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Stocktaking of climate risk assessment approaches related to loss and damage

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Stocktaking of climate risk assessment approaches related to loss and damage

By Laura Schäfer and Kehinde Balogun (UNU-EHS) in cooperation with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

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1. Introduction

Loss and damage is already being experienced around the globe by both developing and developed countries. Existing mitigation commitments and actions will not prevent dangerous climate change related impacts. Historical greenhouse gas emissions and locked in investments into fossil fuel industries have already committed us to a certain level of climate related loss and damage (Kreft 2013). Moreover, not all climate change impacts can be successfully adapted to, be it due to financial, technical, physical or social constraints (IPCC 2014; 2012; Adger et al. 2009; Dow et al. 2013; Huggel et al. 2013). Hence, climate change will lead to economic and non-economic losses induced by extreme weather events as well as slow-onset changes. Taking these limitations of preventing and managing climate impacts into account it appears essential to address the residual loss and damage which cannot be avoided through mitigation and adaptation efforts, especially for particularly vulnerable countries to climate change impacts.

One essential element to address and avoid loss and damage are effective strategies for mitigation and adaptation. The other essential element includes strategies to address incurred and future loss and damage. For this second element, the assessment of risks of loss and damage due to climate change is a crucial pre-condition. However, a comprehensive loss and damage risk assessment methodology has not yet been developed. Approaches, tools and instruments that could assist in assessing the risk of loss and damage can be found within two major frameworks: Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). A range of approaches has been developed within these frameworks, from quantitative to qualitative assessments, spanning both pre- and post-disaster assessments as well as more holistic approaches.

This paper will take a detailed look at approaches to assess the risk of loss and damage in the following fields:

(a) Loss and damage risk assessments within DRR
(b) Loss and damage risk assessments within CCA
(c) Comprehensive risk assessment methods within DRR

This discussion paper does not provide an exhaustive and complete analysis of all existing approaches, but rather an overview of the most relevant ones. Drawing on existing work, the purpose of this paper is to:

(a) Provide an overview and analysis of existing approaches, tools and instruments for assessing the risk of loss and damage;
(b) Identify gaps in the approaches, tools, and instruments in relation to their effectiveness to assess risk of loss and damage;
(c) Give suggestions regarding risk assessment approaches that could be further enhanced to address loss and damage.

Methods

The main purpose of this paper is to provide an overview of existing approaches to assess the risk of loss and damage within the two fields of DRR and CCA on the basis of an assessment of current literature and critical analysis. The following method was employed for the stocktaking:

Firstly, recent overviews and compendiums were acknowledged, including the technical paper on "Current knowledge on relevant methodologies and data requirements as well as lessons learned and gaps identified at different levels, in assessing the risk of loss and damage associated with the adverse

effects of climate change" (UNFCCC 2012a, also UNFCCC 2012b, c, e) and the "Compendium on methods and tools to evaluate impacts of, vulnerability and adaptation to climate change" (UNFCCC 2004). The UNFCCC (2010) "Overview from the Nairobi Work Programme on impacts, vulnerability and adaptation to climate change" and its sources were also analysed. Additionally, sector specific overviews were taken into account, for example the summary of "Methods for the evaluation of direct and indirect flood losses" by Thieken et al. (2008).

Secondly, platforms like Adaptation Community (www.adaptationcommunity.net), Climate Planning (www.climateplanning.org) or the Knowledge Navigator (www.knowledgenavigator.net) were reviewed for relevant approaches.

Thirdly, a key words search was done to gather important approaches in the literature, using the sciencedirect.com database.

The literature reviewed included:

(a) Peer-reviewed journals in English, using keyword searches;
(b) Practitioner and policy-related literature, using keyword searches;

The keywords searched for include (but are not limited to): loss and damage risk assessment, risk assessment, climate risk assessment, adaptation assessment, disaster risk assessment and vulnerability assessment.

Owing to time constraints, a more comprehensive review of all journals, reports, books and other sources in all relevant languages was not possible, which limits the scope of the analysis.

Fourthly, steps 1-3 above identified over 300 approaches, tools and instruments which were analysed regarding their relevance and applicability with regard to loss and damage risk assessment. Following criteria were used: (a) The accessibility of information including tools and instruments; (b) The consideration of climate change impacts within the approach. Over 100 approaches met the criteria; though due to the scope of this paper only 20 approaches were analysis. The selection is balanced regarding scope of the approaches (global, national, local) and their authors (governments, development banks, civil society etc.).

The approaches are categorized as follows:

1. Disaster risk reduction	**2. Climate change adaptation**
1.1 Comprehensive impact and risk assessment	2.1 Vulnerability assessment
1.2 Pre-disaster risk assessment	2.2 Climate change adaptation assessment
1.3 Post-disaster risk assessment	

The results of the analysis are clearly arranged in a table (see Annex 1). It should be noted that there is limited case study literature on the practicability of these assessments; this paper does not contain the implementation processes. Furthermore, the approaches, tools and instruments to assess the risk of loss and damage listed in this stocktaking exercise are not exhaustive, other approaches may exist.

Structure of the paper

The paper is structured as follows:

- Chapter 2 provides a theoretical introduction to the concept of loss and damage as well as an analysis of challenges regarding loss and damage risk assessment, thereby setting the basics for the subsequent analysis.

- Chapter 3 embraces analyses of advantages and disadvantages of identified approaches, instruments and tools regarding their applicability for loss and damage risk assessment, using the above five clusters as structure.
- Chapter 4 investigates gaps within the approaches, instruments and tools identified in chapter 3 describing five major gaps in detail.
- Chapter 5 summarizes the findings and gives recommendations regarding approaches worth further exploration regarding the development of a comprehensive loss and damage risk assessment.

2. Theoretical background - risk assessment beyond the limits of adaptation

Theoretical remarks regarding the concept of loss and damage

With mitigation and adaptation, the 1992 UN Framework Convention on Climate Change (UNFCCC) enfolded two tiers of negotiations, representing a twofold approach to tackle climate change and its impacts. However, that has not been the case ever since. Until the mid-2000s, UNFCCC decisions focused on reduction of greenhouse gas emissions as well as emissions from land-use change and forestry. When awareness rose that the low ambition level of emission reduction will not lead to a successful prevention of climate change, the adaptation to the impacts of climate change was acknowledged as essential complement to mitigation, making adaptation an equally important negotiation tier (Warner & Zakieldeen 2012). The UNFCCC and its Kyoto Protocol as main treaties of the international climate regime now contain obligations for all parties to mitigate climate change and adapt to the impact of climate change, moreover for Annex II parties to assist technically and financially with adaptation and mitigation. Summing it up, the approach so far has been to “prevent if possible and manage impacts through adaptation” (Verheyen 2012). However, as previously stated, current locked investment in fossil fuel and inadequate mitigation ambitions will result in unavoidable losses induced by extreme weather events as well as slow-onset processes. Taking these limitations of preventing and managing climate impacts into account, it is essential to address the residual loss and damage which cannot be avoided through mitigation and adaptation efforts, particularly for countries vulnerable to climate change impacts (Warner & van der Geest 2013).

