Defining loss and damage: The science and politics around one of the most contested issues within the UNFCCC

The global response to climate change has evolved over time. At first, the focus was entirely on *mitigation* – reducing greenhouse gas emissions to limit warming and its impacts. As it became clear that climate change was happening already, and some future impacts would be unavoidable, *adaptation* emerged as another priority.

Small Island Developing States recognized early on that even with adaptation, some severe climate change impacts would be unavoidable– such as sea-level rise that could submerge much of their territory. Out of this recognition grew what some see as a third level of response to climate change: addressing *loss and damage.*

As a concept, loss and damage is well grounded in climate science. There are clearly limits to what people or natural systems can adapt to: humans cannot live underwater; most crops cannot grow in salty soil; many Arctic species won't survive without ice. Given the slow pace of mitigation to date, it is almost certain that at least in some contexts, climate change impacts will exceed adaptation limits.[1] The difference – what scientists have called "residual impacts" – is loss and damage.

Yet in the context of the United Nations Framework Convention on Climate Change (UNFCCC), views on loss and damage differ considerably. Some, starting from the perspective of climate justice, argue that the poorest countries, which have contributed very little to climate change but will suffer the worst harm, should be duly compensated.[2] Others see loss and damage as part of a broader commitment to help the most vulnerable, with an emphasis on risk reduction mechanisms. There is even debate about what losses and damages should be included, and why.

The Paris Agreement recognizes in Article 8 "the importance of averting, minimizing and addressing loss and damage" from climate change, and encourages "cooperation and facilitation to enhance understanding, action and support" on risk reduction and management. An accompanying decision says this language "does not involve or provide a basis for any liability or compensation".[3]

Still, many issues remain unresolved, and loss and damage is likely to be prominent on the agenda of the Marrakech Climate Change Conference in November, which includes a review of the UNFCCC's Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts (WIM).

This briefing note aims to inform discussions of loss and damage by grounding them in science, and separating scientific questions from political ones. We focus on four traits that are often associated with loss and damage: that some climate impacts are *unavoidable,* that the harm may be *irreversible* and *intolerable*, and that those impacts are *attributable* to human activity.

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A child stands amid rubbish on the beach of Funafuti, the capital of Tuvalu, in the aftermath of Cyclone Pam, which caused catastrophic damage.

The UNFCCC context

The Alliance of Small Island States (AOSIS) first brought up the issue of loss and damage in 1991, when the UNFCCC was still being drafted. It proposed establishing an international insurance pool as a collective loss-sharing mechanism to compensate victims of projected sea-level rise.[4]

It took 16 years for the term "loss and damage" to be used in a negotiated UNFCCC decision, in the Bali Action Plan of 2007. In the context of enhanced action on adaptation, the Parties called for "disaster reduction strategies and means to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change".[5]

At the Cancún Climate Change Conference, in 2010, the Parties agreed on a two-year work programme to consider approaches to loss and damage. At the Doha Climate Change Conference, in 2012, developing countries pushed hard to establish a new UNFCCC mechanism on loss and damage. After much debate, it was agreed to do so at the next session of the Conference of the Parties.

Loss and damage emerged as a priority for developing countries at a time of deep frustration among many Parties and civil society groups with the slow progress of the climate talks. Not only did mitigation efforts seem out of step with rising evidence of the dangers of inaction, but support for adaptation in developing countries fell far short of expectations.

As ACT Alliance, a network of 140 humanitarian and development organizations, put it in a briefing during the Warsaw Climate Change Conference in 2013: "Governments should recognise that we cannot choose between mitigation, adaptation and loss and damage. … The lower the mitigation ambition, the higher the adaptation need. The lower the adaptation

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A youth demonstration at the Paris Climate Change Conference highlights loss and damage and a 1.5°C limit on global warming as top priorities.

support available to help poor communities and countries, the more serious the limits to adaptation become from climatic changes, the more loss and damage ensues."

Thus, the group argued: "Rich countries which emitted the bulk of the emissions causing climate change and loss and damage must provide financing and technology to help poor people and countries already suffering from these effects to rehabilitate their livelihoods, where possible, and where these have been irreparably damaged, to develop new ones."[6]

AOSIS used similar language. In a submission prior to the Warsaw conference, the group wrote that a loss and damage mechanism "is more urgent than ever in light of the low mitigation ambition reflected in current pledges and the subsequent worsening of climate impacts to which we cannot adapt". AOSIS also called for loss and damage funding to be separate from adaptation finance, and "come from a dedicated source".[7] Similarly, the G77 and China, the largest group representing developing countries, called for "new, predictable, and reliable financial support for the assessment of, and responses to, loss and damage through an appropriate financial mechanism".[8]

But while all the Parties agreed that residual damages were likely to occur, they differed strongly on how to address them. The notion of compensation was hotly disputed, and there was also intense debate on whether loss and damage should be addressed separately, or as an aspect of adaptation, through existing institutional arrangements. Still, the Parties agreed to establish the Warsaw International Mechanism.

