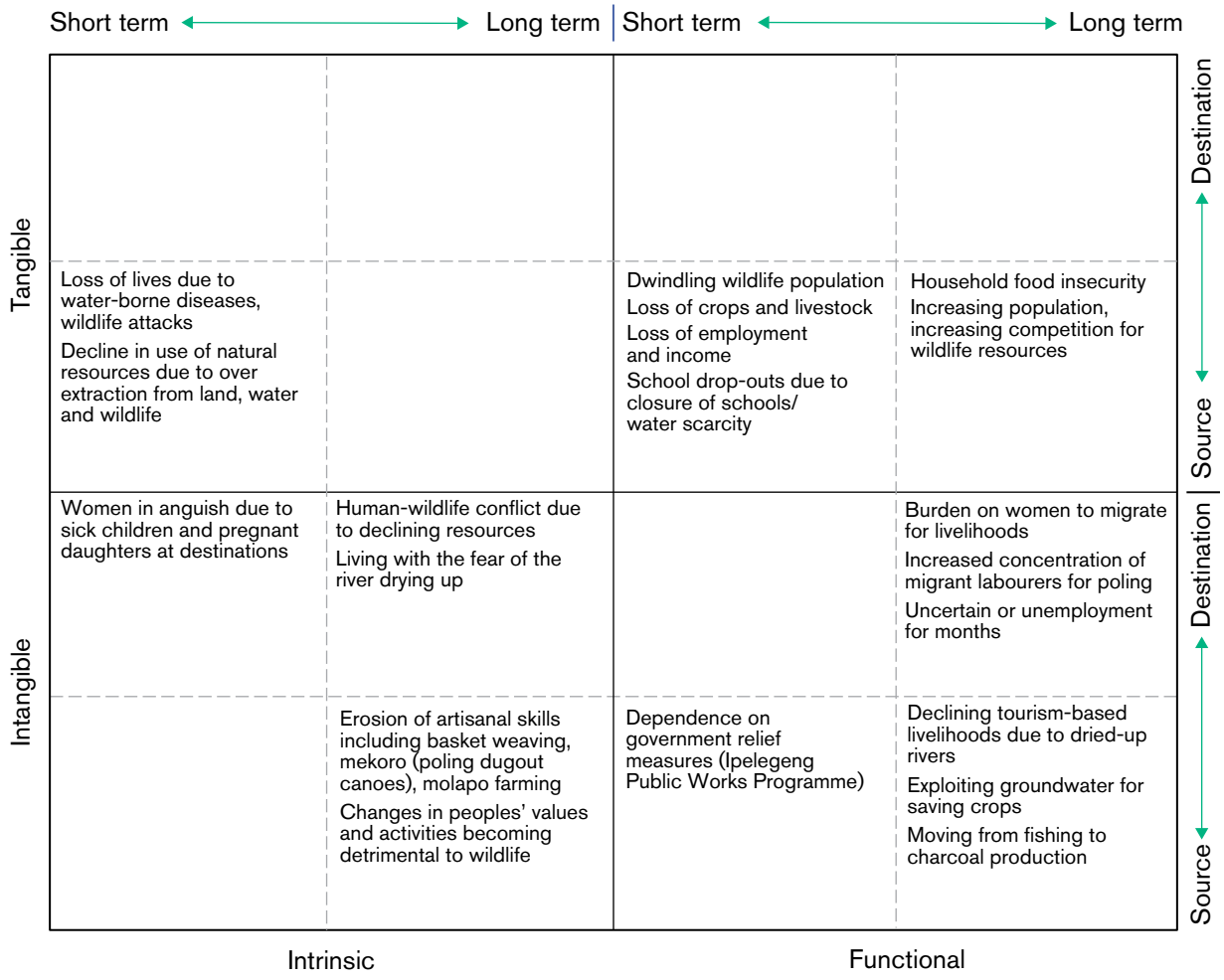
- Increasing droughts: 1961–1999 saw only five droughts declared, whereas during 2001 – 2022, 13 droughts were declared
- Shortening of the rainy season by up to 20 days has been recorded in the Okavango Delta
- Increasing wind speeds are leading to increased evapotranspiration
- It is predicted that the delta will experience a temperature increase of 1.5–2.5 degrees Celsius between 2016 and 2045
- As a result of compounding climate change factors, the flow in the Okavango River is decreasing, posing a long-term threat to the wildlife, lives and livelihoods of vulnerable communities dependent on the delta.

Spatial domain

- The Okavango River originates in Angola and drains through Namibia into Botswana, forming a large area of marshlands, known as the Okavango Delta. The river flow of some 2.5 trillion gallons per year is reducing due to climate change
- The delta, which sustains people's livelihoods via the tourism sector, is experiencing the brunt of climate change
- Villages such as Xharaxao, Boro and Morotseng have started realising the impact, and people have started migrating to distant riverbanks such as Daunara
- Older people, children, pregnant women and sick people are left behind in villages, facing problems such as ill-health, food insecurity and loss of education
- Women who migrate to find new livelihoods face unemployment, long waits to get tourist clients and a lack of food and shelter.

The full extent of ecosystems and biodiversity loss in the Okavango Delta communities of Botswana under different domains using the C-CIQ framework is presented in Figure 25.

Figure 25. Mapping of loss of ecosystems and biodiversity in the Okavango Delta communities of Botswana using the C-CIQ framework



3. Loss of cultural heritage

To explain how the identification and categorisation of different dimensions of loss and damage impacts can uncover the loss of cultural heritage, we present below an analysis of the case study: *Lost to the waves: climate impacts on sacred places in three coastal communities in Fiji*.[4]

Fiji is made up of 300 small islands situated in the Pacific Ocean, of which about 90 islands have been inhabited. The islands are threatened by inundation due to rising sea levels. Hundreds of rural and coastal settlements are expected to be relocated to the uplands. Already, coastal communities are encountering seawater intrusion, frequent flooding, depleting fishery resources, increasing intensity of cyclones, acute shortage of drinking water, and increasing vector and waterborne diseases. Increased salinity of soil has rendered the disappearance of diverse vegetation and trees from the lands that were once rich ecosystems. While the economic losses have had a lasting impact on the lives and livelihoods of people in Fiji, they are also experiencing cultural erosion due to coastal erosion destroying their ancestral burial grounds, sacred places and foundation stones which connect them socially, culturally and spiritually across generations. They want to preserve their customary practices, communal gatherings and cultural events, for which they look for support from the government with policies, programmes and procedures.

4 For the full case study, see Bharadwaj and Mitchell (2023).

Tangible domain

- Loss of homes and damage to properties
- Loss of burial grounds of their ancestors
- Loss of land meant for children's play areas
- Loss of crops and reduced availability of fish
- Loss of medicinal plants
- Devastation of mangrove forests.

Intangible domain

- Erosion of traditional knowledge associated with medicinal plants
- Emotional distress and disconnection caused by the loss of burial sites of family members
- Disrupted social, cultural and spiritual fabric of communities due to seawater encroachment of burial grounds
- Loss of sacred places (such as the sacred ground 'Lalagavesi', the sacred foundation stones of the first Tui Cakau's (paramount chief) residence in Cakaudrove province) used by communities for communal gathering, reflection, remembrance and healings
- Threat to the cultural identity of the people of Cakaudrove Province, also known as Lalagavesi (the term is also used in Fijian protocols when addressing the people of Cakaudrove), necessitates the extension of the Fijian Protocol, which preserves and promotes the rich cultural heritage of the province, fostering a sense of identity, pride and community among its residents.

Intrinsic domain

- Disappearing traditional knowledge about cooking fresh fish due to reduced catches
- Increased dependence on canned and processed foods, leading to long-term health impacts
- People relocating to elevated areas
- People's cultural identities need to be preserved by way of the dignified relocation of the remains of their dead ancestors.

Functional domain

- Dwindling fish stocks, inability to pay for fishing licenses
- Poor quality of life due to dysfunctional infrastructure such as drinking water supplies, electricity services or transportation due to coastal erosion
- Community responses to coastal erosion and sea level rise, such as placing sandbags and creating tyre walls, do not last long due to tides
- Adversity means that community members share the vegetables or fruits they have
- Women's social networking through groups helps them diversify livelihood activities
- Mangrove plantation undertaken to prevent coastal erosion has been unable to withstand strong waves
- Acquisition of new burial sites in the uplands has enabled communities to relocate the remains of family members from old burial sites inundated by seawater
- Houses built by inexperienced builders in the uplands are of poor quality and vulnerable to landslides.

Temporal domain

- Flooding has become recurrent over the last three decades and recent floods have increased in intensity
- Access roads are flooded twice a month due to king tides, restricting mobility
- Time spent fishing has increased due to poor fish stocks, which affects time for family and social gatherings

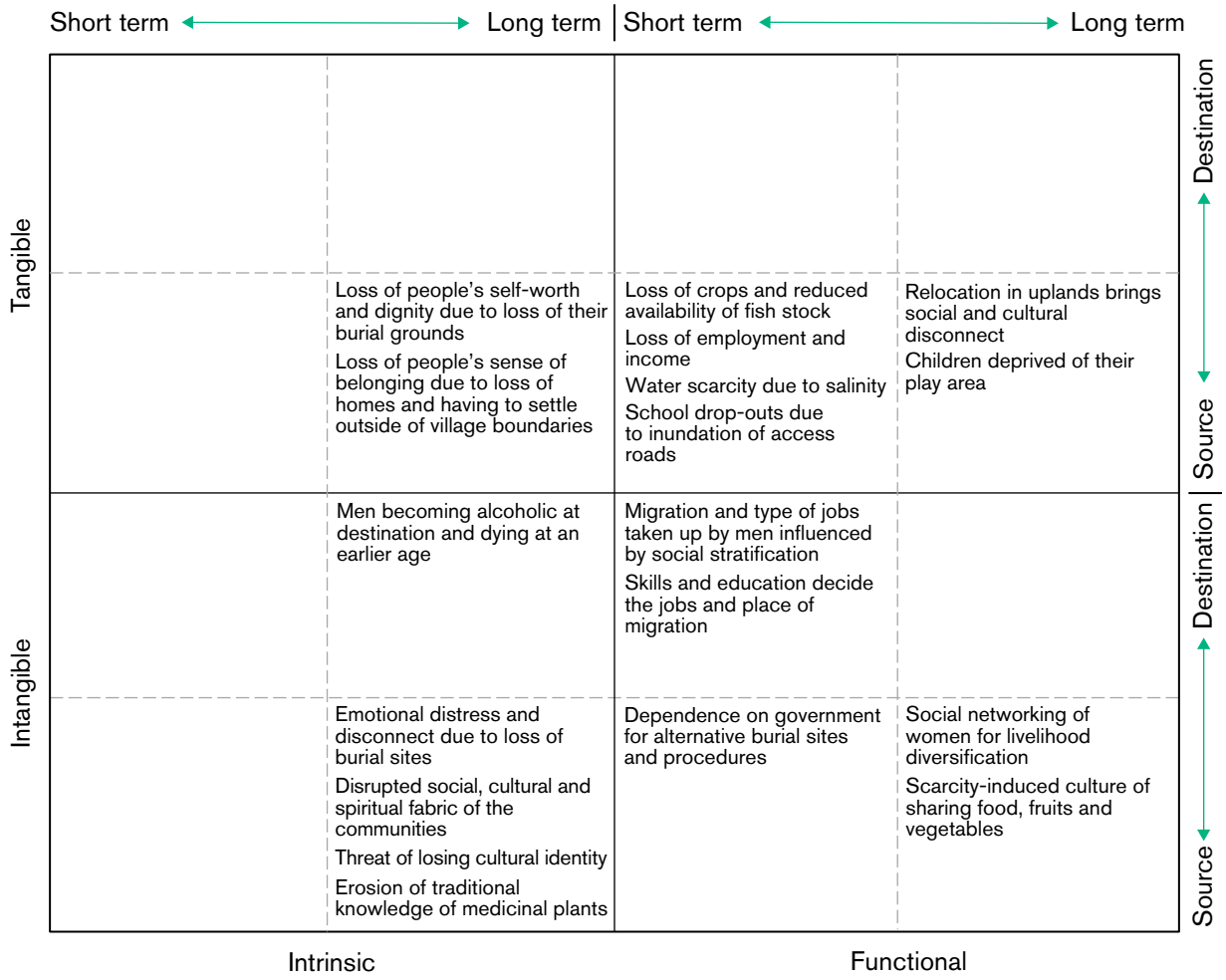
- Loss of burial grounds, which represent a physical connection between the past and present, means that people are losing links to their lineage, heritage and familial ties.

Spatial domain

- People are abandoning their houses and settlements to settle in the uplands
- Floods have cut off roads, preventing children from going to schools
- Intrusion of seawater renders groundwater unfit for consumption
- Unstable land is unfit for laying pipes for drinking water and electricity
- Culturally appropriate protocols are needed for arranging new burial sites, transferring remains to new sites.

The full extent of loss of cultural heritage due to climate impacts on sacred places is presented in Figure 26.

Figure 26. Mapping loss of cultural heritage due to climate impacts on sacred places in three coastal communities in Fiji using the C-CIQ framework



4. Social disruption (migration and displacement)

To explain how the identification and categorisation of different dimensions of loss and damage impacts can uncover loss and damage due to social disruption (migration and displacement), we present here the analysis of the case study: *Climate migration's growing threat to marginalised people in Tamil Nadu, India*.[5]

Increased climate risks and anthropogenic factors transform the basic characteristics of village life, farming patterns, livelihood strategies and coping mechanisms. The village community in Vanagiri, a coastal village of Sirkazhi block of Mayiladuthurai district in Tamil Nadu, is profoundly fragmented in various aspects, including social, economic and gender differentiation. The discrimination is aggravated by climate challenges in the form of land/soil degradation, shift in farming systems, and men's migration to find stable income and employment opportunities. Women are doubly burdened with the responsibility of taking care of their elders and children and managing household chores, in addition to managing their finances and household consumption and cultivating their farms. In the absence of men, women, especially those from landless and socially vulnerable communities, are experience physical and mental stress, sexual exploitation and abuse. Their exposure to climate risks and the degradation of land and water ecosystems deeply impact their livelihoods, augmenting their vulnerabilities and making their lives miserable.

