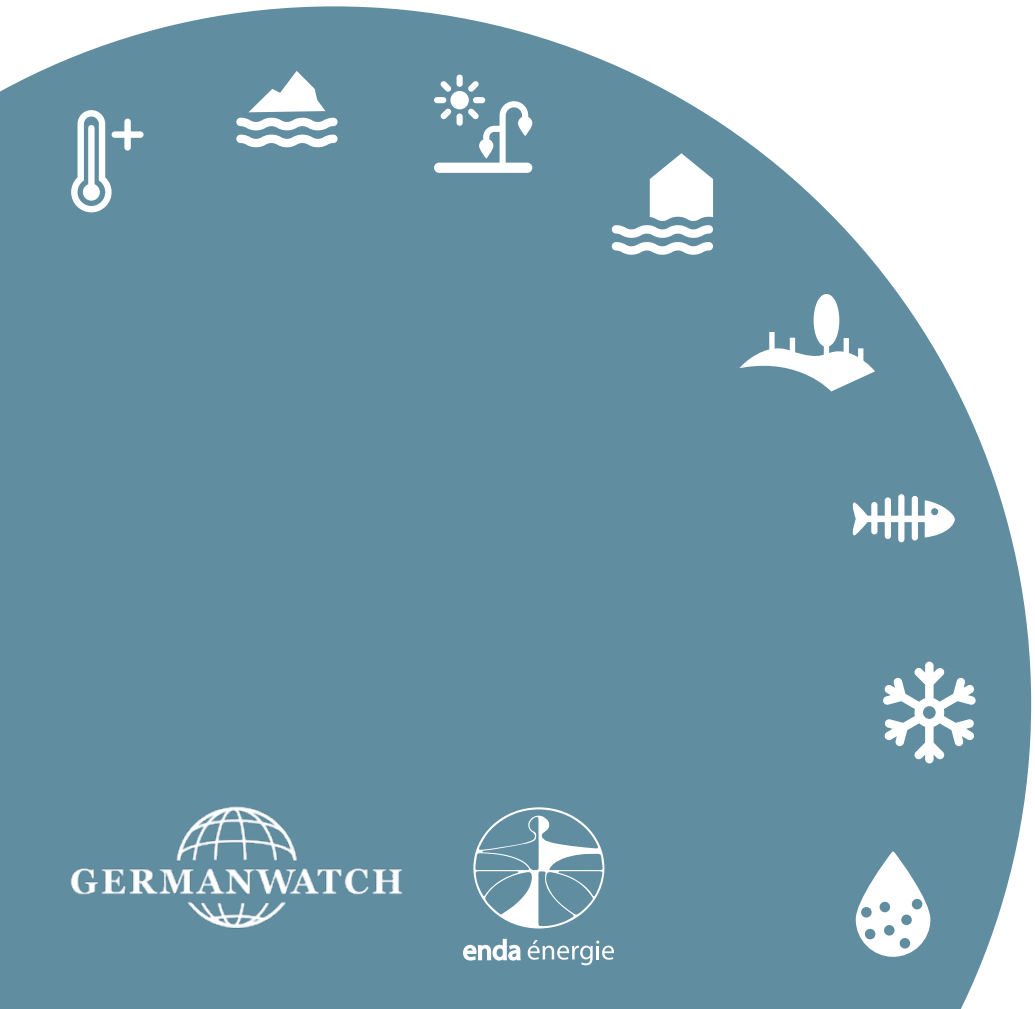
Publication Series

LOSS AND DAMAGE
FROM SLOW-ONSET PROCESSES

Adressing Loss and Damage from Slow-Onset Processes

Key Facts and Figures



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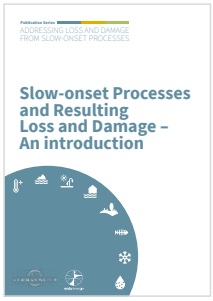
ABBREVIATIONS

CBDR-RC	**Common but differentiated responsibilities and respective capabilities**
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
ExCom	Executive Committee of the Warsaw International Mechanism for Loss and Damage
L&D	Loss and Damage
UNFCCC	United Nations Framework Convention on Climate Change
WIM	Warsaw International Mechanism for Loss and Damage

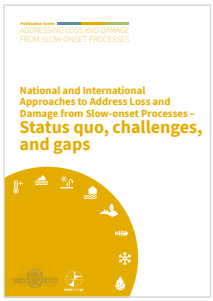
'The era of global warming has ended, the era of global boiling has arrived,' declared UN Secretary General António Guterres in July 2023.[1] And with good reason: 2023 witnessed an extraordinary series of climate-related records being broken around the world (Ripple et al. 2023). Many of these records were the result of slow-onset processes, including atmospheric and ocean temperature records and extreme ice loss in Antarctica. Much like extreme weather events, slow-onset processes substantially impact people's lives, cause loss and damage, obstruct the enjoyment of human rights, and impel human mobility. In contrast to extreme weather events, loss and damage caused by slow-onset processes is still often neglected in the climate change context, both at the national and international levels. This is due to several gaps and challenges in coping with and managing these processes and their outcomes. These include lack of common understanding of terminology related to slow-onset processes, and lack of data and knowledge on these losses and damages (particularly at the local level). They also include lack of clarity regarding adequate measures for dealing with the loss and damage caused by slow-onset processes. The IPCC Special Report on the Ocean and Cryosphere in a Changing Climate therefore concludes that '[m]ore work is needed to explore the range of activities available to respond to loss and damage resulting from slow onset processes [...]' (IPCC 2019a, 630).