The COP19 decision acknowledged that "loss and damage associated with the adverse effects of climate change includes, and in some cases involves more than, that which can be reduced by adaptation". It then assigned the new mechanism three key functions: "enhancing knowledge and understanding of comprehensive risk management approaches"; "strengthening dialogue, coordination, coherence and synergies among relevant stakeholders"; and "enhancing action and support, including finance, technology and capacity-building".[9]

Yet the debate was far from over. At the Paris Climate Change Conference, even as the French hosts tried to focus on mitigation commitments, loss and damage emerged as a major point of contention. In the end, the Paris Agreement devoted a full article to loss and damage.[10]

The COP21 decision provides for a continuation of the WIM after a review in 2016 and expands its mandate by requesting that its Executive Committee establish a "clearinghouse for risk transfer" and a task force on "displacement related to the adverse impacts of climate change".[11]

However, much remains to be decided about the future of the Warsaw International Mechanism, including the specific issues it will address and just how it might be enhanced or strengthened. The Paris Agreement also raises new questions. For example, some have argued that dedicating an entire article to the subject is an implicit endorsement of loss and damage as a "third pillar" of work under the UNFCCC, beside mitigation and adaptation.[12]

Defining 'loss and damage'

Although the Parties to the UNFCCC have recognized the importance of loss and damage, they have yet to agree on an official definition. In policy discussions, the term is used as shorthand for an insight about climate change: that mitigation cannot (or will not) avoid all climate change impacts, and adaptation cannot (or will not) avoid all harm from those impacts.

As noted earlier, this is what scientists call "residual impacts" of climate change. Or as a joint publication by three prominent NGOs put it, "Loss & damage = insufficient mitigation + inadequate adaptation".[13] Residual impacts may occur anywhere in the world, but in the context of the UNFCCC discussions, the focus is on losses and damages that occur in vulnerable developing countries.

That still leaves a broad scope for interpretation and priority-setting. One recent analysis found that stakeholders differ in how they view the distinction between loss and damage and adaptation; how much they emphasize the role of climate change; whether they focus more on preventing loss and damage or on addressing it once it has occurred; their view of the role of finance, and their emphasis on justice.[14]

The analysis finds that those differences lead to a spectrum of views on how to frame loss and damage under the UNFCCC, based on the extent to which social justice is emphasized: Some see no need for a separate loss and damage mechanism, while others see loss and damage as another risk management tool, along with adaptation, disaster risk reduction (DRR) and humanitarian work. A third group emphasizes the need to reduce people's vulnerability to unavoidable climate change impacts; a fourth group wants to compensate vulnerable countries for the harm suffered due to climate change.[15]

Science has not kept up with the political debate. The most authoritative available survey of climate science, the Intergovernmental Panel on Climate Change (IPCC) *Fifth Assessment Report,* does not include loss and damage in its glossary, and an analysis of the Working Group II report, which focuses on climate change impacts and adaptation, found the term was used only 30 times across 32 chapters.[16]

To a great extent, the framing of loss and damage is a question of value judgements and political choices, and different notions of justice. Still, the debate would benefit greatly from ground-

ing in the science. The scientific literature has plenty to say on key traits that are commonly associated with loss and damage in the policy discourse: that it is *attributable* to human-caused climate change, *irreversible, unavoidable* and *intolerable*. In the sections below, we examine each trait in turn, drawing on the scientific literature to inform and clarify the policy debates.

Attributable

The name of the Warsaw Mechanism and the underlying UNFCCC decision defines its focus as loss and damage "associated with climate change impacts". How those words are understood can broaden or narrow the scope of the WIM: Does "associated with" mean "caused by", or does it just matter that climate change has to be a factor? In practice, the implied meaning often depends on the context.

From a risk management perspective, for example, the goal is to identify patterns to predict how climate change may affect risks: Are coastal storms becoming stronger and/or more frequent? Will sea-level rise increase the risk of salt-water intrusion in local water sources? Are wildfire risks becoming so severe that some areas should be deemed unsafe for human habitation?

This is familiar terrain for IPCC Working Group II and the DRR community. The better we understand how rising CO_2 concentrations affect the climate, and how specific climatic changes (e.g. a 1.5°C increase in average temperature, or a shift in rainfall) affect risk, the better we can prepare, and try to minimize harm. In this context, it is not necessary to attribute individual events – and associated damages – to climate change.

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Landslides caused by torrential rains are increasingly common in Central America. Above, a landslide in 2013 onto a highway in Guatemala City.

Attribution is more crucial when loss and damage is framed in terms of justice.[17] The Least Developed Countries (LDC) Group, for example, has argued that because industrialized countries have not done enough to address climate change, "the brunt of loss and damage, today and in future, has to be borne by those countries that contributed the least to the problem, making loss and damage an issue of equity".[18] Similarly, the Heinrich Böll Foundation has argued for applying the "polluter pays" principle to make 91 major producers of fossil fuels and cement, to which it attributes 63% of carbon emissions to date, pay for loss and damage in developing countries.[19]

Few issues are more contentious. What many advocates and governments see as a matter of justice, others – most vocally, U.S. negotiators – see as a "red line".[20] In Paris, the latter prevailed: as noted earlier, the COP decision (1/CP.21, Art. 51) explicitly states that Article 8 of the Paris Agreement – the one on loss and damage – "does not involve or provide a basis for any liability or compensation".

