IBC on Environment and Climate Change

REVIEW OF GOOD PRACTICES

Integrating Disaster Risk Reduction and Climate Change Adaptation for Risk-informed and Climate-smart Development

Issue-based Coalition on Environment and Climate Change
Task Team on Disaster Risk Reduction and Climate Change Adaptation

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CONTENTS

1 INTRODUCTION

Policy coherence for sustainable development is at the heart of the Agenda 2030. This Review of Good Practices looks at the linkages between Disaster Risk Reduction (DRR) and climate change adaptation, around main dimensions of policy, innovation and practice. Building greater policy coherence among DRR and climate change adaptation can contribute to advancing sustainable development.

This paper aims to showcase good practices of policy coherence around climate resilience, with the intention of raising awareness of UN country teams and the strengthened application of both policy agendas in the development and implementation of UN Sustainable Development Cooperation Frameworks at country level. It aspires to remain a living document, continuously enriched through good practices shared by the UN family from across the region.

Exchange of knowledge and efforts to build upon the common aim of the Agenda 2030, the Sendai Framework for Disaster Risk Reduction 2015-2030 and the Paris Agreement for climate change, have contributed to advance both areas. The systemic approach to risk analysis that characterises all-of-society and multi-hazards risk reduction has informed and inspired adaptation actions on the local, regional, transboundary and global levels.

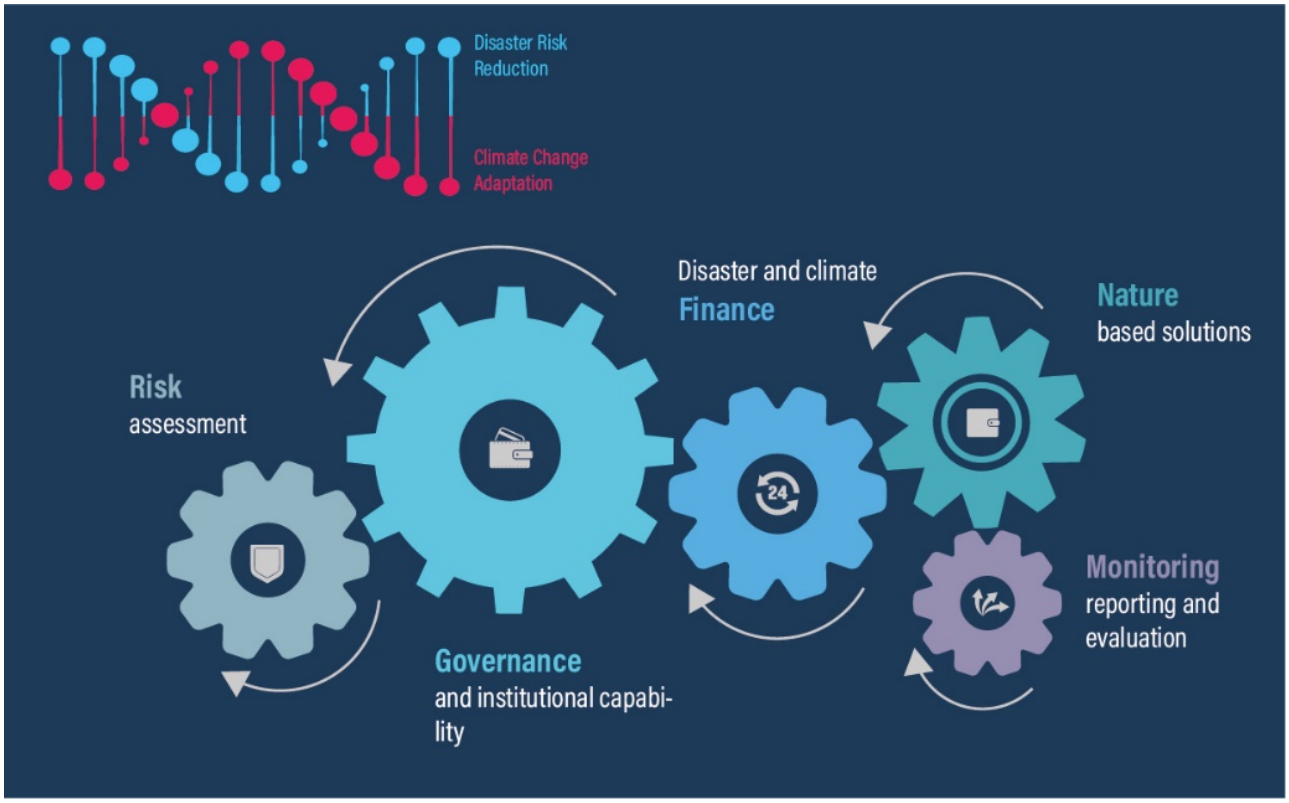
DRR and climate change adaptation are vehicles of transformative action and change. Although different in many respects, the transformative processes have in common the emphasis on key dimensions of vulnerability and the role of citizens and organisations as agents of individual and social change. Through new commitments, knowledge and innovative mechanisms, transformational approaches advance the integration of DRR and climate change adaptation on the local, regional, transboundary and global levels, by designing shared vision and pathways to realize that vision.

This Review is structured around five domains in which good practices fostering coherence and building resilience to climate and disaster risks are introduced:

» **Governance and institutional capability** to coordinate responses to disaster and climate risks, and foster innovative and forward-thinking solutions,
» **Assessment of disaster and climate risks**, vulnerabilities and coping capabilities, which consider systemic interlinkages and dependences,
» **Nature-based Solutions** which provide cost-effective ways of reducing risks and provide additional ecologic, social and economic benefits,
» **Disaster and climate finance** embedded within comprehensive financial protection strategies and contributing to building resilience to financial impacts of climate and disaster risks,
» **Monitoring, reporting and evaluation** or learning to trace progress made in reducing risks and building resilience, assess what has been accomplished, and communicate the processes and outcomes.