Three studies conducted by Germanwatch and ENDA in 2021 have responded to these challenges. Through the analyses, we seeked to foster awareness of the urgency for action in this area and find tangible and feasible solutions to address loss and damage from slow-onset processes. This is with the aim of providing input for policy processes at the national and international levels. This fact sheet summarises key findings of the studies, updated based on recent policy developments and scientific findings. We have included key facts and figures to answer important questions, such as: What are slow-onset processes? What losses and damages do slow-onset processes cause? What approaches and measures are there to address loss and damage due to slow-onset processes? What are financing instruments and sources to adequately address loss and damage due to slow-onset processes?

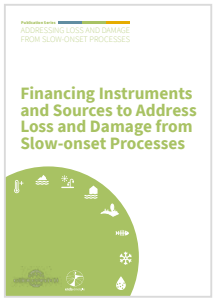
For more details on the facts reported here, we recommend these sources:



Slow-onset Processes and Resulting Loss and Damage – An introduction



National and International Approaches to Address Loss and Damage from Slow-onset Processes



Financing Instruments and Sources to Address Loss and Damage from Slow-onset Processes

Potential for loss and damage finance in the existing UNFCCC financial architecture

1 See https://news.un.org/en/story/2023/07/1139162

SLOW-ONSET PROCESSES AND RESULTING LOSS AND DAMAGE

What is a slow-onset process?

The effects of climate change can be divided into two categories according to the temporal scale over which they occur and the differing speed of manifestation of their impacts: slow-onset processes and rapid-onset events. To date, in the climate context, no officially acknowledged definition of slow-onset processes has been established. We understand slow-onset processes as **‚phenomena caused or intensified by anthropogenic climate change that take place over prolonged periods of time – typically years, decades, or even centuries – without a clear start or end point‘** (see UNFCCC 2012, UNU 2017, UNHRC 2018, IPCC 2012). **Slow-onset processes evolve through gradual transformations - creeping or incremental changes that can generate severe, cumulative and potentially irreversible impacts on ecological and human systems.** Impacts take place at all levels up to the global scale. Slow-onset processes' characteristics can be well understood when compared with rapid onset events, in the climate context typically referred to as extreme weather events. Rapid-onset events are single, discrete events with a clearly identifiable beginning and/or end and that occur or reoccur in a matter of days or even hours at a local, national, or region scale (UNHCR 2018).

Which phenomena fall under the category of slow-onset processes?

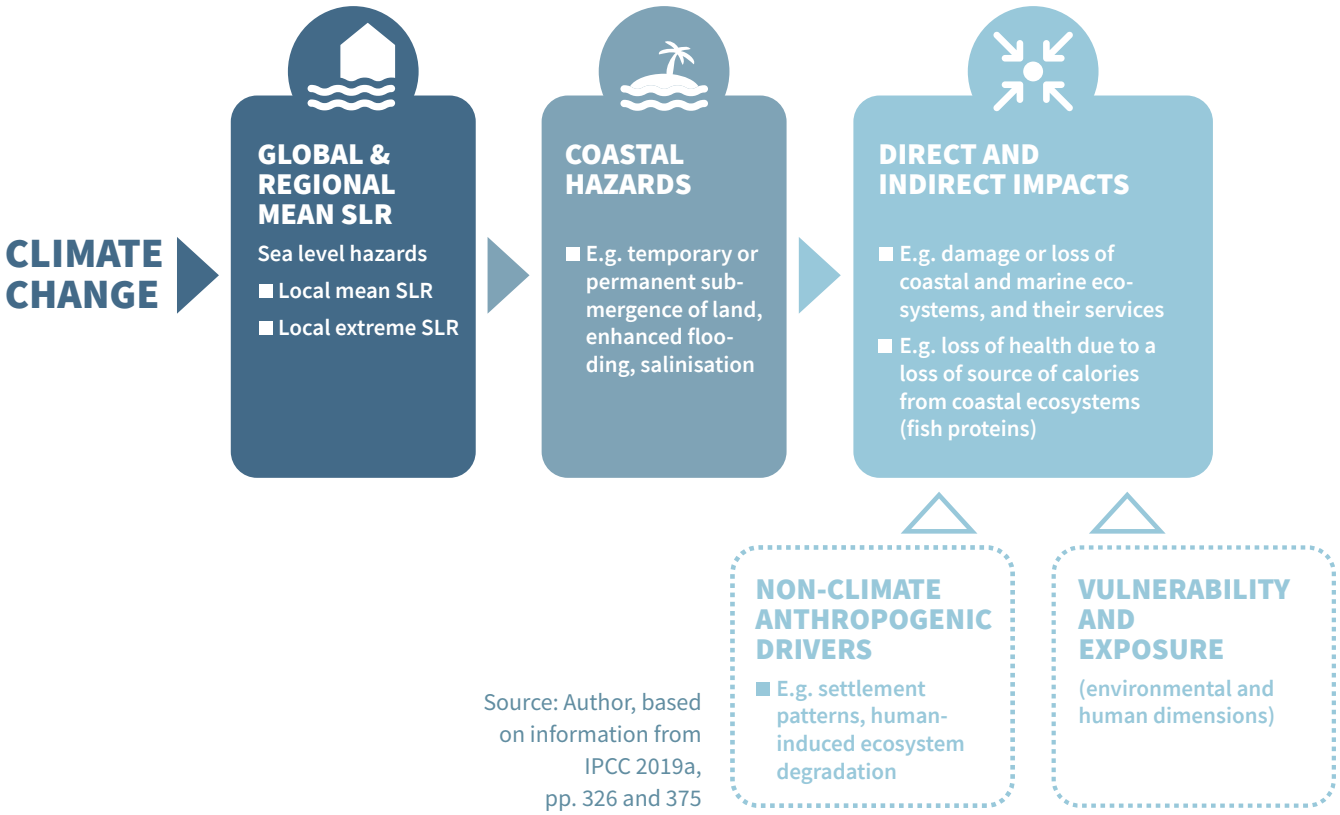
Slow-onset processes include the following phenomena: **increasing mean temperatures, sea level rise, ocean acidification, glacial retreat, permafrost degradation, salinisation, land and forest degradation, and desertification, decreasing precipitation, as well as loss of biodiversity** (see IPCC 2022, UNFCCC 2012, UNU 2017). Droughts are a special case and not included in the list of these processes. Droughts result from a pattern of extreme weather that persists for some time (e.g. a season) and can be classified as an extreme climate event (IPCC 2014).