However, some NGOs and legal experts continue to pursue compensation – focusing on large emitters, such as fossil fuel companies – through other means.[21] For example, Greenpeace has accused 47 oil companies of human rights abuses through the Philippines Human Rights Commission, and 17 attorneys general in the U.S. are considering action against ExxonMobil.[22] Kenya's 2016 Climate Change Act, approved in July, facilitates lawsuits against carbon emitters.[23]

Proving liability and claiming compensation for climate change impacts would first require showing that the losses and damages are clearly attributable to climate change. (Under Kenya's new law, the bar may be lower.) From a scientific perspective, that is far from straightforward.

The first step is fairly simple. The IPCC considers it as *extremely likely* (95–100%) that anthropogenic greenhouse gas emissions, alongside other human drivers, have been the dominant cause of the observed warming since the mid-20th century.[24]

The next step is to establish a causal relationship between emissions and specific climatic changes and events; here the IPCC expresses varying degrees of confidence. It finds it "very likely" (90–100%) that greenhouse gas emissions have contributed to the loss of Arctic sea ice and to global sea-level rise, for example, but only "likely" (66–100%) that they have affected the global water cycle, the retreat of glaciers, or the reduction in spring snow cover over the Northern Hemisphere.[25]

When it comes to extreme events, the IPCC is even more cautious. It finds it likely that the frequency of heat waves has increased in large parts of Europe, Asia and Australia, and very likely that human influence has contributed to changes in the frequency and intensity of daily temperature extremes at the global scale. But it expresses low confidence that anthropogenic climate change has affected the frequency and magnitude of river floods on a global scale; the same applies to the robustness of observed long-term changes in tropical cyclone activity, and in the attribution of global changes in tropical cyclone activity to any particular cause.[26] Given these uncertainties, the IPCC does not even attempt to determine whether specific events can be attributed to climate change.

Still, attribution science continues to advance, and there is growing evidence that human-driven climate change has contributed to some, but certainly not all, recent extreme weather events (others would occur with normal climate variability). This is not to say that climate change "caused" these events; instead, scientists have found that it increased their likelihood of occurring, or their severity.[27]

One recent study calculated what fraction of all heavy precipitation and extreme heat events around the world is attributable to climate change.[28] Probabilistic event attribution studies are also being applied to specific events (e.g. the European rainstorms in May 2016),[29] and some have

argued that this method could serve as a basis for action under the UNFCCC or elsewhere.[30]

Yet one more, crucial step remains: attributing impacts (i.e., actual loss and damage) to the relevant events. The IPCC notes that direct and insured losses from weather-related disasters, for example, have increased substantially in recent decades, regionally and around the world. But the IPCC then expresses high confidence that "increasing exposure of people and economic assets has been the major cause of long-term increases in economic losses from weather- and climate-related disasters". In other words, it is not that the hazards have increased, but that more people and more valuable property are in harm's way.[31] Indeed, a trend analysis of insured losses from natural disasters found no significant trend at the global level after normalizing by GDP, population and wealth per capita.[32]

Another key factor is vulnerability. People living in a country with well-functioning government and emergency preparedness programmes are likely to be less affected by a disaster than people in a country with weak and ineffectual institutions.

A science-based approach to attributing loss and damage to climate change would thus take an integrated approach to risk that also considers climate variability and social vulnerability.[33] This could pose a challenge for anyone seeking to compensation from major emitters, as different actors might be responsible for different drivers of vulnerability. (Plaintiffs in some countries, such as the U.S., would benefit from the concept of joint and several liability, which allows them to seek the full extent of damages from any one defendant.) Another complicating factor is that even if specific damages could be attributed to climate change, further questions would arise about how to allocate responsibility: based on emissions since 1750, since 1992, or somewhere in between?

Irreversible

A similarly tricky issue with loss and damage is determining whether specific impacts are irreversible. Arguably, events that cause harm that is serious, but short-lived and reversible, are already covered by disaster risk reduction mechanisms. Yet the term "loss and damage" itself is often understood to cover both losses, which are irreversible (e.g. loss of lives, ecosystems or culture), and damages, which can be repaired (such as public infrastructure or private property).[34]

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Ethiopia is experiencing the worst drought seen in 30 years, with devastating effects on food security.

Furthermore, loss and damage may be physically irreversible or socially irreversible. A better understanding of the potential type or scale of irreversible risks associate with climate change may be useful in designing policy responses.