The Issue-Based Coalition (IBC) on Environment and Climate Change offers a relevant regional channel to bring agencies together in support of UN Resident Coordinators and Country Teams across Europe and Central Asia. Through its Task Team on Disaster Risk Reduction and Climate Change, the IBC aims to promote, among other things, awareness and understanding of how the UN family can support increased coherence of Disaster Risk Reduction and Climate Change Adaptation policy agendas at a country level.

Building on the "Guidance Note on Using Climate and Disaster Risk Management to Help Build Resilient Societies" on the integration of DRR and climate change adaptation into UN Sustainable Development Cooperation Frameworks, coordinated by UNDRR and supported by an interagency task team chaired by FAO and UNDP and the broader ongoing engagement of UNDRR and IBC partners in the region, this Review of Good Practices provides practical insights into the integration of DRR and Climate Change Adaptation agendas with examples from across the Europe and Central Asia region, and provide concrete recommendations on embedding greater coherence of these agendas in actions at national level through the mandates and actions of UN partner agencies in the region.



The extensive desk review conducted for this study aimed at identifying good practice examples of theory and practice, which foster or exploit synergies between DRR and climate change adaptation and which can serve as inspiration for others. The purpose of these examples is to stimulate debate about how good practice examples should be identified and documented, in order to inspire others to replicate their success in different contexts.

UN Sustainable Cooperation Frameworks, engagement on resilience and climate agendas both nationally and in the region including on the transboundary level. The content of this Review will evolve over time as further good practices are shared and disseminated; this compilation of good practices may aspire to develop into an online database, through which UN Country Teams may identify practical solutions and inspirations from experiences shared from across the UN family.

2 INTEGRATING DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION

DRR and climate change adaptation are central dimensions of all spheres of government and society and target resilience as a precondition and an outcome of risk-informed development. With a majority of disaster events related to climate extremes, both agendas have often been politically and operationally intertwined. Nevertheless, practical implementation of both agendas has generally involved different communities of practice, both within and across national borders. Efforts remain needed to support further coherence of to close-knitted areas of work – as the Review will highlight, their synergies and integration into different policy areas remains a topic of close attention in both national and regional contexts.

While centred around resilience, Disaster Risk Reduction, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, seeks to prevent new and reduce existing disaster risks, and the quest of climate change adaptation is to build adaptive capacity and reduce vulnerability to unavoidable adverse impacts of climate change caused by human-induced greenhouse gas emissions. Sound understanding of vulnerabilities, determinants of risk and people attitudes are equally important for both.

Aligning DRR and climate change adaptation agendas creates conditions for greater policy impact, more efficient use of resources, and more effective action in protecting life, livelihoods and valuable assets. Lack of integration leads to insufficient protection and wasteful use of resources[1].

In addition, both DRR and climate change impacts do not recognize national borders and are felt through entire water cycles. For example, intensity and frequency of floods and droughts is increasing under climate change in transboundary basins and their management requires both **inter-sectoral and transboundary cooperation**. Countries on the national level can benefit while using transboundary approach because it makes DRR and climate change adaptation more efficient by reducing uncertainties through data exchange, enlarging the planning space, identifying better priorities and sharing costs and benefits. The role of the joint basin organisations is also crucial for integrating DRR and climate change adaptation into the basin planning and development[2].

DRR and climate change adaptation face similar institutional and cultural challenges as they uphold a step change in how risks are understood, identified and coped with; management capabilities built up and organized; and societal groups engaged and mobilized. Because both agendas are implemented by "injections" into sectoral policies, including, but not limited to water, urban planning, transport, energy, infrastructure, health, and agriculture, ample experience has been collected on how they contribute, separately or jointly, to policy coherence.

DRR and climate change adaptation adhere to and rely on the same principles of social justice including access to resources, equity, participation, diversity, human rights, and care for the most vulnerable and marginalised. The loss & damage associated with climate change impacts institutionalised with the Warsaw International Mechanism for Loss and Damage associated with climate change impacts (WIM) under UNFCCC, draw on DRR methods and principles.

[1] Sandholz, S. Costs and benefits of (in)coherence: Disaster Risk Reduction in the Post-2015-Agendas. Synthesis Report. (2020)

[2] UNECE. *Water and Climate Change Adaptation in Transboundary Basins: Lessons Learned and Good Practices*. (Economic Commission for Europe UNECE) and International Network Of Basin Organizations, 2015)

Sizeable progress has been made over the past decade or more in connecting the DRR and adaptation communities (i.e., expert networks helping to define the problem, identify solutions and assess their outcomes). A tangible prove of this is the IPCC Special Report on Managing the Risk of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX, 2012) reconciling the terminology, method and frameworks. Less demonstrable and evidence-substantiated progress, except for some countries, has been made in building joint risk management capabilities (see the Evaluation of the EU Strategy on Adaptation to Climate Change).

Major recent assessment reports include:

- Global Assessment Report (GAR2019) offered an update on progress made in implementing DRR and climate change adaptation and shed light on selected countries' experience.
- UNFCCC technical report acknowledged that resilience and ecosystems (Nature-based Solutions) can act as core concepts for motivating closer integration of DRR and climate change adaptation.
- OECD assessment report examined the potential for a more coherent approach to management of climate-related risks.

3 INCLUSIVE AND COORDINATED GOVERNANCE

Institutional alignment needed to meet the DRR and climate adaptation objectives is a slow and cumbersome process, and there is no universal solution for enhancing policy coherence[3]. Every country is characterised by unique architecture of governance systems and procedures across jurisdictional contexts.

National platforms for disaster risk reduction play an important role for ensuring all-of-government and all-of-society approach to reducing risk and building resilience. The platforms foster interrelationships between DRR, sustainable development and climate change adaptation across sectors and across stakeholders. According to a recent inventory by UNDRR, 37 National Platforms for DRR exist in Europe and Central Asia, with heterogeneous structure but all aiming at multi-stakeholder cooperation and mainstreaming DRR into policies and practice.

