



Conclusions and final recommendations

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Conclusions

The report *Science for Disaster Risk Management 2020: Acting today, protecting tomorrow* studies the impacts of disasters on a wide range of economic and social sectors as well as the consequences for the affected communities and ecosystems. A comprehensive assessment of the disaster impacts after an event enlarges our understanding of disaster risk and contributes to making disaster risk management (DRM) more effective. This requires having in place mechanisms of co-development and evidence-based governance that capture the knowledge and needs of diverse stakeholders, which (1) supports an early identification of risk drivers and (2) ensures the use of data and information on past events to formulate effective prevention, mitigation and adaptation measures.

'Impacts' consist of the direct damages and losses from an event (such as deaths, injuries, physical damage to buildings or interruption of services), the cascading effects that propagate, both in time and space, just afterwards, the recovery costs and the opportunities that may arise after the event. The report presents the usual consequences of disastrous events on five groups of assets: population, economic sectors, critical infrastructures, ecosystem services and cultural heritage. The consequences depend on:

- the hazard that materialises, its duration and its magnitude;
- the vulnerabilities and capacities of the asset and the whole system where they are located;
- the actions taken to respond and recover from the event.

The authors of the report, and in particular those of Chapter 3, relate the impacts to the indicators that measure progress towards targets A, B, C and D of the Sendai Framework for Disaster Risk Reduction, while introducing others that can easily emerge in time and space. The report reviews methodologies to analyse the impacts addressed, highlighting the challenges and potential opportunities for strengthening risk and crisis management practices.

The report includes several past disasters, moving towards the identification of practical approaches and potential solutions to these events. The study of impacts represents an important opportunity for the DRM community to learn about disaster risk, to understand how to better plan for future events and thereby facilitate response and recovery. Information gathered about past events helps to identify the failures in communication and in response protocols, the barriers in governance, the lack of awareness and the gaps in knowledge and data. The

past events analysed by the authors show how the events triggered changes in the policy framework, raised awareness and pointed out areas that should be further developed by research.

Although progress has been made in recent years to improve the understanding of disaster risk, societies, institutions and organisations engaged in DRM still focus on emergency response and on the most immediate consequences of an event. Prevention and mitigation actions seem to be undervalued in practice. For instance, more efforts need to be made to integrate knowledge of ecosystems, restoration and nature-based solutions into disaster risk planning policies. DRM should evolve to reinforce anticipation as well as increasing the interconnection of the various phases of the DRM cycle.

The complex nature of risk represents a challenge to identify which impacts are relevant and require monitoring and response, especially for those that emerge some time after the event or those that are geographically far from the place where the hazard first occurred. Some impacts appear with time lag, such as post-traumatic stress, disruptions of supply chains, biodiversity loss or economic recession, and many others are triggered by primary impacts. The DRM community has generally focused on the direct effects of hazards on the asset exposed, although the lack of proper management of indirect consequences can speed the propagation of these impacts to other sectors, services and assets.

Disruptions or limitations in services and economic sectors strongly shape the socioeconomic and cultural dynamics of a place. These potential impacts should be examined and prioritised based on the societal values of the place, to finally choose which impacts are to be avoided. This will, in turn, determine what should be protected and secured, and help define both recovery and preventive actions.

Intangible impacts are commonly overlooked. As they cannot be fully valued in economic terms, intangible impacts are difficult to incorporate as part of disaster risk management. In the medium and long-term, these impacts are frequently difficult to identify while their rate of loss can be unknown. Furthermore, not being able to recognise all the functions, benefits and value of the asset, as happens with ecosystem services and cultural heritage, hinders the possibility of managing their potential vulnerabilities. International strategies and frameworks started to consider those assets, facilitating that these type of assets are included in the political agenda of countries and regions. Nonetheless, guidance is needed to cover them properly, both before and after a disaster. Given that damages

and losses to ecosystem services, cultural heritage and other social values and activities can be hard to compensate for and restore, a precautionary approach is advised when planning and implementing DRM measures.

As a result, methodologies to analyse impact have been mainly developed for direct and tangible damages and losses. These have reached different levels of sophistication depending on the asset and the hazard under consideration. The authors conclude that any methodology to analyse impact would rarely improve or be fully used in practice without the data and the information gathered after the event.

Data and lessons learned are not collected uniformly; they are kept by different levels of governance, institutions and groups; and they are often not available for other purposes beyond particular response or recovery actions. Lessons are not always applied to enhance the whole system. Moreover, resources are rarely assigned to maintain data collection and dissemination over time. Inconsistent data collection and recording hinders its comparison and introduces uncertainties when used in modelling.

