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What the IPCC 5th Assessment Report has to say about loss and damage

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What the IPCC 5th Assessment Report has to say about loss and damage

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List of acronyms

AR5	Fifth Assessment Report
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Country
MDG	Millennium Development Goals
NGO	Non-Governmental Organization
QDA	Qualitative Data Analysis
SIDS	Small Island Development State
SPM	Summary for Policy Makers
TS	Technical Summary
UNFCCC	United Nations Framework Convention on Climate Change
UNU-EHS	United Nations University Institute for Environment and Human Security
WGII	Working Group 2
WIM	Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts

Executive Summary

Loss and damage is an emerging topic in climate change negotiations, research, policy and implementation of climate change action. With the establishment of the "Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts" in December 2013, the topic will grow in importance in coming years. Loss and damage refers to impacts of climate-related stressors that have not been or cannot be avoided through mitigation and adaptation efforts.

This paper uses qualitative data analysis software (text mining) to study what the Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC WGII AR5) has to say about loss and damage. It assesses which climatic stressors, impact sectors and regions the report primarily associates with loss and damage, and compares this with the functions and objectives of the Warsaw International Mechanism.

A clear message of the report is that postponing ambitious mitigation action increases the chances of crossing adaptation limits, and could lead to irreversible losses and damages to ecosystems and society, particularly in low-income countries. For the thirty supporting chapters of IPCC WGII AR5, the emergence of loss and damage in the climate negotiations, particularly in 2012-2013, came too late and they do not deal with it explicitly: the terms "loss and damage" or "losses and damages" only occur 30 times in 32 chapters, and the glossary does not include an entry for "loss and damage". However, independently, the words "loss(es)" or "damage(s)" occur approximately 2000 times. According to

the IPCC report, impacts of climate change threaten to cause – and are already causing – losses and damages to ecosystems, livelihoods, properties and non-tangible assets, with implications for human development and well-being.

The analysis in this paper yields some unexpected findings. For example, whereas vulnerable countries, such as small island development states (SIDS) and least developed countries (LDCs), were the main driving force behind the establishment of the Warsaw International Mechanism for Loss and Damage, this IPCC report mentions *developed* countries much more often in relation to losses and damages. The words Europe, Australia, North America and United States co-occur in one sentence with loss/damage about three times more often than the words Asia, Africa, Latin America and the Pacific. Other findings:

- The word most often used in connection to loss and damage is *risk* (386 times) and the chapters in which the words loss and damage appear most frequently are chapter 19 (Emergent risks and key vulnerabilities) and 10 (Key economic sectors and services). This is an indication that the report talks about losses and damages mostly – but not exclusively – in economic terms and as something of the future.
- The words loss and damage are used least frequently in Chapter 15 (Adaptation planning and implementation), Chapter 14 (Adaptation needs and options) and Chapter 2 (Foundations for decision making). This is an indication that

policy to address loss and damage is still in its infancy.

- The report associates loss and damage much more with extreme weather events, such as floods, storms and hurricanes than with slow-onset events and gradual climatic changes.
- Loss and damage to natural systems (biodiversity, coral reefs, forests, etc.) receives more or less the same level of attention as loss and damage to human systems (economy, livelihoods, agriculture, infrastructure, etc.). Within human systems, monetary and economic losses and damages are mentioned much more often than non-monetary, social and cultural losses, such as those related to food security, health, livelihoods, poverty, displacement, cultural heritage and identity.

The knowledge-building activities proposed in the 2-year work plan of the Executive Committee of the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts emphasize the need to enhance understanding of (i) loss and damage from slow-onset events; (ii) non-economic losses and damages; (iii) loss and damage in vulnerable developing countries; and (iv) how impacts of climate change affect migration and displacement (see Appendix 2). The findings of this paper confirm that these focus areas are well-chosen as they represent important knowledge gaps.

Besides the knowledge-building activities, the WIM Excom – in line with its third function: to enhance action and support, including finance, technology and capacity building to address loss and damage – proposes several activities that aim to facilitate and promote the integration of loss and damage in policy and planning for

adaptation and comprehensive risk management. The analysis in this paper shows that the policy-oriented chapters in IPCC WGII AR5 (2, 14 and 15, see Appendix 1) indeed hardly refer to loss and damage.

UNFCCC decision 2/CP.19 to establish the Warsaw International Mechanism acknowledges that loss and damage can be reduced by adaptation and risk management strategies. However, it also recognizes that loss and damage sometimes involves *more* than what can be adapted to, or in other words, that some loss and damage cannot be avoided (UNFCCC, 2013a). Development cooperation can play an important role in assisting vulnerable countries and populations to minimize avoidable loss and damage and to address unavoided and unavoidable loss and damage. In essence, minimizing avoidable loss and damage ‘simply’ requires from the development sector to improve the effectiveness of their adaptation, resilience-building and risk management interventions. By contrast, to address unavoided or unavoidable loss and damage, for example in places that become uninhabitable or unproductive because of climate change impacts, specific interventions will be required, such as social protection measures, resettlement, assisted migration and insurance solutions.

Introduction

Loss and damage is an emerging concept in the climate change negotiations, research, policy and implementation of climate change action, and is expected to grow in importance in the coming years. A milestone has been the establishment of the "Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts" in December 2013. Loss and damage refers to impacts of climate-related stressors that have not been or cannot be avoided through mitigation and adaptation efforts (Warner and van der Geest, 2013). Enhanced efforts to reduce greenhouse gas (GHG) emissions and effective adaptation and risk reduction measures can reduce future losses and damages, but some losses and damages are unavoidable (Huq et al., 2013). According to the UNFCCC (2012), losses involve impacts that are permanent, and damages can in theory be reversed. However, in the emerging literature on loss and damage, no clear distinction is usually made between the two. Rather, 'loss and damage' is treated as one single concept (Fankhauser et al., 2014).

Efforts to reduce GHG emissions have been insufficient so far, putting the world on a trajectory towards a strong increase in global temperature and associated changes in weather patterns (Meinshausen et al., 2009; van Vliet et al., 2012). Support for adaptation and risk reduction, particularly in developing countries that are most vulnerable to climate change impacts, has increased over the past decade, but vast adaptation deficits still exist (Burton, 2009). There is increasing consensus that there are constraints and limits to adaptation and the ability to avoid loss and damage (Dow et al., 2013; Preston et al., 2013). This is recognized in the summary

for policy makers of the contribution of Working Group II to the Fifth Assessment Report of the Inter-Governmental Panel on Climate Change (IPCC WGII AR5), which states: "Under all assessed¹ scenarios for adaptation and mitigation, some risk from adverse impacts remain² (very high confidence)" (IPCC, 2014, summary for policy makers, p. 14).

After a brief appearance in the early 1990s, climate-related loss and damage became an increasingly important topic in the climate negotiations in the late 2000s, culminating at COP19 in the establishment of the Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts (Roberts et al., 2014, UNFCCC, 2014). Interestingly, loss and damage has only recently become a topic of academic enquiry, following the rise of the concept in the climate negotiations (Warner et al., 2012, 2013). Hence, there is not yet a well-established literature on loss and damage.

Loss and damage as an emerging concept in climate change research is not yet dealt with explicitly in IPCC WGII AR5. In the 2500-plus pages of the report, the term as such is used only thirty times, and the 30-page glossary does not provide an entry for 'loss and damage'. The concept emerged too late for proper uptake in the fifth assessment report. AR5 does have, for the

¹ Note: Finding based on Chapter 19 (Emergent Risks and Key Vulnerabilities), where instead of "under all assessed scenarios" the phrasing is "under any plausible scenario" (Chapter 19, p. 1045).

² The final draft of the SPM stated that "risk from residual damages is unavoidable". In the approval phase, this was changed to the current statement that "risk from adverse impacts remain". Chapter 19 retains the original phrasing.

first time, a chapter on adaptation opportunities, limits and constraints (Chapter 16). This chapter is an important input to the loss and damage debate, as it focuses on situations in which mitigation and adaptation efforts are not enough to avoid impacts from climate change. The chapter was added after it was realized in the Fourth Assessment Report (IPCC, 2007) that this has become a reality. The chapter documents existing evidence on factors that make it harder to plan and implement adaptation (constraints, see box 1) and the points at which actors' objectives cannot be secured from intolerable risks through adaptive actions (limits, see box 1). When actors face 'hard limits', such adaptive actions are simply not possible. In the case of soft limits, options are *currently* not available (IPCC, 2014).