Words into Action Guidelines - National Focal Points for Disaster Risk Reduction National Platforms for Disaster Risk Reduction Local Platforms for Disaster Risk Reduction.	UNDRR	Link
National Platforms for Disaster Risk Reduction - UNDRR Regional Office for Europe and Central Asia Overview	UNDRR	Link
The Dutch National Steering Committee for National Safety and Security, in which ministries are represented along with other governmental bodies and organizations, is considered an example of good governance practice.	Netherlands	Link
Disaster and Climate Resilience Youth Network (DACRYN) for Central Asia (since 2019) is a sub-regional platform for youth and young professionals in DRR to mobilize and empower young people in science for DRR in Ka-	UNESCO	Link

[3] Forino, G., von Meding, J. & Brewer, G. J. A Conceptual Governance Framework for Climate Change Adaptation and Disaster Risk Reduction Integration. *Int. J. Disaster Risk Sci.* **6**, 372–384 (2015)

zakhstan, Kyrgyz Republic, Tajikistan and Uzbekistan. The network is related to the U-Inspire network of the Asia and the Pacific, as its sub-regional chapter and implements activities at the sub-regional and national levels.		
Emergency Alerting Call to Action. For a better coordination on national level, addressing better collaboration among various stakeholders, including disaster risk management agencies, meteorological and geological services, ICT regulators, NGOs, IGOs, and operators, the countries have built (interoperable warning networks) multi-hazard early warning systems (MHEWS) and developed functional and effective communication strategies, platforms, and standardized communication protocols, in particular the Common Alerting Protocol (CAP), an international standard for exchanging multi-hazard emergency alerts and public warnings over different types of networks. Since 2006, WMO has recognized CAP as the key standard for all-hazards, all-media public warning and alerting from authoritative sources. National Meteorological and Hydrological Services are involved in most hazard threat alerting within and among countries and so have led the world in adoption of CAP, which has a proven track record of improved effectiveness and efficiency of official alerting systems. WMO has signed the Emergency Alerting Call to Action as part of its ongoing Global Multi-hazard Alert System (GMAS) development and its collaboration with governmental, non-governmental, and commercial organizations to achieve the broadest adoption of CAP worldwide. The Call to Action was launched at a special event during the Humanitarian Networks and Partnerships Weeks 2021. The CAP Call to Action comes as, further to the development of the WMO GMAS framework, WMO also seeks to expand and improve the provision of Members expert advice to the United Nations and other humanitarian agencies to meet rising demand for authoritative information to support early action and response. Increasing the utilization of CAP with dissemination and aggregation through GMAS, alongside other developments, including the 4.7 million CHF contribution from MeteoSwiss will play a key role in ensuring WMO responding to this demand. In 2019 WMO established a coordination post at UN Headquarters in New York, providing a strategic information flow on weather, climate and water-related hazards to the UN operations and Crisis Centre. WMO New York and Geneva offices have recently combined forces to ensure the provision of authoritative advice to the UN's Inter-Agency Standing Committee.	WMO	Link

Citizen assemblies can help unlock more effective action and help solving intractable issues. A citizens' assembly is a group of people brought together to learn about and discuss issues and reach conclusions about what should be done[4]. The citizens are chosen randomly, based on demographic criteria and attitudes. Participants interact with a range of experts, practitioners, stakeholders and campaigners.

Employment and decent work for preventing crisis situations arising from conflicts and disasters and enabling recovery and building resilience is an important part of risk governance. The recommendations of the International Labour Organization (ISO) provide guidance on measures to generate employment and decent work in crisis situations. Employment and decent work can contribute to peace and resilience in conflict, disaster and fragile situations, and you may find some helpful information and points in the sections on disaster/resilience.	ILO	Link
Climate Citizens' Assemblies were held in Ireland, France and UK. The latter gather 108 people to make recommendations for how the UK can reach its net zero target by 2050.	Ireland France UK	Link Link Link

Cross border coordination. Fostering coherence DRR and Climate Change Adaptation provide an opportunity for co-operation within and across boundaries. Bilateral or multilateral cooperation may rely on non-binding strategic alignment or explicit treaties and can take many forms such as joint risk and vulnerability assessment, transboundary adaptation strategies and plans, contingency planning and exercises, financing and risk pooling arrangements, coordination and/or joint implementation of measures, or technical cooperation.

Water stress, water-related hazards and water quality pose increasing challenges to modern society. And yet, the capacity to monitor and manage this vital resource is fragmented and inadequate. In many countries, meteorological and weather services are separate from hydrological and water services. Cooperation between these services, and with users, is a key to providing integrated and complete information needed to support water-smart decision-making. Climate change, urbanization and pollution mean that water resources are stressed as never before. Water-related hazards like drought and flooding are becoming more serious, and a much greater proportion of annual precipitation is now falling in extreme precipitation events rather than spread more evenly throughout the year. Most rivers and freshwater bodies are transboundary and decisions by one country on water resource management often have implications for other countries, thus making water a potential source for both peace and conflict. And yet, many countries lack the capacity to monitor and analyse relevant data. This means that decisions on major infrastructure projects like dams or hydroelectric plants as well as urban planning are often made on the basis of outdated or incomplete information.

[4] Wilson, C., & Mellier, R. Getting Climate Citizens' Assemblies Right. (2020)