The authors urge a shift from a merely short-term perspective, generally focused on reacting to mitigate immediate consequences, towards a long-term view by tackling the underlying drivers of risk (exposure, vulnerability and capacity). The financial flow during the recovery phase should support and generate new knowledge on how to influence risk drivers. Likewise, risk assessment should apply longer time spans, which would help DRR and climate change adaptation groups to integrate and exploit synergies when studying and tackling vulnerabilities.

The report shows diverse and innovative approaches in the collection and sharing of loss and damage data, which should be further developed using new technologies, such as remote sensing techniques, artificial intelligence, sensors, drones and apps. Some of the options proposed facilitate the participation of a variety of stakeholders, promoting a shared culture of risk.

The scientific community is particularly interested in making the most of the data and information after a disaster, aiming to improve the capacity to predict future events. The interdependencies between hazard intensities and damages and losses when various assets are affected, either simultaneously or in cascade, could be better understood with more organised and comprehensive collection and use of impact data. This would enhance our resilience to future events.

At the same time, actions taken to prevent, mitigate, prepare for and/or adapt to risk cannot be evaluated, and therefore improved, if baseline data is not available. Specific data should be collected before the event to assess the value and vulnerability of exposed assets. All of these call for the definition of metrics and terminology, fully consistent when describing pre- and post-event data, which would allow comparison between groups, sectors, hazards and geographical areas.

Metrics, and their corresponding indicators, should be comprehensive to cover different hazards and sectors. They should be applicable at the local level, and coordination mechanisms should exist to ensure they are used for different purposes and at various levels. There are already initiatives and databases in place, such as the Risk Data Hub and the Disaster Loss and Damage Working Group, which could be connected with the purpose of increasing the knowledge in disaster modelling and mitigation, saving time and resources. At the global level, there have been efforts to coordinate the indicators of the Sendai Framework for DRR with the Sustainable Development Goals and the Paris Climate Agreement.

The study of the impacts shows the effect of globalisation and the many links between sectors and assets, at all levels of governance. DRM requires different sectors and groups to be mobilised and work together. The co-design, co-implementation and co-evaluation of DRM actions with a multidisciplinary and cross-sectorial approach is crucial to increase resilience by designing and implementing evidence-based policies. The costs of response, recovery and reconstruction should be reported, for accountability, and compared with those of prevention and mitigation, to support decision-making.

Differences in responsibilities, interests, language and experience often hinder collaboration among stakeholders. Trust emerges as a prerequisite to overcome these differences, supporting the diverse groups to learn and to create together more comprehensive and widely accepted actions. Long-term partnerships and clarification of roles would facilitate collaborations. Efforts have been made to facilitate the science–policy interface, helping scientists and decision-makers to jointly create disaster risk actions based on shared data and information. Still, two major groups should be better engaged with the rest: citizens and the private sector.

Citizens are acknowledged as fundamental for real action to be implemented, although it is recognised that generally the current governance systems do not

fully facilitate the integration of bottom-up initiatives. These initiatives should serve to consult and empower citizens, tailoring the system to their needs, abilities and limitations. Experience shows that communities are more easily engaged during the recovery processes, owing to their urgency, but the situation rarely extends over the medium or long term. In the face of growing globalisation and climate change, communities need to be engaged to enhance resilience, as decisions need to be taken in uncertain environments or when adaptation is acutely required.

Together with citizens, the private sector needs to be engaged as an active stakeholder, addressing its needs for data, information and knowledge before and after an event and reinforcing its obligations in relation to disaster events. Incentives could be developed for different groups, to make them feel part of the activities to manage disaster risk ensuring private and public efforts support an adaptive, inclusive and agile DRM system. Specific mechanisms should be explored and created to guarantee that, in specific circumstances, data from the private sector are shared with practitioners and scientists.

The report has also shown that more cooperation is still required within the scientific community as well as with other stakeholders. The role of social sciences and humanities has to become more prominent in relation to impact assessment. At the same time, those disciplines have to make an effort to deal with risk in an operational (and even quantitative) way, proposing approaches for measuring social impacts.

The past events described, and in particular the super case studies, show the lack of preparedness of our societies to face some events that, although they could be considered as being of low probability, have enormous impacts at local and national levels. The report calls for cross-border partnerships and collaboration at different levels of policymaking processes.

These different types of collaborations need to be carefully planned, putting mechanisms in place to detect needs and proposals for action. These would serve to jointly develop capabilities and share capacities. Coordination among agencies and other stakeholders is therefore key. As said, all types of impacts should be closely monitored during recovery, to avoid the emergence of new impacts or the increase in vulnerability of some societal groups, sectors and/or ecosystems. The first steps to reinforce capacities should start in the recovery phase.



