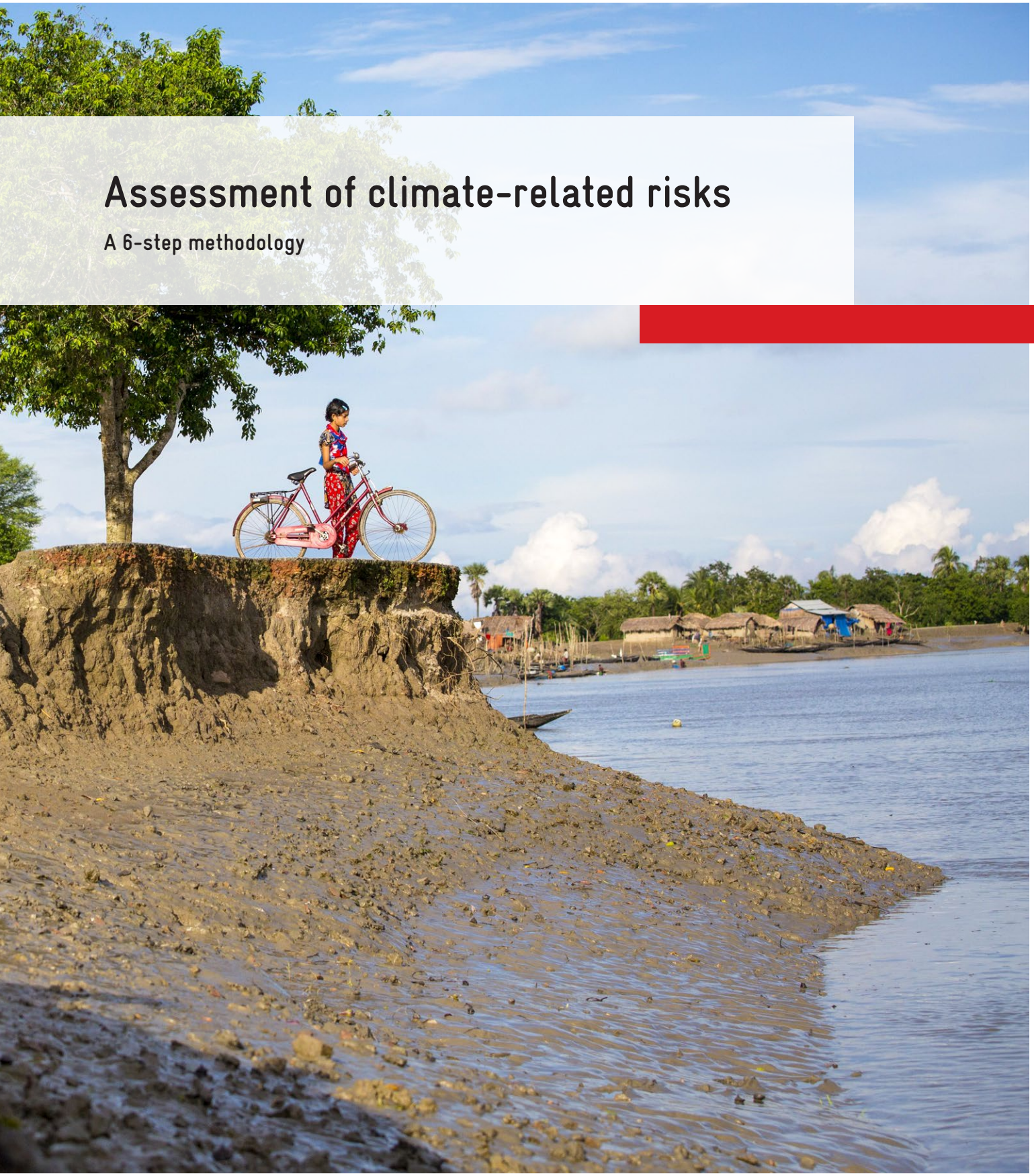
Assessment of climate-related risks

A 6-step methodology



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A 6-step methodology to assess climate-related risks

KEY MESSAGES

→ **Climate risk assessment (CRA) builds the foundation for effective climate risk management (CRM).**

→ **CRA aims to identify risks; assess the magnitude of impacts on people, assets, value chains, (critical) infrastructure, settlements and ecosystems; and ascertain the possible options for action. CRAs can support evidence-based and risk-informed decision making and planning in the context of climate change.**

→ **Important characteristics of GIZ's 6-step CRA methodology include:**

- Participation of stakeholders in the risk assessment process, which is fundamental to increase awareness and understanding of risks. This will contribute to informed and effective decision making as well as to the implementation of required CRM measures.
- Matching information needs with a customised methodology that utilises various and appropriate methods and tools.
- Assessment of climate risks triggered by the entire spectrum of hazards from slow onset processes to extreme weather events.
- Estimation of risk tolerance levels of the concerned system (e.g. vulnerable households).
- Identification of a smart mix of risk management measures (e.g. from a range of tried and tested climate change adaptation and disaster risk reduction measures including risk finance and insurance schemes).
- Consideration of non-economic losses and damages beyond the evaluation of economic losses and damages.
- Integration of results into a CRM framework that encompasses monitoring and evaluation and supports continuous learning.