Loss and damage refers to the adverse or residual impacts of climate change that take place in spite of adaptation, mitigation, disaster risk reduction and other measures that may have been taken to prevent or reduce the effects. With the topic being new and debates still going on, a widely shared definition of climate-related loss and damage does not exist yet. “Damage” on the one hand, which can be put on a level with tort, describes harming climate change impacts afflicting a person or entity possible to repair or rebuild. “Loss”, on the other hand, can be understood as harming climate change impacts not possible to repair or rebuild. These may be economic losses (e.g. loss of geologic fresh water related to glacial melt) but also non-economic losses (e.g. loss of heritage when areas become uninhabitable for populations). A working definition has been proposed in 2012 by Warner et al. They define loss and damage as “the negative effects of climate variability and climate change that people have not been able to cope with or adapt to". This definition is used in this paper to guide the conceptualization of loss and damage.

Box 1: Losses from slow-onset changes

Sea level rise

- loss of territory and productive land
- salinization of soils leading both to a loss of ability to produce food and loss of freshwater for drinking
- loss of critical marine ecosystems for food production due to the loss of mangroves and coral reefs which serve as fish nurseries and habitats
- damage to coastal infrastructure, protective barriers and resources important for coastal based tourist economies

Increasing temperatures

- loss of productive land (soil moisture)
- lost areas for human habitation as temperature extremes become too dangerous for human and animal life
- damage to yields, food production, and farmer livelihoods

Ocean acidification

- loss of fisheries resources
- loss of shell-forming species, coral reefs and reef-dependent fisheries affects food security, trade and tourism
- loss and/or damage of coral reef ecosystems which will lead to greater storm impacts and damage to tourist economies
- loss of livelihoods based on tourism and fisheries

Salinization of croplands and aquifers

- loss of productive land
- loss of ability to produce food and loss of potable drinking water

Land and forest degradation

- undermining food production, famine, increased social costs, decline in quantity and quality of fresh water supplies, increased poverty and pol. instability, reduction in the lands resilience to natural climate variability and decreased soil productivity
- forest depended populations risk loss of territory and livelihoods as forests burn or are degraded through changes in species composition

Loss of biodiversity

- loss of countless species will impoverish our lives (humans are dependent on the natural world for sustenance), damaging ecosystems and threaten the stability of those systems upon which we depend

Desertification

- loss of territory
- loss of productive land
- loss of livelihood options
- when productive lands are lost, migration becomes the primary option

Sources: IPCC 2012; Hoffmaister & Stabinsky 2012

Loss and damage includes the effects from "extreme/sudden onset" (e.g. floods) and "slow-onset" (e.g. melting permafrost) changes as well as of combination of the two (e.g. glacial melting leading to glacier lake outburst floods). An extreme onset event may be a single, discrete event that occurs rapidly - in a matter of days or even hours, whereas slow-onset events is a gradual and incremental process occurring over many years or from an increased frequency or intensity of recurring events (UNFCCC 2012d;

Siegele 2012). The Cancun Agreements list sea level rise, increasing temperatures, ocean acidification, glacial retreat and related impacts, salinization, land and forest degradation, loss of biodiversity and desertification as slow-onset events. Box 1 provides an overview of anticipated loss and damage by slow-onset changes.

Three "types" of loss and damage can be distinguished: avoided loss and damage (through mitigation and adaptation efforts), unavoided loss and damage (when mitigation and adaptation efforts are not enough to avoid losses and damages) or unavoidable loss and damage (those losses and damages resulting from the limitations of human systems and ecosystems to adapt to the most of slow-onset processes or extreme events) (Verheyen 2012).

Loss and damage can be economic in nature as in lost income or damage to property and assets, which are included in formal accounting processes or non-economic, which include, for example, cultural and social impacts of climate change, loss of biodiversity and ecosystem services. Non-economic losses are difficult to measure and (therefore) not included in formal accounting processes (Morissey & Oliver-Smith 2013). Both economic and non-economic loss and damage can be direct (mostly visible damage) or indirect (effects of damages on e.g. the economy of a country) and can take tangible (material, goods) or intangible (non-material pertaining to goods like land and resources and services like social networks, culturally significant symbol) forms (see figure 2).

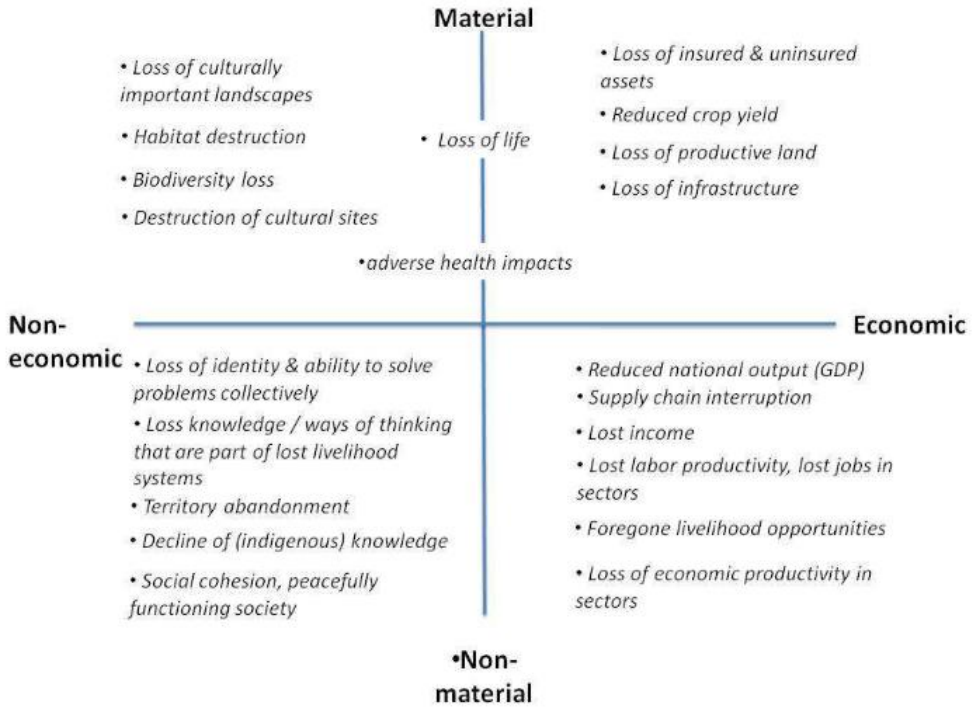

Figure 2: Economic and non-economic losses
Source: Morrissey & Oliver-Smith 2013

The challenging task of assessing the risk of loss and damage

Assessing the risk of loss and damage from climate related disasters should aim at identifying current and future human, economic, social and environmental loss and damage caused by climate disasters. According to ISO 31010, risk assessment is the overall process of risk identification, risk analysis, and risk evaluation. Risk assessment is a component of a more general process which furthermore identifies the abilities and resources available to reduce the identified levels of risk, or the possible effects of a disaster (capacity analysis), and considers the planning of appropriate risk mitigation measures (capability planning), the monitoring and review of hazards, risks, and vulnerabilities (EU 2010)