National Policy Dialogues for Industrial Safety in Central Asia, under the auspices of the UNECE Convention on the Transboundary Effects of Industrial Accidents, launched in Central Asia and Serbia set out to strengthen interinstitutional coordination in relation to industrial accident prevention, preparedness and response.	UNECE	Link
National Policy Dialogues on Integrated Water Resources Management and Water Supply and Sanitation, under the auspices of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention), have been implemented under the EU Water Initiative in Eastern Europe and Central Asia.	UNECE	Link
The Water Convention which secretariat is hosted by the UNECE provides a unique global legal and intergovernmental framework for transboundary cooperation in climate change adaptation including flood and drought management in transboundary basins. Since the publication of its Guidance on Water and Adaptation to Climate Change in 2009, numerous adaptation strategies and plans focusing a lot on DRR have been developed and implemented across basins in the Europe and Central Asia (including the Chu-Talas, the Danube, the Dniester, the Neman and the Rhine) as well as globally (including Lake Chad, Lake Victoria, the Mekong and the Niger). These experiences show that the ingredients for success include good communication, monitoring and data sharing, sectoral cooperation, capacity support, and funding mechanisms.	UNECE	Link
b-solutions is a pilot initiative to tackle legal and administrative border obstacles along the EU land borders. A 2020 compendium of case studies include solutions to forty-three obstacles in different fields, including public transport, health/ emergency services, and institutional cooperation.	European Union	Link
UNESCO Regional Bureau for Culture and Science in Europe has a long tradition of collaboration with the International Sava River Basin Commission (ISRBC). Transboundary cooperation is a key aspect between countries facing flooding events which regularly affect the Sava River basin. UNESCO and ISRBC through the EU-funded SHELTER project aim to develop DRR governance tools and enhance the cooperation among different institutions facing the consequences of flooding on cultural and natural heritage. Transboundary regional approach in integrating DRM policies and developing comprehensive regional methodology will help to better address flood risk challenges at all DRM phases.	UNESCO	Link
WMO has a number of water-related initiatives, including the Flash Flood Guidance System. Additionally, WMO is responsible for the direction of the World Water Data Initiative. Better data is key to better management of water. With these developments, hydrology is more prominent than ever in the WMO. Congress created new possibilities for a more effective integration of hydrology, climate science and meteorology to support its Member States and to inform regional and global processes like the Sustainable Development Agenda and the Paris Agreement.	WMO	Link

Disaster Preparedness and Prevention Initiative (DPPI) is an effort to contribute to the development of a cohesive regional strategy for disaster preparedness and prevention for its ten Member States (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, North Macedonia, Montenegro, Romania, Serbia, Slovenia and Turkey). The DPPI seeks to provide a framework for South-eastern European nations to develop programs and projects leading to strengthened capabilities in preventing and responding to natural and man-made disasters.	DPPI South East Europe	Link

Cities are both drivers and sufferers of climate change, and thus catalysts of climate adaptation and disaster risk reduction. They are battlegrounds of physical, social, environmental and economic transition and at the same time, prime generators of many such changes, often fuelling urban inequalities[5]. Urban regeneration is a response to "opportunities and challenges which are presented by urban degeneration in a particular place at a specific moment in time" (link). It embodies lasting improvements of environmental (e.g., resource use and urban ecosystems), social (e.g., inequalities, cohesion and health), economic and institutional (e.g., economic disparities and governance) conditions.

UK Civil Contingencies Act (2004) requires every local authority area to establish Local Resilience Forums as multi-agency partnerships made up by local authorities and public services, and specialised agencies. The Forums compile risk profiles and plan and prepare for localised emergencies	UK	Link
Megacities Alliance for Water and Climate initiated by UNESCO support urban water governance, including water related disaster responsiveness with water sensitive urban design and nature-based solutions	UNESCO	Link
The Making Cities Resilient 2030 initiative launched by UNDRR supports urban resilience to disasters by engaging cities and partners in building resilience to disasters at local level. Cities are introduced to partnerships, tools and instruments, and encouraged to collaborate to strengthen the urban resilience agenda and contribute to the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 and Sustainable Development Goal number 11.	UNDRR	Link

[5] Nijman, J. & Wei, Y. D. Urban inequalities in the 21st century economy. *Appl. Geogr.* **117**, 102188 (2020)

Community-Based Disaster Risk Reduction resulted as a top innovation in recent survey of novel disaster risk reduction approaches and products. As a bottom-up - and people-centred approach, community-based DRR is capable to harness local knowledge and resources, and stimulate local ownership of the process and the developed solutions (UNU). Most of the international projects include support to local capacity building and community-based DRR.

UNESCO designated sites, including Biosphere Reserves and Geoparks, are 'learning places for sustainable development' and provide local solutions for climate change adaptation and disaster risk reduction based on inclusive, transparent and empowering governance processes. Beigua UNESCO global geopark in Italy developed prevention and education activities for local community and reconstruct the knowledge framework of natural hazard: EVANDE "Enhancing Volunteer Awareness and education against Natural Disasters through E-learning". Psilorities Global Geopark in Greece developed RACCE "Raising earthquake awareness and coping children's emotions" improving knowledge on natural hazards and establishing collaborations between various civil protection operators. UNESCO Global Geoparks (Katla, Psiloritis) are part of the RURITAGE projects' demonstration labs that harness the role of intangible and tangible heritage to strengthen resilience of vulnerable communities as a key approach to sustainable development.	UNESCO	Link Link Link
In the context of the transboundary Sava river basin Open Lab (SHELTER project), UNESCO and ISRBC organise six monthly co-creation workshops with stakeholders from civil protection, heritage and flood management experts from Member Countries to identify together DRR local solutions and strategies for protecting cultural and historical heritage affected by flooding.	UNESCO	Link
Community approach is the essence of first European-wide platform developed by the I-REACT EU project in which UNESCO participated. The serves to integrate emergency management data of multiple sources, including that provided by citizens and communities through the mobile app and the social media analysis tool to account for real-time crowdsourced information, drones to improve mapping, wearables to improve positioning, as well as augmented reality glasses to facilitate reporting and information visualisation by first responders. With this approach I-REACT involved citizens in reporting first-hand information to support policymakers in the decision-making process	European Union	Link

4 RISK ASSESSMENT AND SERVICES

The assessment of climate-related hazards, vulnerabilities and coping capabilities has long stimulated convergence between Climate Change Adaptation and DRR. Climate change is not a hazard per se but a driver of existing and emerging risks. Climate-related hazards are outcomes of multiple stochastic processes which are often not stationary but respond to environmental changes, including climate change. Many risks are complex, non-linear, result of compound or connected events with cross-border or spill-over effects. Single-hazard perspectives are no longer a sufficient basis for risk assessment. Instead, multi-hazard risk assessments that take into account cross-border, spill-over and cascading effects are needed. (see GAR2019)