Physically irreversible risks can occur rapidly or take a longer time to manifest themselves. Irreversible impacts are related to the concept of "tipping points" and "catastrophic climate change", implying that past a certain physical threshold, climate change can cause a major change in the functioning of a system, or "regime shift" (e.g. irreversible melting of the Greenland or Arctic ice sheets).[35]

Recent research has pointed to the risks of a domino effect of multiple interacting tipping points that propagate across scales, and to the question of whether local or regional tipping points can lead to global regime shifts.[36] However, most studies into physical thresholds lack appropriate consideration of the capacity of integrated social-ecological systems to recover.[37]

Slow-onset events can also cause physically irreversible impacts associated with climate change. These events include sea-level rise, changes in precipitation patterns, as well as changes in the large-scale patterns of natural climate variability, such as monsoons and El Niño/Southern Oscillation (ENSO) events. A review for the UNFCCC found that slow-onset events are already negatively affecting developing countries, and the resulting loss and damage are likely to increase significantly, even assuming appropriate mitigation and adaptation action.[38]

Even if impacts are physically reversible, however, there may be social constraints that make them effectively irreversible. Societies that are severely disrupted by a disaster – economic, social and cultural activities stopped, people displaced – may not be able to "bounce back" as soon as the damages are repaired. This is why there is growing interest in non-economic loss and damage and how it may hinder long-term recovery. Under the UNFCCC, this category has been defined to include impacts on human life, health, mobility, territory, cultural heritage, indigenous/local knowledge and biodiversity, among others.[39] Accounting for non-economic impacts can be very challenging.

In summary, science offers no simple answer to the question of which impacts of climate change are reparable or irreversible. This leads to the question of whether the potential to reverse an impact should be a factor in whether it is considered loss and damage. Research suggests that damages from climate change impacts may become irreversible if they continue for long enough and their cumulative effect eventually exceed limits of adaptive capacity.[40]

This means that addressing the risk of irreversible impacts requires a two-pronged approach: to prevent damages from becoming permanent losses, by supporting long-term recovery and reducing the underlying social vulnerability to (repeated) disaster risks; and to prepare and support those threatened by irreversible losses. The first can be achieved through improved disaster risk management, but the second

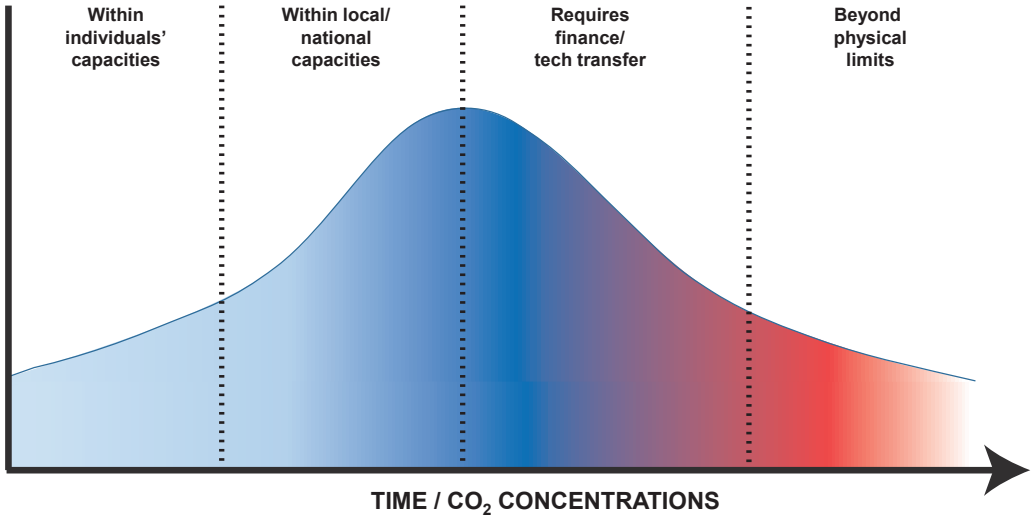

Figure 1: What do we define as "unavoidable" loss and damage?

Losses and damages associated with climate change fall on a spectrum: some can be avoided through measures within individuals' own capacities, while others require local or national government action, and yet others require measures that can only be achieved with international finance and/or technology transfer. Some risks are beyond the physical limits of adaptation. As time progresses, and as atmospheric CO_2 concentrations continue to rise, the curve will move rightward, with ever-more effort required to adapt, and more risks exceeding the physical limits of adaptation.

requires anticipatory policies that address both economic and non-economic losses.

Unavoidable

The notion of loss and damage as climate change impacts "to which we cannot adapt", as AOSIS has put it, suggests that those impacts are unavoidable: the people or countries affected are powerless to prevent harm from occurring. In some cases, such as if an island or low-lying area is submerged by the rising sea, observers are likely to agree that the damage was "unavoidable". In other cases, however, it may not be so clear-cut.

Figure 1 presents a simplified illustration of the range of possible definitions of "unavoidable" and their implications for the scope of the Warsaw Mechanism. The defining criterion is who, if anyone, has the power to avoid a given loss or damage.

At the far right end is our example of coastal areas and sea-level rise: they can adapt to some extent, but at some point, they will be underwater. This is loss and damage beyond the "hard" limits of adaptation.[41] At the opposite end are risks that are within individuals' capacity to avoid: adaptation measures are zero- or low-cost relative to the affected people's incomes, and require no external support. Although individuals who suffer losses in such contexts still often receive humanitarian or government assistance, it is hard to argue that such losses are "unavoidable".

Most of the political discourse on loss and damage draws the line somewhere in the middle. For example, the LDC Group has noted that "there is still a significant role for adaptation in reducing loss and damage", but adaptation requires "adequate financial and technical support in order to facilitate implementation".[42] One can infer that if adequate support is not provided, and adaptation does not occur, the unavoided impacts would be considered loss and damage.