A variety of tools and methods to assess the risk of loss and damage can be found within two major frameworks: Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). A range of approaches has been developed within these frameworks, from quantitative to qualitative assessments, spanning both pre- and post-disaster assessments. However, a comprehensive methodology to assess the risk of loss and damage has not yet been developed. Due to the following major challenges, the development of such a comprehensive loss and damage risk assessment methodology presents a difficult task:

(a) Putting a value to loss and damage

Putting a value to loss and damage is more complex than it may seem to be at a first examination. Valuation of direct losses is indeed facilitated by their monetization in market prices. Money is used as means of representing the relative values that society places on different resources and as conversion mechanism of material value into money and vice versa (Wrathall et al. in press). However, there are also losses where this method is not appropriate, especially when it comes to personal value that people assign to things and places which can hardly be captured by market prices. To identify their value, several methods are available (e.g. contingent valuation, asking people regarding their willingness to pay for the things we want to assess the value of (Adams 1996 in Wrathall et al. in press). The quantification of these non-economic losses poses conceptual, ethical and empirical challenges. Even more problematic to measure are cultural resources, as they are dynamic and therefore contain multiple values

(b) Identifying the thin line between adaptation and loss and damage

The risk of loss and damage is directly related to climate change adaptation, which has the potential to prevent loss and damage to a certain limit. Determining the limit of adaptation, however, is a challenging process, the line between adaptation and loss and damage being a thin one.

With their differentiation between acceptable, tolerable and intolerable risk from climate change, Dow and Berkhout (2014) provide a possibility to approach the thin line between adaptation and loss and damage. While acceptable risks are deemed so low that additional risk reduction efforts (adaptation) are not seen as necessary, tolerable risks relate to activities seen as worth pursuing for their benefits but where additional efforts (adaptation) are required. Intolerable risks are those which exceed a socially negotiated norm (e.g. frequency of flooding) or a value despite adaptive action (Dow & Berkhout 2014). They highlight that defining the limit between tolerable (adaptation) and intolerable (loss and damage) risk is an ethical issue "because the aim of adaptation is to protect what we value" (ibid) - which is significantly different within and cross border societies.

Some adaption limits have been clearly identified, mainly those related to ecological, physical, economic and technological constraints (IPCC 2014, 2007). Recent research however dismantled that adaptation also depends on "social values about what we deem important in society and how we ought to allocate resources" (Adger et al. 2009). Values are hence translated into action through rules and institutions for governing risk (Adger et al. 2005; O'Brien 2009; Dow et al. 2013). The limits to adaptation and the impacts that result by exceeding them are therefore 'endogenous', emerging from within society reflecting goals values and social choice, being subjective and constructed. (Adger et al. 2009; Dow et al. 2013; Huggel et al. 2013). This is an important point as it highlights that in a lot of cases adaptation is not limited by exogenous factors but by values, perceptions, processes and power structures within society and may vary significantly across societies (Adger et al. 2009). Ultimately, assessing the risk of loss and damage will require implementing approach(es) that understands stakeholders and societal values, perceptions, process at all levels of society - regional, national and local level.

(c) Assessing different types of loss and damage

As described above, loss and damage is induced through both, extreme weather events and slow-onset changes. Existing approaches to assess risks in the area of disaster risk management use historical date to calculate future risk, thereby considering a certain scale of disasters according to existing circumstances. Climate change, however, will provoke changes in circumstances and hence changes in the scope of disasters in the future. So far, no methods are available to adequately reflect this process.

3. Stocktaking - Existing climate risk assessment approaches to address loss and damage

The stocktaking took a detailed look at the following types of approaches:

(a) Loss and damage risk assessments within DRR
(b) Loss and damage risk assessments within CCA
(c) Comprehensive risk assessment methods within DRR

Based on a desk-top study the approaches are analysed regarding their advantages and disadvantages for loss and damage risk assessment.

The approaches are categorized as follows:

3.1 Disaster risk reduction	3.2 Climate change adaptation and vulnerability assessment
3.1.1 Comprehensive impact and risk assessment • Natural disaster HotSpot • World Risk Index • Global Climate Risk Index	**3.2.1 Vulnerability assessment** • Climate Vulnerability Monitor • Participatory Vulnerability and capacity assessment (part of Participatory Assessment of Disaster Risk (PADR) • The vulnerability sourcebook
3.1.2 Pre-disaster risk assessment • Comprehensive Approach for Probabilistic Risk Assessment (CAPRA) • Catastrophe Simulation model (CATSIM) • Handbook for Estimating the Socioeconomic and Environmental Effects of Disasters (also for post-disaster) • Community based disaster risk management (also for post-disaster)	**3.2.2 Climate change adaptation assessment** • Climate Change Risk Assessment • Climate change and Environmental Degradation Risk and Adaptation Assessment (CEDRA) • Climate Risk Assessment Guide
3.1.3 Post-disaster risk assessment • Disaster Loss Assessment Guidelines • DesInventar • Climate Vulnerability and Capacity Analysis (CVCA) • Assessing Damage after Disasters: A participatory Framework and Toolkit	

Subsequently, the clustered approaches are briefly introduced and advantages and disadvantages regarding their application for loss and damage risk assessment are explained.