Box 1: IPCC Definitions of adaptation limits and constraints

Adaptation constraints: Factors that make it harder to plan and implement adaptation actions or that restrict options.

Adaptation limit: The point at which an actor's objectives (or system needs) cannot be secured from intolerable risks through adaptive actions.

Hard adaptation limit: No adaptive actions are possible to avoid intolerable risks.

Soft adaptation limit: Options are currently not available to avoid intolerable risks through adaptive action.

Source: IPCC WGII AR5 Glossary

When actors experience constraints to adaptation, loss and damage can be avoided by addressing these constraints. By contrast, when actors face hard adaptation limits, loss and damage is

unavoidable. Besides avoidable and unavoidable, there is a third category, namely unavoids loss and damage (Verheyen & Roderick, 2008). This last category moves the concept from an unsecure future to present-day realities of vulnerable people. While questions remain about the degree to which losses and damages from extreme weather events can be attributed to global warming (Bouwer, 2011; Huggel et al., 2013; Hulme, 2014; James et al., 2014), it is increasingly clear that climate-related stressors have the potential to cause havoc among populations whose underlying vulnerabilities are not sufficiently addressed by adaptation and risk reduction policy.

The key message of chapter 16, supplemented with evidence from other chapters (1, 11, 17, 20, 25 and 26, see Appendix 1) made it to the technical summary which states:

Limits to adaptation emerge from the interaction among climate change and biophysical and/or socioeconomic constraints.³ Opportunities to take advantage of positive synergies between adaptation and mitigation may decrease with time, particularly if limits to adaptation are exceeded. In some parts of the world, insufficient responses to emerging impacts are already eroding the basis for sustainable development. (IPCC, 2014, Technical Summary, p. 88)

³ The final draft of the TS, dated 28 October 2013, stated: "Residual loss and damage will occur from climate change despite adaptive and mitigative action." This statement was removed in the last editing round.

This paper studies which climatic stressors, impact sectors and regions the report primarily associates with loss and damage, and tries to find out whether the report treats loss and damage primarily in connection to natural or human systems. For loss and damage to human systems, the paper looks at the relative attention

given to economic and non-economic losses and damages. Furthermore, it compares these findings with the functions and objectives of the Warsaw International Mechanism (see Box 2) and the work plan that was proposed by its interim executive committee (see Appendix 2).

Box 2: Objective and functions of the Warsaw International Mechanism

Objective:

To address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change

Functions:

- a. Enhancing knowledge and understanding of comprehensive risk management approaches to address loss and damage associated with the adverse effects of climate change, including slow onset impacts;
- 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 associated with the adverse effects of climate change;

Source: UNFCCC (2013)

The structure of the paper is as follows. First, we explain the methods used to analyse the more than 2500 pages⁴ of the report (data mining with qualitative data analysis software). After that, the results sections analyse the use of the terms loss(es) and damage(s) by chapter, and by studying the words used in association with the terms loss and damage along four axes of thematic interest: type of climatic stressors, impact on natural and human systems, economic versus non-economic losses and geographic region. The last section provides conclusions and identifies

key areas in which development cooperation could support to address loss and damage.

Methods

Qualitative data analysis software (QDA Miner/WordStat) was used to extract sentences from the thirty IPCC WGII AR5 chapters plus the summary for policy makers (SPM) and the technical summary (TS) containing the words *loss(es)*, *lost*, *losing*, *lose*, *loser(s)*, *damage(s)*, *damaged* or *damaging*. The resulting 1,911 sentences were exported to a spreadsheet and screened for technical and formatting issues (e.g. incomplete sentences, more

⁴ We analyzed the thirty chapters of IPCC WGII AR5 plus the SPM and TS, totaling 2605 pages.

than one sentence, text in tables not correctly exported, illegible symbols, erroneous spaces, page breaks) and to check whether the words *loss* and *damage* were actually used in a meaningful way (e.g. author name: ‘Scott R. Loss’ was excluded).

The resulting document contained 1,886 sentences, in which *loss*, *damage* and related words occurred 2,177 times (in some sentences, the words occurred more than once). Losses were mentioned much more often than damages (see Table 1). Table 1 also compares the use of the words loss/damage in AR5 with the previous assessment report, published in 2007. It shows that both terms were used much more frequently in WGII AR5 than in WGII AR4. The set of 1,886 sentences was first used for a simple analysis of the frequency of occurrence of the words loss/damage in the 30 chapters of IPCC WGII AR5 plus the SPM and TS, and it forms the basis for a more in-depth analysis of how loss and damage features in the report.

Table 1: Use of the words loss/damage

Key term	Frequency WGII AR5	Frequency WGII AR4
Loss	872	446
Losses	525	265
Damage	419	307
Damages	172	156
Lost	70	60
Damaging	42	19
Lose	23	27
Damaged	22	23
Loser(s)	18	7
Losing	14	8
Total	2177	1313

Source: Authors

Note: The frequency scores include references

In the second step, the file with 1886 sentences was subjected to analysis to explore the words most often used in combination with loss/damage. A threshold was set at frequency 10,

meaning that words that co-occurred with loss/damage less than ten times were excluded from the analysis. The QDA software automatically excludes words that convey little intrinsic meaning, such as *able*, *about*, *above*, *according*, *across*, etc. The resulting list contained 587 words used in relation to loss/damage. This list was cleaned by:

- Removing author names;
- Removing words that conveyed no intrinsic meaning in this context, but were not automatically excluded by the QDA software (e.g. chapter, section, common, IPCC, SPM, table⁵, terms, important, related, report, role, similarly, etc.);
- Clustering words with the same root (e.g. agriculture and agricultural). We were conservative in clustering words because sometimes words with the same root have a different meaning (e.g. *effects* and *effective* were kept separate, and so were *developing* and *developed*). In case of doubt, the original text was consulted to verify whether words conveyed exactly the same meaning.
- In a few instances, words were combined (e.g. the word *Zealand* only occurred in *New Zealand*; *sheet* only in *ice sheet*, *greenhouse* only in *greenhouse gas*, etc.). When the other word (e.g. *ice* in *ice sheet*, *sea* in *sea level rise*) also occurred independently, the frequency score was adjusted (i.e. frequency of *ice sheet* deducted from frequency of *ice*).

⁵ The word *table* co-occurred 41 times with *loss/damage*. In 37 cases, this concerned a reference to a data table. In four cases (so below the threshold of 10), it referred to groundwater or water table. Therefore, the word *table* could be excluded.

The cleaned word list contained 301 words that occurred at least ten times in the same sentence with the words loss(es) or damage(s). This list and the frequencies with which the words occurred was used to support the analysis of how IPCC WGII AR5 covers current and future losses and damages associated with impacts of climate change.

Limitations

The approach in this paper has several limitations. First, it covers only the contribution of working group II to the Fifth Assessment Report. The reason to limit the scope was made because the contributions of Working group I and III focus on the causes of climate change and options for reducing greenhouse gas emissions respectively and not on the impacts of climate change. Second, the use of QDA software to count frequencies with which the terms loss and damage appear in chapters and to analyse which words are used most frequently in combination with these terms, proved an effective method for analysing the more than 2,500 pages of the report. However, the results of this analysis do not necessarily provide a full understanding of what IPCC WGII AR5 has to say about loss and damage. To address this limitation, the original text was frequently consulted to be able to provide background and interpretation to the more quantitative findings. A third limitation is that the final drafts of the IPCC chapters were used for the QDA analysis. These versions were still subject to final copy-editing, and there can be minor differences in the fully edited chapters. All quotes in this paper have been checked, and adjusted to the published version in case of changes.

L&D by IPCC WGII AR5 chapter

In this section, we look at how often different chapters use the words loss and damage (see Figure 1). The analysis is a simple frequency score, distinguishing loss (including related words, such as losses, lost and losing) and damage (including related words, such as damages, damaging and damaged).