State of the art

The impacts associated with slow onset processes[1] (e. g. sea level rise, desertification, salinisation) and extreme weather events (e. g. floods, cyclones, storm surges, heatwaves) are increasing in frequency and / or intensity in many regions of the world, resulting in growing climate-related risks. *(IPCC 2018a, 2019a, 2019b)*. Many developing countries are particularly vulnerable due to financial, technical, physical, institutional, demographic, and socio-economic constraints, and at the same time these countries are forecasted to suffer the worst effects of climate change. Climate risks put their economic development at stake. This highlights the urgent need for an integrated management of climate-related risks at all levels.[2] To foster long-term resilience, it is paramount to develop locally appropriate, effective, efficient, and practicable climate risk management (CRM) frameworks to avert, minimise, and address losses and damages.[3] Climate

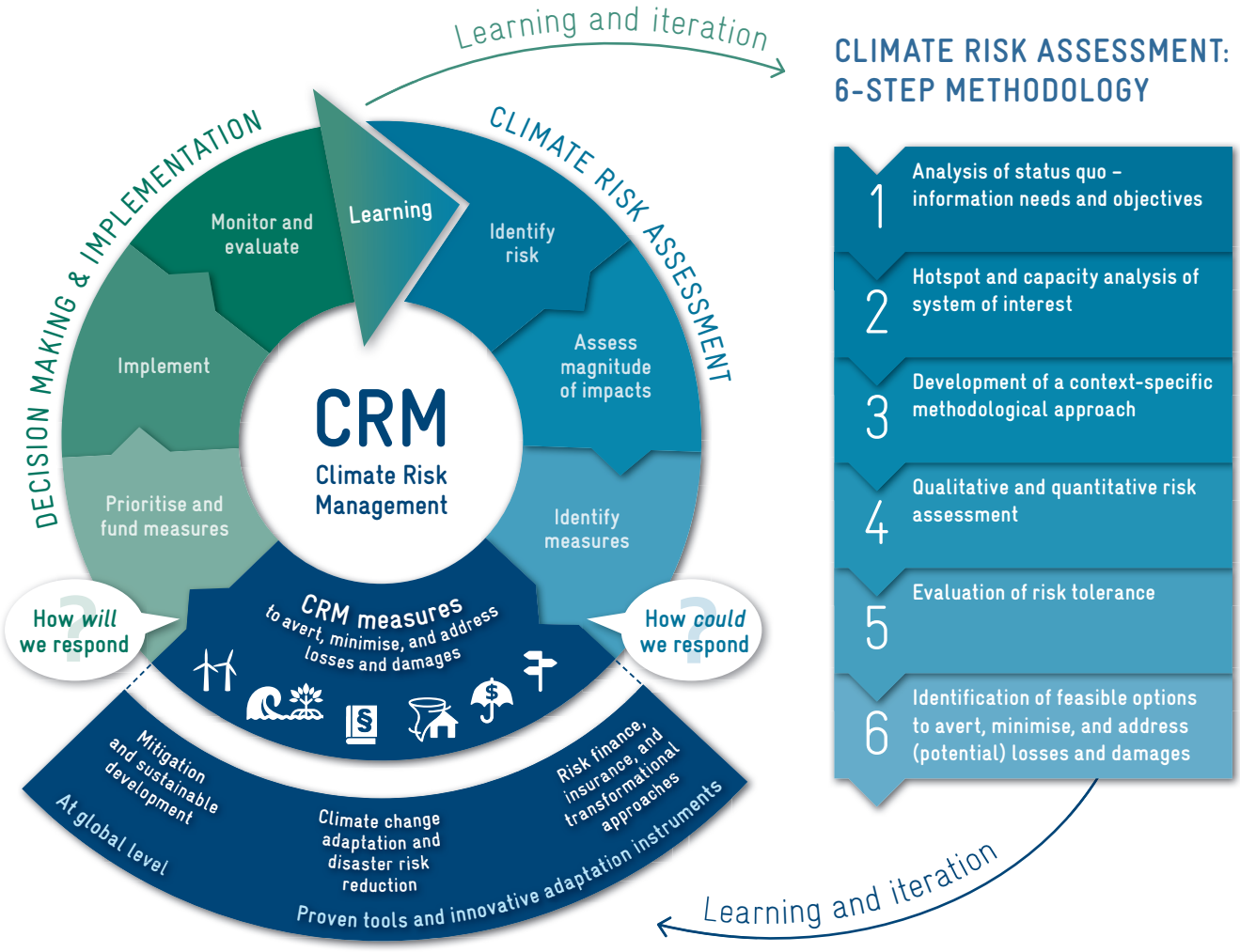

Figure 1: GIZ's CRM framework and the 6-step CRA methodology as a main component

1 Alternative terminologies exist to describe ongoing climate-induced changes of natural systems. The term "event" might be misleading as these changes do not necessarily have a clear time frame.

2 Risk is understood here in accordance with the IPCC as the potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence (IPCC 2018b).

3 As suggested in the IPCC report of 2018, "Loss and Damage" (capitalized letters) is used to refer to the political debate on critical risks affecting vulnerable countries and communities, whereas "losses and damages" (lowercase letters) is used to refer to the harm caused by potential impacts and risk (IPCC 2018a).

risk assessment (CRA) builds the foundation for this. CRAs assess risks; the magnitude of impacts on people, assets, settlements, (critical) infrastructure, value chains and ecosystems; and identify suitable solutions. They support decision makers from the public and private sectors in forward-looking planning. Recognising the usefulness of CRAs in the context of development cooperation, the GIZ Global Programme on Risk Assessment and Management for Adaptation to Climate Change (Loss and Damage) (GP L&D) in cooperation with research and practice has developed a 6-step methodology for CRA which is presented below.

Various methods exist to assess risks and their underlying drivers. However, current approaches are not sufficiently comprehensive since they do not account for the various drivers and dimensions of risks, which can vary strongly according to specific contexts, and are often insufficiently responsive to the various demands of policy and practice. For example, a comparative meta-analysis of about 120 CRA methods by the GP L&D (forthcoming) points out that most methods do not apply to the entire spectrum of hazards from slow onset processes to extreme weather events, neither do they account for interdependencies of risks, prioritise adaptation options, or consider limits of adaptation. Moreover, non-economic losses and damages such as loss of human life, loss of ecosystem services, and proliferation of conflicts are vitally important for those affected but are not sufficiently taken into account in existing approaches *(Tschakert et al., 2019)*. The meta-analysis also highlights that while many CRA approaches acknowledge the importance of non-economic losses and damages in some form, a common definition and terminology is lacking.