Similarly, Climate Action Network (CAN) International notes that adaptation finance "is already insufficient given the scale of the challenge in developing countries, and loss and damage beyond what countries and communities manage to adapt to results in significant additional costs, as well as non-economic impacts".[43] Indeed, only US$22.5 billion in bilateral and multilateral adaptation finance flowed to developing countries in 2014, despite an estimated need of US$70–100 billion per year. New estimates project that adaptation costs will reach US$140–300 billion by 2030.[44]

Less widely discussed is another category of "unavoidable" impacts: those that can or should be avoidable through measures within a country's capacity, but are not avoided because of failures of governance, corruption, social injustice or other problems. Key institutions may resist crucial change; path-dependency has been found to be a major barrier to adaptation.[45] Poor development, which is closely tied to these issues, is widely recognized as the main driver of vulnerability to climate impacts and disaster risk.[46] Should harm that occurs because of these failures be considered loss and damage?

From an administrative perspective, the more narrowly "unavoidable" impacts are defined, the easier the Warsaw Mecha-

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Households on South Tarawa, in Kiribati, do their best to slow coastal erosion due to sea-level rise. They cannot retreat from the coast, as the atoll is narrow and crowded.

nism's task, and the lower the cost of fulfilling its mission. From a humanitarian perspective, however, only the broadest definition may be acceptable: there is a long tradition in DRR of helping everyone, without asking if they failed to do all they could to avoid calamity.

There is one more reason to tread carefully in this regard. Focusing debates only on risks that countries cannot avoid without external finance could create a perverse incentive to ignore local drivers of vulnerability. Given the importance of governance, development choices, and social, economic and political conditions for reducing vulnerability, thi could be a very harmful outcome.

Intolerable

Another challenging question is what makes a climate change impact "intolerable". This is the most subjective of the four terms. Some impacts, such as death or the destruction of one's homeland, would be intolerable to most, and some, such as milder winters or a shift in the growing season, would either be welcome or at least tolerated. Many others, however, would be perceived differently depending on social norms, personal values, adaptive capacity, and the broader context.

For example, if an extreme event left a U.S. town with no electricity and only firewood to cook with, that would be deemed intolerable – yet billions of people around the world live under such conditions.[47] Conversely, the loss of a house may be intolerable to a poor family that has nowhere else to go and no resources to rebuild, but not a big problem for a wealthy family with insurance. The loss of a building or a parcel of land may not matter much in economic terms, but if the site has great cultural significance (e.g. if it is a shrine or a monument), that loss could be seen as intolerable.

One analysis, based on the literature on limits to adaptation, defines intolerable risks as "those which fundamentally threaten a private or social norm – threatening, for instance, public safety, continuity of traditions, legal standard or a social contract – despite adaptive action having been taken".[48] If a risk seems remote (e.g. if an area floods only every 30–40 years), people may deem it tolerable even if the consequences could be severe. Other times it is a matter of priorities: for example, there are many examples of developing countries making choices in the name of economic growth that increased vulnerability to climate change and extreme events.[49]

In political discussions about loss and damage, the understanding of "intolerable" has to balance pragmatism with ethics and equity. Pre-existing differences in living conditions and degrees of suffering due to social inequality (between and within countries) should not lead to lower standards for poorer people. (This dovetails with growing criticism of resilience thinking, which some see as too focused on maintaining or restoring the status quo.[50])

Another factor to consider here is the language of the Paris Agreement. Article 2 sets the goal of holding the global average temperature increase "to well below 2°C above pre-industrial levels" and "pursuing efforts" to limit it to 1.5°C, "recognizing that this would significantly reduce the risks and impacts of climate change". The fight for a 1.5°C target was based on the recognition that even at 2°C, intolerable impacts would occur, including the loss of entire island nations. Some are now discussing whether, in this light, failure by the Parties to keep warming under 1.5°C (or even 2°C) would provide a basis for financial compensation.[51]

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Agricultural land in Myanmar that was damaged by Cyclone Giri in 2010 was rehabilitated with support from the European Union.

Conclusion

For several years now, the Parties to the UNFCCC have been struggling to address loss and damage amid fundamental disagreements about how the issue should be framed and understood. Science has remained mostly on the sidelines – most notably, on attribution of impacts and on social vulnerability.

This gap between science and policy, combined with the difficulties in finding common ground among the Parties, has led to a situation in which the loss and damage is one thing on paper, as outlined in the language on the Warsaw Mechanism, and another in the broader policy discourse. The COP decisions and the Paris Agreement focus mostly on risk management, but advocates and many governments are still keen on compensation. Reconciling these two perspectives will require very skilful diplomacy.

In summary, our analysis of the science relevant to four key traits of loss and damage finds:

Attributable: Attribution of current events, combined with future climate change projections, could be useful for risk management activities under the Warsaw Mechanism. Should the Parties expand or redefine the WIM to include a compensation scheme, attributing specific events, and particularly specific losses and damages, to climate change could be very challenging, as there are multiple uncertainties, and social vulnerability is a key factor.