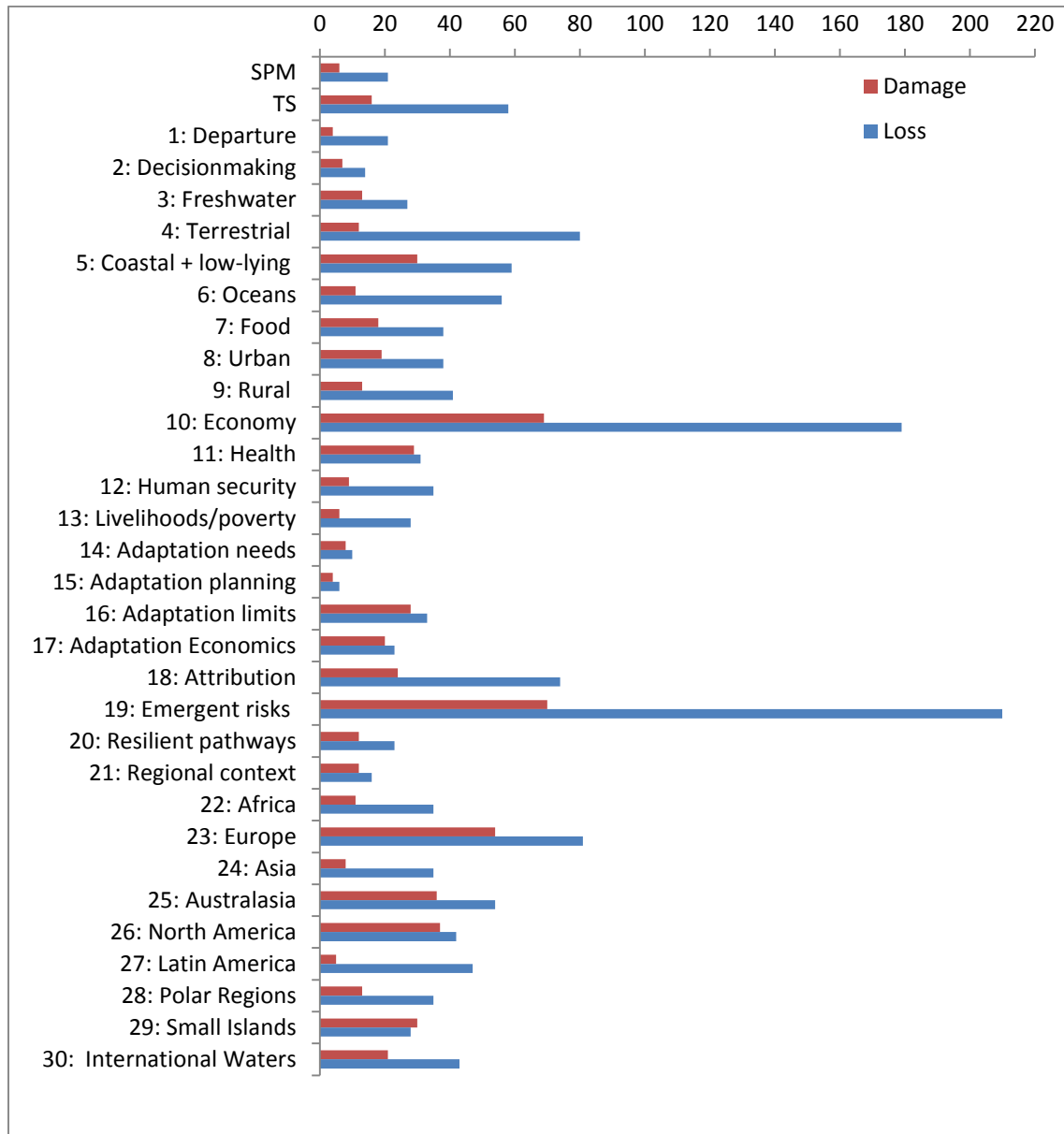
A first observation from Figure 1 is that the word 'loss' is used much more often than the word 'damage'. While the UNFCCC assigns specific meanings to the words 'loss' and 'damage', stating that losses are permanent and damages are reversible (UNFCCC, 2012), it would be inaccurate to conclude that the adverse effects of climate-related stressors, reported in WGII AR5, tend to be irreversible. For example, when adverse effects of climate change on livelihood security are discussed, the authors usually speak of 'loss of livelihood' without implying that livelihoods are lost forever.

The words loss and damage are most frequently used in Chapter 19 (Emergent risks and key vulnerabilities) and Chapter 10 (Key economic sectors and services). This is an indication that losses and damages are mostly framed in economic terms and that they are primarily seen as future threats. While Chapter 10 states that the influence of climate change on the global economy is relatively small compared to other drivers, it does highlight more severe impacts at low latitudes and in low- and middle-income countries. Here, climate change impacts and natural disasters are expected to trap more people in poverty. According to Chapter 19 a severe risk of climate change for human systems is the loss of ecosystem services, which is often exacerbated by local human activities, including mitigation action, such

as the production of bioenergy crops. Risks are highest in low-lying, densely populated areas, particularly in Asia, that are exposed to multiple hazards, such as sea level rise, storm surge, coastal erosion, saline

intrusion and flooding. Key risks identified in Chapter 19 include food insecurity, loss of rural livelihoods caused by water scarcity and loss of coastal livelihoods due to sea level rise and acidification.

Figure 1: Occurrence of the words loss and damage by chapter



Source: Authors

Notes: In this figure, chapter titles have been shortened. Full chapter titles are included in Appendix 1. The words included in the analysis are loss(es), lost, loser(s), losing, damage(s), damaged or damaging.

The lowest frequencies are in Chapter 15 (Adaptation planning and implementation), Chapter 14 (Adaptation needs and options) and Chapter 2 (Foundations for decision

making). This is an indication that policy to address loss and damage is still in its infancy. The establishment of the Warsaw International Mechanism for Loss and

Damage may change that in the nearby future as one of the main functions of the mechanism – besides enhancing knowledge and strengthening dialogue – is to support action to address loss and damage (see Box 2). A key message of Chapter 15 is that adaptation planning is improving but more complex than many assume. The chapter highlights an important hiatus in adaptation planning, namely that monitoring and evaluation of adaptation plans is inadequate, and that this needs to be systemised to know what actions are most efficient to reduce future losses and damages. Another key message of Chapter 15 involves the need to remove institutional barriers to effective adaptation planning. Chapter 14 notes a gap between adaptation needs and options to meet those needs – the adaptation deficit – and sees a role for “procedures to deal with loss and damage” to fill this gap (Chapter 14, p. 845).

The terms loss and damage are used more often in the chapters on Europe, North America and Australia than in chapters on Asia, Africa, Latin America and Small Islands. This is surprising because loss and damage is mostly associated with vulnerable countries such as small island development states and least developed countries. An explanation could be that more empirical evidence was available in high-income countries. Another reason could be that economic losses, expressed in monetary terms, tend to be higher in high-income countries. Recent examples from the United States are hurricane Katrina and super storm Sandy, with an estimated economic damage of 100 and 50 billion US\$ respectively (Chapter 5, p. 383).