CRA as foundation for effective CRM

To address these gaps, GIZ's GP L&D introduced a framework for CRM (Figure 1) that particularly focuses on averting, minimising, and addressing losses and damages.

The CRM framework primarily addresses decision makers from national to local government levels as well as the private and public sector, and is composed of interlinked elements: CRA; identification of CRM measures to avert, minimise, and address losses and damages; decision making and implementation; and learning and iteration.[4] The CRM framework is flexible by design and allows for the modification and revision of decisions over time on the basis of new evidence or data on local conditions.

As part of this framework, GP L&D has developed the above-mentioned 6-step methodology for CRA in collaboration with the International Institute for Applied Systems Analysis (IIASA) and other partners. As climate-related risks are highly context and location specific, it is crucial to customise the assessment to local, regional, national, and institutional contexts before identifying climate risks and assessing their potential impact. The methodology aims at identifying a smart mix of CRM options. These consider environmental, social, economic, institutional, and cultural aspects, and also target interdependencies between slow onset processes and extreme weather events. Instead of applying individual and stand-alone measures, the framework involves a combination of proven and innovative instruments that enlarge the understanding of adaptation as an integrated, participatory, and iterative approach to manage climate-related risk. It comprises measures related to mitigation, adaptation, and disaster risk management as well as risk finance and insurance and further transformational, innovative measures to manage current and future climate risks. The aim is to support decision makers at different levels to identify responses, particularly for actions that go beyond conventional adaptation. Therefore, it is essential to promote dialogue among different stakeholders such as affected governments, communities, and the private sector via participatory methods.

The methodology has been tested in two countries, Tanzania and India.

1. **IN TANZANIA**, the 6-step risk assessment and management has been applied at national and local levels (Lake Rukwa) to make integrated water resources management climate resilient in the face of increasing drought risk.

2. **IN INDIA**, the risks from drought, extreme heat, and water stress (slow onset processes) and floods, landslides, and cyclones (extreme weather events) in coastal and mountain hotspot areas have been assessed with a focus on rural livelihoods and critical infrastructures to inform state-level CRM practitioners about climate adaptation and disaster risk reduction measures.

Consortia of international and national research institutions and consulting firms were employed to conduct the different assessments, which took several months to complete due to the complexity and participatory character of the assessment and required extensive human as well as financial resources.

4 To learn more about this CRM framework and to get information on the linkage to Loss and Damage see the CRM Info Sheet.

The 6-step CRA methodology in practice: Highlights from application

Table 1 provides a complete overview on the six steps. Highlights from the recent applications in Tanzania and India are presented below.

STEP	GUIDING QUESTIONS	EXPECTED OUTCOMES	TOOLS, METHODS, SOURCES
1 **ANALYSIS OF STATUS QUO – INFORMATION NEEDS AND OBJECTIVES**	**What is the current state of knowledge?** → Which are the relevant institutions to collect necessary data and have the mandate to lead the CRA as part of CRM? → Which studies and data already exist? → Which policy frameworks and operating procedures already exist with regard to CRA and CRM? → What are possible regions and sectors of interest in the area? → How can duplication of efforts be avoided?	■ Context profiling: overview of climate (change) risks, other disaster risks, socio-economic data, and institutional set-up ■ Mapping of relevant stakeholders to be included in the assessment ■ Analysis of existing policy frameworks, rules, and regulations regarding climate risks and risk management ■ Identification of potential systems of interest which may include sectors, specific regions, or population groups	■ Literature and policy review ■ Stakeholder identification and consultation
2 **HOTSPOT AND CAPACITY ANALYSIS OF SYSTEM OF INTEREST**	**What region and sector are we looking at?** → Which sectors and livelihood strategies are crucial for the achievement of development objectives in the area of concern? → Which communities/regions and sectors have already been identified as highly vulnerable to the impacts of climate change (including considerations of especially vulnerable groups such as youth, women, elderly, and minorities)? → For which development objectives is information about impacts from projected climate change lacking? → For which sectors and livelihood strategies are adaptation and risk management options still lacking?	■ Selection of a clearly defined sector/region based on criteria such as: □ potential climate (and disaster) risks; □ socio-economic and ecological factors; □ institutional factors; and □ availability of data.	■ Compilation of climate change-related hazards and their potential impacts; ■ Collection of spatial and historical data, such as socio-economic, exposure, weather, and climate data; ■ Use of geographic information systems (GIS) where applicable; ■ Stakeholder consultation; ■ Local, national, international, and secondary sources.
3 **DEVELOPMENT OF A CONTEXT-SPECIFIC METHODOLOGICAL APPROACH**	**How can the magnitude of potential climate-related impacts be assessed in the system?** → Which existing quantitative and qualitative approaches for assessing risks and impacts can be used and adjusted? → What data and information are available for the specific approach? → What data has to be collected additionally, with which methods, and at which costs? Which proxies could be used for unavailable data?	■ Detailed overview of the context-specific methodology that comprises elements such as: □ the description of the methodology, combining quantitative and qualitative approaches; □ an overview of main stakeholders and information sources; □ an implementation plan including timeframe; and □ specific aspects that may include non-economic losses and damages and effects on informal economic activities in relation to losses and damages.	Further (selected) stakeholder consultation (interviews)

Table 1: Six steps for conducting a CRA (developed by GP L&D)