Irreversible: The science distinguishes between physically and socially irreversible impacts. Physically irreversible risks, which can occur rapidly or over many years, often involve "tipping points" in the Earth system. Though much is still unknown, there is a growing body of evidence on tipping points and thresholds, on the global and local scales. The factors that make some impacts socially irreversible are less well understood, but it is clear that when a society's core functions are disrupted, that disruption may hinder people's ability to recover. This is closely linked to the issue of non-economic loss and damage, which is gaining prominence in discussions under the WIM.

Unavoidable: There are "hard" limits to adaptation, and then there are many human-caused "soft" limits: social, economic,

political, etc. Focusing the WIM only on losses and damages beyond the "hard" limits to adaptation – such as when an island is submerged by sea-level rise – might simplify the WIM's mandate, but would exclude a wide range of losses and damages that are arguably just as "unavoidable". Indeed, there is extensive evidence that adaptation finance and technology transfer both fall far short of vulnerable countries' needs.

Intolerable: There is no objective line between tolerable and intolerable impacts. What individuals and societies can or will tolerate depends on personal values, social norms, priorities, and the broader context. An equity and/or human rights perspective is important in defining what is "intolerable", to ensure that action under the WIM does not perpetuate inequalities that force poor and vulnerable communities to tolerate worse conditions than wealthier people.

Our analysis does not offer a clear path forward, but rather highlights key choices and value judgements to be made. In making these choices, Parties need to be mindful that how they define and apply these four terms has implications not only for the international governance of climate change, but also for people who sorely need help.

At the same time, whether or not addressing loss and damage is seen as a "third pillar" of action under the UNFCCC, it is important to remember that it is not a solution to the climate problem, but a last resort. Without effective mitigation and adaptation, the scope of loss and damage will be overwhelming.

Endnotes

1 Dow, K., Berkhout, F., Preston, B. L., Klein, R. J. T., Midgley, G. and Shaw, M. R. (2013). Limits to adaptation. *Nature Climate Change,* 3(4). 305–7. DOI:10.1038/nclimate1847.

Benzie, M., Davis, M., Klein, R. J. T. and Watkiss, P. (2012). *Can '1°C of Climate Change Adaptation' Replace '1°C of Mitigation'? Why Economic Models Can't Solve Policy Dilemmas*. Stockholm Environment Institute, Stockholm. http://www.sei-international.org/publications?pid=2203.

2 For a succinct review of the discourse on loss and damage, see: McNamara, K. E. (2014). Exploring loss and damage at the international climate change talks. *International Journal of Disaster Risk Science*, 5(3). 242–46. DOI:10.1007/s13753-014-0023-4.

3 UNFCCC (2015). *Paris Agreement*. FCCC/CP/2015/10/Add.1. United Nations Framework Convention on Climate Change, Paris. http://unfccc.int/paris_agreement/items/9485.php.

UNFCCC (2016). *Report of the Conference of the Parties on Its Twenty-First Session, Held in Paris from 30 November to 13 December 2015*. Addendum. Part Two: Action Taken by the Conference of the Parties at Its Twenty-First Session. FCCC/CP/2015/10/Add.1. United Nations Framework Convention on Climate Change, Paris. http://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf.

4 For an overview of the history, see: AOSIS (2012). *Views and Information on Elements to Be Included in the Recommendations on Loss and Damage in Accordance with Decision 1/CP.16*. Submission of Nauru to the Subsidiary Body on Implementation, on behalf of AOSIS. Alliance of Small Island States. http://aosis.org/wp-content/uploads/2012/11/AOSIS-Submission-on-Loss-and-Damage-Submission-Final.pdf.

5 UNFCCC (2007). *Bali Action Plan*. Decision 1/CP.13. United Nations Framework Convention on Climate Change. http://unfccc.int/meetings/bali_dec_2007/meeting/6319/php/view/decisions.php.

6 ACT Alliance (2013). Loss and damage – the Warsaw mechanism? *Time for Climate Justice: Your Daily Guide to COP19*, 13 November. http://climatejusticeonline.org/wp-content/uploads/1311-ACT-Alliance-Time-for-Climate-Justice-COP19-Newsletter.pdf. 2.

7 AOSIS (2013). *Views and Information on Elements of an International Mechanism to Address Loss and Damage from the Adverse Effects of Climate Change*. Submission of Nauru on behalf of AOSIS. Alliance of Small Island States. http://unfccc.int/files/adaptation/application/pdf/aosis_submission_on_loss_and_damage__november_12_2013.pdf.

8 G77 and China (2013). *Input from the G77 & China in Preparation for COP19 on Loss and Damage Associated with Climate Change Impacts in Developing Countries That Are Particularly Vulnerable to the Adverse Effects of Climate Change*. Submission to the UNFCCC in preparation for the Warsaw Climate Change Conference. United Nations Framework Convention on Climate Change. http://unfccc.int/files/adaptation/application/pdf/ld_g77_submission_nov_2013.pdf.