Tangible domain

- Soil has become unfit for farming due to salinity
- Loss of employment due to changed cropping patterns
- Smallholder farmers have been forced to sell their lands for shrimp farms and have become landless
- Women's health has been affected by the physical and mental stress of managing their families and farms on their own
- Women often neglect their nutrition and self-care, due to multiple responsibilities in the home and on the farm
- There has been an increase in the number of orphans and young widows due to deaths of migrant men due to alcohol
- Household food insecurity has been caused by poor production and declining labour opportunities.

Intangible domain

- The mental stress experienced by both women and men has increased as they must depend on informal moneylenders for their household consumption needs
- Women are shouldering the twin burden of managing farms and family due to men migrating in search of non-farm, regular and semi-skilled labour
- Women from the lower social strata (scheduled castes) have had to remain farm as labourers, while women from the middle strata have taken up managerial roles in farming
- Women have had to take the lead in farming to avoid leaving their lands fallow.

Intrinsic domain

- Among migrants, men from scheduled castes have only found work as unskilled labourers or menial jobs, while the men from middle strata of society have semi-skilled jobs
- Only women from scheduled castes have had to migrate for work in spinning mills
- Women from scheduled castes are stigmatised as untouchables, preventing them from taking up food-based work in eateries or tea and coffee shops, or from selling batter and curd
- While the state-run employment guarantee scheme does not discriminate against women based on caste, work is allocated separately for scheduled castes and middle-strata women
- Women remain in low-value and under-paid livelihoods
- Women borrowing from moneylenders for household needs have been exploited sexually by moneylenders/landowners
- Long hours spent fetching water exhausts women physically.

5 For the full case study, see Bharadwaj and Mitchell (2023).

Functional domain

- Increased soil salinity has led to a reduction in the net-sown area and a changed cropping system
- There has been a shift from farming food crops to aquaculture (shrimp farming) to manage increased salinity
- Smallholder farmers, who used to be able to harvest three crops a year, are now only able harvest one crop a year. Even though the land is unfit for farming due to salinity, farmers still cultivate at least one crop to avoid leaving their land fallow.
- Migration has been used as an adaptive strategy to escape food insecurity
- Women have diversified their livelihood activities, undertaking home-based tailoring, basket weaving and doll making
- Women farmers cultivating lands they had sold to private companies have been forced to work without title, depriving them of insurance benefits from the state.

Temporal domain

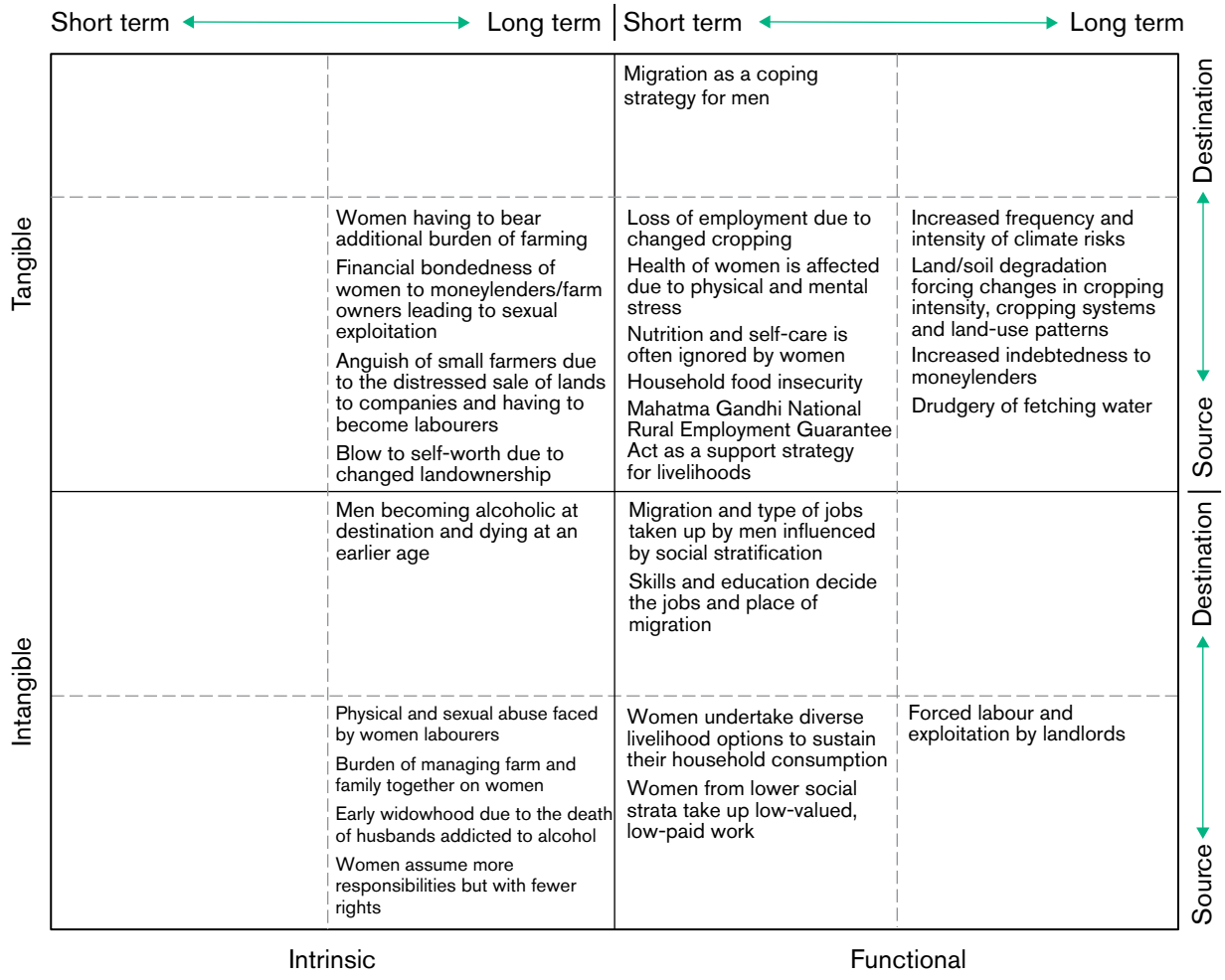
- Eleven major cyclones were recorded from 1992 to 2021, coupled with floods in 1996 and droughts in 1992 and 2015
- Crops have changed from paddy to cotton due to changes in rainfall pattern, reduction in surface water and increased salinity
- The diversity of crops and varieties such as saline-tolerant traditional paddy, millets and groundnut has disappeared due to increased reliance on cash crops
- Conversion of lands from farming to aquaculture (shrimp farming) began after the 2004 tsunami
- There has been a trend of leaving farmlands fallow, or changing cropping systems from food crops to high-value crops such as cotton or orchards
- Reduced opportunities for taking lands on lease for cultivation by landless women labourers.

Spatial domain

- The extent of cultivable lands has reduced by 35%, due to salinity
- Availability of drinking water has become limited, due to increased salinity of groundwater
- Men have migrated to nearby towns/cities, other states or other countries, taking up jobs ranging from unskilled labourers to skilled masons
- Land-use patterns have undergone a drastic change, from three crops a year to a single crop, from food crops to commercial crops, from farming to aquaculture
- The availability of food has been affected due to the change in the cropping system towards cash crops and shrimp farming.

The full extent of social disruption (migration and displacement) in Tamil Nadu, India under different domains using the C-CIQ framework is presented in Figure 27.

Figure 27. Mapping of social disruption (migration and displacement) in Tamil Nadu, India using the C-CIQ framework



5. Mental and physical health impacts

To explain how the identification and categorisation of different dimensions of loss and damage impacts can be done to uncover loss and damage due to social disruption (migration and displacement), we present here the analysis based on the research paper *'Women paying the cost of the climate crisis with their wombs: quantifying loss and damage faced by women battling drought, debt and migration'*.[6]

In Beed district, Maharashtra, India, the adverse effects of climate change are not just environmental but deeply socioeconomic, disproportionately impacting communities with limited economic assets. The erratic monsoon due to climate change has led to repeated crop failures in the region. These agricultural disruptions directly impact the economic stability of families dependent on farming, pushing them into a cycle of distress migration and debt bondage. Families, including women, are forced to seek employment in sugarcane cutting — a labour-intensive and precarious occupation. This shift to sugarcane labour entails migrating for several months to distant farms, which are under the control of labour contractors known as *mukkadams*. The working conditions in these sugarcane fields are gruelling and the contractual arrangements are exploitative. Women labourers, in particular, face a stringent regime in which taking breaks, even for natural biological reasons such as menstruation, can result in substantial fines imposed by the *mukkadams*. This punitive system, borne out of a climate change-induced economic crisis, leaves these women in a vulnerable position where they feel compelled to undergo hysterectomies.

The rationale behind this drastic decision is based on the fear of losing out on wages or incurring fines for taking frequent breaks. By opting for a hysterectomy, these women aim to eliminate the 'problem' of menstruation, which in their precarious economic situation is seen as an impediment to continuous work and income stability. This grim choice, while offering a short-term solution to avoid financial penalties, overlooks the long-term health consequences and further exemplifies the severe impact of climate change on individual lives. The interplay between economic

6 For the full research paper, see Bharadwaj et al. (2024).

pressures and non-economic L&D in the context of distress migration is a critical aspect of climate change's impact. Migratory decisions, while economically driven, result in significant non-economic loss and damage, including the loss of home and community, and life-altering health impacts.

Tangible domain

- Frequent crop failures due to inadequate rainfall or drought (drought years are more frequent, increasing from once in five years during 1986–2011 to once in three years during 2011–2022)
- Mortality or reduced productivity of livestock due to climate extremes, water scarcity and limited availability of fodder
- Reduction in income for farming-dependent families
- Loss of income due to loss of crops, death and sale of animals
- Increased debt burdens causing financial distress
- Physical ailments from labour-intensive jobs at both source and destination sites, resulting in higher healthcare expenses.

Intangible domain

- Erosion of social capital due to migration in search of livelihoods
- Disruption in cohesion, cooperative and community living due to displacement
- Alienation from traditional festivals and rituals, causing a sense of isolation, disconnect and loss of cultural identity
- Loss of knowledge and skill in agricultural operations accumulated over generations
- Vulnerabilities of households that force them to migrate are determined by their social strata (tribal communities), limited landholdings, education, income deficit, indebtedness, poor housing and lack of access to water and sanitation
- Girls, as well as labouring in the fields, manage additional household chores, fetch water and care for younger siblings, all of which affects their schooling
- Girls are being pushed into early marriage
- Mental distress caused by hysterectomies undertaken due to job pressures is affecting women's quality of life and wellbeing
- Hysterectomies lead to loss of libido and decline in sexual satisfaction, leading to feelings of guilt and worthlessness, and other marital issues.

Intrinsic domain

- Loss of sense of belonging and pride in farming which they cherished as their way of life
- Loss of social security previously provided by community connections and cooperative living
- Women are losing their reproductive organs to avoid loss of working days and income due to menstruation
- Women are experiencing mental health issues due to persistent sadness, hopelessness, fatigue and decreased energy, and suicidal thoughts
- Healthcare costs are higher due to the health effects of hysterectomy, such as weakness, pain, discomfort, obesity and urinary incontinence.

Functional domain

- Traditional agricultural systems and related knowledge and skills are deteriorating
- Water scarcity is affecting both availability of drinking water and agricultural production
- There has been a disruption in schooling, especially for girls being unable to attend school due to the need to fetch water
- Women are spending too much time in fetching water, preventing them from doing other productive work
- Traditional local village governancehas weakened, such as the functioning of the *panchayat* and *gramsaba* systems
- Migrant labourers, especially women, are undergoing forced labour conditions, coupled with poor living conditions and significant gynaecological health challenges
- Women suffer due to lack of privacy for bathing, urination and defecation, affecting their physical and mental wellbeing
- Women are subjected to physical, verbal and sexual abuse by employers, contractors and other men at work and at their accommodation
- Migrant labourers are subjected to forced working conditions, such as extended work hours and working without safety equipment, undertaking harmful tasks and encountering wild animals
- Women are forced to work when sick and during menstruation, with the constant fear of wage deduction for leaves of absence, undergoing severe mental and physical stress, leading them to have hysterectomies.