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Recommendations for the audiences

The chapters and subchapters contain specific recommendations on the topics they consider.

All stakeholders have roles to play, but some tasks require a particular group or community to take the lead on them.

2.1 Tasks led by policymakers

Facilitate and promote collaborative processes to collect input from practitioners, scientists, the private sector and citizens.

- Design mechanisms to facilitate bottom-up approaches: open to new types of leaderships the arena of decision-making and collaboration for the implementation and evaluation of DRR measures.
- Collaborate with scientists and practitioners in the monitoring and evaluation of non-structural and new approaches to preventing, mitigating and adapting to risk. Take advantage of the post-disaster phase to fund new endeavours that are in line with the vision and medium-term strategies of the territory.
- Engage in discussions with other governance levels, within the country and internationally, to promote more complete assessment of progress in reducing risk, which requires indirect and intangible impacts to be properly addressed. It is important to consider impacts on health, ecosystem services and cultural heritage. DRM communities should work on important challenges that hinder sustainability: the mitigation of and adaptation to climate change, ecosystem degradation and the loss of biodiversity.
- Work to ensure that a precautionary approach guides policy debates: the benefits of prevention and mitigation action may be difficult to define in the short term. Devote efforts to tackle the full spectrum of damages and losses.

Develop a policy frame to collect, store and reuse data and information, including good practices and lessons learned, during response and recovery processes.

- Design mechanisms to help knowledge flow across different governance levels, particularly from the local level to the national, while scientific support is enabled to more easily reach local and regional levels.
- Establish frameworks for the collection at the most local level possible, as well as retrieval and sharing of data after an event among governance levels. The framework should take into account the databases that already exist on DRM, mainly sector-specific, alongside others that are related to the specific context, as necessary to understand the baseline situation (before the event). The databases can be national or international, but the framework should be wide enough to consider different types of damages and losses so that it can collect and use data constantly. The frameworks should carefully regulate who and how non-public organisations can take part of these activities, ensuring that data is accessible and of quality for different purposes.
- Develop mechanisms for damage and loss data to be shared by the private sector, without compromising or violating privacy.
- Engage with practitioners and scientists to understand the uncertainty around the results obtained from analysis and forecasts. These dialogues would facilitate sharing of tacit knowledge.

Ensure proper monitoring and evaluation of the corrective measures planned and implemented.

- Monitoring and evaluation of policies and programmes implemented should be specially reinforced, particularly after an event, engaging diverse stakeholders. These evaluations are an opportunity to make changes at the levels of projects, organisations and risk management culture. This type of actions would enhance accountability and transparency, reinforcing trust.
- Develop frameworks to identify and properly assess capabilities and

capacity needs, and their development to mitigate and prevent risk. To do so, consider the institutions already engaged in DRM by law and explore how these can cooperate with other groups and organisations, such as the private sector and citizens (individually and through civil society organisations). The roles and responsibilities of the diverse stakeholders and groups must be clarified while power imbalances are addressed.

- Introduce innovative funding mechanisms to encourage and enable alignment and joint investment between various public sector agencies and public–private partnerships. Those partnerships serve to cover the different dimensions of assets and the relation between them. Moreover, sectors are usually divided into various subsectors, which should work together to ensure resilience.

2.2 Tasks led by practitioners

Provide feedback to ensure that tacit knowledge is endorsed by policymakers.

- Practitioners should take a more active role in the policy arena and in particular in the prevention and mitigation of disaster risk. Practitioners should channel impact data and lessons learned from response and recovery to groups in charge of risk assessments and planning and monitoring of measures to reduce disaster risk.
- Support decision-makers in the preparation of a comprehensive framework for impact assessment. Propose procedures to collect disaster impact data across sectors and governance levels for different purposes. Work closely with scientists in the collection and analysis of data after an event.

Be creative and perseverant in your tasks embracing innovation.

- Practitioners should think outside the box when drafting preparedness actions, including training and exercises, to be ready for the next event, not for those that have already occurred. Pay particular attention to thinking of more complex scenarios, including

cascading effects and compound events. Simulation exercises should be carried out together with key actors, such as operators and representatives of critical infrastructures, important industrial sites, economic activities, and natural spaces or natural resources.

- Update the contingency plans and other initiatives, based on the lessons learned from simulation exercises. Address impacts beyond those that are direct and tangible. Work with operators of industries and infrastructures, business representatives and nature conservation groups to learn together and reinforce prevention, mitigation and adaptation measures.

Help the scientific community with data and feedback.

- Support the knowledge flow among different administrative levels and share your tacit knowledge with other groups, in particular with scientists. Properly document lessons and experiences learned, enabling others to compare, share and test them.
- Work to collect detailed data on response and first recovery stages and ensure that they are available later for other purposes.
- Work with scientists to help the private sector and citizens to participate in the implementation of innovative approaches to reducing risk, and in particular to the collection and analysis of impacts.