9 UNFCCC (2014). *Report of the Conference of the Parties on Its Nineteenth Session, Held in Warsaw from 11 to 23 November 2013. Addendum. Part Two: Action Taken by the Conference of the Parties at Its Nineteenth Session*. FCCC/CP/2013/10/Add.1. United Nations Framework Convention on Climate Change, Bonn. http://unfccc.int/resource/docs/2013/cop19/eng/10a02r01.pdf. Decision 2/CP.19.

10 UNFCCC (2015). *Paris Agreement*.

11 UNFCCC (2016). *Report of the Conference of the Parties on Its Twenty-First Session*.

12 See, e.g., Climate Focus (2016). *Loss and Damage in the Paris Agreement*. Climate Focus Client Brief on the Paris Agreement IV. Amsterdam. http://www.climatefocus.com/news/cop21-paris-2015-loss-and-damage-paris-agreement-and-green-climate-fund-and-paris-agreement.

13 Harmeling, S., Chamling Rai, S., Singh, H. and Anderson, T. (2015). *Loss and Damage: Climate Reality in the 21st Century*. CARE International, ActionAid and WWF. http://www.preventionweb.net/go/46961. See back cover.

14 Boyd, E., James, R. and Jones, R. (2016). *Typologies of Loss and Damage and Associated Actions*. Policy brief revised from a draft prepared for the April 2016 meeting of the Executive Committee of the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts. University of Reading, Environmental Change Institute at Oxford University, and Met Office Hadley Centre. http://www.eci.ox.ac.uk/publications/policy-brief-pdf/160608_Typologies_ExCom3Update_Final.pdf.

15 Parker, H. R., Boyd, E., Cornforth, R. J., James, R., Otto, F. E. L. and Allen, M. R. (2016). Stakeholder perceptions of event attribution in the loss and damage debate. *Climate Policy*, online 11 January. DOI :10.1080/14693062.2015.1124750.

16 van der Geest, K. and Warner, K. (2015). *What the IPCC 5th Assessment Report Has to Say about Loss and Damage*. UNU-EHS Working Paper No. 21. United Nations University Institute of Environment and Human Security, Bonn. http://collections.unu.edu/view/UNU:3172.

17 For a detailed argument for compensation, including implications for the UNFCCC, see: Wallimann-Helmer, I. (2015). Justice for climate loss and damage. *Climatic Change*, 133(3). 469–80. DOI:10.1007/s10584-015-1483-2, and Adelman, S. (2016). Climate justice, loss and damage and compensation for small island developing states. Journal of Human Rights and the Environment, 7(1). 32–53. DOI:10.4337/jhre.2016.01.02.

18 LDC Group (2012). *Submission by the Gambia on Behalf of the Least Developed Countries Group on Loss and Damage*. United Nations Framework Convention on Climate Change. https://unfccc.int/files/adaptation/application/pdf/submission_by_the_gambia_on_behalf_of_the_least_developed_countries_on_loss_and_damage.pdf. p.5.

19 Richards, J.-A. and Boom, K. (2014). *Carbon Majors Funding Loss and Damage*. Heinrich Böll Stiftung, Berlin. https://www.boell.de/en/2014/06/05/carbon-majors-funding-loss-and-damage.

20 Adler, B. (2015). Here's why the words 'loss and damage' are causing such a fuss at the Paris climate talks. *Grist,* 8 December. http://grist.org/climate-energy/heres-why-the-words-loss-and-damage-are-causing-such-a-fuss-at-the-paris-climate-talks/.

21 Pashley, A. (2015). Did the Paris deal rule out climate compensation? *Climate Home*, 18 December. http://www.climatechangenews.com/2015/12/18/did-the-paris-deal-rule-out-climate-compensation/.

22 Darby, M. (2016). Oil majors summoned to Philippines human rights inquiry. *Climate Home*, 27 July. http://www.

climatechangenews.com/2016/07/27/oil-majors-summoned-to-philippines-human-rights-inquiry/.

Darby, M. (2016). Scale of climate damages 'could dwarf tobacco lawsuits'. *Climate Home*, 21 June. http://www.climatechangenews.com/2016/06/21/scale-of-climate-damages-could-dwarf-tobacco-lawsuits/.

23 Odhiambo, E. (2016). In Kenya, companies now liable for climate change damages. Trust.org, 1 July. http://news.trust.org/item/20160701145000-qju48/.

24 IPCC (2014). *Climate Change 2014: Synthesis Report*. Intergovernmental Panel on Climate Change, Geneva. http://www.ipcc.ch/report/ar5/syr/. p.47.

25 IPCC (2014). *Climate Change 2014: Synthesis Report.* p.48.

26 IPCC (2014). *Climate Change 2014: Synthesis Report.* p.53.

27 Huggel, C., Stone, D., Auffhammer, M. and Hansen, G. (2013). Loss and damage attribution. *Nature Climate Change*, 3(8). 694–96. DOI:10.1038/nclimate1961.

28 Fischer, E. M. and Knutti, R. (2015). Anthropogenic contribution to global occurrence of heavy-precipitation and high-temperature extremes. *Nature Climate Change*, 5(6). 560–64. DOI:10.1038/nclimate2617.