Temporal domain

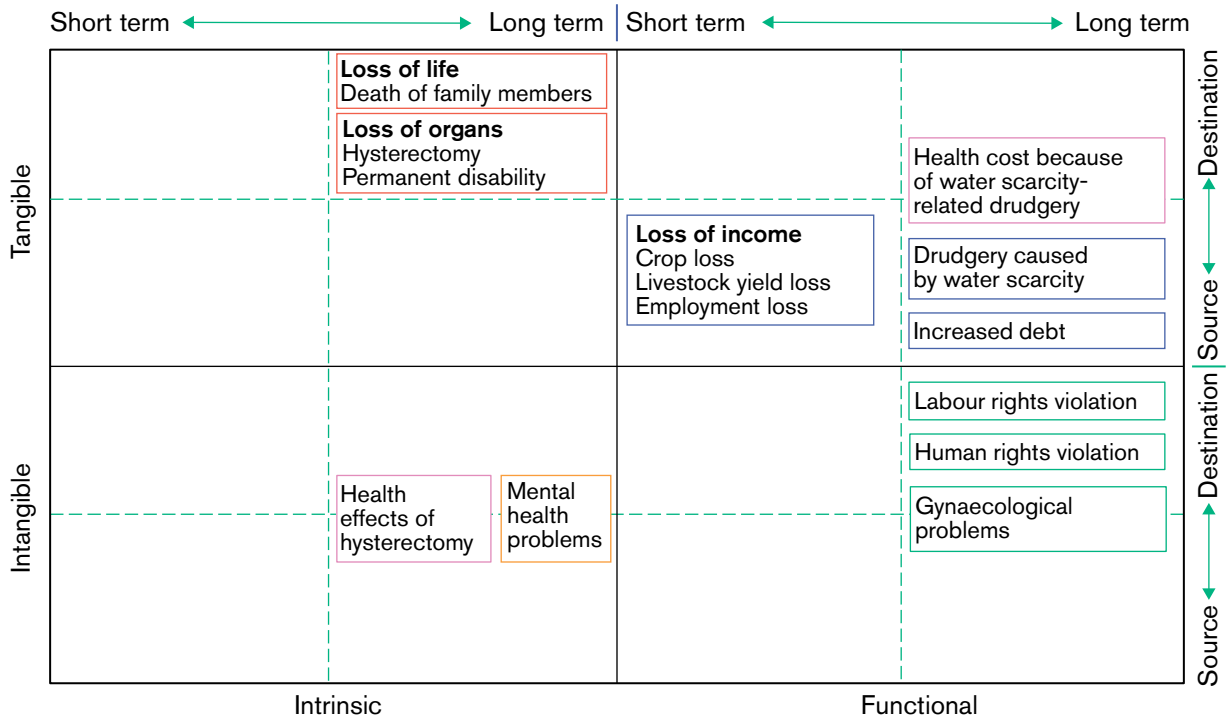
- Increased frequency and intensity of droughts is causing sudden loss of employment or reduced crop yields, disrupting the daily lives and economic stability of households
- Seasonal migration is being used as a coping strategy to escape from hunger and financial distress caused by climate change-induced droughts
- Chronic physical and mental health issues are being caused by prolonged periods of drought and resultant stressors
- Recurrent droughts are leading to accumulated debts, which escalate mental health issues, pushing villagers to migrate
- Women sacrifice their wombs to avoid loss of working days, employment and loss of income, discounting the long-term health ramifications.

Spatial domain

- Geographically, Beed district is disadvantaged due to its recurrent exposure to droughts and water scarcity, with arid farming as the only option
- The 'pull' factors that prevail at the destination sites include irrigated farming, sugarcane production, job opportunities for seasonal works
- The 'push' factors that prevail at the source site (Beed) include recurrent droughts, water scarcity, crop failures, loss of work and income, and accumulating debts
- At destination sites, the workers, especially women, undergo severe physical and mental stress, with resultant health consequences
- Workers move from one farm to another within the sugar mill's catchment area with the potential to work across farms and they experience different types of impacts, such as exploitative labour conditions and health risks in sugarcane fields.

The full extent of mental and physical health impacts in Beed district, Maharashtra, India, under different domains using the C-CIQ framework is presented in Figure 28.

Figure 28. Mapping of mental and physical health impacts in Beed district, Maharashtra, India using the C-CIQ framework



While the case study examples provided here primarily fall into one of the five categories of non-economic loss and damage, it is important to recognise that each case often involves multiple types of L&D. This overlap highlights the complexity and interconnected nature of these impacts, underscoring the need for a flexible categorisation approach that considers all evident types of L&D within the local context.

For instance, in the Beed case study, although the primary classification was 'physical and mental health impacts', the assessment also identified related issues, such as migration and loss of quality of life. This suggests that while a particular case study may initially seem to fit neatly into one category, a thorough examination often reveals a broader spectrum of interconnected impacts.

Therefore, users engaging with this framework should not be limited by the initial broad category under which a case study or data point is classified. Instead, they should explore and document all relevant types of L&D evident in each situation. This approach ensures a comprehensive understanding of the multifaceted nature of climate impacts, allowing for more effective planning and implementation of interventions that address the complex realities faced by affected communities.

STEP 4

Index-based valuation of loss and damage impacts

Step 4 introduces an index-based valuation of economic and non-economic loss and damage impacts. Once the categorisation of the economic and non-economic L&D has been carried out, the C-CIQ framework can be used to quantify and value these impacts. The C-CIQ toolkit combines economic valuation, multi-criteria decision-making analysis, composite risk indices and semi-qualitative analysis to holistically analyse and quantify the tangible, intangible, intrinsic and functional dimensions of climate impacts across various spatial and temporal scales.

The C-CIQ approach was rigorously applied and tested for research in Beed district (see the section on mental and physical health impacts, Step 3, page 68). The research showed that the toolkit can be useful in revealing the depth of economic and non-economic L&D impacts on households, especially impacts on women, girls and children. This practical application not only helped in quantification of the immediate losses but also provided insight into the increased vulnerability of certain groups to climate disasters. By employing the C-CIQ toolkit, several composite indices, such as a Labour Rights Violation Index, a Human Rights Violation Index and a Mental Health Impact Index were constructed. These indices provide quantifiable metrics to evaluate the specific and compound impacts of climate change on different groups in Beed.

In Step 4, we have used general examples and, where relevant, the example of Beed, to illustrate how the C-CIQ toolkit can be used for the valuation of economic and non-economic L&D.

Economic valuation

Climate-induced extreme events lead to both economic and non-economic L&D. Economic losses include assets, goods or services typically bought and sold in markets, which are usually covered in assessments. However, non-economic losses such as health impacts, loss of cultural heritage and social disruption due to displacement often go unaccounted for because they do not have a standard market price. Also, the non-economic losses and damages are perceived differently across communities. Some communities might value these losses intrinsically, appreciating them for their inherent worth, while others recognise their functional value — what practical benefits they provide. Therefore, a complete valuation of L&D must consider both the economic and non-economic dimensions to fully capture the impacts of climate change. Additionally, because climate change can continue to degrade remaining resources, it is crucial to assess these impacts over time and across different regions. This approach helps in understanding the broader, long-term effects of climate change on vulnerable populations.

1. How to undertake economic valuation of economic and non-economic L&D

In the economic valuation approach, estimation of loss and damage or cost of interventions is undertaken by categorising L&D based on tangibility, functional and intrinsic values and identifying indictors that adequately represent the nature of impact suffered under each of those domains of L&D, as depicted in Figure 29.

Economic L&D can be assessed using market values because these losses involve goods and services that are regularly traded in markets. However, for non-economic L&D, which includes impacts without direct market prices, alternative valuation methods are necessary. These include using 'shadow' prices derived from non-market valuation techniques such as the revealed preference method and the stated preference method.

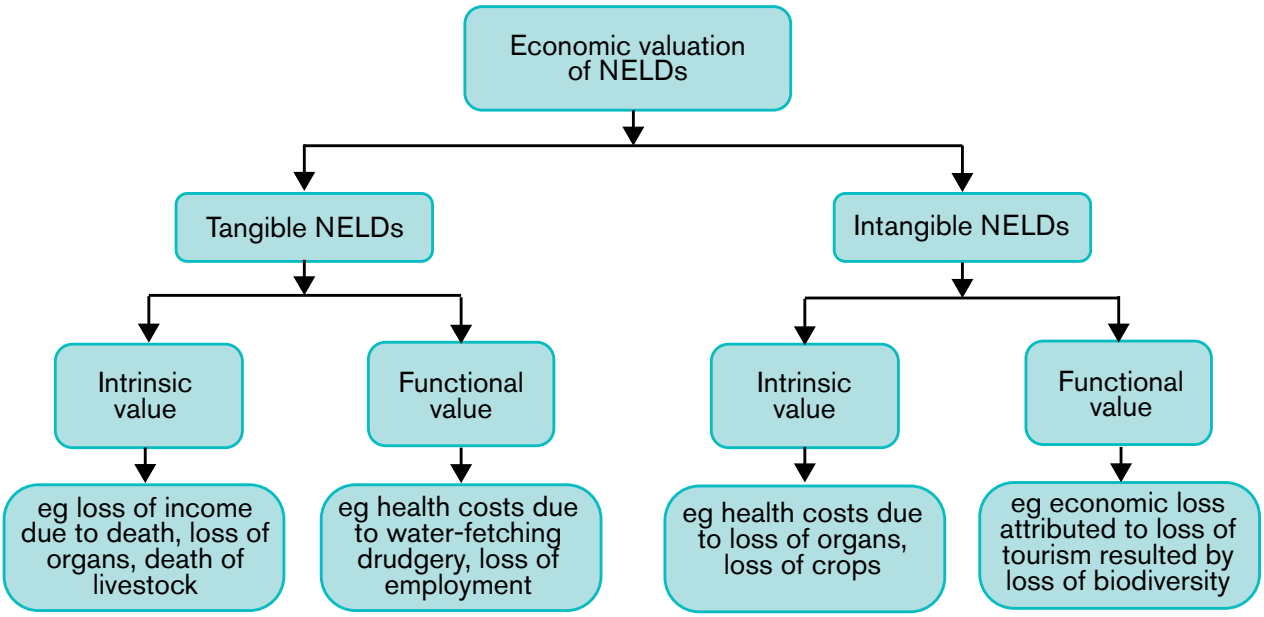
The toolkit incorporates various types of these non-market valuation methods. These can be selected and applied based on the local context and the specific type of loss and damage being assessed. This flexibility allows for a more accurate evaluation of non-economic impacts, which are critical for understanding the full extent of climate-induced losses.

The following sections explain different types of non-market valuation methods and how they can be applied.

Revealed preference method

The revealed preference method evaluates non-market impacts based on actual market behaviour. This method is useful for things such as health effects and the contributions of environmental goods and services to land values, which can be indirectly observed through market transactions. For instance, it looks at how people spend money in real-life situations to infer values for things not sold directly, such as clean air or quiet spaces. This approach avoids the biases that can occur with hypothetical scenarios, providing a more grounded and reliable assessment of value (see also Box 2).

Figure 29. Constructing indicators for different categories of loss and damage using the economic valuation approach



Box 2. Example: how the revealed preference method can be applied to assess non-economic L&D in a coral reef ecosystem

Coral reefs are vital to marine biodiversity and provide significant ecological services, including coastal protection and supporting fisheries. However, they are extremely sensitive to water temperature changes, and climate-induced warming has led to widespread coral bleaching. This degradation not only affects biodiversity but also impacts communities that depend on these ecosystems for livelihoods and cultural activities.

The revealed preference method can be used to value the non-economic L&D from coral bleaching by observing changes in community behaviours and expenditures that indirectly reflect the value they place on the reef's ecological and cultural services.

Data collection:

- Collect data on tourism revenue in the area before and after significant bleaching events. A decline in tourism can indicate the economic implications of reduced reef health, reflecting its value to the tourism industry.
- Analyse the trends for property values in coastal areas adjacent to reefs. Properties near healthy reefs are often valued more highly due to the aesthetic and recreational benefits reefs provide. Observing how property values change in relation to reef health can reveal how much residents value the reef's presence.

Analysis:

- Compare changes in tourism revenue over time with records of coral health. Decreases in revenue following bleaching events can be linked to the reef's declining health, indicating how much tourists value the reef.
- Perform a comparative analysis of property values in areas with degraded reefs against those with healthy reefs, adjusting for other market factors. This will help quantify the premium that property buyers place on proximity to healthy coral reefs.

Using the revealed preference method provides tangible evidence of how much communities value coral reefs beyond direct economic interactions. By linking economic behaviours to ecological health, this approach helps quantify the broader societal and cultural impacts of coral reef degradation.

Stated preference method or contingent-based valuation

The **stated preference method**, also known as **contingent valuation**, is a survey-based economic technique used to evaluate the value that individuals place on non-market goods or services. Unlike methods that observe actual behaviour in markets, the contingent valuation method directly asks people how much they would be willing to pay (WTP) or accept in compensation (WTA) for specific environmental changes. This method is particularly useful for assessing values for goods that are not bought and sold in markets, such as environmental and public goods (see also Box 3).

Box 3. Example: how the stated preference/contingent valuation method can be applied to assess non-economic L&D in a coral reef ecosystem

Design a survey to gauge the willingness of residents and tourists to pay for conservation measures that would mitigate coral bleaching and preserve the reef's health. The survey would present scenarios of different levels of reef health (from healthy to severely bleached) and ask respondents to state how much they would be willing to pay annually to prevent the reef from further degradation.

1. Develop questions that clearly explain the situation of the coral reef and the potential measures that could be taken to protect it. Include visual aids showing healthy vs. bleached reefs to help respondents visualise the differences.
2. Distribute the survey to a broad and representative sample of the local population and tourists who visit the reef. Ensure demographic data is collected to analyse responses across different groups. Collect data on how much each respondent states they would be willing to pay for the preservation efforts.
3. Willingness to pay (WTP) analysis:

- Calculate average WTP: From the collected data, calculate the average amount that respondents are willing to pay per year to fund measures that prevent further bleaching of the coral reef.
- Economic valuation: Aggregate the individual WTP amounts to estimate the total economic value that the community places on preserving the reef.

Example calculation:

- Assume the survey results show an average WTP of US$50 per person per year.
- With 1,000 respondents, the total annual value placed on preventing reef bleaching could be estimated at US$50,000.