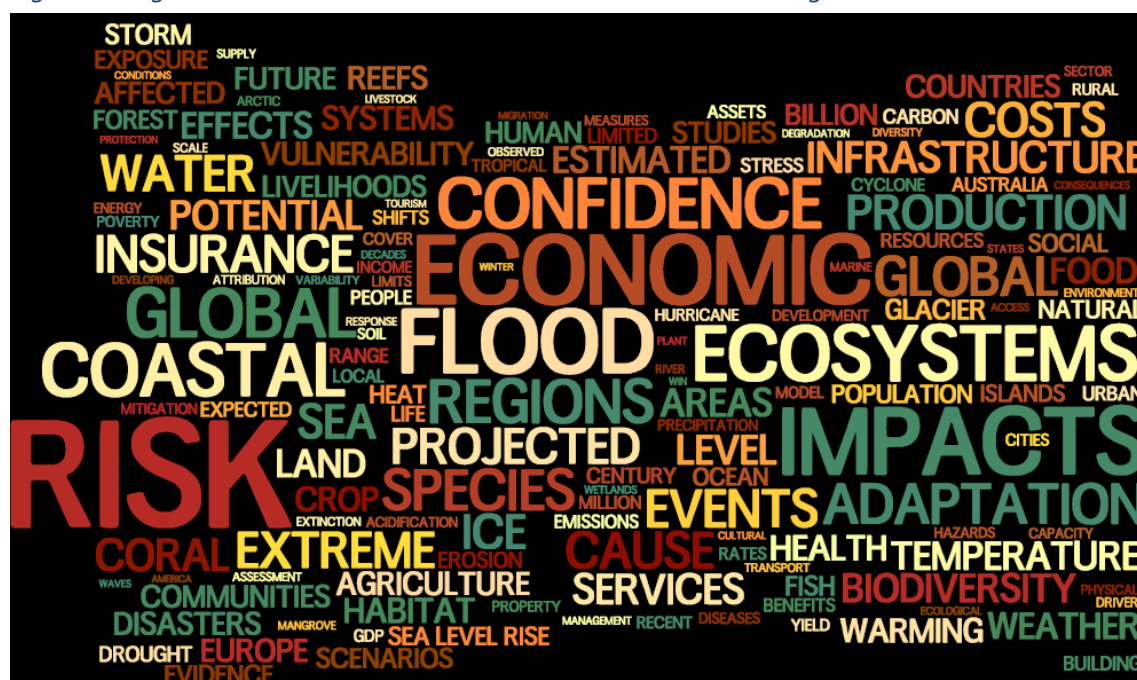
A last observation from Figure 1 is that the words loss and damage are used substantially less often in the Summary for Policy Makers (27 times in 44 pages) than in the Technical Summary (74 times in 76 pages). An explanation could be that the SPM needs to be approved line by line by member countries (38th session of the IPCC, 25-29 March 2014) and that Annex-1 countries successfully tried to minimize the use of the term as they fear that the rise of the concept will open the door to compensation claims. A detailed summary of the approval session shows that several attempts by vulnerable countries to maintain loss and damage language in the text were resisted by Annex-1 countries (IISD, 2014).

Terms associated with loss/damage: An analysis along 4 axes

In this section, we look at the words used in combination with the terms loss and damage. First, all words are taken together, and illustrated visually in a tag cloud (see Figure 2). After that, the words are analysed along four axes: type of climatic stressors, impact on natural versus human systems, economic versus non-economic losses and geographic region.

Figure 2 shows a tag cloud of words that co-occurred at least 25 times in the same sentence with the words loss or damage in the thirty IPCC WGII AR5 chapters plus the SPM and TS. The larger the word size, the more often mentioned in relation to loss/damage.

Figure 2: Tag cloud - Words used in one sentence with loss or damage



Source: Authors

Notes: The threshold for inclusion in figure is set at 25.

The word most often used in connection to loss/damage is ‘risk’ (383 times). This is an indication that the report talks about losses and damages mostly – but not exclusively – as a future threat. This is also in line with the analysis in the previous section, which showed that the words loss and damage most often occur in Chapter 19 (Emergent risks and key vulnerabilities).

the word ‘adaptation’ in one sentence with loss/damage is particularly frequent in Chapter 16. The central argument in that chapter is that there are limits and constraints to adaptation (see also Dow et al., 2013) and that not all climate-related losses and damages can be avoided even if mitigation and adaptation efforts are intensified.

Other words that were used at least one hundred times in combination with loss or damage are – in descending order – economic, impacts, flood, coastal, adaptation, ecosystems, events⁶, species, insurance, water, sea, ice, costs, coral, infrastructure, biodiversity and land. These words include climatic stressors, impact types, processes and potential solutions. Below, they are analysed in more detail, and in relation to other words. The use of

Type of climatic stressor

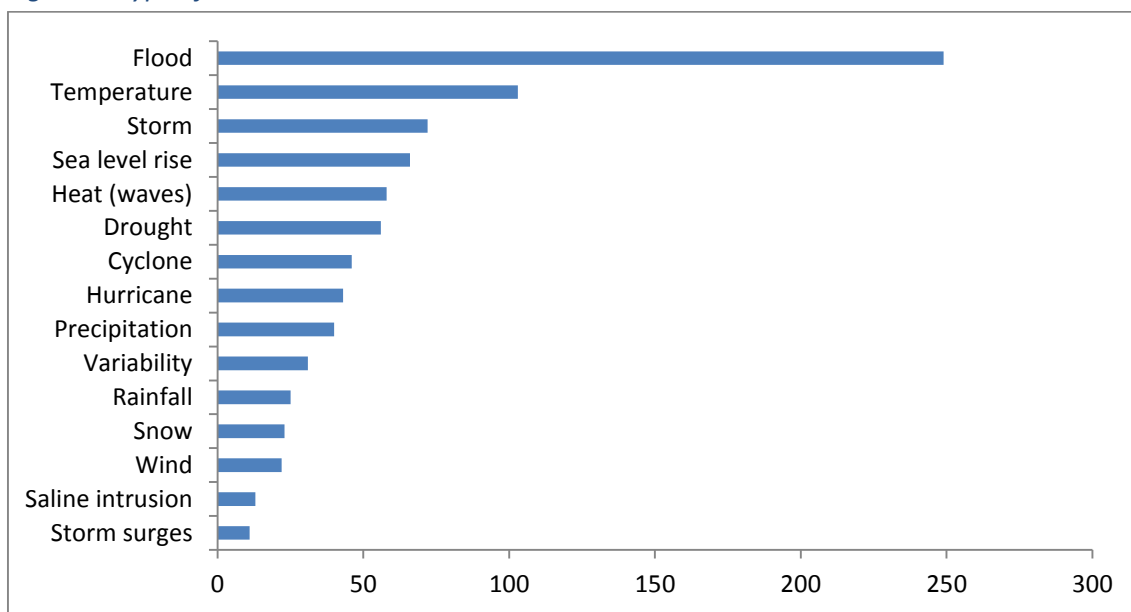
Figure 3 shows the climatic stressors that are mentioned in IPCC WGII AR5 at least 10 times in one sentence with loss or damage. Floods clearly stand out as the climate-related stressor that is most frequently associated with losses and damages. Second comes temperature (rise), which primarily causes loss and damage to ecosystems and animal and plant species. The IPCC report discusses evidence of loss and damage from extreme weather events, such as floods, storms, heatwaves and cyclones/hurricanes, much more frequently than evidence of loss and damage from slow-onset events, such as

⁶ The word ‘events’ is mostly used in ‘extreme weather events’. By contrast, ‘slow-onset events’ were mentioned only once in relation to loss and damage (in Chapter 13: Poverty and livelihoods).

sea level rise and changing rainfall patterns. While there is a long tradition of documenting disaster losses, much less work has been on loss and damage from more gradual climatic changes. The 2-year work plan of the Executive Committee of

the Warsaw International Mechanism addresses this knowledge gap with focused activities that aim to enhance understanding of loss and damage from slow-onset processes.