Disaster risk reduction

Comprehensive impact and risk assessment

The analysis **"Natural disaster HotSpot"** by the World Bank assesses the risk of mortality and economic losses as disaster-related outcomes, estimating risk levels by combining hazard exposure with historical vulnerability. The assessment is adequate for identifying areas that are at relatively higher single- or multiple-hazard risk (e.g. areas that are at higher risk of flood losses than others), as well as for assessing the exposure and potential magnitude of losses in the areas. The results are used to make statements about risk levels on a global scale, as risks are calculated for grid cells rather than for countries, the assessment also allows to estimate risk levels at sub-national scales. The results, although on a broad scale, can be used to inform the prioritization of areas for more localized and detailed risk assessments. Using detailed regional data, identified risks can be assessed further by applying the methodological framework on regional level. However, presented data are inadequate for understanding the absolute levels of risk posed by any specific hazard or combination of hazards. The global analysis is moreover limited by issues of scale as well as by the

availability and quality of data. For a number of hazards, only 15- to 25-year records of events were available for the entire globe and relatively crude spatial information for locating these events. Moreover, data on historical disaster losses, and particularly on economic losses, are also limited.

The **Global Climate Risk Index**, produced by the German NGO Germanwatch, determines the risk of becoming the victim of a disaster as a result of natural hazards for 173 countries throughout the world. The assessment exclusively focuses on climate change related hazards, hence incorporates only weather related events (storms, floods, temperature extremes, mass movements) and no geological factors (e.g. earthquakes, tsunamis) not depending on the weather therefore not possibly related to climate change. The assessment uses four indicators:

1. Number of death;
2. Number of death per 100.000 inhabitants;
3. Sum of losses in US$ in purchasing power parity (PPP);
4. Losses per unit of GDP. This approach requires data that is in most cases easily accessible on the global level.

However, the socio-economic variables in comparison to damages and death does not allow for an exact measurement of the vulnerability but rather an indication of vulnerability. The index is based on the average values of included years making it hard to differentiate between countries continuously affected by extreme events and those that only rank high due to exceptional catastrophes. Moreover, the index does not allow for an assessment of continuous changes of important climate parameters that may have a substantial influence on development factors (e.g. availability of water).

The **Comprehensive Approach for Probabilistic Risk Assessment (CAPRA)** developed by the World Bank, the Inter-American Development Bank (IDB) and the International Strategy of United Nations for Disaster Reduction (ISDR) is a techno-scientific methodology and information platform, composed of tools for the evaluation and communication of risk at various territorial levels. This model allows the evaluation of probabilistic losses on exposed elements using probabilistic metrics, such as the exceeding the probability curve of the expected annual loss and probable maximum loss, useful for multi-hazard/risk analyses. Using CAPRA it is possible to design risk transfer instruments, the evaluation of probabilistic cost-benefit ratio, providing an innovative tool for decision makers to analyse the net benefits of the risk mitigation strategies, such as building retrofitting. The tool is useful for land use planning, loss scenarios for emergency response, early warning, on-line loss assessment mechanisms, and for the holistic evaluation of disaster risk based on indicators that facilitates the integrated risk management by the different stakeholders involved in risk reduction decision-making. However, the tool relies on a combination of point values some conservative and some typical yielding a point estimate of exposure that is at some unknown point in the range. Moreover it is difficult to incorporate new or alternate data into the model setup. Especially the integration of new hazards or damage algorithms with respect to climate change is a complex issue.

Pre-disaster assessment

The **Comprehensive Approach for Probabilistic Risk Assessment (CAPRA)** developed by the World Bank, the Inter-American Development Bank (IDB) and the International Strategy of United Nations for Disaster Reduction (ISDR) is a techno-scientific methodology and information platform,

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The **Catastrophe Simulation model (CATSIM)** by the International Institute for Applied Systems Analysis (IIASA) assesses the costs and risks of financial vulnerability and analysis selected ex-ante financial instruments measures for reducing vulnerability. Thereby, it supports policymakers, particularly in developing countries, to devise public financing strategies to be implemented in both the pre- and post-disaster context. The model will then show the best combination of financial strategies to suit current national circumstances. To calculate the risks of damage, CATSIM uses a probability based approach, the Monte Carlo Simulation Technique. An online application with an easy-to-use graphical interface that allows the user to define parameters for hazards, vulnerability, and elements exposed.

The **Handbook for Estimating the Socioeconomic and Environmental Effects of Disasters** (also for post-disaster), developed by Economic Commission for Latin America and the Caribbean (ECLAC) describes methods required to assess the social, economic and environmental effects of disasters, breaking them down into direct damage and indirect losses and into overall and macroeconomic effects. The handbook provides the means to identify the most affected social, economic and environmental sectors and geographic regions, and therefore those that require priority attention in reconstruction. The application of the methodology also enables users to estimate whether there is sufficient domestic capacity for dealing with reconstruction tasks, or if international cooperation is required. The approach used in the Handbook allows a very high degree of detail of damage and loss assessment, although it depends on the availability of quantitative information in the country or region affected. This high degree of detail is a result of the great variety of sectors and sub-sectors included in the assessment. What should be particularly highlighted is the social sector - besides affected population and damage to housing and human settlement it offers methods for estimating damage to education and culture (the sector's infrastructure, equipment and general functioning). This way, the Handbook allows to addresses important aspects of non-economic losses within the assessment.

The **Community based disaster risk management model** by the Asian Disaster Preparedness Center includes training manual for the inclusion of local actors in application of measures in risk analysis, disaster

prevention and mitigation and disaster preparedness. The model offers specific methods for community based risk, needs and damage assessment. This interactive assessment facilitates the involvement of potentially affected people into the process, using their experiences regarding "elements at risk" (people, households and community facilities and services, livelihood and economic activities, the natural environment) that permit the effective determinance of their vulnerability and hence improves the estimation of losses on community level. Outcomes and plans based on this approach are more sustainable as they are based on a process of community mobilization and hence are locally owned. However, the approach requires a lot of time, especially regarding the necessary streamlining of the process and the pre-gathering of available information. Moreover, results are dependent on good facilitation skills during the implementation phase.

Post-disaster assessment

The **Disaster Loss Assessment Guidelines** by Emergency Management Australia provide a detailed description of the process of loss assessment, and lead the reader through the steps required to carry out an economic assessment of disaster losses. The guidelines help to estimate the average annual damages from a hazard such as flooding at a specified location, probably as an input to cost-benefit analysis and provide a step-by-step assessment process. Much of the supporting material is generic and can be applied to all hazards. Although this document sets out the steps to be followed in making a real loss assessment, the process is complex and requires some specialist expertise.