By using the stated preference method, this approach provides direct insight into the non-market valuation of coral reefs, capturing people's valuation of ecological and recreational benefits provided by the reef. This method is particularly valuable when policy decisions require quantifiable evidence of the benefits of investing in conservation and climate adaptation strategies.

Direct costs and indirect costs

Direct costs: direct costs arise from immediate and measurable impacts of climate events. They are explicitly linked to the event itself and include expenses that are incurred directly as a result of the event. Some examples include:

- **Loss of crops:** Directly destroyed by drought
- **Death of livestock:** Caused directly by drought or extreme heat
- **Loss of employment:** Jobs lost due to the closure of businesses affected by flooding or other disasters.

Indirect costs: indirect costs are consequences of the primary impact, often delayed or removed in terms of causality from the initial event. These costs are not immediately apparent but manifest over time due to the cascading effects of the climate event. Examples include:

- **Land degradation:** Prolonged drought deteriorates soil quality, reducing land productivity over time
- **Increased health costs:** Fetching water from distant sources due to water scarcity leads to increased physical strain and potential health issues
- **Decreased efficiency:** Workers suffering from mental trauma due to a disaster impacts their productivity.

Hedonic pricing method

The hedonic pricing method is an economic valuation technique used to estimate the value of ecosystem or environmental services that affect market prices (see for example Box 4). This method works by breaking down a product or service into its constituent attributes and statistically analysing how each characteristic contributes to the overall market price. In the context of environmental economics, hedonic pricing is often applied to real estate, where prices can be influenced by both tangible and intangible factors.

Hedonic pricing can be used to estimate indirect costs related to changes in environmental quality, such as reductions in the value of land due to reduced productivity because of drought or floods. However, it is different from direct and indirect costs because it is specifically a method for assessing how various factors influence market prices, rather than a categorisation of costs themselves. Thus, while direct and indirect costs can help categorise the types of economic impacts, hedonic pricing provides a method to quantify some of these impacts, particularly those that affect land or property values or other market transactions.

Box 4. Example: estimating loss of land value due to land degradation using the hedonic pricing method

To estimate the loss of land value due to drought-induced land degradation using the hedonic pricing method, follow these detailed steps:

1. Identify relevant attributes

- Soil quality (measured by soil fertility index)
- Proximity to water sources (distance to nearest river or reservoir)
- Land productivity (crop yield per hectare)
- Environmental conditions (degree of land degradation due to drought).

2. Data collection

- Gather data on land sales prices (or rental values) in various regions, including both degraded and non-degraded land
- Collect information on the above attributes for each land parcel.

3. Regression analysis

- Conduct a regression analysis to model the relationship between land prices and the identified attributes, including the degree of land degradation. For simplicity, assume a linear regression model:

  $$\text{Land Price} = \beta 0 + \beta 1(\text{Soil Quality}) + \beta 2(\text{Proximity to Water Sources}) + \beta 3(\text{Land Productivity}) + \beta 4(\text{Degree of Land Degradation}) + \varepsilon$$

- Estimate the coefficients ($\beta 0$, $\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$) using the collected data.

4. Estimate loss in land value

- Suppose the regression analysis results indicate that for each unit increase in the degree of land degradation (measured on a scale from 0 to 10), land prices decrease by US$500 per hectare, holding other factors constant
- If a parcel of degraded land with a land degradation score of 8 would have been priced at US$10,000 per hectare in the absence of degradation, its estimated price with degradation would be:

  $$\text{Estimated Price} = \text{US\$10,000} - (8 * \text{US\$500}) = \text{US\$6,000 per hectare}$$

- The difference between the estimated price of non-degraded land and degraded land represents the loss in land value due to drought-induced land degradation.

5. Validation and sensitivity analysis

- Validate the regression results using statistical techniques and conduct sensitivity analysis to assess the robustness of the estimated loss in land value
- Interpret the findings, highlighting the extent of the loss in land value attributable to drought-induced land degradation
- Provide insights into the implications for policymaking and resource allocation to address land degradation and its economic consequences.

Cost-benefit analysis

Cost-benefit analysis is a tool used to assess the overall costs against the benefits of an investment or decision. It can be useful in valuing L&D associated with environmental impacts (see for example Box 5). In the context of valuing L&D, cost-benefit analysis can involve careful consideration of both the immediate and long-term costs related to investments and long-term costs related to measures to prevent or mitigate damage. For instance, costs might include the upfront investment in flood barriers or the ongoing expenses of forest conservation programmes. Conversely, the benefits would not only encompass the direct avoidance of property damage and loss of life but also the preservation of ecosystem services and biodiversity, which have profound long-term economic implications.

Box 5. Example: using cost-benefit analysis to assess the decision to migrate

Suppose a household has migrated from their home village due to drought. They work in housing construction at the destination site, earning US$7,000 per year. Their living cost at the destination site is US$4,000 per year. Health costs due to poor work and living environments at the destination site amount to US$3,000. Travel costs are US$1,000 per annum. Let us calculate the cost-benefit ratio (CBR) for the household because of migration:

Total benefits for the household:

- Earnings from house construction labour: US$7,000

Total benefits = US$7,000

Total costs for the household:

- Living costs at the destination site: US$4,000
- Health cost because of poor work and living environments: US$3,000
- Travel cost: US$1,000

Total costs = US$4,000 (living costs) + US$3,000 (health costs) + US$1,000 (travel cost) = US$8,000

Now, we can calculate the cost-benefit ratio:

CBR = Total benefits / Total costs

CBR = US$7,000 / 8,000

CBR ≈ 0.875

So, the CBR for the household is approximately 0.875. This means that for every US$1 spent on migration and living in the destination, the household receives approximately US$0.875 in benefits.

Replacement cost

The replacement cost method is an economic valuation technique used to estimate the cost of replacing or restoring an asset to its original or functional condition after it has been damaged or degraded. This method is particularly applicable to environmental assets affected by climate extremes, where we can assess the value of L&D based on the direct replacement or restoration cost. For instance, the destruction of freshwater resources such as built-up reservoirs, may require reconstruction of the waterbody while degraded lands may require soil and water conservation measures (see for example Box 6).

Box 6. Example: how replacement cost can be calculated for a reservoir damaged due to climate change

Supposing a built-up reservoir used for agricultural irrigation in a rural community has been severely damaged due to an extreme flooding event exacerbated by climate change.

1. Estimation of replacement costs:

- Reservoir walls: estimate the cost to rebuild the walls. Assume the cost to procure materials and labour totals US$500,000
- Pumping infrastructure: assess the cost to replace or repair the damaged pumps and associated electrical systems. Assume this cost is US$200,000.

2. Total replacement cost:

- Add up the costs of rebuilding the reservoir walls and repairing the pumping infrastructure to find the total replacement cost
- Total replacement cost = Cost of rebuilding walls + Cost of repairing pumps = US$500,000 + US$200,000 = US$700,000.

Prevention cost

The prevention cost method is an economic valuation approach focused on estimating the expenses involved in implementing measures that prevent or mitigate potential L&D from foreseeable risks. This method involves calculating the costs of actions taken in advance to avoid or reduce the impact of adverse events, such as natural disasters exacerbated by climate change (for example, the cost of establishing an early warning system, preventive structures for coastal erosion (see Box 7), or introducing resilient farming practices to avert crop losses).

Box 7. Example: how prevention costs can be calculated for coastal erosion

Imagine a coastal community is facing increasing threats of coastal erosion and storm surges due to rising sea levels caused by climate change.

Steps to calculate prevention costs

1. Conduct a detailed assessment to identify the most vulnerable areas along the coast that are prone to erosion and storm surges.

2. Choose a suitable preventive measure such as the construction of sea walls, mangrove restoration and/or the establishment of buffer zones. For this example, we consider building sea walls as the chosen preventive measure.

3. Estimation of costs:

- Construction costs: Estimate the cost of materials, labour and equipment needed to build sea walls along the identified vulnerable coastal areas. Assume the total construction cost is estimated at US$3 million.
- Maintenance costs: Calculate the annual maintenance costs for the sea walls, including repairs and inspections. Assume an annual maintenance cost of US$100,000.

4. Total prevention costs:

- Add the initial construction costs and the discounted value of ongoing maintenance costs (assuming a project lifespan of 20 years).

5. Economic justification:

- Conduct a cost-benefit analysis comparing the total prevention costs with the potential economic losses from coastal property damage, displacement of communities, and loss of marine habitats if no action is taken. Assume potential losses without preventive measures are projected at US$10 million over 20 years.

By investing in preventive measures, communities can avoid higher future costs and reduce the impact of adverse climate events.

Opportunity costs approach for risk mitigation

The opportunity costs approach in risk mitigation involves understanding and evaluating the costs of foregoing one option in favour of another, particularly in the context of implementing strategies to reduce risks and losses (see Box 8). This approach is especially relevant when resources are limited and choosing one course of action means missing out on the benefits of another potentially valuable option.

Box 8. Example: how opportunity costs can be calculated for resettlement due to coastal erosion

Suppose a community is facing severe coastal erosion that threatens homes and livelihoods. Two main options are considered: building coastal defences (for example, sea walls) or resettling the community to safer inland areas. To calculate opportunity costs:

1. Assess alternatives

- Option A — build coastal defences: costs US$5 million and is expected to protect the coast for an additional 20 years
- Option B — resettle the community: costs US$4 million, but involves moving the community away from the coast, losing access to marine resources and traditional lifestyles.

2. Evaluate forgone benefits

- If Option B (resettlement) is chosen, the community will save on the immediate costs of building sea walls but lose long-term benefits related to coastal activities, such as fishing and tourism, which might be worth more than the cost of coastal defences.

3. Calculate opportunity costs

- The opportunity cost of choosing resettlement (Option B) over building defences (Option A) would be the lost economic and cultural benefits of remaining on the coast. Valuing the lost benefits at US$6 million over 20 years, the opportunity cost of resettlement is US$1 million more than the expense of constructing defences when the total economic impact is considered.

Considering both the direct costs and the opportunity costs, the decision would favour building coastal defences if preserving the coastal lifestyle and economy is deemed more valuable than the lower upfront cost of resettlement. By investing in preventive measures, communities can avoid higher future costs and reduce the impact of adverse climate events.

By using economic valuation methods, users can understand the full extent of costs associated with impacts of climate change. Methods such as direct and indirect cost analysis, replacement cost, prevention cost and the opportunity cost approach each provide unique insights into the financial implications of climate-related events. These methodologies not only quantify immediate and visible damages but also capture the broader, often hidden costs that affect communities over the long term.

Valuing these losses and damages accurately is vital for effective policymaking and resource allocation. It will ensure that financial investments in climate resilience and adaptation are both justified and optimised. By comprehensively evaluating the economic impacts, decisionmakers can prioritise actions that safeguard vulnerable communities and ecosystems, thereby enhancing societal and environmental resilience against future climate risks. Further, an understanding of the economic implications of these impacts helps communicate the urgency and scale of climate change to a broader set of stakeholders, fostering a deeper commitment across all sectors to invest in sustainable solutions.

Multi-criteria decision-making analysis

What is multi-criteria decision-making analysis?

Multi-criteria decision-making (MCDM) is a method used to evaluate and compare different options when making decisions, especially when those options need to meet several objectives. This approach is particularly useful in situations where decisions are complex and involve multiple factors that are not easily quantifiable by monetary values alone. MCDM is commonly used in government and other sectors to help decisionmakers choose the best option or a set of preferred options for further exploration.

MCDM involves defining clear objectives and identifying criteria by which to measure how well each option achieves these objectives. Decisionmakers play a crucial role in this process by setting the criteria, assigning importance to each criterion (weighting), and evaluating how each option performs against these criteria. The process combines these assessments into overall scores for each option, providing a structured way to compare them.

One of the key strengths of MCDM is that it introduces a transparent and structured approach to decision-making. By explicitly stating the objectives and criteria, the process helps clarify the decision-making process and provides insights that might not be obvious without such a structured analysis. However, it is important to acknowledge that while MCDM strives for objectivity, the selection of criteria and weighting can introduce subjectivity, reflecting the preferences and judgments of those involved.

How can MCDM analysis be useful for assessing loss and damage?

MCDM can be highly valuable for understanding the perspectives of communities and other stakeholders when assessing different options in the context of climate change L&D. By integrating multiple criteria that reflect a community's values and priorities, MCDM can help capture what stakeholders consider most critical — be it the loss of cultural heritage, quality of life or environmental stability.

This method facilitates a structured conversation about what losses are most significant to a community. For instance, while government agencies might prioritise economic impacts, communities might place higher value on preserving cultural landmarks or maintaining social cohesion. MCDM allows these diverse priorities to be openly discussed and quantitatively assessed, ensuring that the resultant decision-making process is inclusive and reflects a broad range of concerns.

Moreover, MCDM can be particularly effective in examining factors that influence community decisions, such as migration in response to climate impacts. By using MCDM, one can identify and weigh the various factors — such as job and safety concerns, economic opportunities or environmental changes — which contribute to the community's decision to migrate. This can help assess how much climate change influences migration decisions, compared to other social or economic factors.

For example, in a coastal community experiencing frequent flooding and erosion, MCDM could help determine whether to invest in engineering solutions to protect the area or support relocation efforts to safer regions. Criteria might include the cost of protective infrastructure, the historical and cultural significance of the area, the potential for future climate change impacts, and the community's attachment to their land. By evaluating these factors through MCDM, the community can make a more informed decision about whether to stay and adapt or relocate.

MCDM enhances the decision-making process by ensuring that it is not only systematic and transparent but also deeply rooted in the values and priorities of those most affected by climate change. This leads to more sustainable and acceptable solutions for managing L&D associated with climate impacts.