STEP	GUIDING QUESTIONS	EXPECTED OUTCOMES	TOOLS, METHODS, SOURCES
4 QUALITATIVE AND QUANTITATIVE RISK ASSESSMENT	What is at risk? Where and from what? To which extent? → What are the current and projected climate change impacts? → How would socio-economic trends in the system be influenced by implemented or planned measures? → Which indicators need to be selected to evaluate risk components (hazards, vulnerability and exposure)?	■ A thorough risk assessment that includes qualitative and quantitative analyses; ■ Presentation of combination of suitable CRM measures including information on costs, benefits, and framework conditions.	■ Assessment according to chosen method, e.g. risk modelling, indicator/scenario analysis, market price and economic valuation, or compilation of impact chains; ■ Qualitative assessments and consultation of stakeholders may be considered as information source in the case of lack of data; ■ Inclusion of local socio-economic trends such as demographic change.
5 EVALUATION OF RISK TOLERANCE	What level of risk tolerance does the affected population exhibit? → What are risk levels for communities, sectors, or livelihood strategies (including considerations of especially vulnerable groups)? → Is the identified risk acceptable (no further actions necessary), tolerable (further incremental actions required to manage risk) or intolerable (transformational actions to avoid risks are necessary)?	■ Assessment of risk tolerance that compares different interconnected climate-related risks with non-climate-related risks, such as general health or accidents; ■ Quantitative assessment of the extent of associated risks; ■ Evaluation of response mechanisms reaching from incremental to transformational adaptation.	■ Field surveys and/or focus groups on risk perception; ■ Expert-judgement on levels of risk tolerance (acceptable, tolerable, intolerable).
6 IDENTIFICATION OF FEASIBLE OPTIONS TO AVERT, MINIMISE, AND ADDRESS (POTENTIAL) LOSSES AND DAMAGES	How can we respond using the identified CRM measures from step 4 and 5? → Which measures can effectively prevent/reduce potential losses and damages? → At what cost? To what extent? → Which constraints (financial, institutional, technical) need to be considered? How will we respond? → Which options are prioritised in consultation with stakeholders and do they cover all risk tolerance levels? → What do respondents and decision-makers consider feasible and relevant?	■ Detailed overview of possible CRM interventions including risk levels, relevance/importance, and feasibility; ■ Provision of policy-relevant information to support decision-makers in forward-looking planning and implementation of measures.	■ Stakeholder-based elicitation of options; ■ Cost-benefit analysis; ■ Cost-effectiveness analysis; ■ Robust decision-making approaches; ■ Multi-criteria analysis; ■ Adaptation pathways.

1 2 Using a participatory approach to create ownership for risk management in Tanzania

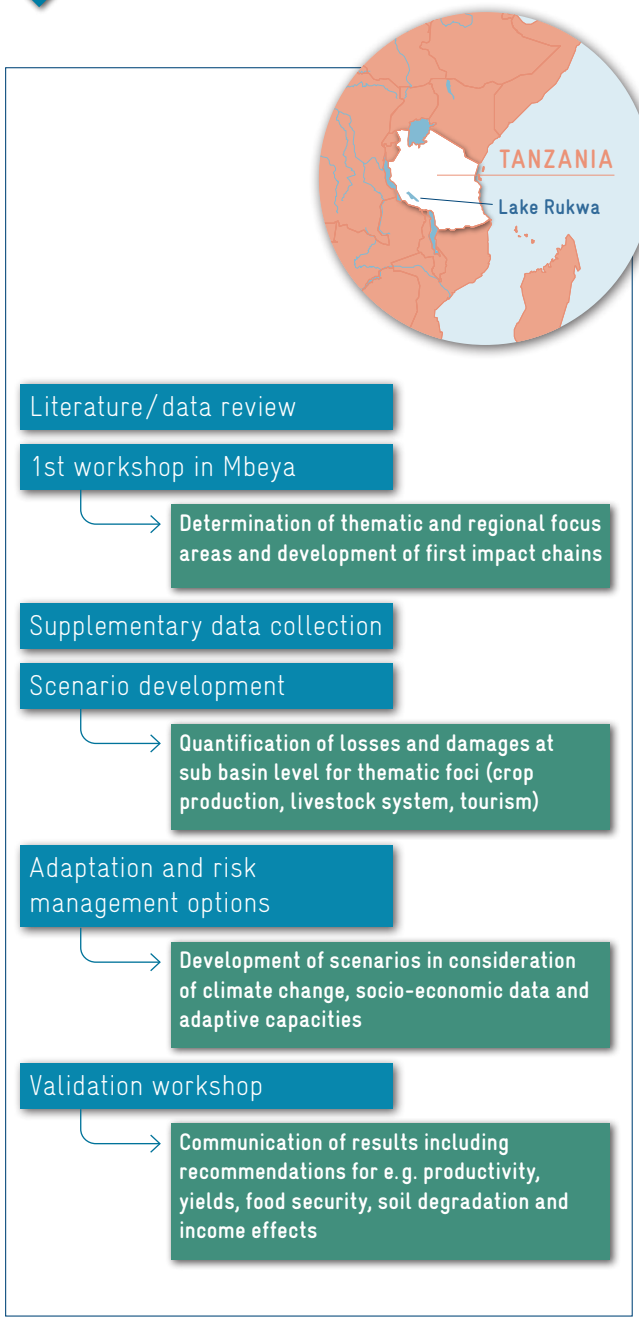

Figure 2: Context-specific methodological design and tools applied for Tanzania/Lake Rukwa assessment

A CRA has been carried out in the water catchment area of Lake Rukwa Basin in Tanzania (Figure 2). The objectives of the assessment were defined in advance: to directly support stakeholders at the local level, and to use the assessment as a basis for the National Adaptation Plan process and other decision-making processes at the national level. For this reason, stakeholders at all levels were involved in the process from the very beginning. In local fora, the results of the CRA as well as recommendations for action were translated into concrete activities and action plans.