Key characteristics of slow-onset processes

The following key characteristics help to better understand the nature of slow-onset processes: **Interlinked and mutually enforcing nature of different slow-onset processes:** The progress of one slow-onset process is often highly interlinked with that in others, such as sea level rise and salinity intrusion, leading to loss of soil fertility and a change in delta ecosystems. Slow-onset processes, thus, are highly interconnected and sometimes exacerbate or trigger one another. **Interlinked nature of rapid-onset events and slow-onset processes:** Slow-onset processes can occur coincidently, simultaneously, or sequentially with rapid-onset events. This leads to even more substantial disruption of natural and human systems due to simultaneous manifestation of multiple hazards and impacts. **Cascading nature of slow-onset processes:** Changes in one of an ecological system's components (e.g. sea level) can cause cascading impacts and bring about numerous consequences, such as food insecurity or displacement. It must further be noted that one slow-onset processes impact (e.g. sea level rise) may trigger a multitude of hazardous impacts (e.g. coastal erosion, salinity intrusion, leading to soil fertility loss and delta ecosystem change). **Hybrid nature:** Most slow-onset processes induced impacts cannot be solely attributed to these processes; rather, they are simultaneously influenced by other anthropogenic parameters (Raymond et al. 2020). Slow-onset processes therefore can be shaped by internal characteristics of the different systems and

external confounding factors, such as longstanding stressors (e.g. overexploitation of natural resources) (see **figure 1** below). **Tipping points and permanent shifts:** Slow-onset processes and their impacts span a broad range of natural systems. Failing to manage their associated risks may lead to the ecological thresholds or tipping points of systems being crossed (IPCC 2012). This can result in nonlinear instabilities in a system and domino-like, potentially irreversible damages, because 'once an ecological threshold is crossed, the ecosystem in question is not likely to return to its previous state' (Allen et al. 2009). Two examples of major sea level rise related tipping points are the potentially irreversible retreat of the Greenland Ice Sheet, which could lead to ≤ 7 m of sea level rise, and the West Antarctic Ice Sheet, which could lead to 3 m.

Figure 1: Slow-onset processes' chain of effects for sea level rise (SLR)