Process for conducting multi-criteria decision-making analysis

MCDM can be particularly effective for assessing the complex dimensions of loss and damage or for assessing factors contributing to a community's decision to migrate in response to environmental threats. The following step-by-step guide can be used for applying MCDM:

Step 1: Define the decision context and objectives for assessment

- Clarify whether the emphasis is on evaluating or prioritising various options. For example, when assessing migration in the context of climate impacts, one could look at evaluating the reasons for migration or ranking/prioritising the factors that contribute to migration.
- Establish the specific goal of the assessment or decision-making process, such as minimising environmental impact, maximising community resilience or maintaining cultural integrity in response to environmental challenges.

Step 2: Identify the options

- For migration decisions, compile all potential factors that contribute to the decision to migrate and what factors can reduce the reasons contributing to distress migration or enhance resilience. For loss and damage assessments, list possible response strategies such as restoration projects, financial compensation mechanisms or community adaptation initiatives.
- Check that each option is viable within the physical, financial and sociopolitical constraints of the community.

Step 3: Develop criteria for assessment

- Identify criteria relevant to assessing the options from Step 2 (whether to migrate or stay) such as cost, effectiveness, social acceptance, cultural impacts, environmental sustainability and speed of implementation.
- The chosen criteria should cover all important aspects of the decision, reflecting the multifaceted impacts of climate change on the community.

Step 4: Weight the criteria

- Reflect the relative importance of each criterion, as determined by the community's preferences and priorities, which can be gathered through focus group discussions, shared learning dialogues or surveys.
- Verify that the weighting accurately represents the community's values and the urgency of different concerns.

Step 5: Score each option

- Evaluate how well each option satisfies each criterion, possibly using qualitative assessments from community consultations or quantitative data where available.
- Engage experts in climate adaptation, social sciences and local cultural practices to provide detailed assessments for technical or nuanced criteria.

Step 6: Aggregate the scores

- Use methods such as weighted sum models[7] to integrate scores across all criteria to derive an overall effectiveness score for each option.
- Determine which options provide the best balance of benefits across the various criteria.

Step 7: Perform a sensitivity analysis

- Explore how changes in the importance assigned to each criterion or in the scores of options influence the final decision. This helps assess the robustness of the conclusion.
- Refine the analysis based on insights gained from sensitivity checks to better align with community resilience goals and practical realities.

Applying MCDM in this way enables communities and policymakers to systematically tackle the complexities of climate-induced L&D and migration decisions. It ensures that every facet of the decision is considered, leading to more sustainable, culturally sensitive and widely supported outcomes.

7 A weighted sum model is a decision-making approach that assigns weights to different criteria based on their importance, ensuring that the weights add up to 1. Each option is then scored on these criteria, typically from 0 to 100. The scores for each option on these criteria are multiplied by their respective weights and summed to determine the best option. This method helps prioritise options based on multiple important factors.

Quantification of economic and non-economic loss and damage through composite risk index

To quantify economic and non-economic L&D, we have developed a framework based on the use of a composite index that is simple, easy to construct and comparable, enabling researchers, practitioners and policymakers to apply them in diverse settings. The method uses indexes, which are composite measures made up of different variables, or sub-indices that reflect specific kinds of climate change L&D. The indices measure the intensity of non-economic L&D across various domains: the tangibility spectrum and the intrinsic-functionality spectrums. Additionally, by integrating temporal and spatial dimensions, we provide critical reference points that help in interpreting the data provided by the indices. This ensures a comprehensive understanding of non-economic L&D's impact over time and across different geographic locations.

How to construct the main index and sub-indices

To ensure the indices are both easy to use and transparent, we apply the maximum value scaling method for normalisation (see Box 9). A detailed explanation of how to use these indexes and scale them for easy comparison is set out below.

Constructing the indices

- **Choose variables:** pick various factors that represent different losses and damages caused by climate change. These could include things such as the number of homes destroyed, areas of crops lost or the mental health impact on a community.
- **Create sub-indexes:** each factor becomes a sub-index. We put these together to form a bigger picture, which is our main index.
- **Scale the values:** to compare these different factors fairly, we need to scale them. We do this by assigning a score between 0 and 100 to each sub-index using the maximum value scaling method. This makes the data more intuitive and comparable.

Why scaling is important

Scaling helps us understand the severity of loss and damage in a consistent way. By normalising scores, we can easily compare the impact in one community to the impact in another or see how the situation changes over time. This method also ensures transparency and clarity, as anyone looking at the scores can see how they relate to the worst-case scenarios.

With these indices and scaling methods, practitioners and policymakers can effectively quantify and compare the impacts of climate change across different communities, track trends and prioritise resources where they are needed most.

For instance, in the study conducted in Maharashtra using this approach, the composite indices were crucial in analysing how climate impacts are forcing rural families into migrating for work in sugarcane fields where exploitative practices are prevalent. The indices helped quantify not just the direct economic losses due to lost wages but also the non-economic losses, such as the societal and health impacts on women making the life-altering decision to undergo hysterectomies to avoid work absences (Bharadwaj et al., 2024).

Box 9. Maximum value scaling method and range scaling method

Maximum value scaling is a method to normalise data by dividing each value in a dataset by the maximum value in that dataset. This scales all values to a range between 0 and 1. For example, if the highest value in your data is 100, and you have a value of 50, the normalised value would be 50/100 = 0.5. This helps to compare data on a common scale.

The formula we use is:

Scaled Value= (Vi/Vmax) × 100

where Vi is the score of a specific factor, and *V*max is the highest score recorded for that factor.

Range scaling method: we can alternatively use the range scaling method. In this method, you subtract the lowest observed value (Vmin) from a variable (Vi) and then divide by the range of the dataset (Vmax - Vmin). This scales the data to a range between 0 and 100, making it easier to compare different values.

This method is reflected in the formula:

Scaled Value $=(V_i - Vmin / Vmax - Vmin) \times 100$

where Vmin is the lowest score in the dataset for that factor.

This method is particularly useful when new data points are added over time, as it allows the index to stay consistent and still provide meaningful comparisons year after year.

For example, let's say you have a dataset representing the number of employment days lost by different households in a year: [5, 10, 20, 30, 40].

- Vmin = 5
- Vmax = 40

To scale a value, say 20 days lost, use the range scaling method:

1. Subtract the minimum value: 20 - 5 = 15

2. Divide by the range: 15 / (40 - 5) = 15 / 35 = 0.4286

3. Multiply by 100: 0.4286 × 100 = 42.86

So, the scaled value of 20 days lost would be 42.86.

This way, you can compare the number of employment days lost by different households on a consistent scale, regardless of the actual number of days lost

Robust sampling approach for capturing data for constructing indices

When capturing data for constructing a composite and sub-indices, there is a need to ensure that the distinct impacts felt by different vulnerable groups are adequately captured (see for example Box 10). By doing so, the composite indices can more accurately depict the specific challenges faced by each subgroup. The following approach for robust sampling can be followed:

- Begin with stratified sampling[8] to ensure each segment of the population is represented, especially the most vulnerable people, who might be marginalised in standard surveys.
- Within each stratum, use systematic random sampling to give every household an equal chance of selection, preventing selection bias.
- After collecting initial responses, categorise households into groups based on their experience of L&D (for example, well-off versus poorer households, migrating versus non-migrating households).
- Collect data using both quantitative (surveys) and qualitative (interviews, focus groups) methods to capture a broad spectrum of impact.
- Conduct focus groups and interviews across various demographic segments of the community to ensure that different perspectives on L&D are heard and documented.
- Regularly review the sampling strategy and adjust based on preliminary findings to ensure that emerging vulnerable groups are included.

Box 10. Example sampling approach: researching climate impacts in the Beed district of Maharashtra, India

In the Beed study, the team executed a sampling approach to assess the impacts of climate change on rural families, particularly in the context of migration to work in sugarcane fields.

- The site for detailed assessment was chosen through purposive sampling, targeting areas severely affected by climate change.
- Households were then systematically selected, giving equal inclusion chances across the population, ensuring that the full range of experiences, from severe loss to no impact, was documented.
- Post-stratification allowed researchers to analyse data from those who were forced to undertake distress migration (Group I) against those who did not migrate (Group II), providing a nuanced view of how climate events affected different groups and what factors made one segment less vulnerable than others.
- Researchers carried out household surveys with a representative sample from both groups. The study also integrated focus group discussions that included a mix of people from varying ages, genders, and occupations to gather insights into the community challenges due to climate change. Key informant interviews were conducted with journalists, human rights activists, doctors and local leaders to gather diverse perspectives on socioeconomic dynamics and the overarching effects of climate impacts.

This sampling approach ensured that the research captured a comprehensive view of economic and non-economic L&D, as well as the factors influencing migration decisions among the most affected groups. By systematically categorising and sampling households, and supplementing quantitative data with rich qualitative insights, the Beed study offered a detailed and inclusive analysis of the local climate change impacts.

8 A stratified sample divides a population into subgroups (strata) based on a characteristic (for example, migrants and non-migrants). Random samples are then taken from each stratum to ensure representation.

Understanding how to construct composite Index and sub-indices for different domains of loss and damage impacts

In this section, we demonstrate the practical application of our methodology for constructing and measuring indices across the tangibility spectrum and the intrinsic-functionality spectrums, using the case study of Beed. Having previously outlined the theoretical framework, we now focus on demonstrating how the concept of creating a composite index and sub-indices can be implemented in a real-world setting to capture and quantify the wide-ranging impacts of climate change on a community. This practical example will provide users with a detailed understanding of the steps taken to measure both tangible and intangible losses, offering a clear illustration of the process from data collection to the normalisation[9] and scaling of indices.

Tangible-functional loss and damage index

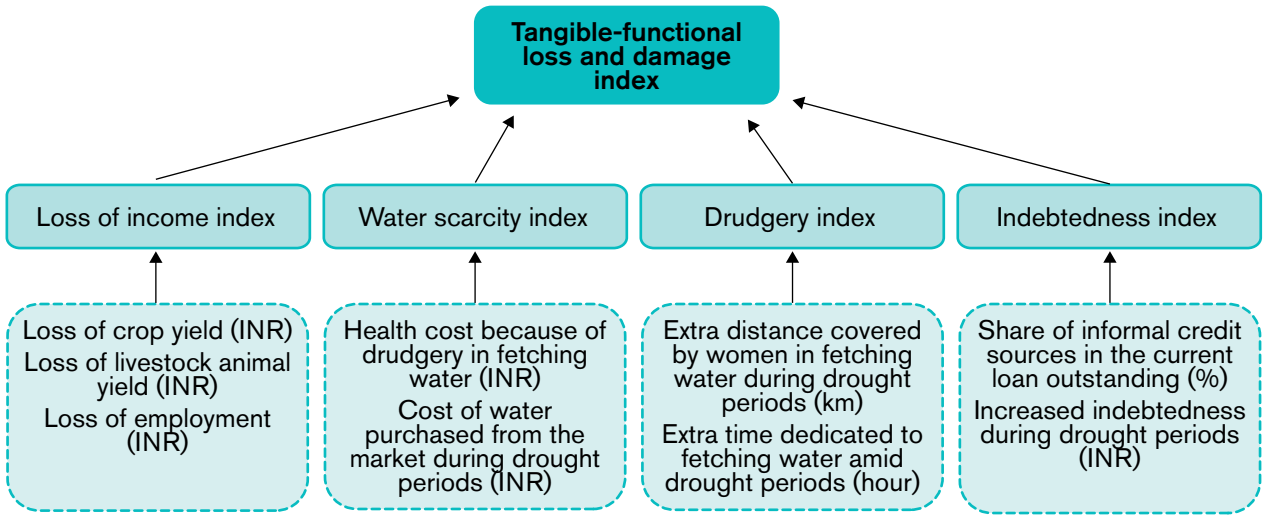
In Beed district, the effects of climate change manifest in very tangible ways. When weather patterns shifted and rainfall became unreliable, crops failed to grow properly, causing farmers to lose their main source of income. Livestock, essential for their livelihoods, could not survive the harsh conditions. These visible impacts — such as loss of income, increased indebtedness due to prolonged droughts, and the task of fetching scarce water from longer distance — are easily observed and quantified. However, these tangible effects also lead to deeper, less visible consequences. The economic strain and physical labour contribute to severe loss and damage, including loss of organs and various health issues. These functional impacts highlight the profound and multifaceted toll that climate change takes on the community.

The tangible-functional loss and damage index is a metric designed to provide a comprehensive picture of how these different dimensions interact and affect the community. This composite index is constructed by combining several sub-indices, each representing a different aspect of L&D experienced by individuals and households. The sub-indices include:

- Loss of income index
- Water scarcity index
- Drudgery index, and
- Indebtedness index.

Figure 30 shows the individual variables leading to sub-indices and the overall index. Together, the sub-indices form the tangible-functional loss and damage index.

