TOWARDS A SOLID SCIENCE BASE:

LOSS & DAMAGE IN THE IPCC SPECIAL REPORTS ON LAND AND OCEANS AND THE CRYOSPHERE

Issues relevant for loss and damage have increased in prominence in the recent IPCC Special Reports. As climate impacts materialize and climate science advances, more and more information relevant for loss and damage is being included.

The reports agree that attributable climate change impacts are evident at today's levels of warming. Almost all marine heat waves are attributable to climate change, providing a solid underpinning for the loss and damage discourse. In high mountain regions, shrinking of glaciers and reductions in snow cover due to climate change have led to negative impacts for food security, water resources, water quality, livelihoods, health and well-being, infrastructure, transportation, tourism and recreation, as well as culture of human societies.

Limits to adaptation, including ecosystem-based adaptation responses, will be increasingly exceeded as global temperatures rise, leading to escalating losses and increasing costs.
Losses, including those that are irreversible, will increase substantially if the world fails to limit warming to 1.5°C.

Loss and damage refers to the adverse impacts of climate change that cannot be or have not been avoided through mitigation and adaptation, and many LDCs and SIDS are already experiencing loss and damage first hand. Scientific information on what losses and damages could be expected in the future will be essential for helping vulnerable countries to plan strategies for coping with potentially devastating and irreversible impacts.

The good news is that the IPCC authors have responded to this request. After the 1.5°C Special Report (2018) led the way by prominently featuring loss and damage, the Special Reports on Land (SRCCL, 2019a) and Oceans & the Cryosphere (SROCC, 2019b) also reflect the concept and its growing evidence base and introduce novel responses. This briefing takes a look at these novelties through the lens of **limits to adaptation and loss and damage,** which are of increasing relevance in today's context, as climate change and extreme weather events intensify.

IPCC plenaries allow governments to feed into the scoping processes for each report, and when the outlines for the SRCCL and SROCC were agreed, SIDS and LDCs called strongly for loss and damage to be considered. While all governments did not yet have the appetite to include an explicit point on loss and damage in the report outlines, it was agreed that the core components of loss and damage – namely climate change attribution, adaptation limits and residual risk – should be assessed.

Indeed, the special reports have strengthened our understanding of **attributable climate impacts** considerably. Attribution of extreme events is ever evolving including for extreme precipitation and extreme sea level events associated with tropical cyclones. Furthermore, extreme events in the ocean such as marine heat waves to date are already almost completely attributable to climate change and the SROCC found that: *"It is very likely that between 84–90% of marine heatwaves that occurred between 2006 and 2015 are attributable to the anthropogenic temperature increase"*[1]. High mountain and polar land regions are also affected by attributable impacts in the cryosphere: *"global warming has led to widespread shrinking of the cryosphere, with mass loss from ice sheets and glaciers (very high confidence), [and] reductions in snow cover (high confidence)"*[2]. This leads to hydrological changes

[1] SROCC, SPM, statement A2.3

[2] SROCC, SPM, statement A1

which have impacted terrestrial and freshwater species and ecosystems in these regions, *"changing the seasonal activities, abundance and distribution of ecologically, culturally and economically important plant and species, ecological disturbances, and ecosystem functioning (high confidence)"*[3]. Consequentially, "*food security, water resources, water quality, livelihoods, health and well-being, infrastructure, transportation, tourism and recreation, as well as culture of human societies*" have been negatively impacted[4].

Figure 1 (SPM.2) synthesises the observed regional impacts from changes in the ocean and high mountain and polar land regions, including the attribution confidence related to these changes.