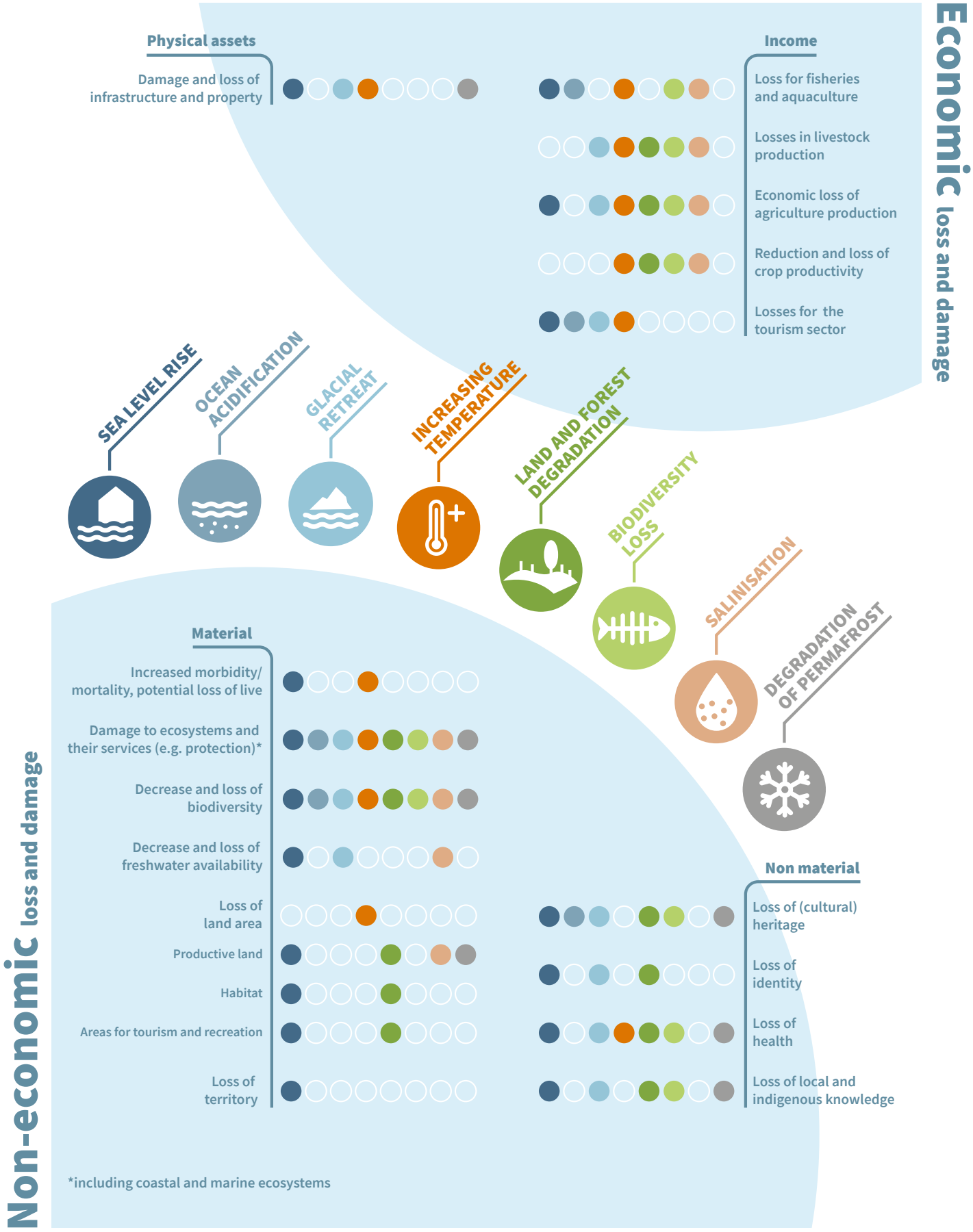


Source: Author, based on information from IPCC 2019a, pp. 326 and 375

What losses and damages do slow-onset processes cause?

Loss and damage/losses and damages is/are understood as ‚adverse impacts of human-induced climate change on human societes and the natural environment that cannot or have not been avoided by mitigation or adaptation, or that will not be avoided in the future' (author's definition based on Mace/Verheyen 2016: 198). A main distinction can be made between **economic loss and damage** (including [a] physical assets and [b] income) and **non-economic loss and damage** (including [a] material and [b] non-material forms). According to the IPCC 6th Assessment Report (2022) "a growing range of economic and non-economic losses has been detected and attributed to climate extremes and slow-onset events under observed increases in global temperatures (…)". All slow-onset processes cause a high number of different losses and damages; according to our analysis, sea level rise and land and forest degradation lead to the greatest number of losses and damages (see **figure 2** on page 6). This includes economic damage to physical assets (e.g.

Figure 2: Overview of loss and damage due to slow-onset processes[2]



Source: Author.

2 The figure is based on an extensive literature review but makes no claim of completeness. See annex here for full list of literature: https://www.germanwatch.org/sites/default/files/FINAL_Slow-onset%20paper%20Teil%201_20.01.pdf.

infrastructure and property) and income (e.g. losses for fisheries and aquaculture, losses in livestock and agriculture production, and losses for tourism). It also includes non-economic loss and damage in its material form (e.g. damage to ecosystems and their services, and loss of land area or territory) and non-material form (e.g. loss of heritage, identity, health, and local and indigenous culture). In the analysis conducted the selected slow-onset processes caused a higher number of non-economic than economic losses and damages. Slow-onset processes are interlinked and mutually reinforcing. They all lead to a damage and/or loss of ecosystems and their services, leading to a decrease and loss of biodiversity.

Slow-onset processes and the losses and damages they cause can be drivers of human mobility (Zickgraf 2021). Migration as an adaptation strategy or way of dealing with loss and damage, however, can lead to further non-economic losses, such as loss of culture and traditions, language, social networks, identity and community cohesion (Campbell/Warrick 2014). Research showed that slow-onset climate changes are more likely to induce increased migration and displacement than rapid-onset changes (Kaczan / Orgill-Meyer 2020). Similar to rapid-onset events, slow-onset processes and resulting losses and damages disproportionally affect vulnerable people and systems (IPCC 2022, Warner/van der Geest 2013, Zorn 2018). This is also partially due to the fact that slow-onset processes, as well as climate-related rapid-onset events, and related hazards perpetuate collective and individual vulnerabilities (UNU 2017). These parts of the population are more vulnerable to a hazard's damaging effects (because, for instance, their livelihood depends on fewer assets and their consumption is closer to subsistence levels) but have lower coping capacity (because, for instance, they cannot rely on savings to buffer the impacts and may need longer to rebuild and recover).

NATIONAL AND INTERNATIONAL APPROACHES TO ADDRESS LOSS AND DAMAGE FROM SLOW-ONSET PROCESSES

STATUS QUO, CHALLENGES, AND GAPS

What approaches and measures are there to address loss and damage due to slow-onset processes?

The differentiation in **averting, minimising, and addressing loss and damage** anchored in the Paris Agreement can be useful with a view to concrete measures for dealing with loss and damage.

- **Averting loss and damage:** Loss and damage is determined by the level of preventive action, both through reducing greenhouse gas emissions (mitigation) and by adaptation and disaster risk reduction measures to reduce vulnerabilities and build resilience. Therefore, the first priority should be to prevent or minimise potential loss and damage through effective mitigation, adaptation, and risk reduction measures.

- **Minimizing and addressing loss and damage:** It is, however, no longer possible to prevent or minimise all loss and damage, and not all climate change impacts can be successfully adapted to, whether because of financial, technical or physical constraints. The other essential element of loss and damage measures therefore includes strategies to address and minimise unavoided or unavoidable loss and damage. Measures need to cover both economic and non-economic losses and damages. **Table 1** below provides an overview of potential measures to address loss and damage due to slow-onset processes. It is based on scientific literature on such measures, as well as views by developing country parties on the type and nature of actions to address loss and damage for which the UNFCCC may need to collect financing (UNFCCC 2018).