Risk profiles and information gathered through extensive desk research supported local stakeholders in defining the regional and thematic foci of the assessment. These were determined at the first analyst and stakeholder workshop. By majority vote, the participants selected three regional sub-basins and sectoral focus topics. Overall, the strong participatory approach taken led to identifying and filling key data gaps, raising awareness for climate and other environmental risks such as water shortages, as well as increasing ownership through collective decision making on relevant CRM measures.

3 4 Using impact chains to understand risks and cause-effect relationships

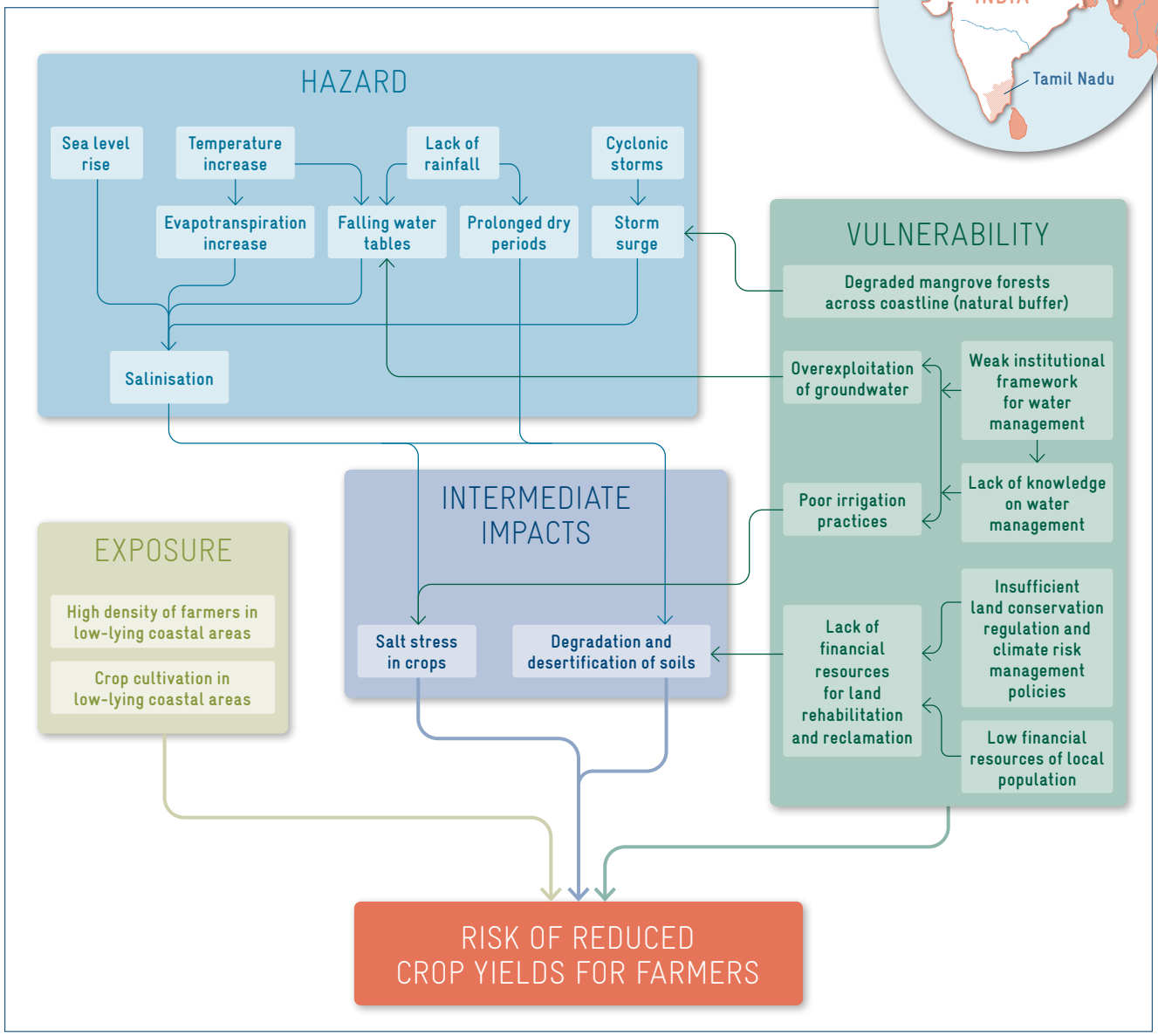

Figure 3: Illustrative and hypothetical impact chain for salinisation based on a case study in Tamil Nadu (India).
(Source: Own illustration based on Adelphi and GIZ, 2015)

Impact chains[5] are a powerful tool to enhance understanding and transparency of major risks. In the CRAs in India (see Figure 3 for a hypothetical impact chain for salinisation based on a case study in Tamil Nadu, India) and Tanzania, simplified impact chains were created to develop a common understanding of risks among a group of stakeholders with different backgrounds and knowledge. The participatory approach ensures that the most relevant factors are displayed. These impact chains help to derive interdependencies of all risk components (hazard, vulnerability, and exposure) and to demonstrate how bio-physical and socio-economic factors interact. They also include cultural and ecological factors that are important for non-economic evaluation. During the assessment, analysts can build upon and refine these simplified impact chains. This tool is usually beneficial at a later stage, also because participants/stakeholders can relate it back to their initial work. The instrument can also be applied for multi-hazard risks.