Hazard Definition and Classification Review 2020	UNDRR	Link
Recent assessment reports have reviewed the progress of integrating the national risk assessments and climate change and vulnerability assessments.	UNDRR	Link
Norway has integrated climate projections and forecasts in disaster risk management.	Norway	Link
United Kingdom and the Netherlands have elaborated national risk assessment (NRA) with fully integrated climate risk and vulnerability assessments. In the UK, infrastructure managers are obligated to consider the impact of natural hazards and climate change on their services	UK Netherlands	Link Link
A transboundary multi-hazard risk map addressing NATECH risks has been developed in the Danube Delta. It includes the location of oil terminals and a water risk index, spanning the Danube Delta across the Republic of Moldova, Romania and Ukraine. The transboundary hazard map was developed under the UNECE Project on Hazard and Crisis Management in the Danube Delta, with the support of the German Environment Agency	UNECE	Link
Under EU-funded project SHELTER, Spain, Turkey, Italy, Netherlands and Sava river basin countries elaborate replicable resilience, vulnerability and risk assessment methodology to develop a multiscale data model and multi-hazard risk assessment tool to address a risk regarding specific hazards and their synergistic impact	European Union	Link

Multi-Hazard Early Warning Systems and National Meteorological and Hydrological Services. The observations and data gathered by National Meteorological and Hydrological Services (NMHSs) form the foundation for the monitoring and prediction of weather, climate, water and related environmental conditions as well as the issuance of warnings and alerts. However, there is marked disparity in the observation networks with developing and least developed countries having sparse networks that do not adequately represent the weather and climate conditions affecting these countries. The sparse observation networks ultimately affect the quality and range of services that NMHSs can provide.

Hydro-meteorological and climate services help individuals and organizations to make risk-informed decisions supporting disaster and climate risk reduction[6]. Historic climate records, catalogues of extreme events, reanalyses, forecasts, projections and indices used in outlooks, early warnings, vulnerability and risk assessments enable higher agricultural productivity, more efficient use and allocation of water, greater financial security and returns on investments, more reliable access to and production of renewable energy, and more effective protection of vulnerable communities and ecosystems (see EEA).

To meet increasing demand for the free exchange of observational data needed to deliver better weather- and climate-related services, the WMO Executive Council has approved a new unified data policy.	WMO	Link
To support countries to generate and exchange basic observational data critical for improved weather forecasts and climate services, the Systematic Observations Financing Facility (SOFF) has been created by WMO, in collaboration with a wide range of international organizations, including the Members of the Alliance for Hydromet Development.	WMO	Link
Copernicus Climate Change Service is one of six services of Copernicus program, designed to deliver knowledge to support adaptation and mitigation policies. Climate Data Store provides free and open access to climate reanalysis data, forecasts, analytics and derived essential climate variables. DRR is among priority areas of Copernicus program which also includes services for Emergency Management. Sectoral Information System to support DRR provides access to pluvial flood risk assessment caused by extreme rainfall events, building upon dynamically downscaled climate reanalysis.	European Union	Link
Central Asia Hydrometeorology Modernization Project improved the accuracy of hydrometeorological services, particularly in the Kyrgyz Republic and Tajikistan, and supported other countries in improving skills and technical capacity in weather forecasting. It also implemented a flow forecasting and flood warning system for the Amu Darya and Syr Darya basins and Central Asia flash flood guidance system	World Bank	Link
Global Environment Facility and Adaptation Fund projects implemented by UNESCO Almaty office target regional improvements in cryosphere monitoring and preparedness for, and response to, the risk of glacial lake outburst floods. The UNESCO Office in Almaty initiated recently a new regional project "Reducing vulnerabilities of populations in the Central Asia region from glacier lake outburst floods (GLOFs) in a changing climate" which focuses links strongly climate change adaptation measures and disaster risk reduction. The project aims to strengthen monitoring, analytical and the response capacity of institutions and government officials responsible for disaster risk reduction, emergency and climate change adaptation through community-based and gen-der-sensitive education and communication,	UNESCO	Link

[6] Larosa, F. & Mysiak, J. Business models for climate services: An analysis. *Clim. Serv.* 100111 (2019)

and by establishing early warning systems sup-ported by the necessary monitoring strategies		
Germany launched a regional initiative "Green Central Asia", with focus on climate and security, supporting countries in assessing the impacts of climate change and in taking preventive measures	Germany	Link
Climate services for DRR and adaptation are essential for developing countries to link early warning tools and climate action in a coherent framework.	WMO	Link
The World Food Programme identified priority actions and best practices, including disaster risk knowledge; detection, forecast and monitoring the hazards; warning dissemination and communication; preparedness to respond; and monitoring/evaluation of the results. Successful examples include seasonal-based climate services products to forecast the rains onset anomalies.	WFP	Link
The Swiss development and cooperation agency (SDC) will support Central Asia in building resilience of local population to climate change through the implementation of adaptation measures in 2-4 defined watersheds targeting water and DRR sector. The research results on the selected cryospheric (including on permafrost) monitoring sites will inform planning of specific adaptation measures and will support fund mobilization for their implementation.	Switzerland	Link
Multi-hazard early warning systems are essential in providing timely and accurate warnings of hazardous weather events to reduce loss of lives and minimize their negative impact on society, economy, ecology, infrastructure and industry. WMO Global Multi-hazard Alert System (GMAS) aims to increase and enhance the availability of authoritative warnings and information related to extreme and/or potentially high-impact weather, water and climate events – regionally and globally	WMO	Link
South-East European Multi-Hazard Early Warning Advisory System (SEE-MHEWS-A) is one of the GMAS pilot projects aiming to provide NMHSs operational forecasters with effective and easy to apply tools for improved and accurate forecasting of hazardous events and early warnings and to ensure that the National authorities have the best possible information to carry out early actions and make the decisions that can mitigate potential impacts of hazardous situations	WMO	Link
Flood forecasting and warning as a focused activity in the hydrometeorological sector relates to the non-structural measures for the flood management under the overall framework of Integrated Flood Management (IFM) approach to be applied at the national, regional or local level. Flood forecasting and warning services should ultimately operate with the NMHSs in support of the civil protection and emergency response services. Forecasting and warning services are developed, in most cases, to deliver reliable and timely information to the civil protection services as well as to the general public. This should be constituted with enough lead time to allow	WMO	Link