Table 1: Measures and actions needed to address loss and damage due to slow-onset processes

Measures and actions needed to address loss and damage due to slow-onset processes	
Setting up financial protection measurese	**Including but not limited to:** ■ Setting up, scaling up, or capacity building for insurance schemes ■ Integrating climate change risks and impacts into or setting up, scaling up, or capacity building for social protection schemes ■ Setting up, scaling up, or capacity building for contingency funds
Recovery and rehabilitation	**Including but not limited to:** ■ Reconstruction and reparation of destroyed infrastructure to restore the supply of and access to basic health, education, and water and sanitation services (including health, education, transport, communication, environment, water supply and sanitation, and public buildings) – with priority on building back better ■ Rebuilding/restoring of livelihoods (assist affected people in recovering their pre-disaster levels of household income, including recovery of production in the agriculture, industry, commerce, and other sectors [e.g. reconstruction of plantations, provision of seeds and other inputs, and restoration of equipment and gear]) ■ Restoration of ecosystems and landscapes (rehabilitation of damaged unique ecosystems, such as mangrove areas) ■ Reconstruction of housing ■ Restoration of cultural assets ■ Capacity building in the context of recovery and rehabilitation **Applicable, for example, for areas not permanently submerged but affected from more frequent high sea level events**

Measures and actions needed to address loss and damage due to slow-onset processes	
Displacement, migration, and alternative livelihoods	**Including but not limited to:** ■ Support measures for planned relocation/resettlement (e.g. if areas can be foreseen as no longer inhabitable or manageable, and safe alternative localities are available), including, for example: a. Monetary costs of relocating infrastructure and people b. Psychological support c. Social support for vulnerable groups d. Language and educational support e. Ensuring housing, property, and land f. Ensuring access to jobs, schools, medical services, and sustainable living g. Establishing legal protection for displaced persons h. Support for preserving culture and language ■ Support measures for climate-induced displaced persons and people affected by forced migration (e.g. those displaced by a slow-onset process, detailed measures similar to the point above) ■ Building up alternative livelihood provisions/developing alternative livelihoods, such as from fishing to agriculture systems ■ Measures to address the root causes of vulnerability, such as through social protection that addresses multi-dimensional inequalities by enhancing capacities, and reduces dependencies and vulnerabilities ■ Capacity building in the context of displacement, migration and alternative livelihoods
Addressing non-economic loss and damage	**Including but not limited to:** ■ Recognition of loss (accompanied/unaccompanied by financial payments) ■ Active remembrance (e.g. through museum exhibitions, school curricula) ■ Counselling (e.g. for people experiencing trauma related to loss and damage) ■ Capacity building to address non-economic loss and damage

Source: Authors. Measures taken from AGN 2018, AOSIS 2018, ExCom 2019, IPCC 2019, LDCs 2018, Ministry of Economy Republic of Fiji 2018, Schinko et al. 2018 UNFCCC 2018, Vanuatu 2018, Wallimann-Helmer et al. 2018 and post-disaster needs assessments (including Government of Malawi 2019, Government of Vanuatu 2016, Government of the Union of Myanmar 2015)

What is the status quo of addressing losses and damages due to slow-onset processes at the national level?

Countriesstill have major gaps in addressing losses and damages due to slow-onset processes. Our analysis[3] showed that decision makers are generally aware of the problems and to try to reduce the risk of loss and damage, countries integrate some slow-onset processes as part of their adaptation and risk reduction strategies and plans and even nationally determined contributions (NDCs). Despite this, although some slow-onset processes, such as sea level rise, are included in climate change and disaster risk management plans, the plans are often not effectively implemented at the local level. Moreover, a common challenge interviewees from different countries report is the lack of (sufficient) local data on different slow-onset processes and their local level impacts. Although general slow-onset processes are known in their countries, there is often only limited knowledge on the local-level impacts of, for example, sea level rise on different parts of the country. Slow-onset processes have, thus far, not been adequately monitored over the long term in most countries so as to determine the baseline risk associated with slow-onset hazards and to track rates of change (UNFCCC 2012). Although some curative and transformative measures could be identified in Senegal, a systematic approach to adequately address loss and damage owing to slow-onset processes could not be identified. For Senegal, the lack of adequate financial tools and instruments and the weakness of domestic financing remain key challenges in financing the fight against slow-onset climate hazards' impacts. Although there are some funds that could partially cover loss and damage due to slow-onset processes, many are not yet operational. There are also no formal mechanisms for managing forced or planned retreat due to sea level rise. This lack results in households at the frontline of climate change paying for an important part of the funding for the fight against the impacts of slow-onset processes, such as coastal erosion, salinisation of land and water resources, loss of biodiversity, desertification, and declining yields due to rising mean temperatures.

What is the status quo of addressing losses and damages due to slow-onsets under the UNFCCC?

- **Key agreements:** Slow-onset processes have a long history of being discussed under the United Nations Framework Convention on Climate Change (UNFCCC) and are included in a large number of decisions. In 1991, the Alliance of Small Island States (AOSIS) proposed an international insurance pool, consisting of a collective loss-sharing scheme to compensate victims of sea level rise. This led to inclusion of references to slow-onset processes in preambular paragraph 12 of the UNFCCC. Slow-onset processes are also mentioned in the Paris Agreement. Article 8 recognised the importance to averting, minimising, and addressing loss and damage associated with, among other things, slow-onset events[4], for sustainable development. The agreement also called for enhanced cooperation and facilitation to increase understanding, action, and support in the areas of, among others, slow-onset events (Art. 8 [4c]).

- **Warsaw International Mechanism (WIM) and its Executive Committee (ExCom):** Regarding concrete technical work, the WIM ExCom is the main body under the UNFCCC that deals with slow-onset process-related issues. It guides implementation of the mechanism's functions, which are, according to 3/CP. 18 (FCCC/CP/2012/8/Add. 1): a) Enhancing knowledge and understanding b) Strengthening dialogue, coordination, coherence, and synergies among relevant stakeholders c) Enhancing action and support, including finance, technology, and capacity building, to address loss and damage. The

3 Based on literature review, a country case study of Senegal, and interviews in Malawi, Madagascar, Laos, the Philippines, and Sri Lanka (see interviews).