Figure 3: Type of climate-related stressor



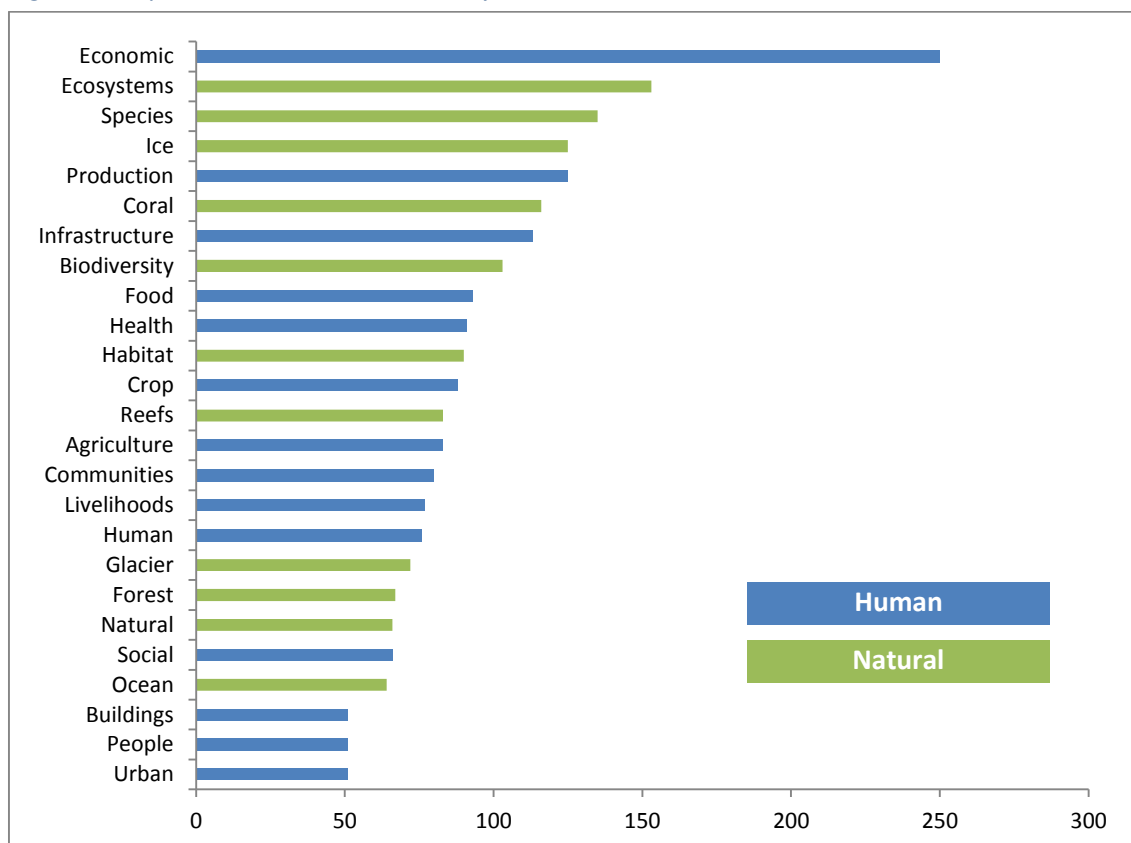
Source: Authors

Note: The threshold for inclusion in figure is set at 10.

Interestingly, from a climate science perspective, it is much less complicated to attribute loss and damage to anthropogenic global warming in the case of slow-onset processes than in the case of extreme weather events (James et al., 2014). However, assessing loss and damage from slow-onset processes tends to be more tedious. A complicating factor is that slow-onset processes and sudden-onset events usually interact. For example, sea level rise (slow-onset) exacerbates impacts of cyclones and tidal floods (sudden-onset). Also, sudden-onset events can act as

triggers to push slower-onset changes over tipping points. For example, a severe drought can trigger desertification. Another complicating factor in assessing loss and damage from slow-onset changes is that human systems have more time to adapt to these changes. Whereas an assessment of loss and damage from a cyclone would typically take place at a discrete point in time – usually soon after the cyclone – the timing of an assessment of loss and damage from sea level rise is less obvious.

Figure 4: Impacts on natural vs human systems



Source: Authors

Notes: The threshold for inclusion in figure is set at 50. Words used in connection to impacts on human as well as natural systems were excluded from the figure

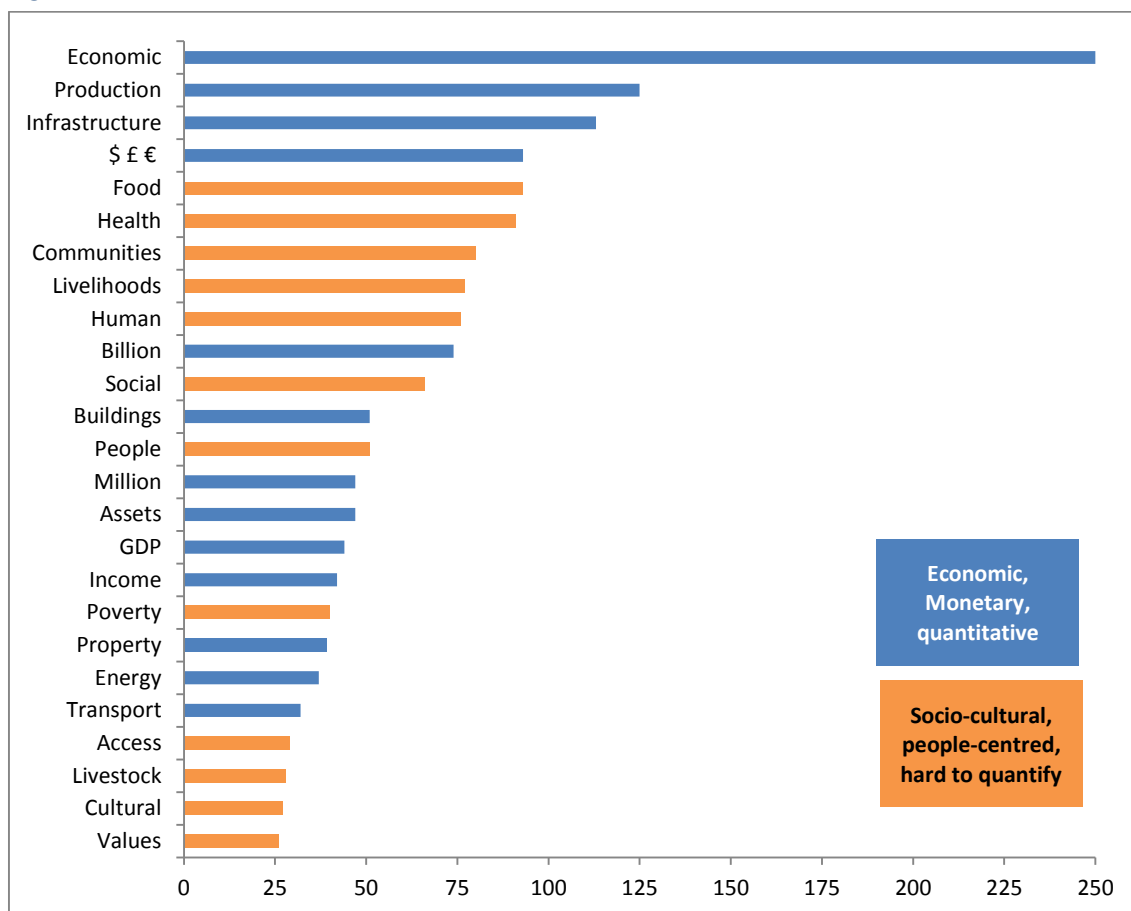
Impacts on natural versus human systems

Figure 4 shows words used in the same sentence as loss/damage that involve impacts on natural (the green bars) and human systems (the blue bars). In some cases a word can imply human impacts as well as ecosystem impacts.⁷ In such instances, the original text was consulted and based on that a decision was made. For example, the words fish, population, physical, environment, migration, mortality and morbidity were used in connection to impacts on human as well as natural systems, and therefore excluded from the figure. Other words, such as production,

⁷ The authors acknowledge that impacts on natural systems often affect human systems through loss of ecosystem services (Costanza et al., 1997; Alcamo et al., 2003; Zommers et al., 2014).

indigenous and diseases could in theory be used in both realms, but in practice were only used in relation to human impacts. Overall, IPCC WGII AR5 pays a similar level of attention to impacts on human and natural systems. In natural systems, the report expresses particular concern about loss and damage to ecosystems, species, habitat and biodiversity. Figure 4 also reveals an emphasis on marine and arctic ecosystems and less attention for terrestrial ecosystems. The impacts on human systems, discussed in IPCC WGII AR5, primarily involve economic losses and damage to infrastructure. Substantially less attention is given to impacts on food security, health, livelihoods and communities, as is also shown in the next figure (Figure 5).

Figure 5: Economic versus socio-cultural losses



Source: Authors

Note: The threshold for inclusion in figure is set at 25.

The work plan of the Warsaw International Mechanism clearly focuses more on loss and damage to human systems than on natural systems. The work plan only makes reference to natural systems once⁸, and this is in direct relation to the ecosystem services that vulnerable people depend on. As adaptation options for ecosystems tend to be more limited than for human systems, substantial loss and damage to ecosystems and their services can be expected (Zommers et al., 2014). While it is understandable that the Warsaw

⁸ This is in the first cluster of activities, which aims to enhance understanding of how loss and damage affects vulnerable people. The reference to ecosystems was only included in the work plan after the last round of invited comments from observers (personal communication with Excom members).

Mechanism focuses its activities on human systems, it may be very useful for the executive committee to seek expert views on how loss and damage to ecosystem services will affect vulnerable communities in developing countries.