Figure 30. Formulation of the tangible-functional loss and damage index



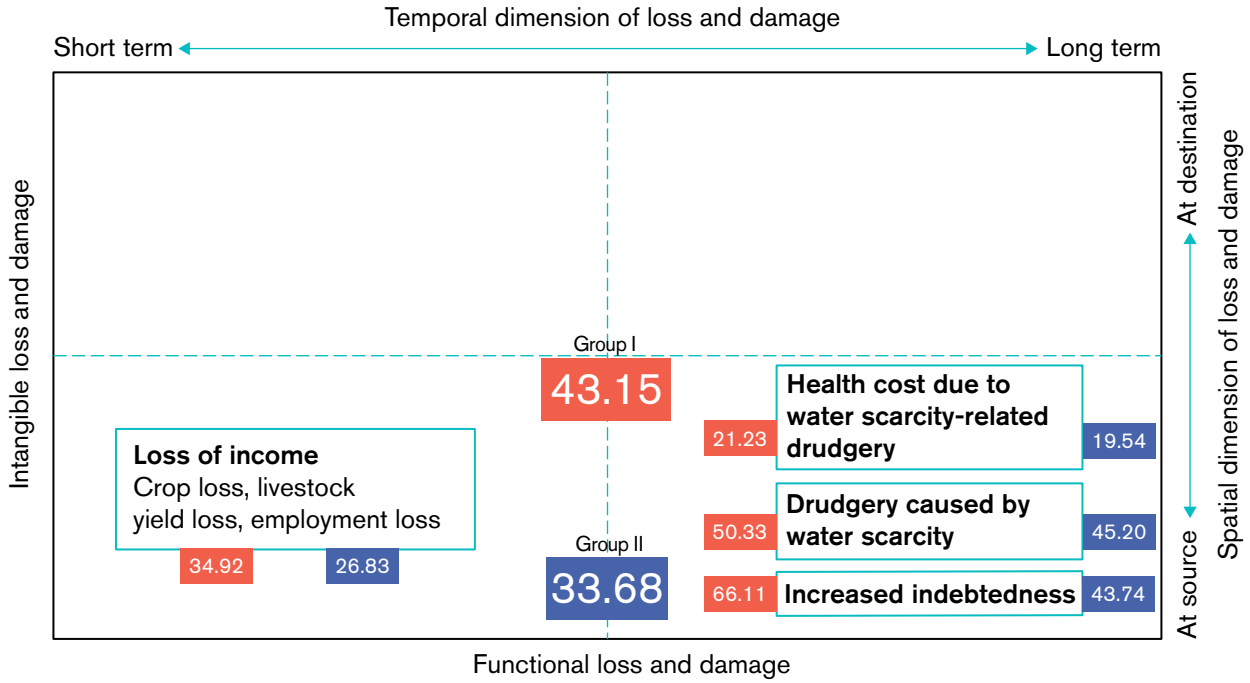
INR: Indian rupees

9 Normalisation is a process of adjusting values from different datasets to a common scale, typically 0 to 1 or 0 to 100, allowing for easier comparison and analysis. It involves rescaling data to eliminate units of measurement, ensuring consistency across diverse datasets.

What does the tangible-functional loss and damage index reveal?

Figure 31 presents a tangible-functional loss and damage index that captures the multifaceted impacts on households from Group I and Group II in the context of droughts in Beed.

Figure 31. Tangible-functional loss and damage index for Group I (forced to migrate) and Group II (did not migrate)



An assessment of the index reveals the following:

- **Loss of income index:** this reflects direct financial impacts due to crop loss, livestock yield loss and employment loss. Group I, characterised by lower economic assets, appears to suffer more significant income loss, indicated by the higher percentage (43.15%) compared to Group II (33.68%). This suggests that the lack of diversified income sources and reliance on agriculture make Group I more vulnerable to climate-induced economic fluctuations.
- **Water scarcity index:** this captures the additional financial burden due to the increased cost of obtaining water. The higher figure for Group I (21.23%) compared to Group II (19.54%) underscores the disproportionate impact of water scarcity on economically disadvantaged groups, who may already be struggling to meet their daily needs.
- **Drudgery index:** this measures the physical and time burden of fetching water, which is more arduous during drought periods. Group I experiences a significant increase in drudgery (50.33%) relative to Group II (45.20%), reflecting the additional strain on households with fewer resources to mitigate the effects of water scarcity, such as the ability to purchase water or invest in infrastructure.
- **Indebtedness index:** this indicates the level of debt incurred by households as they cope with the financial strains of drought. Again, Group I shows a higher percentage (66.11%) compared to Group II (43.74%), suggesting that households with lower economic assets are more likely to fall into debt during drought conditions as they struggle to cover basic expenses and potentially face exploitative lending practices.

By integrating diverse yet related dimensions, this index provides an understanding of the range of tangible and functional challenges faced by the community. It not only captures the immediate financial costs but also the broader socioeconomic strain that can persist in the long term. The approach ensures that the various facets of tangible and functional losses — from economic impacts to the burden of additional labour — are combined into a single, coherent framework.

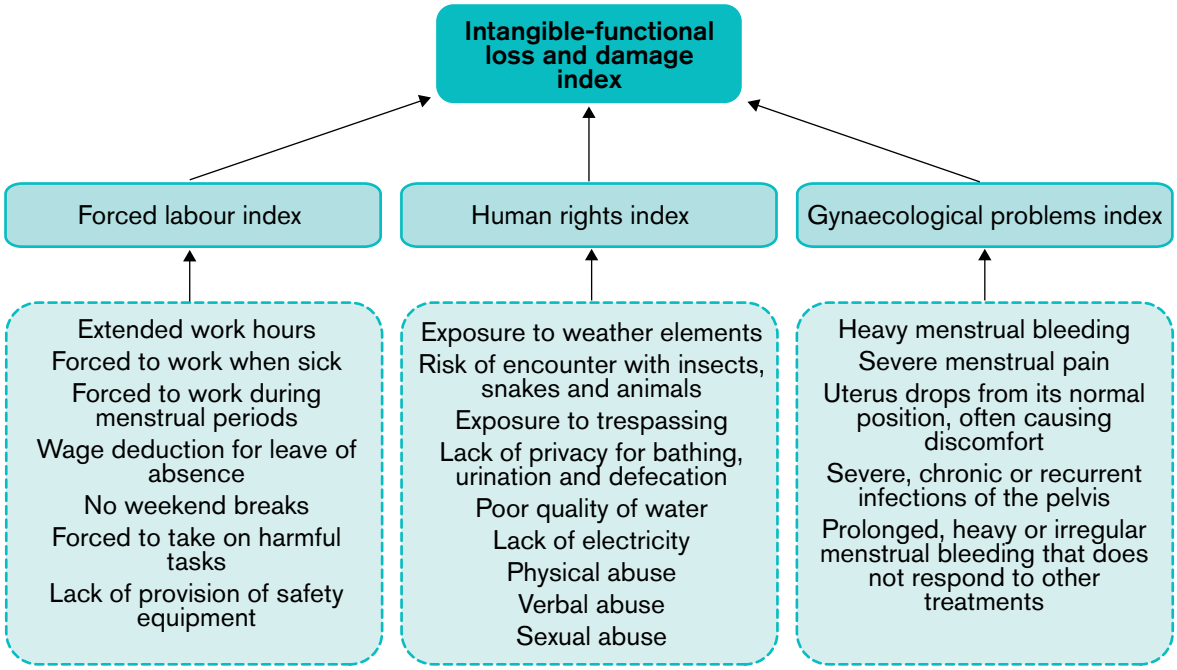
The intangible-functional loss and damage index

In the case of Beed, where the women migrant labourers live and work in exploitative conditions, they are exposed to functional issues such as forced labour, human rights violations and gynaecological problems. The intangible-functional loss and damage index provides a comprehensive view of the non-physical and operational impacts of climate change and environmental stress on vulnerable populations. This index is crucial for understanding the broader consequences that extend beyond direct economic losses. To construct this index, we considered the:

- Forced labour index
- Human rights index, and
- Gynecological problems index.

Figure 32 shows individual variables comprising the sub-indices and the overall index.

Figure 32. Formulation of intangible-functional loss and damage index



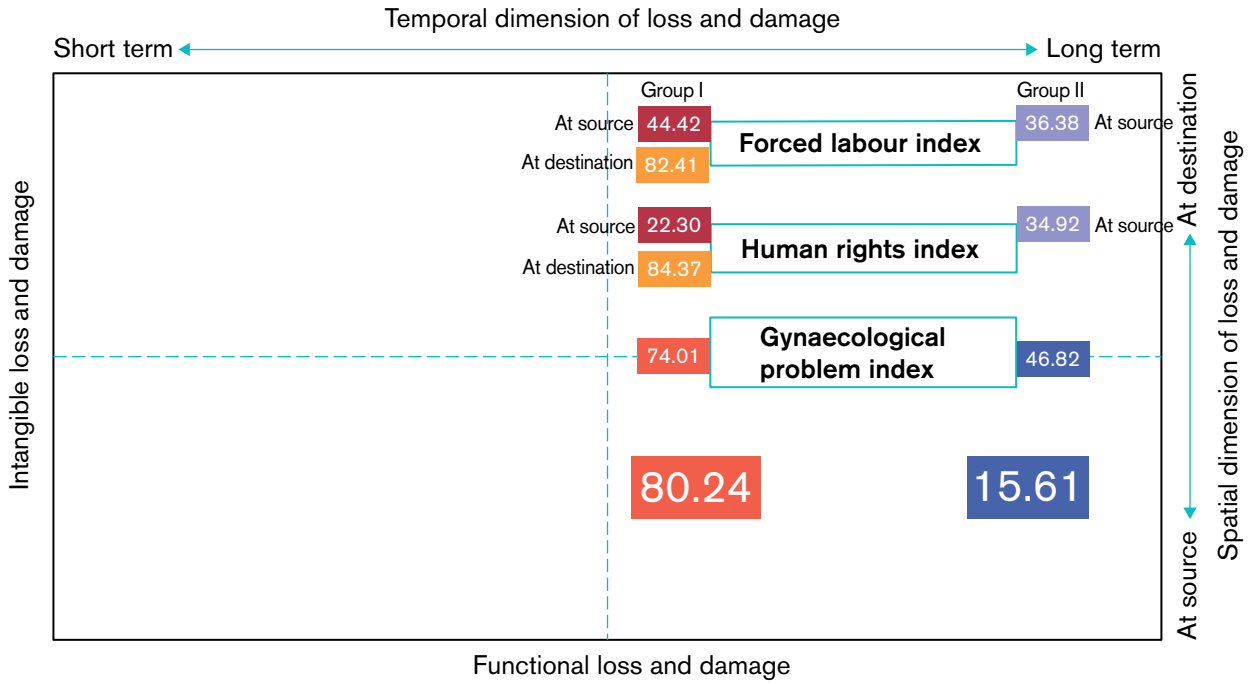
What does the intangible-functional loss and damage index reveal?

The intangible-functional loss and damage index (Figure 33) provides composite measure derived from the sub-indices.

The overall analysis of the intangible-functional loss and damage index shows that Group I, primarily consisting of migrating households with lower economic assets, demonstrates higher values across all sub-indices at their destination.

- This group's **forced labour index** is particularly alarming at the destination (82.41%), indicating severe labour rights violations and exploitative work conditions away from home
- Their **human rights index** is also extremely high at the destination (84.37%), pointing to the dire circumstances under which they live and work, without adequate shelter, privacy or security
- The **gynaecological problems index** score for Group I is significantly higher (74.01%) than Group II, showcasing the profound health issues faced by women in these communities, which are exacerbated by their working and living conditions.

Figure 33. Intangible-functional loss and damage index for Group I (forced to migrate) and Group II (did not migrate)



Together, these indices highlight the multifaceted nature of intangible and functional losses that communities face. They underscore the importance of considering both immediate and long-term support mechanisms for vulnerable populations, particularly for ensuring access to healthcare, improving living conditions and protecting individuals from exploitative work conditions. Addressing these issues is critical to fostering sustainable communities that can withstand and recover from the challenges posed by climate change and environmental degradation.

The tangible-intrinsic loss and damage index

In the case of Beed, the health effects of a hysterectomy or the loss of organs were considered intrinsic values by the community. These tangible changes have a cascading effect that goes deeper, affecting the lives of the people in ways that are not as easy to measure. For example, women have hysterectomies to avoid having a menstrual cycle during their work in sugarcane fields, and this can result in long-term health impacts. These losses are tangible and intrinsic as they directly affect the individual's body and can have lifelong consequences on their health and wellbeing. They can face health issues such as gynaecological problems due to the stress and strain of their work and environment. And the psychological pressure of dealing with these challenges can lead to mental health problems.

The tangible-intrinsic loss and damage index is an important metric that quantifies the concrete and profound impacts of health-related adversities and their associated costs. This composite index is comprised of two critical sub-indices:

- Loss of organs index, and
- Medical expense due to organ loss index.