DesInventar is a system which inventories disasters, developed by Corporacion OSSO, LA RED and UNISDR. It is methodology allows registering information about the characteristics and effects of diverse types of disasters, focusing on disasters at regional or national scale. This procedure enables a look at the accumulation of these types of disasters from a national and regional perspective, both in retrospective and prospective. The tool allows to show the reaches a detonation factor (event) can have and the disasters it may generate, on one or more geographic units of minimum resolution (municipal or equivalent in Latin America), making easier the count of the possible variables around the affected region from a space/time perspective and to obtain statistics on how losses affect human lives, economy, culture, historic patrimony, physical infrastructure, etc. Climate change factors may be easily incorporated into the assessment as within DesInventar disasters are considered as all losses stemming from impacts of phenomena with are natural, technological or anthropological in origin. Although focusing on economic effects on disasters, DesInventar also perceives socio-cultural effects as important ones to be assessed, focussing on cultural infrastructure (e.g. religious buildings and monuments, architectural or cultural heritage buildings). However, the system proofed to be unreliable for estimation of natural disaster behaviour tendencies in some municipalities. Information is incomplete, and interpretation of different results obtained through this source could generate confusion and lead to mistaken interpretation.

The **Climate Vulnerability and Capacity Analysis (CVCA)** developed by CARE is based on a methodology to help understand the implications of climate change for the lives and livelihoods of the most vulnerable. By combining local knowledge with scientific data, the process builds people's under-standing about climate risks and adaptation strategies. It provides a framework for dialogue within communities, as well as between communities and other stakeholders.

CVCA provides a framework for dialogue within communities, as well as between communities and other stakeholders. The results provide a solid foundation for the identification of practical strategies to facilitate community-based adaptation to climate change. Moreover, it provides detailed guidance on using participatory tools in a CVCA analysis. However, using CVCA it is not possible to quantify vulnerability or provide results that can be generalized to regional or national levels.

Assessing Damage after Disasters: A participatory Framework and Toolkit by the Organisation for Development Education (UNNATI) is a tool for field practitioners working in post-disaster humanitarian response. It provides a participatory and vulnerability focused framework and tools to carry out a multi-sectoral damage assessment. By assessing psycho-social impacts of disasters it covers an important aspect of non-economic losses. However, the guide only suggests a general overview and basic assessment tools and methodologies that help align the process of post disaster recovery with a community empowerment perspective. It may not be possible to classify all types of losses or damages into categories discussed in this guide assessment.

Climate change adaptation

Vulnerability assessment

The **Climate Vulnerability Monitor** developed by DARA comprises 34 indicators of the economic, human and ecological effects of climate change and the carbon economy. Indexes form the backbone of each indicator and are responsible for generating the relative level of vulnerability registered for each country. Each index is determined exclusively on the basis of mortality and/or GDP per capita data, capturing only the climate change or carbon economy effect in isolation from other factors. It enables a comparison of impacts on a per capita basis across countries and combines estimations from expert and scientific literature or models with bodies of ecological, economic or societal data. It is assumed that the impacts of climate change and the carbon economy are already at play in the world's economic, environmental and social systems. However, the emission scenario chosen for most indicators is not the highest available - numerous impacts are simply beyond the analysis here for lack of adequate reference studies or due to methodological difficulties. The mainly near-term monitor does not factor in the potential costs of future large-scale abrupt impacts, although a number of prominent economists whose timeframes of analysis are more extended advise otherwise. Moreover, the monitor uses the equivalent of a direct-cost approach for estimations, exploring impacts as losses or gains to independent sectors or as discrete gains/losses for those directly affected. This does not take into consideration the passing on of gains or losses elsewhere.

The **Participatory Vulnerability and capacity assessment (part of Participatory Assessment of Disaster Risk (PADR)** by British Overseas NGOs for Development (BOND) and the Tearfund is a tool for participatory assessment of vulnerability on the local level by using meetings with community leaders, focus group meetings and informant interviews. The assessment includes: 1.) Elements at Risk; 2.) Unsafe Conditions; 3.) Dynamic Pressures and; 4.) Underlying causes. The assessment enables causes as well as symptoms to be addressed. Outcomes and plans based on this approach are more sustainable as they are based on a process of community mobilization and hence are locally owned. However, the approach might raise community expectations that cannot be met. Moreover, the approach requires a huge amount of time to streamline

the process and pre-gather available information.

The **Vulnerability Sourcebook** by GIZ is a standardized approach to vulnerability assessments covering a broad range of sectors and topics (e.g. water sector, agriculture, fisheries, different ecosystems) as well as different spatial levels (community, sub-national, national) and time horizons (e.g. current vulnerability or vulnerability in the medium- to long-term). It offers step-by-step guidance for designing and implementing a vulnerability assessment which covers the entire life cycle of adaptation interventions and applies a mix of quantitative and qualitative methods. However, not all methods that are applied for quantifying indicators are equally reliable. If users apply participatory techniques or expert interviews, they need to approach a representative selection of stakeholders for the outcome to be valuable for the approach.

Climate change adaptation assessment

Climate Change Risk Assessment (CCRA) by the Department for Environment, Food and Rural Affairs of the United Kingdom of Great Britain and Northern Ireland analyses the key risks and opportunities that changes to the climate bring to the UK. Provides a baseline that sets out how climate risks may manifest themselves in the absence of current and planned actions. The baseline of the CCRA Evidence Report allows Government and others to assess the extent to which our actions and plans are climate resilient, and to judge what more needs to be done. The approach applies a mix of quantitative and qualitative methods and provides a comprehensive assessment due to the high amount of sectors covered. Moreover, the approach plans for a high degree of stakeholder involvement. More than 700 climate risks were identified. From the outset these were classified according to the perceived magnitude of potential impacts, level of confidence and 'urgency of decisions.' Scores were moderated by stakeholders, including policy makers, as part of an extensive participatory process. A more detailed assessment of selected risks was able to quantify some risks and gather expert feedback on others. This provides an improved evidence base on the consequences of climate change, vulnerability of people and places and the adaptive capacity of a sub-set of sectors. Limitations arise due to limitations of climate models used.

Climate change and Environmental Degradation Risk and Adaptation Assessment (CEDRA) developed by the Tearfund helps agencies working in developing countries to access and understand the science of climate change and environmental degradation and compare this with local community experience of environmental change. Climate change cannot be addressed in isolation from environmental degradation as the two are very closely inter-linked. CEDRA takes a risk management approach to prioritizing hazards to address. The approach offers step-by-step guidance and helps local NGOs in developing countries to work out whether their projects are strong or need to be strengthened to cope with the impacts of climate and environmental change. However, experience of working in development is essential, as well as working experience in agriculture, water and sanitation, construction and/or community participatory approaches are beneficial.

The **Climate Risk Assessment Guide Central Asia** by UNDP guides a process to assess the impacts and outcomes of climate - related events on lives and livelihoods in Central Asia. Procedures set out in the Guide provide results that can be compared at the sub-national level across Central Asia. However, the guide requires subject matter experts (e.g.

meteorology, hydrology, geology, economics, social science research, etc.). Moreover, it is based on weak data on the impacts of climate risks at the sub-national level. Community-based participatory impact assessment procedures can be used to address this limitation although this reduces the detail of the analytical process.