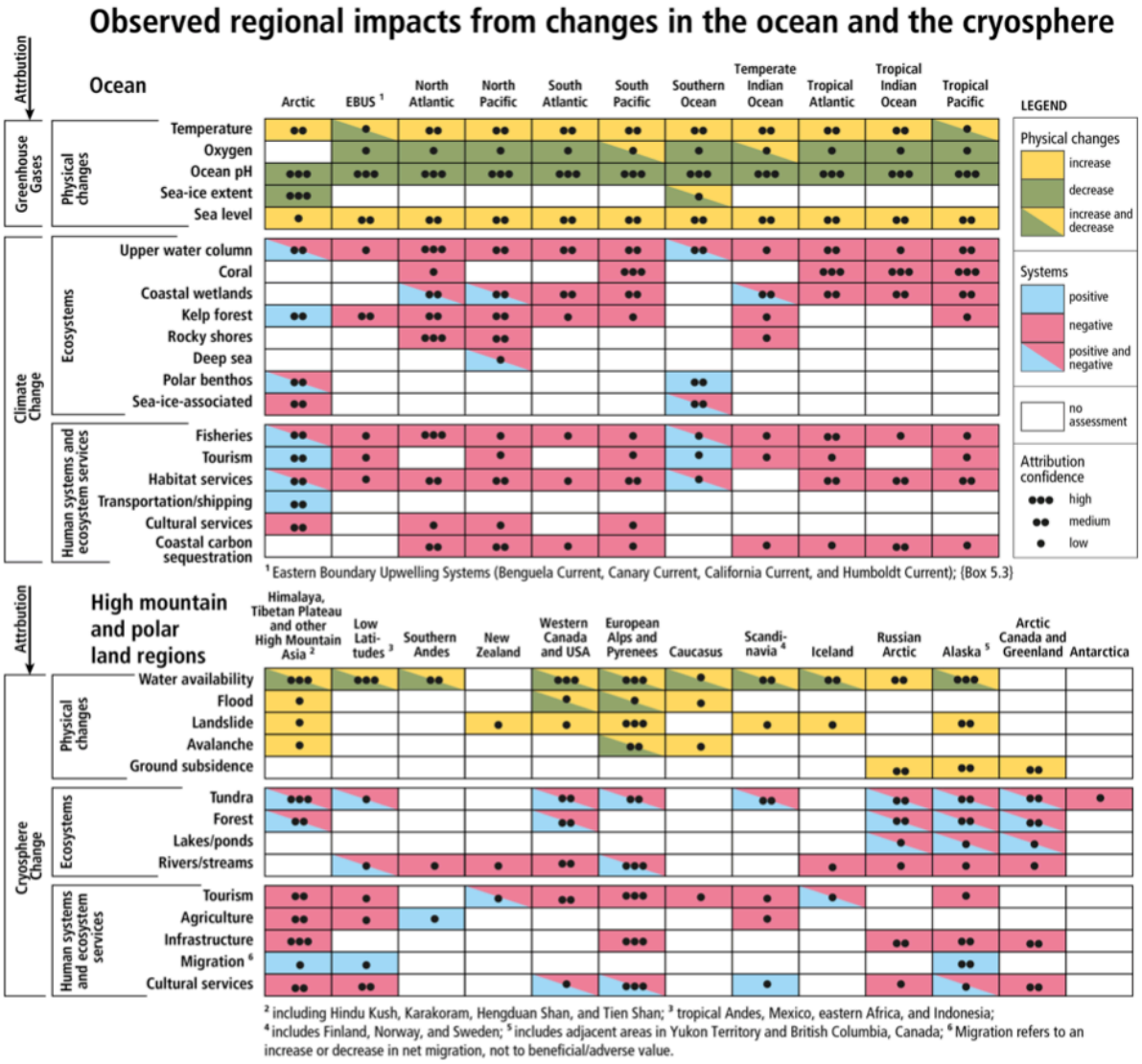

Figure 1: Synthesis of observed regional impacts from changes in the ocean (top) and high mountain and polar land regions (bottom) assessed in the SROCC, SPM.2

For each of the IPCC reports, the most robust and policy relevant findings are included in the Summary for Policy Makers (SPM), which is then discussed and approved line-by-line by government representatives. For the IPCC's scientists to assess the science on loss and damage in the underlying reports is

[3] SROCC, SPM, statement A4

[4] SROCC, SPM, statement A7

one thing, but for related findings to make their way into the SPM gives them additional scientific and political weight.