Figure 34. Formulation of the tangible-intrinsic loss and damage index

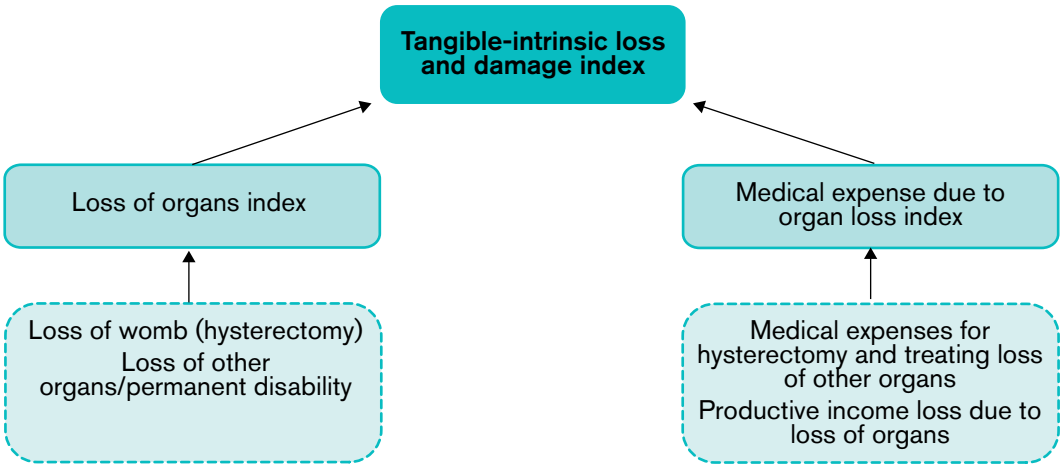
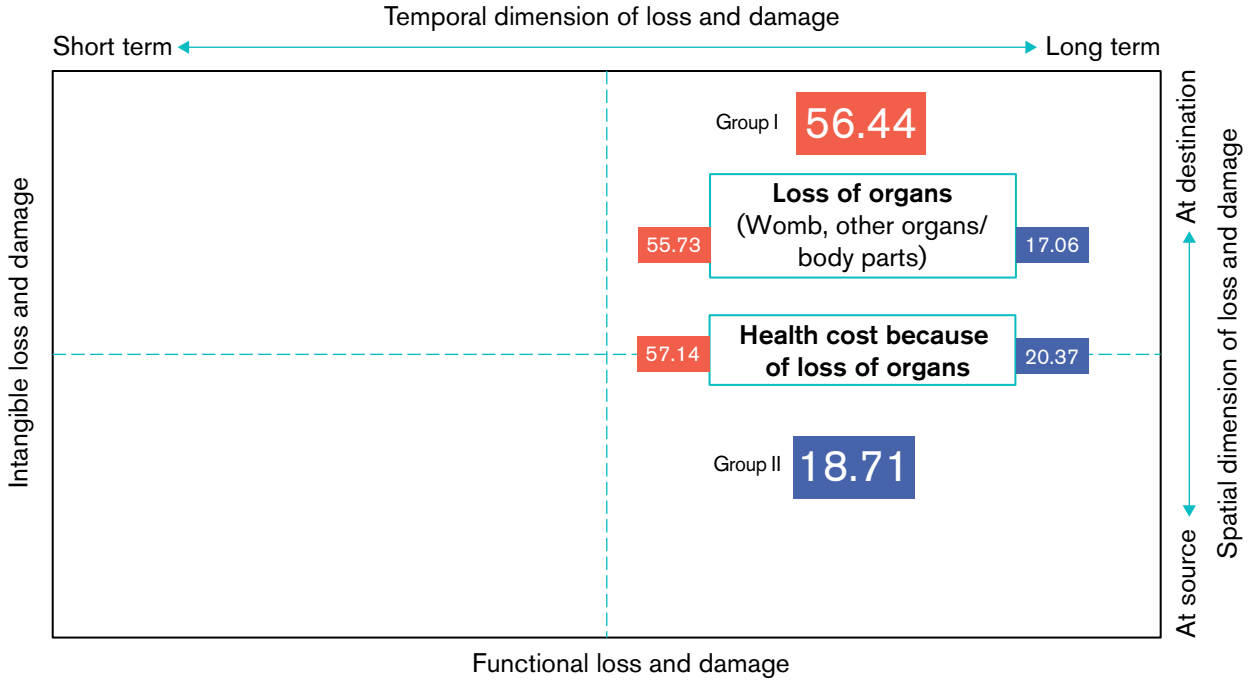


Figure 34 shows the relationship between these indices. It shows how specific, quantifiable losses and expenses are integrated into a broader measure that reflects the multifaceted nature of tangible and intrinsic impacts on people's lives.

What does the tangible-intrinsic loss and damage index reveal?

The tangible-intrinsic loss and damage index shown in Figure 35 summarises the substantial and often overlooked non-economic losses that disproportionately affect households with fewer economic assets. The index is a composite measure, integrating sub-indices such as the loss of organs index and the medical expenses due to loss of organs index, which tracks the financial burden of medical treatment associated with such losses.

Figure 35. Tangible-intrinsic loss and damage index for Group I (forced to migrate) and Group II (did not migrate)



The overall analysis of the tangible-intrinsic loss and damage index shows higher index values for Group I, with 56.44% for the loss of organs and 57.14% for health costs due to loss of organs, against 17.06% and 20.37% for Group II, respectively. The significant index value for Group I suggests that these households endure more severe health consequences and financial strain due to organ loss, which can be attributed to their socioeconomic

conditions, being mainly Indigenous tribal and scheduled caste populations with small landholdings, inadequate infrastructure and lower levels of education and skills.

The implications of these findings are profound. Group I not only faces immediate health risks and out-of-pocket expenses but also the long-term financial implications of lost income and the potential for intergenerational poverty. The loss of an organ can often result in the inability to continue labour-intensive jobs, leading to unemployment or underemployment, and the associated medical costs can deplete any savings, thrusting families into a cycle of debt and poverty.

In contrast, Group II, while not immune to these issues, shows lower index values, indicating that while they are affected by organ loss and its associated costs, the impact is less severe. This is reflective of their relatively stable economic situation and better access to healthcare and financial resources.

In essence, the tangible-intrinsic loss and damage index captures both the immediate physical and financial toll of such health setbacks as well as the long-term, often irreversible, damage to a person's fundamental capacity to lead a productive and fulfilling life. This index is especially relevant in contexts where healthcare is inaccessible or unaffordable and where the loss of bodily function significantly hampers one's livelihood and quality of life.

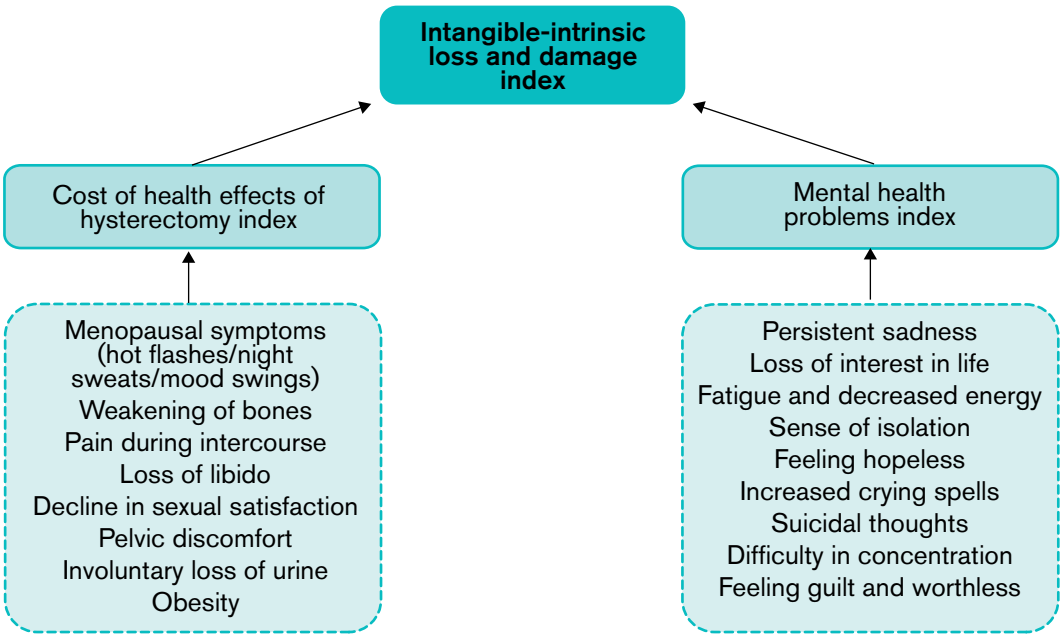
The intangible-intrinsic loss and damage index

In the case of Beed, women migrant labourers undergoing hysterectomies face aftereffects of major surgery and subsequent physical and mental health issues, which pushes them deeper into deprivation. The damages are intangible, yet intrinsic, due to their long-term effects on the women's quality of life. The intangible-intrinsic L&D index provides a measure of the non-physical, psychological impacts of health conditions and life circumstances that are not often captured by traditional economic assessments.

This composite is made up of two sub-indices (Figure 36):

- Cost of health effects of hysterectomy index, and
- Mental health problems index.

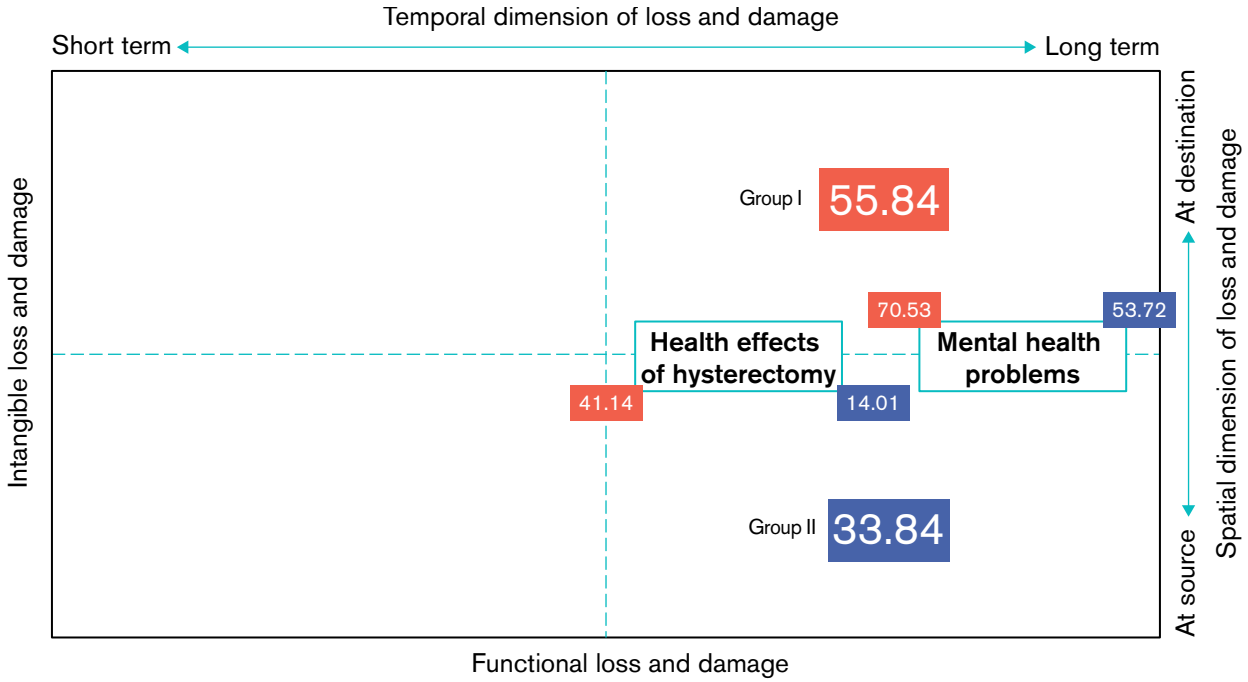
Figure 36. Formulation of the intangible-intrinsic loss and damage index



What does the intangible-intrinsic loss and damage index reveal?

The intangible-intrinsic loss and damage index (Figure 37), offers a comprehensive view of the non-economic challenges faced by two groups.

Figure 37. Intangible-intrinsic loss and damage index for Group I (forced to migrate) and Group II (did not migrate)



The analysis of the cost of health effects of hysterectomy index shows a significantly higher score for Group I (41.14%) than for Group II (14.01%). This suggests that the women in Group I are experiencing more severe health issues post-hysterectomy. The implications of this are profound, not only affecting their physical health but also their ability to work and support their families, thus exacerbating their economic vulnerability.

Furthermore, the mental health problem index presents an even more striking contrast, with Group I scoring 70.53%, compared to Group II's 53.72%. This denotes a substantial burden of mental health issues within Group I. Persistent sadness, loss of interest in life, fatigue and a sense of isolation are all significantly higher in Group I, indicative of the psychological toll that their environmental and social conditions take.

Together, these sub-indices create a comprehensive framework that illustrates the broader impact of health interventions and the cascading effects they have on an individual's mental and emotional state. This index underscores the critical need to address the full scope of consequences stemming from medical procedures such as a hysterectomy: not only the immediate physical ramifications but also the long-term psychological and emotional impacts. It emphasises the importance of holistic care approaches that include mental health support as an integral component of treatment and recovery plans, especially for those who may have limited access to such resources due to economic constraints or social circumstances.

Semi-quantitative and qualitative approaches

The C-CIQ toolkit incorporates both semi-quantitative and qualitative approaches to collecting data and information needed for economic valuation, MCDM and constructing a composite risk index.

The toolkit's semi-quantitative approach is designed to bridge the gap between purely numerical data and the interpretation of qualitative analysis. It involves the use of indicators that quantify aspects of climate risks along with predisposing, precipitating and protective factors (the 3Ps). These methods typically involve:

- Using predefined indicators that quantify aspects of climate risks, such as the frequency of extreme weather events or the economic costs of natural disasters. These indicators are often derived from a mix of raw data and expert judgement.
- Community stakeholders or experts assign scores or rankings to different risk factors or potential interventions. This process quantifies perceptions and priorities, providing a structured way to measure complex attributes that are difficult to capture with direct measurements.

Qualitative methods in the toolkit are employed to deepen the understanding of the contexts and subjective experiences associated with climate risks. These approaches include:

- **Focus group discussions:** these are used to gather detailed narratives and personal accounts that reveal how communities perceive and react to climate impacts
- **Key informant interviews:** engaging with local leaders, activists and experts helps gather expert insights and contextual intelligence that might not be captured through broad surveys
- **Shared learning dialogues:** these dialogues facilitate a deeper engagement with stakeholders, fostering a shared understanding and enabling stakeholders to contribute actively to problem-solving
- **Participatory rural appraisal:** tchniques such as community mapping, seasonal calendars and trend analysis involve the community directly in identifying and analysing climate risks. This methodology helps uncover local knowledge and practices related to climate adaptation and resilience.