Economic versus socio-cultural loss and damage

Figure 5 plots words used in the same sentence with loss/damage that are related to climate impacts on human systems. A distinction is made between economic (the blue bars) and socio-cultural impacts (the orange bars), or to be more precise, between economic, physical, monetary and quantifiable impacts on the one hand, and socio-cultural, people-centred and hard to quantify impacts on the other. While a distinction is usually made between

economic and non-economic losses, we feel that these labels are not fully adequate in this context. Economic losses are defined by the UNFCCC as “losses of resources, goods and services that are commonly traded in markets.” (UNFCCC, 2013b: 3). By contrast, non-economic losses are understood in the technical paper as losses to things that are not commonly traded in markets, and therefore challenging to assess. In our view, these two categories are blurred and the label non-economic can be misleading. Loss of livelihood, for example, is hard to quantify and has socio-cultural elements, but in essence, a livelihood comprises the assets and activities required for people to make a living (Scoones, 1998). Hence, categorizing loss of livelihood under non-economic losses is problematic.

IPCC WGII AR5 reports about loss and damage primarily in relation to physical, economic and monetary impacts (the blue bars) of climate change and extreme weather events (see Figure 5). On the people-centred side (the orange bars), food security, health and livelihoods are the key sectors where climate change-related losses and damages are observed and expected. Climate change-induced food security problems are particularly expected in Sub-Saharan Africa, where temperature increases in some areas may be beyond adaptation limits, and where an increased frequency and intensity of droughts and floods would affect yield levels and post-harvest losses. Expected impacts of climate change on human health would result partly from food insecurity, but also from an increase in vector- and water-borne diseases, associated with global warming.

Some expected focus areas⁹ of the Warsaw International Mechanism (WIM) for Loss and Damage, such as impacts of slow-onset events, displacement, non-economic loss and damage and vulnerable populations were not mentioned often enough to be included in the figure (the threshold for inclusion in figure 5 was set at 25). The WIM executive committee has correctly identified these areas as important knowledge gaps. For example, a recent technical paper by UNFCCC (2013) states that in many developing countries non-economic losses may be more significant than economic losses and should be a central aspect of climate change policy.

Below, we have listed a selection of quotes from different chapters that show that IPCC WGII AR5, despite its tendency to focus primarily on economic losses, also has some important things to say about non-economic, non-monetary, social and cultural loss and damage, such as displacement, loss of social identity and loss of damage to cultural heritage:

- SPM, p. 19: “Disaster loss estimates are lower-bound estimates because many impacts, such as loss of human lives, cultural heritage, and ecosystem services, are difficult to value and monetize, and thus they are poorly reflected in estimates of losses.”
- TS, p.73: “Loss of land and displacement, for example, on small islands and coastal communities, have well documented negative cultural and well-being impacts.”
- Chapter 5, p.364: “Without adaptation, hundreds of millions of people will be affected by coastal flooding and will be displaced due to land loss by year

⁹ Expected focus areas based on UNFCCC, 2013a, Decision 3/CP.18, paragraph 6 and 7.

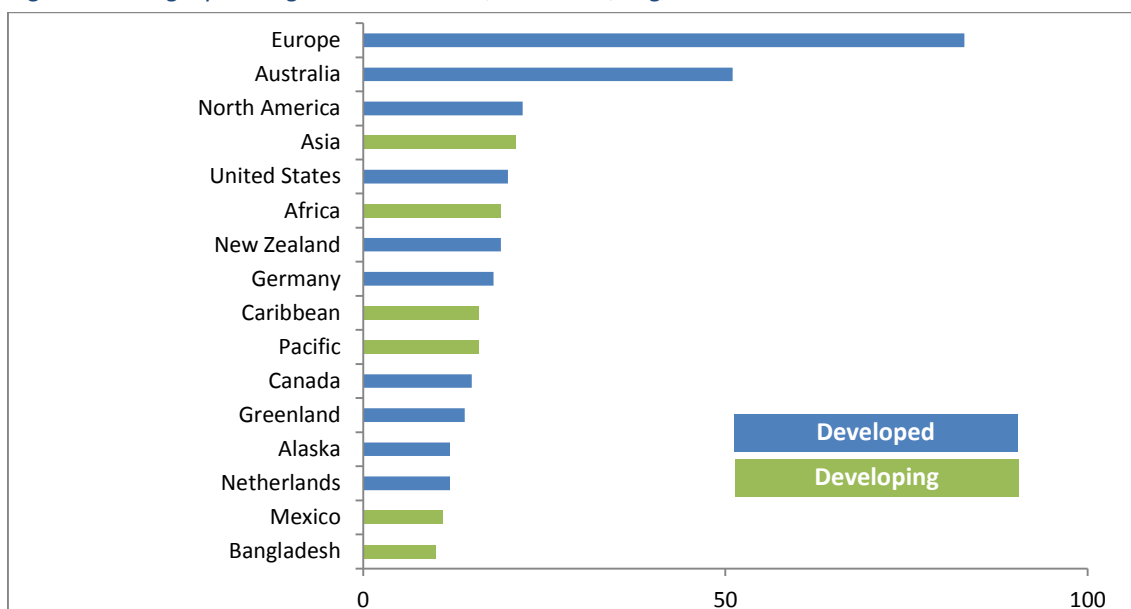
2100; the majority of those affected are from East, Southeast and South Asia (*high confidence*).”

- Chapter 16, p.922: “Strategies such as migration (...) may involve the loss of sense of place and cultural identity, particularly if migration is involuntary.”
- Chapter 29, p. 1639: “Relocation and displacement are frequently cited as outcomes of sea-level rise, salinization and land loss on islands.”
- Chapter 23, p.5: “Climate change and sea level rise may damage European cultural heritage, including buildings, local industries, landscapes, archaeological sites, and iconic places [medium confidence].” Geographic regions: continents, countries, regions

Whereas vulnerable countries, such as small island development states (SIDS) and least developed countries (LDCs) were the

main driving force behind the establishment of the Warsaw International Mechanism for Loss and Damage, surprisingly, this IPCC report mentions *developed* countries much more often in relation to loss and damage. The words Europe, Australia, North America and United States co-occur with loss/damage about three times more often than the words Asia, Africa, Latin America and the Pacific (see Figure 6). Similarly, Germany is mentioned in connection to loss/damage more often than the entire Caribbean and almost twice as often as an extremely vulnerable country like Bangladesh. An explanation may be that more research has been done and more empirical evidence was available in high-income countries. Another reason could be that economic losses, when expressed in monetary terms, tend to be higher in high-income countries.

Figure 6: Geographic regions: continents, countries, regions



Source: Authors

Notes: The threshold for inclusion in figure is set at 10. Latin America was not mentioned often enough in connection to loss/damage to be included in Figure 6. The authors acknowledge that Europe includes countries, such as Belarus, Moldova, Rumania and Croatia, that are considered developing countries and that Asia includes countries, such as Japan, South Korea and Singapore, that are considered developed countries.

What WGII AR5 has to say about the four GIZ pilot regions

This section presents key findings of IPCC WGII AR5 about observed and expected climatic changes, impacts, adaptation – including limits and constraints – and loss and damage for the GIZ pilot regions: Central America, East Africa, the South Pacific and India. While findings are presented at continental level, where possible the analysis zooms in to sub-regions.

Central America

The main climatic stressors for this region are decreasing rainfall trends, increasing temperature and temperature extremes. Of concern is also the likely loss of the Mesoamerican coral reef under business as usual emission scenarios, which would cause major economic losses as well as irreparable damage to ecosystems. Deforestation and land degradation (sometimes related to GHG mitigation, as in the case of biofuels) exacerbate impacts of climate change, and should be addressed by ecosystem-based adaptation practices. The region has experienced substantial economic growth in the past decade, but increasing inequality – a root cause of vulnerability – is a major concern because it limits adaptive capacity.

Between 2000 and 2010, Latin America experienced 630 extreme weather events, such as floods, storms and hurricanes, which affected 46.6 million people. Approximately 16,000 people died and economic losses amounted to over US\$ 200 million. In Central America, the frequency of such events has increased sharply over the past three decades. The region is at high risk from hydrometeorological events due to its geographic location and the high

vulnerability of its population. On a positive note, the region has witnessed much progress in disaster risk management, including preventive measures (e.g. increasingly effective Early Warning Systems) and emergency response. The chapter identifies one important gap or missed opportunity in the region's disaster management that needs improvement: the involvement of local communities, organizations and cooperatives.

With regard to impacts of climate change in Central America, IPCC WGII AR5 also emphasizes effects on human health. It states with very high confidence that respiratory and cardiovascular diseases, vector- and water-borne diseases, Hantaviruses and Rotaviruses, chronic kidney diseases, and psychological trauma are associated with climate-related drivers that are expected to further intensify in the future.