Both SPMs from the Special Reports on Land and Oceans highlight **the risks of losses** from climate change. The SPM of the SRCCL describes the loss of natural systems (such as forests, savannahs and wetlands for example) and losses in land productivity and food production occurring under current levels of global warming[5]. **Irreversible losses** in land ecosystem functions and services will occur if greenhouse gas emissions reductions are deferred[6]. In the SPM of the SROCC, losses with regards to warm-water coral reefs (very high risk even if global warming is limited to 1.5°C), species habitat and diversity and globally unique biodiversity are stressed[7].

The SPM of the Land Special Report acknowledges that **limits to adaptation** can be exceeded, which can trigger escalating losses or result in undesirable transformational changes (such as forced migration, conflicts and poverty)[8]. Limits to adaptation may be exceeded through "*coastal erosion exacerbated by sea level rise where land disappears (high confidence), thawing of permafrost affecting infrastructure and livelihoods (medium confidence), and extreme soil erosion causing loss of productive capacity (medium confidence)*"[8]. In addition, "*extreme forms of desertification can lead to the complete loss of land productivity, limiting adaptation options or reaching the limits to adaptation (high confidence)*[9]. The emphasis on escalating losses and undesirable transformation highlights how crucial the loss and damage debate is, and how essential it will be to include loss and damage in policy processes.

The SROCC assesses relevant material on loss and damage related to sea level rise, storm surges, glacial retreat and coral reef impacts. For the first time, the IPCC has covered responses that exceed adaptation, namely **loss and damage responses**. The SPM states that: "*Even with major adaptation efforts, residual risks and associated losses are projected to occur (medium confidence), but context-specific limits to adaptation and residual risks remain difficult to assess*"[10].

This is also illustrated in the burning embers diagram on sea level rise risk and responses (Figure 2, SPM.5). It shows the **risk level** in 2100 under different scenarios for illustrative geographies – namely resource-rich cities, large tropical agricultural deltas, arctic communities and urban atoll islands. The effects of **response options** to risk reduction are included, illustrating the relative contributions of in situ responses (e.g. hard engineered coastal defences, restoration of degraded ecosystems, subsidence limitation) and planned relocation – a response to loss and damage.

The figure shows that although resource-rich coastal cities have the potential to significantly reduce risks through in situ responses, urban atoll islands, which are facing the highest risk levels, cannot reduce these risks much even under the assumption that the maximal potential response (with both planned relocation and in situ responses) could be deployed. It is important to emphasise that the response options in this figure are set at their maximum potential levels, including planned relocation of Arctic communities and inhabitants of urban atoll islands even under a low emissions scenario, and risk levels can still not be substantially reduced for these communities.

Figure 2 (SPM.5) also importantly highlights that there are limits to **ecosystem-based adaptation responses** to reduce risks from sea level rise. The feasibility of coral conservation and restoration as

[5] SRCCL, SPM, statements A1.3, A5.3, A6.5 and B4.5

[6] SRCCL, SPM, statement D3.3

[7] SROCC, SPM, statement B.4 and B.6

[8] SRCCL, SPM, statement B5.5

[9] SRCCL, SPM, statement B4.5

[10] SROCC, SPM, statement B9.3

adaptation measures is constrained at 1.5°C and lost at 2°C (*high confidence)*, while wetland conservation – including mangroves and marshes – has decreased effectiveness at 2°C *(high confidence)*. While these ecosystem-based adaptation measures have a number of co-benefits, they become increasingly ineffective as global temperatures rise.