4 Note that UNFCCC uses the term slow-onset events which we find not appropriate to describe slow-onset processes (see publication part 1).

topic of slow-onset processes has been included in the ExCom's work since its establishment and first workplan. An analysis of the ExCom list of activities however clearly showed that the focus in addressing loss and damage from slow-onset processes lied, and lies, in enhancing knowledge and understanding, and in strengthening dialogue (Schäfer et al. 2021a). The third function of the WIM, enhancing action and support, falls short; thus far, only three activities that fulfil this function have been implemented or planned. This finding is also reflected in the 2019 WIM Review that analysed the progress of the ExCom's Workplan. In the breakout group discussion on the question of 'Which ExCom Workplan Activities haven't worked well' slow-onset events are mentioned explicitly (UNFCCC 2019a). This includes the notion that, 'There has been no particularly impactful activity on the slow-onset event activities, the database has been the biggest one' (UNFCCC 2019a). The 2019 review in Article 24 consequently stresses 'the importance of enhancing the work on slow onset events and non-economic losses associated with climate change impacts' (UNFCCC 2019 b). In October 2020, the ExCom expert group on slow onset events was finally launched. The group provides an opportunity to fill these gaps and also to develop activities that help to better fulfil the WIM's 'action and support' function regarding slow-onset processes. Its first rolling plan of action focusses on glacial retreat, sea level rise and desertification and aims to identify (1) examples of projected compound risks and impacts associated with the selected slow onset events and (2) steps that governments can take to respond to these risks in a timely manner (UNFCCC 2021). It also wants to prepare technical advise for countries which would be a good first step to close the gap on enhancing action and support around the issue.

- **The Loss and Damage Fund:** COP 27 established "new funding arrangements and a fund for assisting developing countries that are particularly vulnerable to the adverse effects of climate change with a focus on addressing loss and damage" (UNFCCC 2022). The decision to establish a dedicated Loss and Damage Fund (L&D fund) at COP27 was a historic milestone after years of many developed countries blocking negotiations on loss and damage finance. COP 28 now needs to operationalize and capitalize the fund so that it can support affected countries and people as quickly as possible. A transitional committee is tasked to prepare recommendations on key aspects for the fund's operationalization to COP and CMA. The L&D fund was also discussed at the Glasgow Dialogue 2023. During these discussions, slow-onset processes were highlighted as one priority gap the fund should provide finance for. Important points on slow-onset processes highlighted in the dicussion were (UNFCCC 2023):

  - The longer-term nature of support needs in relation to slow-onset processes was highlighted: The fund needs to commit funds over the long-term horizon (30–40 years).
  - Funding for loss and damage due to slow-onset processes should be grant-based and predictable over time. It should not lead to further indebtedness of countries.
  - The L&D fund should provide funding for long-term loss and damage planning and policy framework. Transformative approaches, such as permanent relocation or just transition to alternative livelihoods should be supported.
  - Programmatic approaches are of particular importance in the context of slow-onset processes loss and damage. Many slow-onset processes tend to have transboundary implications and regional programmatic approaches should be considered.

What are key gaps and challenges in addressing losses and damages from slow-onset processes?

A number of different gaps and challenges in adequately addressing losses and damages due to slow-onset processes at the national and international levels exist. These include:

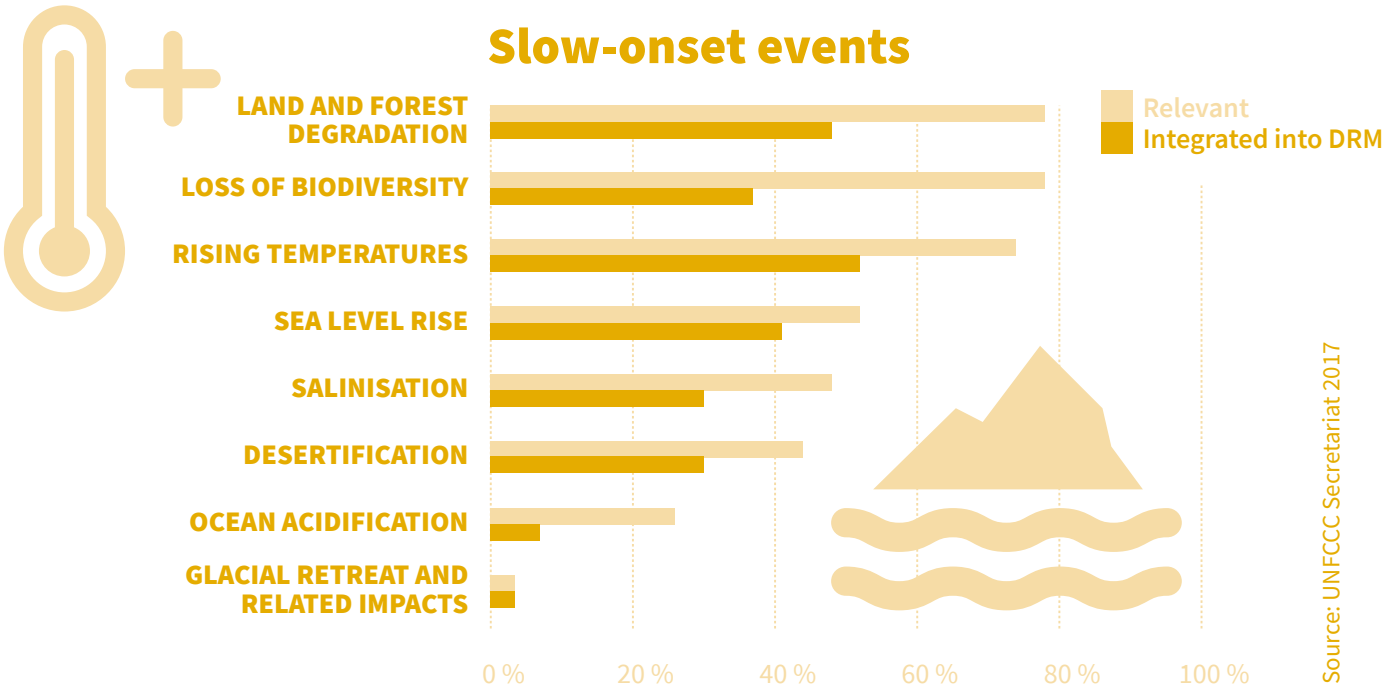
- **Decision making under uncertainty:** All decisions on such processes having to be made under considerable uncertainty. For sea level rise, uncertainty exists regarding the amount, the costs and prioritisation of adaptation action, and the implications of taking no action (Thorarinsdottir et al. 2017).