4. Gap analysis

Analysing approaches to assess the risk of loss and damages, several major gaps could be identified. The most important gaps are listed and described subsequently:

Assessment of non- economic losses

Most assessments focus on measuring economic impacts, easy to quantify in monetary terms. Non- economic losses such as loss of human lives, cultural heritage, and ecosystem services and social structures are not adequately accounted for in these assessment approaches (Surminski et al. 2012; IPCC 2012). This is largely due to the difficulty putting a market value or quantifying these factors due to variation in human perception and judgement of factors they considered important. Subsequently, they are no incorporated in these assessment processes. However, their assessment would be particularly important, as non-economic losses "have the potential to fundamentally undermine a communities' resilience" (Morissey/Oliver-Smith 2013). Things might get lost which help maintain cultural identity and relations which are the basis for solving problems cooperatively, being the "core principle behind the concept of resilience" (Morissey/Oliver-Smith 2013).

To identify their value, several methods are available (e.g. contingent valuation, asking people regarding their willingness to pay for the things we want to assess the value of (Adams 1996 in Wrathall et al. in press). However, the quantification of these non-economic losses poses conceptual, ethical and empirical challenges, cultural resources being particularly problematic regarding their measuring as they contain multiple values. In the final analysis following key questions remains to be answered: "Can money payments ever come close to addressing, much less making good the true nature of the loss?" (Wrathall et al. in press). Nevertheless how can cultural identity and relations which are the basis for solving problems cooperatively, and the "core principle behind the concept of resilience" (Morissey & Oliver-Smith 2013) be valued?

Assessment of slow-onset changes

Current methods and tools for loss and damage risk assessment are primarily focused on extreme weather events. Being related to the DRR framework, existing assessments focus on one-of hazards or disasters. Assessment methods and tools for slow-onset events however, are hardly available. Even less attention is paid to accumulated shocks from extreme events and slow-onset changes. For example, damage to mangrove forests may affect breeding of fish species, which in turn affects fish populations and availability of fish for coastal fishing communities, in turn local and perhaps regional nutrition is affected. This could then affect human health and raise demand for alternative food supplies from agriculture, which in itself is under climatic stress. The ripple effects of climate change impacts has various parameters and dimensions intricately linked and therefore difficult to analyse due to cascading impacts.

Determining the limits to adaptation

The risk of loss and damage is directly related to climate change adaptation, which has the potential to prevent loss and damage to a certain limit. However, none of the analysed approaches considers the connection of loss and damage and adaptation hence, none

offers a methodology to determine the limits to adaptation.

Overall trends

Slow-onset changes, such as sea-level rise, increasing temperatures, ocean acidification, glacial retreat and related impacts, land and forest degradation, loss of biodiversity, salinization and desertification are processes exacerbating threats already posed by extreme events and seriously undermine prospects for achieving sustainable development. Permanent loss and damage will go far beyond economic losses alone – livelihoods will be lost, nation states and their territory will have to be abandoned and migrants from climate impacted lands will lose their homes, culture and communities. Most current assessment approaches are based on the implicit assumption that society will stay the same. However, trends like urbanization have the power to greatly modify the vulnerability of today's and future population. But these trends are not adequately taken into account in current risk assessment.

Lack of information

There are various information lacking in relation to loss and damage assessment, the most important ones being; (1) the lack of hazard information meaning the availability of observed climate data and climate projections; (2) the lack of information when it comes to assessment of economic losses. According to Morrissey and Oliver-Smith (2013), "if we don't know how many houses exist in an informal settlement then we can't know how many were destroyed in a flooding event. If we don't know how many hours people spend working in the informal economy, then we can't work out the lost value of that labour to increased work exposure to water borne illness."(Morissey & Oliver-Smith. 2013). If we have no idea how much of something has been lost, the loss assessment will be challenging.

From the above analysis there is an urgent need to improve the understanding of the characteristics of slow onset changes, including the linkages with extreme weather events, potential tipping points, the capacity and skills needed for quantifying losses, and what types of approaches are necessary (Pinninti 2014). Such an improved understanding would lead to raised awareness of the magnitude of the loss and damage resulting from incremental climatic processes, especially among policymakers. It would also facilitate a clarification of the necessary enabling environment, such as regulatory frameworks, policies and institutional structures, which will provide implementation space.

5. Conclusions

The preceding stocktaking and analysis revealed that there is a huge variety of approaches to assess loss and damage available within DRR and CCA. Existing approaches have different limitations in the context of loss and damage; in particular, existing approaches have major gaps regarding the assessment of non-economic losses, slow-onset changes, determining the limits of adaptation and the integration of global trends. However, some approaches offer distinct value with the potential to close those gaps. Concluding, the paper present approaches, worth taking a closer look at in view of developing a comprehensive loss and damage risk assessment methodology.

Limits of adaptation

Loss and damage goes far beyond economic losses, however non-economic losses such as loss of livelihood, territorial land and culture poses conceptual, ethical and empirical challenges. The **World Risk Index** has provided broad scope of indicators (susceptibility, coping capacities, adaptive capacity, and exposure) that could act as baseline for

determining vulnerability parameters. This could be expanded from the understanding that there are limits to how far ecosystems and human systems could adapt, given a continued increase in disaster impact. The methodology used in the World Risk Index could be combined with participatory approaches such as the **Climate Vulnerability and Capacity analysis** by CARE to understand the potential limits to adaptation on the local level.

Non-economic losses

Cultural and territorial resources lost due to hazard impacts are particularly problematic to measure. This is largely due to the difficulty putting a market value or quantifying these factors due to variation in human perception and judgement of factors they considered important. However, we found approaches taking at least important aspects of non-economic losses into account. The **Handbook for Estimating the Socioeconomic and Environmental Effects of Disasters** allows a very detailed assessment of loss and damage in the social sector. Besides affected population and damage to housing and human settlement it offers methods for estimating damage to education and culture (the sector's infrastructure, equipment and general functioning). Additionally, the framework **Assessing Damage after Disasters: A participatory Framework and Toolkit** by the Organisation for Development Education (UNNATI) provides a method to assess psycho-social impacts of disasters, thereby covering an important aspect of non-economic losses.