5 For detailed information on impact chains and a guidance on how to develop them, see GIZs Risk Supplement to the Vulnerability Sourcebook

5 Evaluation of risk tolerance to identify CRM options

Field surveys and expert-based assessments can be used to directly measure or indirectly infer risk tolerance levels (see glossary for definition). Field surveys help to get a better understanding of the risk perception of the affected community and how hazards jeopardise their livelihoods. This is generally an important step, which needs further development in methodologies currently applied.

The two assessments in India evaluated risks to rural livelihoods associated with crop damage, damages to housing, health problems, and loss of working days. In the Himachal Pradesh assessment, risks were organised into different domains/thresholds according to the accumulated losses in relation to total annual income: from acceptable (farming households' resources are sufficient to recover) through tolerable (households need to adapt or sell assets in order to maintain livelihoods) up to intolerable (households are not able to recover on their own). In Tamil Nadu, surveys were conducted on implemented or planned adaptation options. Risk tolerance levels were estimated by experts based on how well adaptation options would tackle risks. Options were organised along a continuum as illustrated in Figure 4, in which acceptable refers to the risk domain where no additional actions are needed; tolerable indicates a further need for considering additional incremental interventions (e. g. applying technologies to fix excessive salt in the soils); and lastly, at the upper end, the intolerable risk domain is one where increasingly transformational actions have to be considered, such as leaving land uncultivated and seeking alternative employment in other economic sectors.

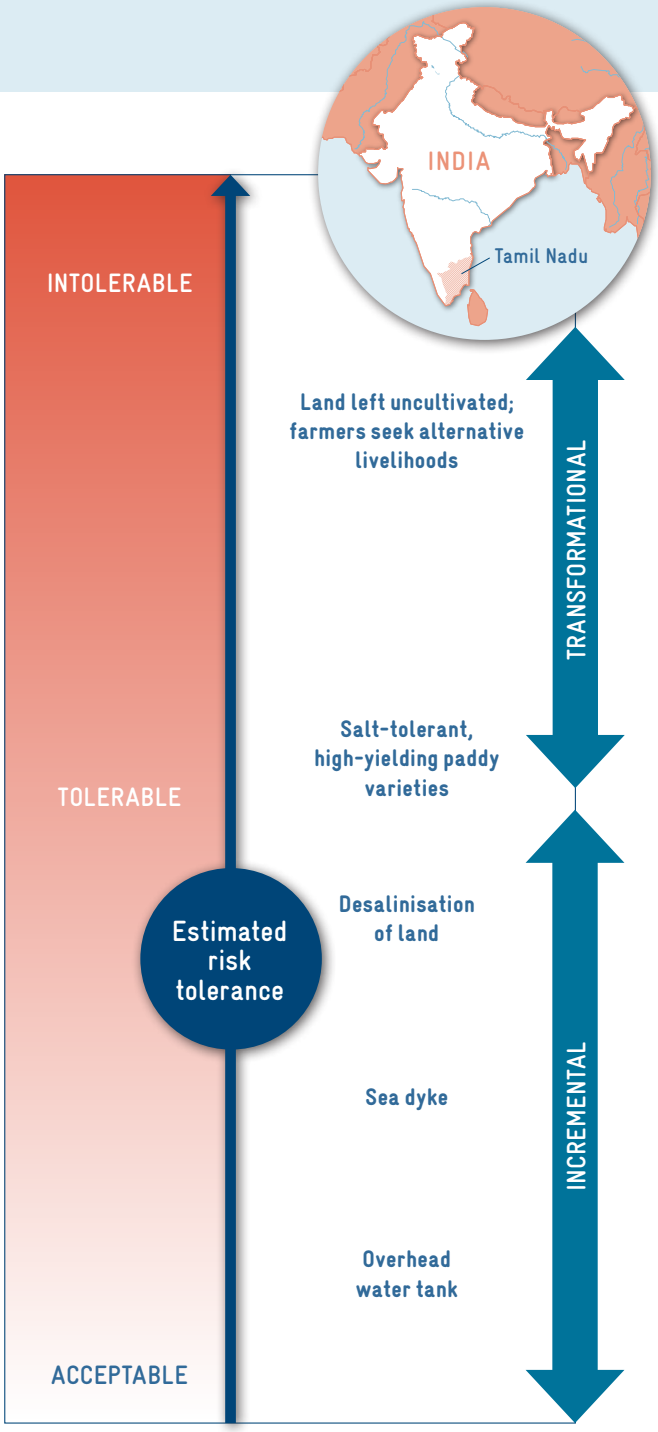

Figure 4: Estimated risk tolerance for interventions adopted by farming households faced with drought and salinisation in Tamil Nadu, India. Based on information of a community survey and expert judgement.

(Source: Mechler et al., 2019a)

6 Identification of feasible options

Finally, potential CRM options are evaluated and translated into action. Instead of applying individual and stand-alone measures, CRM involves a combination of proven and innovative measures that enlarge our understanding of adaptation as an integrated, participatory, and iterative approach to manage climate-related risk. The combination of measures shall address all identified risk tolerance levels including residual risks which cannot be averted.

Based on the risk assessment in Himachal Pradesh, the survey led to a (long) list of various risk management actions undertaken and under consideration by the communities. Most frequently mentioned were demand for cheap seeds, government subsidies, improved transport, and water infrastructure.

A range of decision support techniques and tools has further been applied to select a smart mix of suitable options from this list. These include expert-based cost – benefit analysis, cost-effectiveness analysis, and robust decision making, as well as approaches that more strongly exhibit participatory elements such as multi-criteria analysis and adaptation pathways.