- **Lack of institutional frameworks, responsibility, and fragmented responses:** Risks and disasters compete for media and political attention and resources. Slow-onset processes often fail to secure the type of public and political engagement frequently given to highly destructive and sudden disasters. The above challenges contribute to what researchers often describe 'early warning, late response' behaviour, due to a lack of institutional frameworks and responsibility, and to fragmented responses (Staupe-Delgado 2019).

- **Lack of and/or insufficient data and knowledge:** The lack of, or insufficient, long-term monitoring of slow-onset processes which hinders defining the: (a) impacts of slow-onset processes at the local level; (b) point in time when impacts become harmful for ecosystems, societies, and/or economies; and (c) amount of resources needed to address losses and damages from slow-onset hazards.

- **Addressing slow-onset processes with climate risk management strategies:** Slow-onset processes are not well integrated into climate risk management at the national level. Existing approaches for climate and disaster risk management primarily focus on managing risks and impacts of extreme weather events. They do not effectively cover risks and impacts from slow-onset processes. This is also due to conceptual gaps in the climate risk management cycle's concept, applying a phase logic with a linear disaster

Figure 3: Slow-onset processes in countries' disaster risk management



sequence with a clearly definable beginning and end (Staupe-Delgado 2019).

- **Insufficient financing and the lack of adequate financial tools and instruments.** This gap is due to the fact that existing financial instruments have strong limitations in addressing loss and damage from slow-onset processes (UNFCCC 2016). Dealing with chronic risks requires setting up financial protection measures to increase financial resilience and to protect fiscal balances, subnational governments, households, and businesses. This includes, 'long-term build-up of funds to pay the inevitable claim and are in many ways a form of saving' (UNFCCC 2008). At the country level, there is often no financial management approach for the slow-onset processes countries are facing and, 'the annual budget cycle often cannot accommodate needs related to events that evolve over many years' (UNFCCC 2012). This leads to severe effects for households as, due to the current lack of financial protection strategies, households pay for a large part of the funding for the fight against the impacts of climate change. The discussions on the operationalization of the L&D fund acknowledge the insuffient finance - slow-onset processes were highlighted as one priority gap the fund should provide finance for (UNFCCC 2023).

FINANCING INSTRUMENTS AND SOURCES TO ADDRESS LOSS AND DAMAGE FROM SLOW-ONSET PROCESSES

To adequately address (the risk of) loss and damage due to slow-onset processes we need both:

- **Financing instruments and mechanisms** that ensure adequate financial capacity of governments, households, and businesses to address the (financial) consequences of risks that materialise, to cope with potential impacts and thus implement respective measures.

- **Financing sources** that provide funding to set up and implement financing instruments or finance measures that support countries in addressing climate risks and impacts. The financing can come from national or international sources.

Financing instruments

Based on a comprehensive literature review (see Schäfer et al. 2021b), we identified different options for the financial management of loss and damage due to slow-onset processes. These options are described below. The instruments presented include those already implemented and tested, as well as those still in the theoretical conceptual phase. Potential financing instruments and mechanisms to address loss and damage from slow-onset processes include:

- **Social protection** schemes can contribute to addressing (the risk of) loss and damage due to slow-onset processes, particularly with a focus

on reaching populations' most vulnerable parts. A growing body of research recognises that social assistance instruments can reinforce the most vulnerable group's capacity to respond to climate-induced shocks (Bowen et al. 2020, Aleksandrova 2019, Ulrichs et al. 2019). Promising suggestions include the broadening of government-run social safety nets to include slow-onset processes such as sea level rise or social protection schemes used to support transformative livelihood strategies and ecosystem restoration initiatives.

- Instruments that can deal with unavoidable loss and damage from slow-onset processes are **national loss and damage funds and mechanisms**, like the one Bangladesh is currently working to establish. These include long-term accrual of funds to pay inevitable losses, and they are a form of saving. These funds could be based on examples of trust funds, already applied by countries to pool, save, grow, and disseminate financial resources over time and address future needs. Additionally, dedicated loss and damage funds such as Fiji's Climate Relocation and Displaced Peoples Trust Fund for Communities and Infrastructure could be a blueprint for providing finance for unavoidable loss and damage, such as that from sea level rise. Considering the 'polluter pays' climate justice principle, as well as the perspective of growing costs of slow-onset processes in the future, these mechanisms require adequate contributor support, both for capitalisation and for sustaining them. A particular challenge for these solutions is posed by the fact that at a certain stage, slow-onset processes in a combination with other stresses may exceed vulnerable social and ecological systems' abilities to cope, which leads to the risk of a system collapse.