By integrating semi-quantitative and qualitative approaches, the C-CIQ toolkit ensures a comprehensive data-collection framework that supports all stages of climate risk assessment, from initial identification of vulnerabilities to the development of resilience strategies. The combination of these approaches allows the toolkit to validate and triangulate data across different sources and methods, enhancing the reliability and accuracy of the assessments. It also helps in incorporating community perspectives directly into the decision-making process, ensuring that the solutions developed are not only based on empirical data but are also culturally appropriate and contextually relevant. The integration of semi-quantitative and qualitative approaches thus enhances the robustness and relevance of climate risk assessments, ensuring that they are not only statistically valid but also socially and culturally resonant.

STEP 5

Co-developing solutions pathways for resilience

The index-based valuation approach provides a way to capture the multidimensionality of climate impacts, providing a robust basis for action. The C-CIQ toolkit will enable the users to build on this analysis for co-developing practical approaches to address L&D and strengthen existing adaptation strategies that can help communities manage climate risks comprehensively.

Once different forms of economic and non-economic L&D and those most vulnerable to those impacts have been identified, the C-CIQ toolkit can be used to understand how vulnerable communities can be supported to prepare, cope and recover from them. C-CIQ allows this information to be taken back to the community using a participatory and inclusive community engagement approach for co-developing context-specific solutions.

The information collected by using the toolkit will help users bridge the knowledge and practice gap by exploring various strategies, systems, delivery mechanisms and financing options that can offer comprehensive support and improve preparedness. This phase of the toolkit's use involves refining existing policies and developing new initiatives that build resilience capacities, categorised into absorptive, adaptive and transformative capacities. Each type of capacity is targeted to ensure that communities are not only prepared to handle current climate risks but are also equipped to face future challenges, thereby facilitating a holistic approach to climate resilience.

How to co-develop resilience strategies with the community

1. Share the outcomes of the valuation with the community and other stakeholders

To initiate the process for co-developing solutions, the users should first share the findings of the climate impact valuation with the community. This is crucial for building upon existing local efforts and reinforcing ongoing initiatives. Steps to share key findings with the community include:

- Outline the range of economic and non-economic L&D identified through the assessment.
- Present the economic values derived from these losses and damages, providing a clear quantification of impacts. This will also include explaining to the community what these economic valuations mean and how they were quantified.
- Share the composite risk indices to reflect the critical aspects of L&D, which households, groups and individuals are most vulnerable, and to what extent.

To facilitate this sharing, participatory rural appraisal techniques such as shared learning dialogues will be needed. These sessions will be designed to present the findings in a straightforward, accessible manner, encouraging critical reflection and active participation from all community members and stakeholders such as local NGOs, community-based organisations and local government. The goal is ensure a transparent flow of knowledge and experience, fostering a deep understanding of the impacts.

The dialogues are important for engaging communities in the planning, designing, implementation and monitoring of resilience-building programmes. They create inclusive spaces where community members and stakeholders can understand the outcomes, contribute their insights and take ownership of the intervention processes. By actively involving local voices in these discussions, we ensure that the strategies developed are deeply rooted in the community's specific needs and priorities, enhancing the effectiveness and sustainability of resilience initiatives.

2. Map the existing resources and identify gaps

To effectively enhance adaptive and transformative capacities within the community, it is crucial to conduct a participatory assessment of the resources currently available and accessible. This assessment helps understand how these resources can be best utilised and identifies any gaps that may exist. The type of resources critical for this assessment include natural, physical, financial, technological and human resources. Each of these plays a role in influencing the vulnerabilities and resilience capacities of a community.

Using participatory rural appraisal techniques such as resource mapping, transect walks and problem tree analysis, a community can gain a comprehensive understanding of the resources it has. This includes evaluating the adequacy, quality and performance of these resources to ensure they are effectively integrated into resilience planning (see Step 1). Using social mapping alongside resource mapping provides a detailed view of resources such as:

- **Common property resources:** this includes land, water resources and community infrastructure such as roads, emergency shelters and public utilities
- **Natural resources:** forests, wetlands, biodiversity, wildlife, landscapes, grasslands, watersheds, river systems, groundwater, coastal and marine resources are all vital natural assets
- **Financial resources:** access to both formal and informal savings, credit, insurance products and services, and DRR funds
- **Human resources:** the community's education and literacy levels, traditional knowledge, skills and expertise are key human resources.

Understanding these resources allows individuals, communities and organisations to enhance their adaptive and absorptive capacities. Identifying gaps in these resources is equally important as it guides the planning of targeted interventions to fill these gaps, thereby strengthening the community's overall resilience to climate impacts. This comprehensive mapping and gap analysis will ensure that all available resources are leveraged and that deficiencies are addressed proactively.

3. Map the existing programmes for adaptation, disaster risk reduction and resilience building

A critical aspect of effective resilience planning involves assessing existing programmes and building upon their foundations. This process will begin with a participatory review of current social protection, adaptation and DRR initiatives to understand their impact on community resilience and vulnerability reduction. The C-CIQ toolkit includes various participatory tools that can be employed to engage with communities, local NGOs, government bodies and other relevant stakeholders in this assessment process. These tools include community risk and vulnerability mapping, resource and livelihoods mapping, matrix ranking, social mapping, perception mapping and institutional mapping (as set out in Step 1). Focus group discussions can also be useful for this analysis, providing diverse viewpoints and fostering a shared understanding of the issues.

Questions that can be co-explored with the community to assess the effectiveness of existing programmes can include:

- What programmes are available to reduce vulnerabilities or enhance adaptive capacities?
- Who has access to these programmes? Are there any conditions for inclusion?
- Are the programmes sufficient to minimise loss and damage?
- Do these programmes meet the specific challenges faced by the community?
- What are the shortcomings of each programme? What changes are necessary?

Aspects that can be explored under these questions are as follows:

- **Timeliness and effectiveness:** Does the support reach those most in need in a timely and effective manner? Is it delivered in a way that allows communities to adequately prepare for and respond to climate impacts?
- **Inclusivity:** Do existing programmes include different vulnerable groups in their eligibility criteria, or are some groups excluded?
- **Delivery mechanisms:** Are there local institutions capable of delivering these programmes effectively to those eligible?
- **Types of support:** What forms of support are provided (for example, cash transfers, food aid, cash for work)? Are these supports appropriate and sufficient to help communities cope during crises?
- **Targeting and benefit incidence:** How well do programmes target the most vulnerable, and to what extent might they inadvertently benefit the non-poor or less vulnerable?
- **Benefit adequacy and support package:** What is the average per capita transfer, and does it adequately cover both economic and non-economic L&D?

By conducting these comprehensive assessments, the user will be able to co-identify the strengths and weaknesses of existing programmes, which can help in developing further strategies to enhance them to better meet community needs. This approach ensures that adaptation and resilience-building efforts are both effective and inclusive, addressing the full spectrum of community needs during climate crises.

4. Developing a solution matrix via participatory processes

After the mapping of existing resources and programmes has been carried out, the C-CIQ framework assists in closing knowledge and practice gaps by helping users co-explore what programmes, strategies, systems, delivery mechanisms and financing approaches can provide a holistic safety net and support better preparedness, minimise impacts and enable robust recovery. This involves co-developing a solutions matrix that includes strategies for improvements in existing policies and programmes or evolving newer ones to guide the development of resilience capacities categorised into absorptive, adaptive and transformative capacities. The scope of the discussion with the community and other stakeholders will therefore need to include the types of programmes that help build these successive capacities in the community, explained as follows:

Absorptive capacity allows communities to manage and withstand the effects of climate shocks by reducing immediate damages and maintaining functionality during crises. Key aspects that can be covered in the solutions matrix are:

- Emergency fund access: establishing and facilitating access to emergency funds that can be quickly mobilised in response to climate events
- Strengthened safety nets: developing and enhancing social safety nets such as food, health and temporary shelter provisions that safeguard the most vulnerable populations during and after disasters
- Community-based early warning systems: implementing localised early warning systems that enhance real-time responsiveness and community preparedness for impending climate events.

Adaptive capacity focuses on adjustments in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change. It encompasses:

- Diversified livelihood strategies: promoting livelihood diversification to reduce dependency on climate-sensitive resources, thus enhancing economic resilience
- Infrastructure resilience upgrades: upgrading infrastructure to withstand climate impacts, such as improving water management systems to deal with droughts and floods
- Educational and training programmes: providing education and training to build knowledge and skills that support adaptive practices and technologies.

Transformative capacity involves creating systemic and long-term changes that fundamentally enhance the capabilities of communities to face climate change. This includes:

- Policy reforms and innovation: advocating for and implementing policy reforms that address underlying risk factors for climate vulnerability, such as land rights issues and environmental regulations
- Institutional and governance strengthening: strengthening institutions and governance systems to support integrated climate risk-management approaches
- Community empowerment programmes: facilitating programmes that empower communities to have a voice in planning and decision-making processes, ensuring that local needs and priorities are addressed.

When discussing these types of resilience-building solutions, the user will need to facilitate discussion on addressing the following key questions:

- What critical interventions are necessary to enhance resilience at the household and community levels?
- What immediate, medium-term and long-term solutions does the community prioritise?
- What are the perceived barriers or risks that could potentially increase their vulnerabilities?

All the information generated will be collated and presented to stakeholders for validation and approval. Table 1 provides a standard template with sample information showing how the information can be organised.

Table 1. Standard solution-matrix template showing sample information

Resilience capacity	Proposed solution	Key actions	Stakeholders involved	Time frame	Resources needed	Expected outcomes
Absorptive Capacity	Emergency fund access	Establish emergency funds, streamline access procedures	Local government, NGOs	Short term	Funding, administrative support	Quick response to climate events, reduced immediate damages
	Strengthened safety nets	Develop and enhance safety nets (food, health, shelter)	Local government, community groups, NGOs	Short term	Food supplies, medical aid, shelter materials	Protection of vulnerable populations during crises
	Community-based early warning systems	Implement early warning systems, conduct training	Local authorities, community leaders	Medium term	Technology, training programmes	Enhanced preparedness and real-time responsiveness
Adaptive Capacity	Diversified livelihood strategies	Promote livelihood diversification programmes	Local businesses, community groups	Medium term	Training, seed funding	Reduced dependency on climate-sensitive resources, improved economic resilience
	Infrastructure resilience upgrades	Upgrade water-management systems, reinforce structures	Local government, engineers	Long term	Construction materials, expertise	Infrastructure capable of withstanding climate impacts
	Educational and training programmes	Provide adaptive practices and technologies training	Educational institutions, NGOs	Long term	Curriculum development, trainers	Increased knowledge and skills for adaptation
Transformative Capacity	Policy reforms and innovation	Advocate for and implement policy reforms	Policymakers, advocacy groups	Long term	Research, policy drafting	Underlying risk factors addressed, improved regulatory framework
	Institutional and governance strengthening	Strengthen institutions and governance systems	Government agencies, NGOs	Long term	Capacity building, institutional support	Integrated climate risk management approaches
	Community empowerment programmes	Facilitate programmes for community participation in planning	Community leaders, NGOs	Long term	Workshops, communication tools	Empowered communities with a voice in decision-making

Once identified, these solutions are ranked and prioritised as:

- Solutions that are needed in the short, medium or long term based on their expected implementation and impact timelines, and
- Solutions needed at different geographical scales, from the micro-level (neighbourhoods and villages/slums), meso level (districts and provinces), to macro level (state or national).

By structuring the decision-making process around a solution matrix, the C-CIQ toolkit ensures that community-driven solutions are not only well organised but also designed according to the specific needs and conditions of the community. This method facilitates a clear, actionable pathway for implementing strategies that effectively enhance resilience and reduce vulnerabilities across various dimensions.

Conclusion

The C-CIQ toolkit is an advanced, comprehensive tool designed specifically to tackle the intricate challenges posed by climate change impacts. It combines various methodologies, including both economic and non-economic L&D assessments, ensuring a thorough understanding of climate impacts. A fundamental aspect of the toolkit is its emphasis on community involvement, which guarantees that the solutions devised are not only practical but also customised to meet the unique needs of those directly impacted by climate change.

Despite the inherent complexity of approaches such as economic valuation, the C-CIQ toolkit has been intentionally simplified for accessibility. This simplification makes the toolkit a useful resource for local organisations, think tanks, researchers and policymakers. We have demystified complex analytical methods to ensure that they are straightforward, easy to comprehend and versatile enough to be applied in diverse geographic and social contexts. This approach empowers a wide range of stakeholders to implement the toolkit effectively and use its insights for local and regional planning.

The toolkit also facilitates the development of both immediate and long-term strategies for enhancing community resilience. By combining localised insights with robust scientific data, the C-CIQ toolkit fosters effective, inclusive and sustainable approaches to climate adaptation and resilience.

Looking forward, the toolkit is poised to evolve further, aiming to offer even more nuanced insights and sophisticated strategies. These enhancements will assist communities around the world to not only manage but thrive in the face of escalating climate challenges. In sum, the C-CIQ toolkit is not just a methodological resource but a crucial catalyst for empowering communities and shaping resilient, informed responses to climate change worldwide.

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Knowledge Products

Toolkit

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Across the world, climate impacts such as extreme heat and floods are destroying lives, livestock and property. Loss and damage (L&D) occurs when the capacities of affected communities and countries are compromised to the extent that they can no longer absorb the effects of climate impacts or adapt to climate risks. Climate-related L&D has consequences beyond the economic; these impacts are often referred to as non-economic loss and damage, such as the loss of cultural heritage. We urgently need to develop new ways to manage L&D risks, and to do this we need to understand and measure the full range of L&D. But current methodologies for understanding and measuring climate-related L&D have significant gaps.

This toolkit offers a comprehensive step-by-step guide to quantifying and valuing economic and non-economic L&D, and co-developing policy and programmatic responses to manage climate risks. We have sought to demystify complex analytical methods and make them straightforward, easy to understand and versatile enough to be applied in diverse geographic and social contexts.

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