29 The World Weather Attribution project, an international collaboration, now does these studies regularly. For the European rainstorm analysis, see: https://wwa.climatecentral.org/analyses/european-rainstorms-may-2016/.

30 Thompson, A. and Otto, F. E. L. (2015). Ethical and normative implications of weather event attribution for policy discussions concerning loss and damage. *Climatic Change*, 133(3). 439–51. DOI:10.1007/s10584-015-1433-z.

31 IPCC (2014). *Climate Change 2014: Synthesis Report.* p.53.

32 Barthel, F. and Neumayer, E. (2012). A trend analysis of normalized insured damage from natural disasters. *Climatic Change*, 113(2). 215–37. DOI:10.1007/s10584-011-0331-2.

33 Huggel, C., Stone, D., Eicken, H. and Hansen, G. (2015). Potential and limitations of the attribution of climate change impacts for informing loss and damage discussions and policies. *Climatic Change*, 133(3). 453–67. DOI:10.1007/s10584-015-1441-z.

34 Huq, S., Roberts, E. and Fenton, A. (2013). Loss and damage. *Nature Climate Change,* 3(11). 947–49. DOI:10.1038/nclimate2026.

35 IPCC (2014). *Climate Change 2014: Synthesis Report*, sections 2.3 and 2.4.

36 Lenton, T. M., Held, H., Kriegler, E., Hall, J. W., Lucht, W., Rahmstorf, S. and Schellnhuber, H. J. (2008). Tipping elements in the Earth's climate system. *Proceedings of the National Academy of Sciences of the United States of America*, 105(6). 1786–93. DOI:10.1073/pnas.0705414105.

Kopits, E., Marten, A. and Wolverton, A. (2014). Incorporating 'catastrophic' climate change into policy analysis. *Climate Policy*, 14(5). 637–64. DOI:10.1080/14693062.2014.864947.

Hughes, T. P., Carpenter, S., Rockström, J., Scheffer, M. and Walker, B. (2013). Multiscale regime shifts and planetary boundaries. *Trends in Ecology & Evolution*, 28(7). 389–95. DOI:10.1016/j.tree.2013.05.019.

37 Klein, R. J. T., Midgley, G. F., Preston, B. L., Alam, M., Berkhout, F. G. H., Dow, K. and Shaw, M. R. (2014). Adaptation opportunities, constraints, and limits. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, et al. (eds.). Cambridge University Press, Cambridge, UK, and New York. 899–943. https://www.ipcc.ch/report/ar5/wg2/.

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38 UNFCCC (2012). *Slow Onset Events*. Technical paper; FCCC / TP/2012/7. United Nations Framework Convention on Climate Change, Bonn. http://unfccc.int/resource/docs/2012/tp/07.pdf.

39 UNFCCC (2013). *Non-Economic Losses in the Context of the Work Programme on Loss and Damage*. Technical paper; FCCC / TP/2013/2. United Nations Framework Convention on Climate Change, Bonn. http://unfccc.int/resource/docs/2013/tp/02.pdf.

40 Felgenhauer, T. (2015). Addressing the limits to adaptation across four damage–response systems. *Environmental Science & Policy*, 50. 214–24. DOI:10.1016/j.envsci.2015.03.003.

41 Dow et al. (2013). Limits to adaptation.

42 LDC Group (2012). *Submission by the Gambia on Behalf of the Least Developed Countries Group on Loss and Damage.* p.4.

43 CAN International (2016). *Submission for the 4th SCF Forum on Financial Instruments to Address Loss & Damage*. Climate Action Network International, Beirut. http://www.climatenetwork.org/publication/can-submission-input-scf-forum-financial-instruments-loss-and-damage-february-2016. p.1.

44 UNEP (2016). *The Adaptation Finance Gap Report 2016*. United Nations Environment Programme, Nairobi. http://drustage.unep.org/adaptationgapreport/2016.

45 Barnett, J., Evans, L. S., Gross, C., Kiem, A. S., Kingsford, R. T., Palutikof, J. P., Pickering, C. M. and Smithers, S. G. (2015). From barriers to limits to climate change adaptation: path dependency and the speed of change. *Ecology and Society*, 20(3). Art. 5. DOI:10.5751/ES-07698-200305.

46 Schipper, E. L. F., Thomalla, F., Vulturius, G., Davis, M. and Johnson, K. (2016). Linking disaster risk reduction, climate change and development. *International Journal of Disaster Resilience in the Built Environment*, 7(2). 216–28. DOI:10.1108/IJDRBE-03-2015-0014.

47 See: http://www.iea.org/topics/energypoverty/.

48 Dow et al. (2013). Limits to adaptation. p.305.

49 Schipper et al. (2016). Linking disaster risk reduction, climate change and development.

50 See, e.g., MacKinnon, D. and Derickson, K. D. (2013). From resilience to resourcefulness A critique of resilience policy and activism. *Progress in Human Geography*, 37(2). 253–70. DOI:10.1177/0309132512454775.

51 Tschakert, P. (2015). 1.5°C or 2°C: a conduit's view from the science-policy interface at COP20 in Lima, Peru. *Climate Change Responses*, 2(3). DOI:10.1186/s40665-015-0010-z.

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