stakeholders to take measures to protect themselves from flooding or take appropriate actions.		
In line with the Sendai Framework, end-to-end early warning systems for flood forecasting (E2E-EWS-FF) is a WMO framework to promote the enhancement of flood forecasting and early warning capabilities of NMHSs, which is interoperable at all levels from data collection to informing users and decision support system	WMO	Link
For the past two years the World Meteorological Organization has been undertaking a pilot in Regional Association VI (Europe) on cataloguing hazardous events and assigning to each a unique identifying number. The unique identifier can be used to link data on the events to data associated loss and damage. The hazardous event data has been collected by the German weather services, DWD, working with NMHSs. Data on loss and damage is collected by National Disaster Management Offices with support from UNDRR and UNDP. WMO, UNDRR, UNDP cooperation on linking these datasets would be a valuable initiative for the region and an example that other regions could follow	WMO	

NATECH events – natural-hazard triggered technological accidents (such as Fukushima) – are on the rise, due to climate change impacts – these cascading risks need to be considered, built into risk assessment approaches, which need to be regularly reviewed and updated.

According to a survey conducted in 2017 by OECD, the effects of climate change on Natech risks have, thus far, rarely been considered in NATECH Risk Management. Effects of climate change should be taken into account in risk analyses for hazardous installations.	OECD	Link
German Environment Agency hosts a database of 40 examples of Natech Risk Management practices.	Germany	Link

5 NATURE-BASED SOLUTIONS

Nature-Based Solutions (NbS) are solutions to societal challenges that are inspired and supported by nature. They include "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits"[7].

NbS can provide means to mitigate climate risks - through mass stabilisation, water flow regulation, wind dissipation, and temperature regulation - remove particle pollution and improve air quality, protect soil and biodiversity, and enhance climate resilience. NbS provide over one-third of the

[7] https://oaj.fupress.net/index.php/techne/article/view/7883

cost-effective climate mitigation[8] needed to stabilise warming to below 2°C. Compared to engineered, built or fossil-based solutions, NbS approaches may be cost-effective and have many environmental, social and economic benefits.

Many countries developed DRR and Climate Change Adaptation plan based on ecosystem approaches. Community disaster resilience initiatives employ ecosystem-based interventions at the households and community level to reduce climate risk and foster nature conservation and management. The 2020 IUCN Global Standard for Nature-based Solutions defines criteria and indicators supporting purposeful design, implementation, monitoring and continuous improvements of NbS interventions.

Collections of best practices offer examples and experiences form implementing NbS for risk management. Examples include physical interventions of restoration and conservation of nature, green regeneration of cities, and national greening programme, policies and initiatives, that provide multiple benefits beyond the risk reduction for the community.	UNDRR	Link
'Building with Nature' project set out to restore mangrove forest for coastal erosion and flooding prevention, while enabling inclusive economic growth for local populations and integrating sustainable aquaculture solutions	European Union	Link
'Sponge City' embraces permeable pavements, green rooftops, rain gardens, ponds and wetlands capturing excess water during intense precipitation events	World Future Council	Link

Nature-based solutions have been applied to preserve riverine ecosystems and biodiversity, while contributing to managing flood risk and water quality including in transboundary context. Since NbS represent a holistic approach applied on the ecosystem-based level, it is especially valuable for transboundary basins where the entire basin is seen as one ecosystem and adaptation priorities are identified and selected accordingly. In this respect, applying NbS in transboundary basins can help avoiding mal-adaptation, making DRR more efficient and enabling maintaining of the ecosystem services within the basin as a whole.

The Elbe management plan is an example of international cooperation. It employs green restoration and protection of floodplains and wetlands, and removal/setback of levees. Cost-effectiveness analysis demonstrated that green measures provided economic gains per hectare for flood risk reduction. Indirect benefits, such as nutrient retention and biodiversity conservation, increased the value of green intervention fourfold	Elbe river basin	Link
One more example refers to application of the NbS to better adapt to climate change in the Dniester basin shared by Moldova and Ukraine. The Strategic Action Programme, Strategic Framework for Adaptation to Climate Change and its Implementation Plan endorsed by the governments	OSCE	Link

[8] Griscom, B. W. *et al.* Natural climate solutions. *Proc. Natl. Acad. Sci.* **114**, 11645–11650 (2017)

of both countries identify joint adaptation and DRR options at the basin level, including NbS that require transboundary cooperation, for example, reforestation activities, restoration of floodplains, fish conservation and dedicated awareness raising; some of them were already implemented. These NbS related activities have not only increased basin resilience, but also improved and promoted transboundary water cooperation more broadly, such as the entry into force of the Treaty between the Republic of Moldova and Ukraine on Cooperation in the Field of Protection and Sustainable Development of the Dniester River Basin in 2017 and the establishment of the bilateral Dniester Commission in 2018. Currently under the Dniester Commission there are dedicated working groups on ecosystems, biodiversity and river basin planning and management which include joint activities on NbS		
OPERANDUM is developing a set of co-designed, co-developed, co-deployed, tested and demonstrated innovative NBS for the management of the impact of hydro-meteorological risks (HMRs) in European rural and natural Open-Air Labs (OALs). The OALs which include UNESCO Biosphere Reserves provide science-based evidence for the efficacy of NBS while promoting multi-stakeholder engagement to facilitate the adoption of new policies for the reduction of HMRs via NBS and to promote NBS uptake	European Union	Link
Great Altay Transboundary Biosphere Reserve's solutions for SDGs (Kazakhstan/Russian Federation): conservation of forests and montane ecosystems to combat desertification, degradation of biodiversity, reduction of risk of forest fires	Kazakhstan Russian Federation	Link
Brighton and Lewes Downs Biosphere Reserve implements Sustainable Development Goals (United Kingdom) - flooding due to climate change and extreme weather events - piped connections into specially designed rain gardens	UK	Link
Montseny Biosphere Reserve implements Sustainable Development Goals (Spain) - forest management - Climate change adaptation	Spain	Link
URDAIBAI Biosphere Reserve implements Sustainable Development Goals (Spain) - climate change adaptation - sea level rise	Spain	Link
Superblock programme in Barcelona includes NbS addresses outdoor thermal comfort and energy savings using natural cooling. Other examples include green roofs extension in the city of Larissa in Greece, 'cool islands' in Paris, temporary flood storage area and water squares in Miskoic, Hungary, and sustainable urban drainage in Malmo (Sweden). Sand engine in the Netherlands provides coastal protection from storm and erosion through beach nourishment and dune preservation	Spain	Link
EU Horizon 2020 GEO4CIVHIC project, develops natural, fully renewable shallow geothermal solutions in retrofitting historical and civil buildings in cities. It demonstrates various geothermal heating and cooling solutions, easiest to install, cost-effective and most suitable for each building type,	European Union	Link