Slow-onset changes

Existing assessments focus on one-of hazards or disasters. Assessment methods and tools for slow-onset changes however, are hardly available. Even less attention is paid to accumulated shocks form extreme and slow-onset events. However, considering slow-onset changes in probabilistic assessments like the **Comprehensive Approach for Probabilistic Risk Assessment** by World Bank, Inter-American Development Bank (IDB), International Strategy of United Nations for Disaster Reduction (ISDR) could provide a possibility to assess the risk of loss and damage arising from slow onset changes.

Overall trends

Most current assessment approaches are based on the implicit assumption that society will stay the same. However, as previously stated trends like urbanization have the power to greatly modify the vulnerability of today's and future population. To take those trends into account, one could broaden participatory approaches (e.g. the **Vulnerability Sourcebook** by GIZ or the **Participatory Vulnerability and Capacity Assessment** by BOND) to capture voices of local populations on how their societies are slowly changing (indigenous knowledge), and then considering these changes as factors in the assessment process.

This paper shows that there are approaches that provide possibilities to close the identified gaps. In view of developing a comprehensive approach for loss and damage risk assessment, the first step could be to further explore the analysed approaches above to make use of their distinct value, taking into account identified challenges.

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Appendix: Stocktaking of climate risk assessment approaches

The tables on the following pages list selected climate risk assessment approaches within the fields of disaster risk reduction (DRR) and climate change adaptation (CCA). Based on a desk-top study the approaches are analysed regarding their advantages and disadvantages for loss and damage risk assessment.

The approaches are categorized as follows:

1. Disaster risk reduction
    1.1. Comprehensive impact and risk assessment
    1.2. Pre-disaster risk assessment
    1.3. Post-disaster risk assessment
2. Climate change adaptation
    2.1. Vulnerability assessment
    2.2. Climate change adaptation assessment

A.1 Disaster risk reduction

A.1.1 Comprehensive impact and risk assessments

Examples	Organisation	Concrete Output	Level	Advantages for Loss and Damage Risk Assessment	Disadvantages for Loss and Damage Risk Assessment
Natural disaster HotSpot	WB	Estimation of risk levels by combining hazard exposure with historical vulnerability.	Global	• Adequate for identifying areas that are at relatively higher single- or multiple-hazard risk. •	• Data are inadequate for understanding the absolute levels of risk posed by any specific hazard or combination of hazards. • Analysis is limited by issues of scale as well as by the availability and quality of data (e.g. data on historical disaster losses, and particularly on economic losses).
World Risk Index	UNU-EHS	Indicates a level of exposure and vulnerability to extreme events tool to assess the disaster risk that a society or country is exposed to by external and internal factors.	Global	• Effort to adequately represent social risk factors, although data is not yet available on global level. • Detailed indicator list for exposure, susceptibility, coping capacity, adaptive capacity allow very good measurement of vulnerability. • Applicability of method on regional and local level.	• Global data for exposure based on model calculations - uncertainty within the model.
Global Climate Risk Index	Germanwatch	Determines the risk of becoming the victim of a disaster as a result of natural hazards for 173 countries throughout the world.	Global	• Exclusive focus on climate change related hazards. •	• As index is based on the average values of included years, the differentiation between countries continuously affected by extreme events and those that only rank high due to exceptional catastrophes is difficult. • Approach does not allow exact measurement of vulnerability. • Does not allow for an assessment of continuous changes of important climate parameters.

A.1.2 Pre-disaster risk assessment

Examples	Organisation	Concrete Output	Level	Advantages for Loss and Damage Risk Assessment	Disadvantages for Loss and Damage Risk Assessment
Comprehensive Approach for Probabilistic Risk Assessment	World Bank, Inter-American Development Bank (IDB), International Strategy of United Nations for Disaster Reduction (ISDR)	CAPRA is a techno-scientific methodology and information platform, composed of tools for the evaluation and communication of risk at various territorial levels. This model allows the evaluation of probabilistic losses on exposed elements using probabilistic metrics, such as the exceedance probability curve, expected annual loss and probable maximum loss, useful for multi-hazard/risk analyses.	National	• Using CAPRA it is possible to design risk transfer instruments and the evaluation of probabilistic cost-benefit ratio. • Useful for loss scenarios for emergency response and on-line loss assessment mechanisms.	• Relies on a combination of point values, some conservative and some typical yielding a point estimate of exposure that is at some unknown point in the range. • Difficult to incorporate new or alternate data into the model setup. Especially the integration of new hazards or damage algorithms with respect to climate change is a complex issue. •
Catastrophe Simulation model (CATSIM)	International Institute for Applied Systems Analysis (IIASA)	Helps policymakers, particularly in developing countries, devise public financing strategies to be implemented in both the pre- and post-disaster context. National data can be input into CATSIM allowing policy advisers to pose "what if" questions. The model will then show the best combination of financial strategies to suit current national circumstances.	National	• Easy-to-use graphical interface that allows the user to define parameters for hazards, vulnerability, and elements exposed. • User can change parameters and assumptions to show the appropriate financial strategies in the given circumstances.	•
Handbook for Estimating the Socioeconomic and Environmental Effects of Disasters (also for post-disaster)	Economic Commission for Latin America and the Caribbean (ECLAC)	Describes the methods required to assess the social, economic and environmental effects of disasters, breaking them down into direct damage and indirect losses and into overall and macroeconomic effects.	National, regional	• Provides the means to identify the most affected social, economic and environmental sectors and geographic regions, and therefore those that require priority attention in reconstruction. • Allows to addresses important aspects of non-economic losses within the assessment.	• degree of detail of damage and loss assessment that can be achieved by applying the Handbook depends on the availability of quantitative information in the country or region affected.
Community based disaster risk management (also for post-disaster)	e.g. Asian Disaster Preparedness Center	Training manual for the inclusion of local actors in application of measures in risk analysis, disaster prevention and mitigation and disaster preparedness.	Local	• Outcomes and plans based on this approach are more sustainable as they are based on a process of community mobilization and hence are locally owned.	• Raises community expectations; should be part of ongoing process with community. • Time required -streamline process; pre-gathering of available information. • Dependent on good facilitation skills.