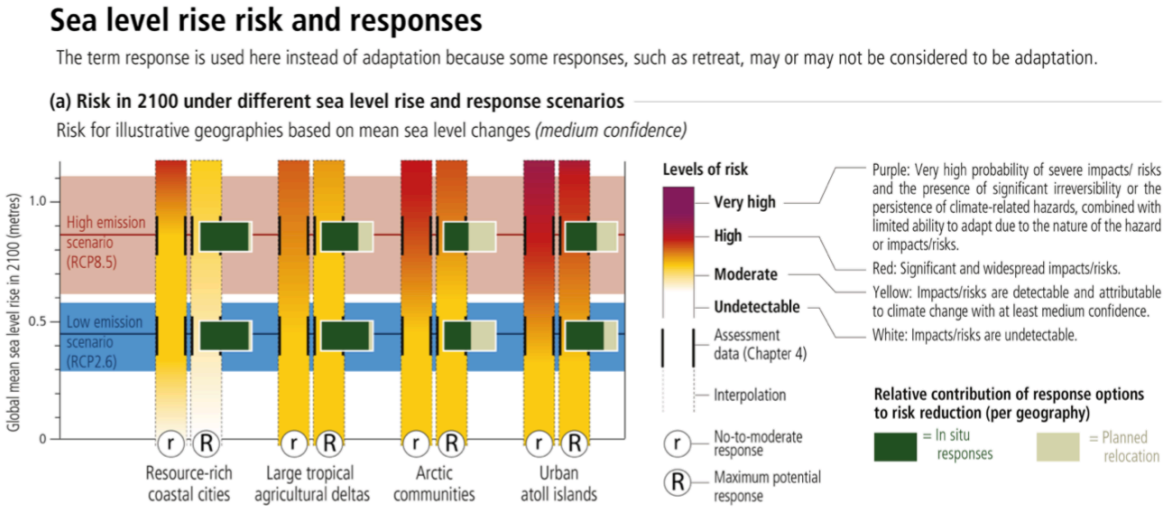

Figure 2: Burning embers diagram from the SROCC, SPM.5

These two Special Reports clearly outline that losses, including irreversible ones, will occur if GHG emissions are not reduced. Adaptation can provide support in reducing these risks induced by climate change but limits to adaptation do exist and residual responses that cannot be considered adaptation (such as relocation) have to be acknowledged. An important area of further work will be better understanding the feasibility of different response options; information on the maximum potential for reducing risks is meaningless to policymakers if the implications of such measures and their likelihood of success is not also considered. In addition, governance has to be accounted for in assessments of climate change impacts as it can significantly undermine the adaptive capacity of countries to climate change.

The prominence of loss and damage in the IPCC's three recent Special Reports is a promising sign that understanding of the concept and its implications is improving. Hopefully this will continue in the Sixth Assessment Report of the IPCC, which is currently being written up and will be published in 2021. The outline of the working group II report on impacts, adaptation and vulnerability promises to include scientific, technical and socioeconomic aspects of current and future residual impacts of climate change, including residual damage, irreversible loss, limits to adaptation and economic and non-economic losses caused by slow-onsets and extreme events. In addition, the policy community has repeatedly called for a sound scientific basis on loss and damage [e.g. decision 5/CP.23]. In particular the Warsaw International Mechanism needs a strong knowledge base in order to operate effectively. The clear reflection of relevant science in the IPCC reports is thus a welcome and much needed development that needs to be further continued.

References

IPCC. (2018). Summary for Policymakers. In V. Masson-Delmotte, P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, … T. Waterfield (Eds.), *Global Warming of 1.5 C: An IPCC special report on the impacts of global warming of 1.5 C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change,* (p. 32 pp). Retrieved from https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_High_Res.pdf

IPCC. (2019a). Summary for Policymakers. *IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*. https://doi.org/10.4337/9781784710644

IPCC. (2019b). Summary for Policymakers. *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. Retrieved from https://www.ipcc.ch/report/srocc/