Successful adaptation that minimizes loss and damage in Central America will require a new governance model that seeks synergies between development needs and climate action.

The chapter on Latin America identifies the following research and data gaps:

- There is a lack of high quality and continuous climate, oceanic and hydrological data, particularly in Central America, which makes it more difficult to identify changes in the frequency and intensity of extreme weather events.
- Within Latin America, data and research is skewed towards the southernmost countries (Chile, Argentina, and Uruguay) and Brazil.

- There is a lack of interdisciplinary research that is capable of separating the effects of climatic and non-climatic stressors on natural and human systems. This is paramount for a region like Central America where deforestation and land use change abound.
- Research on the efficiency of adaptation measures is lacking
- Traditional knowledge has not been documented and used adequately.

South Pacific

IPCC WGII does not have a separate chapter for the Pacific, but Chapter 29 on Small Islands covers the region. The main climate-related stressors for the Pacific are sea level rise, increased sea surface temperature, ocean acidification, cyclones and storms. Impacts on natural systems and ecosystem services include loss and damage to coral reefs, mangroves, sea-grasses, intertidal flats, more coastal erosion and loss of freshwater resources, which in turn affect human systems. Some of the societal impacts of climate change that will be hard to avoid in the longer term, and that are already affecting islands in the region, are land loss, loss and damage to properties and infrastructure, loss of livelihood (especially in fisheries), impacts on health and forced migration and displacement.

The 'Small Island' Chapter of IPCC WGII AR5 identifies several barriers and limits to adaptation that stand in the way of minimizing loss and damage. Broadly categorized under financial, technical, human resources, socio-cultural, and legal / political constraints, the chapter emphasizes some problems that are specific to small islands. For example, due to their small size, economies of scales are lacking, and so are viable options for

diversifying the economy and livelihoods. Another relevant observation is that islands tend to be so 'particular' – in terms of heterogeneity and in their difference from continental areas – that much of the knowledge produced by climate science and impact research is of little use to island policy makers. The chapter further describes cultural constraints to adaptation that are food for thought for the development sector. Many cultural constraints can be addressed through bottom-up design and implementation of adaptation measures.

The chapter on Small Island identifies the following research and data gaps:

- Due to the small land size of Pacific islands, further downscaling of climate change scenarios is required to make the data relevant for decision-making.
- There is a need for research that disentangles the relative contribution of climatic and non-climatic factors to observed weather events and their impacts.
- To support decision-making, better research about the economic and social costs of adaptation is needed.

East Africa

The principal climatic changes observed and expected for the African continent are higher temperatures, changing rainfall patterns and more concentrated rainfall. There are large regional variations, with decreasing rainfall expected for West Africa and Southern Africa, exposing these regions to higher drought risk, and higher rainfall amounts in East Africa, exposing this region to increased flood risk. The main impacts will be on water availability and food security. While most African countries have recorded significant progress in MDGs overall, the continent

has been less successful in fighting hunger and extreme poverty. Moreover, there is large spatial and socio-economic inequality in MDG progress, leaving large regions and population groups more vulnerable to climate change impacts than before. There has also been progress in managing agricultural risk from climate variability, but according to the Africa chapter this is most likely not enough to avoid loss and damage to agriculture (lower crop yields and loss of livestock in drought-prone areas). In recent years, index-based insurance solutions have emerged that can be instrumental in addressing such losses and avoiding the uptake of erosive coping¹⁰ strategies that undermine future livelihood sustainability and perpetuate social vulnerability.

An important adaptation constraint, identified in the Africa chapter of IPCC WGII AR5, is that institutional and 'autonomous' adaptation are often at odds. Interventions by governments and NGOs that are supposed to support people to be better prepared for climatic changes are often maladaptive. Other maladaptive practices involve development interventions that favour short-term economic growth, but undermine people's resilience in the longer term. A last maladaptive practice that is highlighted in the Africa chapter concerns diversification of livelihoods into activities – such as charcoal production and artisanal mining - that damage ecosystem services. Besides adaptation constraints, the continent also faces hard biophysical limits to adaptation, particularly related to crop growth under high temperatures.

¹⁰ The concept of 'erosive coping' is explained in more detail in van der Geest & Dietz (2004) and Warner et al., (2013).

The IPCC report identifies the following data and research gaps for the African region:

- Poor access to hydrometeorological data due to limited availability and affordability (especially for African researchers, who tend to have lower budgets than their colleagues in developed countries).
- Need to downscale GCM data to serve impact analysis at appropriate geographic scale.
- Lack of long-term and uninterrupted datasets in relevant sectors, such as ecosystems and agriculture;
- More research needed on vulnerability to and impact of climate change across multiple scales, sectors and systems;
- Not enough known about the link between climate change, adaptation and human mobility, and the environmental impacts of such mobility;
- A better understanding is needed about what factors contribute to success and failure of different adaptation measures, including community-based adaptation.

India

Climatic changes for the Asian continent include a warming trend, variable trends in precipitation across space and seasons, rapid melting of glaciers, increased risk of glacier lake outburst floods, increased frequency of extreme weather events, sea level rise and associated problems, such as salinity intrusion and coastal erosion. For India, *all* models show an increase in extreme rainfall events during the summer monsoon. In regions with decreasing rainfall trends, water security is at risk, aggravated by high population pressure and sub-optimal water management.

Increasing temperatures are expected to cause loss and damage to rice production as heat stress limits are approached.

While some positive effects of climate change are expected at higher latitudes in Central Asia due to CO₂ fertilization and longer growing seasons, particularly adverse effects on agricultural production are expected in South Asia, which already has high rates of poverty. Coastal areas in India are extremely exposed to cyclones and tropical storms. The trend in frequency and strength of these phenomena is unclear, but sea level rise and loss of coral reefs and mangrove forests are expected to exacerbate wave damage in the nearby future.

The chapter identifies adaptation options for different climatic stressors and cites research about the capacity of these measures to reduce losses and damages. In the megacity of Mumbai, for example, upgrading the drainage system can reduce damages by 70%, and full penetration of insurance would halve the adverse effects and speed up recovery.

The chapter's section on adaptation limits and constraints is relatively weak. Financial, institutional, social and cultural constraints are mentioned, as well as biophysical limits to ecosystem adaptation, but no further region-specific details and examples are given.

The chapter on Asia identifies the following research and data gaps:

- There is a lack of research on the health effects of climate change;
- A better understanding of the impact of climate change on ecosystem services and biodiversity is needed;
- There is a blind spot in current knowledge about impacts, vulnerability

and adaptation in relatively small urban centres (<500,000 inhabitants);

- Linkages between ecosystems and livelihoods are not thoroughly understood;
- A better assessment of the cost-effectiveness of different adaptation measures is needed.

Conclusion and recommendations

'Loss and damage' refers to impacts of climate-related stressors that have not been or cannot be avoided through mitigation and adaptation efforts. As a concept, it does not feature prominently in IPCC WGII AR5, but the summary for policy makers and the technical summary do state with very high confidence that there is a risk of unavoidable losses and damages despite current and future mitigation and adaptation efforts. Moreover, throughout the 30 chapters of the report, evidence of current losses and damages are presented, and the risks of future losses and damages are assessed. A clear message of the report is that postponing ambitious mitigation action increases the chances of crossing adaptation limits, and could lead to irreversible losses to ecosystems and society, particularly in low-income countries.

This paper used qualitative data analysis software (text mining) to study what IPCC WGII AR5 has to say about loss and damage. The words 'loss' and 'damage' occur over 2,000 times and we assessed which climatic stressors, impact sectors and regions the report primarily associates with loss and damage. Further, the paper studies implications of the findings for research, policy and action to address loss and damage by comparing them with the functions and objectives of the Warsaw

International Mechanism for Loss and Damage associated with Climate Change Impacts.

The word most often used in connection to loss and damage is *risk* (386 times) and the chapters in which the words loss and damage appear most frequently are chapter 19 (Emergent risks and key vulnerabilities) and 10 (Key economic sectors and services). This is an indication that the report talks about losses and damages mostly – but not exclusively – in economic terms and as a future threat. The authors of this paper agree with the WIM executive committee that non-economic losses and damages need to be better understood as well, and that climate-related loss and damage is not just something of the future; it is already occurring today. Existing adaptation limits and constraints and current patterns of loss and damage to vulnerable populations need to be better understood. To inform policy and action, assessments of loss and damage in vulnerable communities need to measure what is measurable and qualify the nature of what is unmeasurable.