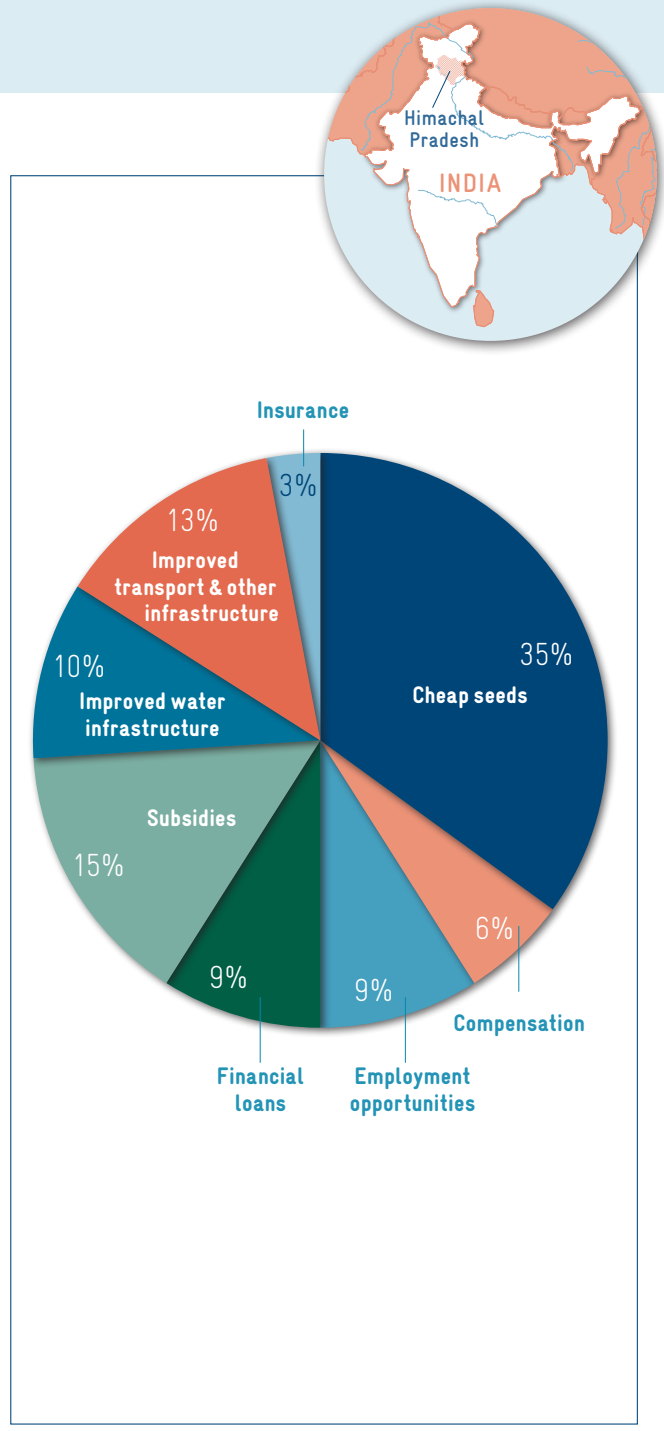

Figure 5: Community-level adaptation options to be enhanced by government support as identified for Kullu district. (Source: University of Geneva et al., 2019)

Conclusion and the way forward

CRM serves as a framework to combine proven measures from climate change adaptation and disaster risk management with innovative measures to address residual risks which cannot be averted. The 6-step CRA methodology presented here offers a flexible guidance on how to conduct risk assessments which cover the different domains introduced and allow decision makers to identify a suitable mix of measures appropriate to their respective context. The 6-step approach does not determine which specific CRA method shall be used, but instead allows a flexible application of various methods. Stakeholders can decide to use their own or external CRA methods according to their needs. The 6-step methodology has been developed with analysts and stakeholders with the objective of producing relevant and useful information that is required for CRM planning and implementation. First evidence has been created via applications in Tanzania and India, where the approach has shown its benefits for political processes such as National Adaptation Plans. Due to its flexible character, the CRA methodology will further evolve through ongoing applications in other areas and sectors and may contribute to different processes including the revision of Nationally Determined Contributions (NDC). In that way, the methodology can shape risk management measures at the front lines of climate change.

To further establish CRA as a foundation for effective CRM, pathways for progress include:

1. Highlighting the importance of climate risk assessments for sustainable development

Already today, with a global average temperature increase of 1.2° C above pre-industrial levels *(WMO, 2021)*, the negative impacts of climate change have become more severe and intense. Every year, extreme weather events cause around 25,000 deaths and affect another 191 million people worldwide *(CRED and UNDRR, 2021)*. These impacts are likely to increase with continuous global warming. Even when the current emission pledges and targets set by the global community are kept, a warming exceeding 2° C is a very likely scenario *(CAT, 2020)*. This means that the frequency and intensity of extreme weather events and the spread of slow onset processes will increase further. Moreover, certain tipping points in the Earth system could be reached, resulting in cascading risks with potentially catastrophic impacts *(Lenton et al., 2019)*. It is evident that climate risks have the potential to threaten sustainable development achievements, such as poverty alleviation, global prosperity, or sustainable use of ecosystems and marine resources. Therefore, climate risks need to be addressed and considered in future planning at all levels, from individual to national, and in all policy fields.

CRAs should become an integral part of project planning and be mainstreamed across all sectors. CRAs are increasingly gaining importance among development cooperation stakeholders and efforts to promote the mainstreaming of CRAs have been stepped up. Two examples for increasing efforts to mainstream CRA into development cooperation are GIZ's Environment and Climate Safeguards and the United Nations Office for Disaster Risk Reduction (UNDRR) and GIZ Technical Guidance on Comprehensive Risk Assessment and Planning in the Context of Climate Change (see box). These efforts should be taken further, through recognising CRA as a precondition for effective CRM and as a cornerstone for sustainable development globally.