A.1.3 Post-disaster risk assessment

Examples	Organisation	Concrete Output		Advantages for Loss and Damage Risk Assessment	Disadvantages for Loss and Damage Risk Assessment
Disaster Loss Assessment Guidelines	Emergency Management Australia	Provide an explanation of the process of loss assessment, and lead the reader through the steps required to carry out an economic assessment of disaster losses.	National	• Helps to estimate the average annual damages (AAD) from a hazard such as flooding at a specified location, probably as an input to cost-benefit analysis. • Step-by-step assessment process. • Much of the supporting material is generic and can be applied to all hazards.	• Although this document sets out the steps to be followed in making a real loss assessment, the process is complex and requires some specialist expertise.
Desinventar (also pre-disaster)	Corporacion OSSO, La Red, UNISDR	Conceptual and methodological tool for the construction of databases of loss, damage, or effects caused by emergencies or disasters.	National, regional, local	• Climate change factors may be easily incorporated into the assessment as within Desinventar disasters are considered as all losses stemming from impacts of phenomena with are natural, technological or anthropological in origin. • Socio-cultural effects included in assessment (regarding infrastructure).	• Proofed to be unreliable for estimation of natural disaster behaviour tendencies in some municipalities. Information is incomplete, and interpretation of different results obtained through this source could generate confusion and lead to mistaken interpretation.
Climate Vulnerability and Capacity Analysis (CVCA)	CARE	Methodology to help understand the implications of climate change for the lives and livelihoods of the most vulnerable. By combining local knowledge with scientific data, the process builds people's under-standing about climate risks and adaptation strategies. It provides a framework for dialogue within communities, as well as between communities and other stakeholders.	Local	• Provides a framework for dialogue within communities, as well as between communities and other stakeholders. The results provide a solid foundation for the identification of practical strategies to facilitate community-based adaptation to climate change. • Detailed guidance on using participatory tools in a CVCA analysis.	• Not possible to quantify vulnerability or provide results that can be generalized to regional or national levels.
Assessing Damage after Disasters: A participatory Framework and Toolkit	Organisation for Development Education (UNNATI)	Tool for field practitioners working in post-disaster humanitarian response, a participatory and vulnerability focused framework and appropriate effective tools to carry out the multi -sectoral damage assessment.	Local	• Includes the assessment of psycho-social impacts of disasters as important aspect of non-economic losses.	• Only suggests a general overview and basic assessment tools and methodologies that help align the process of post disaster recovery with a community empowerment perspective. It may not be possible to classify all types of losses or damages into categories discussed in this guide.

A.2 Climate Change Adaptation

A.2.1 Vulnerability assessment

Examples	Organisation	Concrete Output	Level	Advantages for Loss and Damage Risk Assessment	Disadvantages for Loss and Damage Risk Assessment
Climate Vulnerability Monitor	DARA	The Monitor comprises 34 indicators of the economic, human and ecological effects of climate change and the carbon economy. Indexes form the backbone of each indicator and are responsible for generating the relative level of vulnerability registered for each country. Each index is determined exclusively on the basis of mortality and/or GDP per capita data, capturing only the climate change or carbon economy effect in isolation from other factors.	National	• Enables a comparison of impacts on a per capita basis across countries. • Combines estimations from expert and scientific literature or models with bodies of ecological, economic or societal data. It is assumed that the impacts of climate change and the carbon economy are already at play in the world's economic, environmental and social systems.	• The emission scenario chosen for most indicators is not the highest available - numerous impacts are simply beyond the analysis here for lack of adequate reference studies or due to methodological difficulties. • The study uses the equivalent of a direct-cost approach for estimations, exploring impacts as losses or gains to independent sectors or as discrete gains/losses for those directly affected. This does not take into consideration the passing on of gains or losses elsewhere.
Participatory Vulnerability and capacity assessment (part of Participatory Assessment of Disaster Risk (PADR)	British Overseas NGOs for Development (BOND); Tearfund	Tool for participatory assessment of vulnerability on the local level by using meetings with community leaders, focus group meetings and informant interviews. The assessment includes: 1.Elements at Risk, 2. Unsafe Conditions, 3. Dynamic Pressures and 4. Underlying causes.	Local	• Outcomes and plans based on this approach are more sustainable as they are based on a process of community mobilization and hence are locally owned.	• Raises community expectations; should be part of ongoing process with community. • Time required -streamline process; pre-gathering of available information. • Dependent on good facilitation skills.
The vulnerability sourcebook	GIZ	Standardised approach to vulnerability assessments covering a broad range of sectors and topics (e.g. water sector, agriculture, fisheries, different ecosystems) as well as different spatial levels (community, sub-national, national) and time horizons (e.g. current vulnerability or vulnerability in the medium- to long-term).	National, regional, local	• Offers step-by-step guidance for designing and implementing a vulnerability assessment which covers the entire life cycle of adaptation interventions. • Mix of quantitative and qualitative methods.	• Not all methods that are applied for quantifying indicators are equally reliable. If users apply participatory techniques or expert interviews, they need to approach a representative selection of stakeholders for the outcome to be valuable for the approach.

A.2.2 Climate change adaptation assessment

Examples	Organisation	Concrete Output	Level	Advantages for Loss and Damage Risk Assessment	Disadvantages for Loss and Damage Risk Assessment
Climate Change Risk Assessment	Department for Environment, Food and Rural Affairs of the United Kingdom of Great Britain and Northern Ireland	Analyses the key risks and opportunities that changes to the climate bring to the UK. Provides a baseline that sets out how climate risks may manifest themselves in the absence of current and planned actions. The baseline of the CCRA Evidence Report allows Government and others to assess the extent to which our actions and plans are climate resilient, and to judge what more needs to be done.	National	• Focus on climate change. • Mix of quantitative and qualitative methods. • Comprehensive assessment due to the high amount of sectors covered. • High degree of stakeholder involvement. • Improved evidence base on the consequences of climate change, vulnerability of people and places and the adaptive capacity of sectors by consideration of more than 700 climate risks.	• Limitations due to limitations of climate models used.
Climate change and Environmental Degradation Risk and Adaptation Assessment (CEDRA)	Tearfund	CEDRA helps agencies working in developing countries to access and understand the science of climate change and environmental degradation and compare this with local community experience of environmental change. Climate change cannot be addressed in isolation from environmental degradation as the two are very closely inter-linked. CEDRA takes a risk management approach to prioritizing hazards to address.	Local	• Offers step-by-step guidance. • Helps local NGOs in developing countries to work out whether their projects are strong or need to be strengthened to cope with the impacts of climate and environmental change.	• Experience of working in development is essential, and experience working in agriculture, water and sanitation, construction and/or community participatory approaches are beneficial.
Climate Risk Assessment Guide	UNDP	Process to assess the impacts and outcomes of climate - related events on lives and livelihoods in Central Asia.	Regional	• Procedures set out in the guide provide results that can be compared at the sub-national level across Central Asia.	• Requires subject matter experts (e.g.,meteorology, hydrology, geology, economics,social science research, etc.). • Weak data on the impacts of climate risks at sub-national level. Community-based participatory impact assessment procedures can be used to address this limitation although this reduces the detail of the analytical process.

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 conduct a **stocktaking of climate risk assessment approaches related to loss and damage.** The results are presented in this UNU-EHS Working Paper. .