IPCC WGII AR5 discusses losses and damages mostly in relation to floods and other extreme events, such as storms and hurricanes. It has much less to say about losses and damages from slow-onset processes and gradual climatic changes. While existing disaster loss databases and institutional structures for disaster management can play an important role in assessing and addressing loss and damage, the risks of loss and damage from slow-onset processes and gradual climatic changes, and the dangerous interaction between slow-onset processes and sudden-onset events, needs more attention in research, policy and implementation. The two-year work plan

of the Warsaw International Mechanism includes focussed activities in this area.

Unexpectedly, whereas vulnerable developing countries were the main driving force behind the establishment of the Warsaw International Mechanism for Loss and Damage, IPCC WGII AR5 mentions *developed* countries much more often in relation to losses and damages. The chapters on Africa, Asia and Latin America contain less evidence of climate-related losses and damages. This could be because more research has been done and more empirical evidence is available in high-income countries or because economic losses, when expressed in monetary terms, tend to be higher in high-income countries. The authors of this paper want to emphasize that the real losses and damages in terms of human suffering, disrupted livelihoods and undermined sustainable development pathways are manifold more severe in the world's least developed countries and small island development states. Research, policy and implementation action should concentrate on those countries first. Indeed, the Warsaw International Mechanism – according to the decision text (UNFCCC, 2014) – has a mandate to address loss and damage purely in “developing countries that are particularly vulnerable to the adverse effects of climate change”. While that seems a justified choice, there is a risk that this may deepen ideological divides between rich and poor countries, which are already affecting climate negotiations, as became very clear during COP-20 in Lima, Peru.

The chapters that are most policy-relevant¹¹ are also the most silent about

¹¹ Chapter 15 (Adaptation planning and implementation), Chapter 14 (Adaptation

loss and damage. This is an indication that policy to address loss and damage is still in its infancy. The establishment of the Warsaw International Mechanism for Loss and Damage may change that in the nearby future. UNFCCC decision 2/CP.19 to establish the Warsaw International Mechanism acknowledges that loss and damage can be reduced by adaptation and risk management strategies. However, it also recognizes that loss and damage sometimes involves *more* than what can be adapted to, or in other words, that some loss and damage cannot be avoided (UNFCCC, 2013a).

Development cooperation can play an important role in assisting vulnerable countries and populations to minimize avoidable loss and damage and to address unavoided and unavoidable loss and damage. In essence, minimizing avoidable loss and damage requires from the development sector to improve and expand what they are already doing. The sector needs to make its adaptation and

risk management interventions more effective and reduce underlying vulnerabilities. By contrast, to address unavoided or unavoidable loss and damage, for example in places that become uninhabitable or unproductive because of climate change impacts, specific interventions will be required. Examples of such measures are social protection for people living in places that become unproductive due to climate change impacts; preventive resettlement and assisted migration for people who are trapped in places that become uninhabitable due to climate change; and insurance solutions for people living in places where risks of livelihood failure or loss and damage to houses and assets due to climate-related events becomes intolerable.

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Appendix 1: Full chapter titles IPCC AR5 WGII

The analysis presented in this paper is based on all 30 chapters plus the summary for policy makers (SPM, 44 pages) and the technical summary (TS, 76 pages)

- Ch. 1: Point of departure (35 pages)
- Ch. 2: Foundations for decision making (53p)
- Ch. 3: Freshwater resources (76p)
- Ch. 4: Terrestrial and inland water systems (153p)
- Ch. 5: Coastal systems and low-lying areas (85p)
- Ch. 6: Ocean systems (138p)
- Ch. 7: Food production systems and food security (82p)
- Ch. 8: Urban areas (113p)
- Ch. 9: Rural areas (74p)
- Ch. 10: Key economic sectors and services (86p)
- Ch. 11: Human health (69p)
- Ch. 12: Human security (63p)
- Ch. 13: Livelihoods and poverty (57p)
- Ch. 14: Adaptation needs and options (51p)
- Ch. 15: Adaptation planning and implementation (46p)
- Ch. 16: Adaptation opportunities, constraints, and limits (79p)
- Ch. 17: Economics of adaptation (49p)
- Ch. 18: Detection and attribution of observed impacts (94p)
- Ch. 19: Emergent risks and key vulnerabilities (107p)
- Ch. 20: Climate-resilient pathways: adaptation, mitigation, and sustainable development (42p)
- Ch. 21: Regional context (97p)
- Ch. 22: Africa (115p)
- Ch. 23: Europe (93p)
- Ch. 24: Asia (68p)
- Ch. 25: Australasia (101p)
- Ch. 26: North America (88p)
- Ch. 27: Central and South America (102p)
- Ch. 28: Polar Regions (71p)
- Ch. 29: Small Islands (60p)
- Ch. 30: International Waters (138p)

Appendix 2: Action areas of the WIM work plan

The initial 2-year work plan of the Executive Committee of the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts, in accordance with decisions 3/CP.18 and 2/CP.19, has identified the following action areas.

1. Enhance the understanding of how loss and damage associated with the adverse effects of climate change affects particularly vulnerable developing countries; segments of the population that are already vulnerable owing to geography, socioeconomic status, livelihoods, gender, age, indigenous or minority status or disability; and the ecosystems that they depend on, and of how the implementation of approaches to address loss and damage can benefit them.
2. Enhance understanding of and promote comprehensive risk management approaches (assessment, reduction, transfer, retention), including social protection instruments and transformational approaches, in building long-term resilience of countries, vulnerable populations and communities.
3. Enhance data and knowledge on the risks of slow onset events and their impacts, and identify ways forward on approaches to address slow onset events associated with the adverse effects of climate change with specific focus on potential impacts, within countries and regions.
4. Enhance data and knowledge on non-economic losses associated with the adverse effects of climate change and identify ways forward on reducing the risk of and addressing non-economic losses with specific focus on potential impacts within regions.
5. Enhance understanding of capacity and coordination needs to prepare for, respond to, and build resilience, including through recovery and rehabilitation, against losses and damages associated with extreme and slow onset events.
6. Enhance understanding and expertise – and their application – of how impacts of climate change are affecting patterns of migration, displacement, and human mobility.
7. Encourage comprehensive risk management by the diffusion of information related to financial instruments and tools that address the risks of loss and damage associated with adverse impacts of climate change, to facilitate finance in loss and damage situations in accordance with the policies of each developing country and region, taking into account necessary national efforts to establish enabling environments. These financial instruments and tools may include: comprehensive risk management capacity with risk pooling and transfer; catastrophe risk insurance; contingency finance; climate-themed bonds and their certification; catastrophe bonds; and financing approaches to make development climate-resilient, among other innovative financial instruments and tools.(2)
8. Complement, draw upon the work of, and involve, as appropriate, existing bodies and expert groups under the Convention, as well as relevant organizations and expert bodies outside the Convention at all levels as the ExCom executes the above elements of the work plan.
9. Develop a 5-year rolling work plan for consideration at COP22 building on the results of this 2-year work plan to continue guiding the implementation of the functions of the Mechanism.

Losses and damages from climate-related stressors have increased dramatically over the past decades. The most recent scientific projections anticipate a significant increase in the frequency and intensity of extreme weather events and increasingly adverse slow-onset changes associated with global warming. These pose a growing risk to human well-being and sustainable development, especially in developing countries.

The emerging topic of 'loss and damage' has taken on increasing significance in the climate negotiations under the United Nations Framework Convention on Climate Change (UNFCCC), especially since the 19th Conference of the Parties (COP-19) and the establishment of the 'Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts' in 2013. It is expected that there will be greater emphasis on adaptation and loss and damage in the new climate agreement that is to be negotiated in 2015.

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is at the forefront of developing and implementing comprehensive climate risk management approaches to support countries and people in their efforts to minimize loss and damage. To inform their work in developing countries, GIZ invited the United Nations University Institute for Environment and Human Security (UNU-EHS) to analyse **what the IPCC 5th Assessment Report has to say about loss and damage**. The results are presented in this UNU-EHS Working Paper.