the climate and the geological conditions. The project counts real and virtual and real demonstration sites in Malta, Belgium, Ireland and Italy, this last one in Ferrara World Heritage Site coordinated by UNESCO Regional Bureau for Science and Culture in Europe		
The Words into Action Guidance developed by UNECE and UNDRR addressed the role of nature-based solutions in transboundary cooperation and management of water related disasters.	UNDRR UNECE	Link
The secretariat of the UN Convention on Biological Diversity adopted a voluntary guidance on implementing NbS for DRR and Climate Change Adaptation.	UNCBD	Link

6 DISASTER RISK AND CLIMATE ADAPTATION FINANCE

The common goal of disaster risk and climate adaptation finance is to build resilience to financial impacts of climate and disaster risks.

Comprehensive financial protection strategies combine various financial instruments - such as contingency funds, contingent loans and grants, and risk transfer solutions. Each of these instruments can efficiently handle only a certain type of risk, depending on its frequency, intensity and impacts. A strategy that builds upon a diversified pool of mutually complementing financial tools and institutions is better equipped to cope with risks.

Insurance is the most common form of financial protection against risk of contingent losses. Risk-based actuarial pricing can provide incentives for investments in loss reduction. Insurance play an important role in mitigating disaster impacts through all aspects of the risk management cycle, including risk identification and modelling, risk awareness, damage prevention, risk transfer, and recovery. Climate change poses new challenges to insurers and markets. Because of the uncertainties characterising the changes in patterns of climate extremes, insurers may need to increase the premiums or withdraw from the market.

Besides insurance, other innovative financial instruments offer protection against climate and disaster risks. Catastrophe bonds are fully collateralized instruments that pay off on the occurrence of a defined catastrophic event[9]. Resilient impact bonds remunerate investors based on how well resilient measures are implemented, according to pre-defined performance indices[10].

Sovereign catastrophe risk pools are effective instruments allowing countries to pool risks in diversified portfolios and transfer excess risk to the reinsurance and capital markets. The existing catastrophe risk pools have relied on donor partners for their technical and financing capacity.

Climate-related risks are a source of financial risk and therefore addressed by central banks and supervisory authorities. Banks, insurers and assets managers are expected to provide information

[9] Cummins, J. D. CAT bonds and other risk-linked securities: State of the market and recent developments. *Risk Manag. Insur. Rev.* **11**, 23–47 (2008)

[10] Vaijhala, S. & Rhodes, J. Resilience bonds: A business-model for resilient infrastructure. *F. Actions Sci. Rep.* **2018**, 58–63 (2018)

to investors and lenders about how they have considered climate-related (physical and transition) risks to their business.

A recent report of the Regional Environmental Centre for Central Asia assessed the state of climate finance in Central Asia. It has reviewed the sources and targets of the international donor funding described some past and ongoing projects in more depth	Regional Environmental Centre for Central Asia	Link
To address low insurance penetration and large protection gap (i.e., uninsured portion of losses), several countries of the Southeast Europe and Central Asia, assisted by international donor organisation, initiated a thorough review of their financial protection strategies. The Kyrgyz Republic for example passed a mandatory property insurance law in 2015 and established the State Insurance Organization as a public joint stock company.	Kyrgyz Republic	Link
As the first country in Europe and Central Asia, Serbia introduced a Catastrophe Deferred Drawdown Option (Cat-DDO) as a part of the country's National Disaster Risk Financing and Insurance Strategy. The policy loan instrument guarantees access to a contingent credit line to mobilize immediate post-disaster funding in the aftermath of a disaster.	Serbia	Link
Europa Re AG (Europa Re) is a reinsurance company offering innovative and affordable catastrophe and weather risk insurance products and solutions communities and countries in South-eastern Europe (SEE) and globally. Europe RE provided specialized technical support to the government of Kazakhstan for addressing the adverse effects of climate change and the development of advanced insurance market infrastructure.	Kazakhstan	Link
A recent report of the European Environment Agency reviews numerous case studies of NbS throughout Europe and discussed innovative financing options - including sustainable business innovation and insurance value of ecosystem services.	EEA	Link
The UNFCCC Standing Committee on Finance holds a Forum on Finance for NbS and has collected numerous contributions on innovative practice examples.	UNFCCC	Link

Although it is known that climate change does not recognize borders, financing DRR and climate change adaptation, including in transboundary basins, remains one of the biggest challenges.

In the European Drin basin located in the Western Balkans the Strategic Action Programme (SAP) for the sustainable management was endorsed by high level representatives from the five riparian countries (Albania, Greece, Montenegro, North Macedonia, Kosovo) on 24 April, 2020. The SAP	European Drin Basin	Link

included floods and droughts among priority transboundary issues whereas climate change was integrated as cross-cutting issue impacting them. The process of SAP development as well overall cross-border cooperation in the region facilitated funding for transboundary disaster risk reduction to better adapt to climate change in the Drin basin from different donors including climate funds such as the Adaptation Fund.		