MAINSTREAMING CRA IN DEVELOPMENT COOPERATION – TWO EXAMPLES

GIZ's Environment and Climate Safeguards are a mandatory screening process that each project has to undergo in its planning phase. The aim of the safeguards is to ensure that environmental and climate aspects are systematically considered in the planning and implementation of GIZ's development measures. Each project proposal needs to include an assessment of adaptation to climate change. This assessment investigates whether the intended development outcomes of a measure depend to a considerable extent on climatic parameters or on climate- and weather-related events and whether the project impacts adversely on the adaptive capacity of target groups or ecosystems. If this is the case, measures must be identified that boost adaptation to climate change and/or the adaptive capacity of humans and ecosystems to enable development progress despite climate change. More rapid and low-cost climate risk assessments such as the Environment and Climate Safeguards can provide entry points for deeper assessments like the 6-step CRA.

Furthermore, UNDRR and GIZ have developed a Technical Guidance on Comprehensive Risk Assessment and Planning in the Context of Climate Change, which provides orientation on how risks in the context of climate change can be addressed through risk assessments as well as in decision making and planning in a more comprehensive and systemic way. Based on 10 key principles for comprehensive risk assessment, the guidance offers an overview on a broad range of steps and tools for conducting assessments and integrating results into planning processes for various sectors, spatial scales, and levels. It integrates perspectives and approaches from disaster risk reduction and climate change adaptation while simultaneously linking to other goals and targets (such as the Sustainable Development Goals). Eventually, the guidance aims at deepening the understanding and supporting the implementation of comprehensive risk management in the context of climate change *(UNDRR & GIZ, forthcoming)*.

2. Establishing a comprehensive approach to climate risk management as a guiding principle for building resilient, future-proof societies

The recognition that adaptation and mitigation will be insufficient to address the adverse impacts of climate change entirely is growing internationally. The IPCC acknowledges that "Global warming of 1.5°C will have consequences for sustainable development, poverty and inequalities", and that this will include residual risk as well as losses and damages *(Roy et al., 2018)*. Residual risk refers to the remaining risk of losses and damages that could occur even after adaptation and mitigation measures have been put in place. Human and natural systems may be affected, and economic and non-economic losses and damages may result.

It is thus paramount to establish an integrated approach for the management of climate-related risks as a guiding principle of planning and decision-making processes for building resilient, future-proof societies around the world. This approach shall be designed to address residual risks by applying a smart combination of risk management measures, including risk transfer instruments and transformational approaches. Risk transfer instruments such as climate risk insurance, contingency funds, and social protection schemes can foster resilience to climate change by spreading risk across different actors, geography, and time, while transformational approaches such as the diversification of livelihoods or planned relocation can reduce the exposure of people and livelihoods. CRA builds the foundation of effective CRM. It can support the establishment of a holistic CRM approach through the promotion of an anticipatory and participatory approach and the identification of suitable measures targeting residual risks on the path towards resilient, future-proof societies.

3. Mainstreaming climate risk assessment and management at the international level

The CRA process and its results can inform stakeholders and decision makers about potential losses and damages from climate change *(UNDRR & GIZ, forthcoming)*, but can also stimulate the international discourse on Loss and Damage by generating experience and demonstrating:

- how efficient and beneficial CRA can be, e. g. from the perspective of benefit-cost ratio;
- how the risk tolerance of stakeholders can be evaluated through the assessment and subsequently used for prioritising interventions;
- how participatory approaches can be beneficial when used in CRA; and
- how CRM measures to avert, minimise, and address losses and damages can be identified, prioritised, and usefully combined, including risk transfer instruments such as climate risk insurance schemes.

With further increasing risks from climate change, CRA and CRM are deemed key for achieving the goals of international agendas including the Paris Agreement and the 2030 Agenda for Sustainable Development. Eventually, CRA and CRM should be continuously mainstreamed into ongoing processes and actions and become integral parts of politics, future-oriented development planning, and not least investment planning in the public and private sectors.

Glossary

(all definitions from IPCC (2018b) unless noted otherwise)

Adaptation: The process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. Incremental adaptation (or risk management) maintains the essence and integrity of a system or process at a given scale. Transformational adaptation changes the fundamental attributes of a socioecological system in anticipation of climate change and its impacts.

Climate risk management: Risk management that aims to manage risk along the entire risk continuum, from short-term extreme weather events such as storms and floods to long-term gradual changes such as sea level rise and desertification (GIZ, 2019).

Future-proofed societies: Future-proofing is the process of anticipating the future and developing methods of minimising the negative effects of shocks and stresses due to future events (Rich, 2014).

Residual risk: Risk that remains after adaptation and risk reduction efforts (IPCC, 2020).

Risk: The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence.

Risk assessment: The qualitative and/or quantitative scientific estimation of risks.

Risk management: Plans, actions, strategies or policies to reduce the likelihood and/or consequences of risks or to respond to consequences.

Risk transfer: Risk transfer aims at transferring risk e.g. of potential losses or damages to another entity, e.g. a selected actor or risk pool. Risk finance instruments and risk pooling tools are components of risk transfer approaches. One common example are insurance schemes.

Risk tolerance: A method to evaluate what risks means for agents exposed to risk. Risk can generally be broken down into acceptable (no further actions necessary), tolerable (further incremental actions required to manage risk) or intolerable risk (transformational actions to avoid risks are necessary) (Mechler et al., 2019b).

Further links

GIZ (2019). ↗**CRM Info Sheet**

GIZ with Adelphi and EURAC (2014). ↗**Vulnerability Sourcebook** (following IPCC's 4th assessment report)

GIZ with EURAC (2017). ↗**Risk Supplement to the Vulnerability Sourcebook** – Guidance on how to apply the Vulnerability Sourcebook's approach to the new IPCC AR5 concept of climate risk

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