There are **several interesting funds from other areas and from which we can learn regarding** the establishment of loss and damage funds (both for slow-onset processes and extreme weather events) and the operationalisation of key climate justice principles. Particularly, the European Solidarity Fund presents an example of a functional regional loss distribution mechanism to alleviate non-insurable damage. The Fund pools risk among European countries, paying out in the form of grants to supplement public spending by the beneficiary state, and is intended to finance essential emergency and recovery measures to alleviate damage that, in principle, is non-insurable. The Fund's eligibility criterion is the damage due to the disaster beyond a threshold and specific for each country (EU Parliament 2020). This could be a model for financing loss and damage resulting from climate change-related slow-onset processes. For integrating the polluter pays principle into a fund structure, the International Oil Pollution Compensation and the Hazardous and Noxious Substances Fund, as well as the so-called Superfund, provide interesting examples at the international and national levels. All funds provide for liability of people/organisations responsible for environmental damage, thereby establishing systems for compensation to be paid in the event of an accident, and including compulsory insurance solutions.

Instruments with **no or only a limited applicability** for addressing loss and damage from slow-onset processes are:

- **Insurance products**, which theoretically could play a role in addressing some slow-onset processes but would be extremely difficult to implement. Existing and effective insurance schemes primarily provide quick and efficient first-response relief via short-term financial liquidity for specific events and are therefore difficult to apply to slow-onset processes. However, different authors have developed theoretical approaches on how to use insurance as a risk financing tool for slow onsets (Conway/Young 2023). These ideas can be compared with capital-forming life or pension insurance, which are characterised by the fact that, additional to highly uncertain benefits, they provide for secure or almost secure benefits. The approaches suggested would require a public–private partnership approaches wherein, in line with climate justice principles, Global North countries contribute substantively to build up capital required over a long period. Also products that help to restore

ecosystem services damaged as a consequence of slow-onset processes seem theoretically feasible but highly difficult to implement, as they require substantial amounts of data.

- **Catastrophe bonds:** There are ideas on how to apply the catastrophe bonds concept to slow-onset processes. One idea is a sea level rise bond, which would provide a pay-out when the event's mean sea level exceeds a predetermined threshold (CIGI 2016). The index measure would be based on a series of official tide gauges. This bond is only in the conceptual stage, and further research would be needed to analyse its feasibility. Even if, however, innovative products are developed, there must be consideration with this type of solution that bonds generally come with stricter terms and conditions and have a higher fixed cost than traditional insurance, irrespective of how much is insured. They are also often only available to institutional investors.

- Also, **forecast-based financing** is not a suitable tool in the context of slow-onset processes. Regarding general application of forecast-based financing for slow-onset processes such as desertification or sea-level rise, representatives from the humanitarian field are sceptical, not seeing this substantial difference this approach can make (IFHV 2021). For these types of processes, they see governments and development banks as stepping in (ibid.). Although forecast-based financing as such might not be applicable for slow-onset processes, the approach can be interesting – pay-outs as soon as a trigger is hit to allow for a quick response before a slow-onset process' actual impact hits.

The need for comprehensive risk management and a human rights-based approach

Addressing residual risks and loss and damage of slow-onset processes through financing instruments and tools should be only **one step in a systematic process for managing related risks and impacts.** This process should involve a range of activities aimed at improving the understanding of risks, to prevent, reduce, and transfer risk, as well as measures to continually improve disaster preparedness, response, and recovery. Existing climate risk management approaches, however, do not yet effectively cover risks and impacts from slow-onset processes. Also, non-economic loss needs to be included in risk management frameworks (Martyr-Koller et al. 2021). Initial steps in addressing the conceptual gap are taking place (see the example of the climate risk management cycle that considers rapid-onset events and slow-onset processes, by NIDM and GIZ [2019]).

Consideration of the **human rights** impacts of financing instruments and activities is essential to ensure that key actors respect and promote existing human rights obligations and principles; thus, promoting full enjoyment of human rights. Applying a human rights-based approach can ensure this (see Schäfer et al. 2020).

Financing sources

Funding to address slow-onset processes must be reliably provided through grants, in addition to existing development cooperation and climate finance funds. For slow-onset processes caused by climate change the principles of common but differentiated responsibilities and respective capabilities (CBDR-RC) and polluter pays apply. The industrialized countries must take the lead here. Their emissions mean they bear the main historical responsibility for the climate crisis. However, applying CBDR-RC and polluter pays means that wealthy emerging economies – especially the oil and gas countries – should now also contribute to providing climate finance for loss and damage including from slow-onset processes. To cover the extreme financial needs of developing countries in dealing with loss and damage – estimates put the amount at up to 580 billion US dollars from 2030 (Markandya/González-Eguino 2018) – additional funds must also be mobilized. These include innovative financial instruments such as a tax on international shipping and payments from carbon majors – the 100 largest oil, gas and coal companies, which together account for 70 percent of global emissions.

Criteria for testing the adequacy of financing sources

Important criteria for assessing the adequacy of financing sources include the polluter pays principle and the principle of CBDR-RC, solidarity, and intergenerational equity, as well as appropriateness, additionality, equitable access, and predictability. Moreover, loss and damage finance should be provided as grants and non-debt creating instruments and must acknowledge, respect, and promote intersectional human rights (see Schalatek/Bird 2023, Climate Action Network 2023).

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Interviews: List of interviews can be found on p. 46 here.