7 MONITORING, REPORTING AND EVALUATION

Monitoring, reporting and evaluation (or learning) (MRE) serves multiple purposes, including tracing progress made, assessing what has been accomplished, and communicating the processes and outcomes of disaster risk reduction and climate adaptation.

International processes implemented by UN Member countries are accompanied by a monitoring exercise, requiring reporting of data against set indicators and contributed to on a systematic basis by national authorities. The Sendai Framework for Disaster Risk Reduction is structured around 7 global targets and 38 indicators, which national authorities monitor using a Sendai Framework Monitoring System. The Sustainable Development Goals framework is composed of 17 goals and 169 targets, for which each national government – as well as other stakeholders, including local governments, business and civil society – is expected to identify, implement and report on specific actions that lead to their achievement. Under the soon to be implemented Paris Agreement enhanced transparency framework, countries will report, among other things, information on climate change impacts and adaptation. Data generation and preparation of biennial transparency reports provide an excellent opportunity to further advance coherence between adaptation and DRR MRE at national level (see UNFCCC).

Common data sharing systems for monitoring and evaluation (including in the transboundary context) may also provide an opportunity to develop common framework and processes for risk and vulnerability assessments, and measuring targets (see APN).

MRE provides feedbacks on progress and performance, that is whether the goals, target and efforts are sufficient and how they contribute to reducing vulnerability and risks. Because policy making is often based on conditional, uncertain or otherwise incomplete understanding of risks, MRE is also expected to improve the existing knowledge and help to identify key challenges, opportunities and persisting know-ledge gaps (see EEA). MRE measures coherence between DRR and climate change adaptation efforts across diverse policy areas.

Synthesis of the past and ongoing efforts is provided by the Sendai Framework Monitor system and UNEP's Adaptation Gap 2020 report.

Observational basis for climate monitoring. Climate monitoring is performed by a system of observing systems covering the atmosphere, the ocean, hydrology, the cryosphere and the biosphere. Each of these areas is monitored in different ways by a range of organizations. Cutting across all these areas, satellite observations provide major contributions to global climate monitoring.

Global climate indicators reveal the ways in which the climate is changing and provide a broad view of the climate at the global scale. They are used to monitor the key components of the climate system and describe the most relevant changes in the composition of the atmosphere, the heat that arises from the accumulation of greenhouse gases (and other factors), and the responses of

the land, ocean and ice to the changing climate. These indicators include global mean surface temperature, global ocean heat content, state of ocean acidification, glacier mass balance, Arctic and Antarctic sea-ice extent, global CO_2 mole fraction and global mean sea-level and are discussed in detail in the sections below. Further information on the data sets used for each indicator can be found at the end of this report.

In 1992, the Global Climate Observing System (GCOS) was established by WMO, the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP) and the International Science Council (ISC) to coordinate and facilitate the development and improvement of global climate observations. GCOS has identified a set of Essential Climate Variables (ECVs) that together provide the information necessary to understand, model and predict the trajectory of the climate as well as plan mitigation and adaptation strategies. The status of the observational basis for these ECVs is published in regular status reports.	WMO	Link
It has been 28 years since the World Meteorological Organization issued the first state of the climate report in 1993. The report was initiated due to the concerns raised at that time about projected climate change. While understanding of the climate system and computing power have increased since then, the basic message remains the same, and we now have 28 more years of data that show significant temperature increases over land and sea, as well as other changes, such as sea-level rise, melting of sea-ice and glaciers and changes in precipitation patterns. This underscores the robustness of climate science based on the physical laws governing the behaviour of the climate system. All key climate indicators and impact information provided in this report show relentless, continuing climate change, an increasing occurrence and intensification of high-impact events and severe losses and damages affecting people, societies and economies.	WMO	Link

Peer review is a well-established instrument, widely used in policy evaluation. Peer Review of disaster risk management provides a country or a region with an opportunity to reflect on its readiness to cope with natural and man-made disasters and to identify ways of improving the risk management.

The EU peer review programmes for Civil Protection, implemented in partnership with UNDRR and OECD, promote an integrated approach to disaster risk management. Peer reviews also support a wider policy dialogue, improving policy coherence and facilitating the exchange of good practices on civil protection and disaster risk management.	European Union	Link
UNECE Expert Forum for producers and users of climate change statistics introduced a set of core climate change related indicators to facilitate and harmonize monitoring, reporting and evaluation practices. Implementation guidelines provide recommendations and tools for measuring indicators.	UNECE	Link

Kyrgyzstan established a stakeholder platform to organize the work between data producers and users, as a part of the annual Statistical Plan and the 5-year Strategy for Development of State Statistics.	UNECE	Link
Russian Federal State Statistics Service created a database presenting official statistics on climate indicators and statistics on natural emergencies.	UNECE	Link
The progress of the *Climate Ready Scotland* strategy is measured by using over 100 indicators related to risks/opportunities and impacts, as well as actions undertaken.	Scotland	Link

Composite indices translate many-sided indicators of progress into statistical measures of overall performance. As such, they are used to measure and compare the DRR and climate adaptation performance of countries and cities. For example, the ND-GAIN index measures the adaptation readiness, PW-Index the political will and commitment to DRR and Climate Change Adaptation , and INFORM GRI levels of hazards and risks for humanitarian crisis management decisions.

INFORM GRI has been extended to project future climate-change hazards and provide better insights on how amplified climate risk can be compensated by improved vulnerability and adaptive capacity.	INFORM GRI	Link
Global Adaptation Mapping Initiative is a collective global effort to gather and synthesize empirical evidence on adaptation progress.	Global Adaptation Mapping Initiative	Link
NDC Ambition Index provides a regional synthesis of the climate change mitigation and adaptation commitments in the agriculture sectors of the Southern Europe, Eastern Europe and Central Asia region.	FAO	Link