2.3 Tasks lead by scientists

Continue research efforts on disaster risk dimensions and management.

- Efforts should be devoted to improving the methods to capture indirect and intangible impacts. For that, the scope of impact analysis should be widened to accommodate cascading effects or to study compound events, considering the links of the asset studied with others, in time and space.
- Engage in activities beyond risk analysis, such as risk identification, risk

transfer, scenario building and strategic foresight. It is necessary that the groups engaged in risk analysis are engaged in these exercises.

- Risk treatment requires special dedication. The cost and effect of mitigation measures should be studied after an event, paying attention to the causes and drivers that increase disaster risk. At the same time, propose measures to prevent and mitigate losses and damages that could be put in practice by citizens and the private sector. Here DRM and climate change adaptation groups can easily collaborate.
- Methodologies for measuring the value of assets should be further developed and adapted to address measuring loss in value.
- Research should be devoted to studying the socioeconomic processes and factors that lead to impacts on the various assets presented in the report, particularly at individual and community levels. There are few studies on this topic in Europe.
- Further develop new techniques and methods to collect and analyse the vast amount of impact data. Show their added value to policymakers through examples and good practices.

Acquire additional knowledge by interacting with other communities.

- Efforts are still necessary for different scientific groups and disciplines to ensure relevant results are obtained. A good starting point would be for different disciplines to work together to propose impact metrics to be monitored (in time and space) after an event, which would be the same as those to be used in forecasting risk. Propose these for drawing up and updating a framework for impacts to be assessed. Support policymakers in that endeavour, pointing out the opportunities and the challenges to be overcome.
- Facilitate a culture of learning with the other stakeholders, and in particular with the practitioners and the groups working in the field, by testing new tools and approaches in various contexts. Go beyond the traditional role of giving advice and transferring information.

Make sure the knowledge is useful and used.

- Work to synthesise research results and define problems for non-expert audiences.
- Together with practitioners, present the gaps in knowledge regarding propagation of effects within sectors and assets in particular areas of interest. During relief and response phases, support practitioners to assess scenarios.
- Work with practitioners to make sure that models and tools to analyse impacts are available and endorsed by them.
- Collaborate with practitioners in reaching citizens, before and after an event, through educational programmes and communication campaigns. Carry out research on how to mobilise different groups that are traditionally not engaged in DRM.

2.4 Tasks led by citizens

Raise your voice for a more resilient future.

- Discuss DRR with family, friends and neighbours, and invite them to participate more actively by volunteering, attending events at which policies and programmes are presented to communities, speaking up when plans and projects are open for public comments, and reward political groups that have worked to reduce disaster risk, among other ways.

Be active to reduce disaster risk at a local level.

- Become aware of the responsibilities and benefits of managing disaster risk. Be well informed and be engaged in workshops, training or discussions at the local level. Engage in disaster risk management activities, through different organisations that are on the ground (such as religious, communal groups or local environmental protection groups) or specific projects that may arise from various institutions.

- Invest in individual and communal protection measures and evaluate the measures taken.
- Facilitate the work of responders during an emergency, and avoid passing on information that could be misleading or confusing.

Engage with other stakeholders in DRM activities.

- Contribute to damage data collection efforts, through platforms, social media and apps. Be open to sharing both tangible and intangible impacts to make the identification and analysis of impacts more comprehensive.
- Engage in disaster risk management activities, through different organisations that are on the ground (such as religious, communal groups or local environmental protection groups) or specific projects that may arise from various institutions.
- Cooperate with policymakers in defining a vision for the territory, especially in the post-event period. Keep in mind that some changes may be required in the landscape and the functioning of the area to build back better and exploit new opportunities.
- Participate in a DRM learning culture, in particular engaging in discussions with scientists and practitioners to define and value intangible assets, before the event.
- Various activities represent a business opportunity, which could be exploited by small and new businesses, for example related to the framework(s) for collecting, retrieving and sharing loss and damage data and to the implementation and evaluation of new prevention and mitigation projects at the local level.

It is worth mentioning that all four communities need to join in a discussion of important but ambiguous terms, such as 'resilience', 'impact' and 'affected people'.

3

Future challenges

In the moment of writing, EU and the world is struggling to manage the many and varied consequences related to the COVID-19 emergency. The pandemic represents our present but other impacts could arise and materialise in the next months and years while some underlying drivers of disaster risk could intensify. Institutions and groups engaged in disaster risk management should update their plans and protocols to the new risk landscape.

The availability of accurate and complete data which can be used for different purposes remains key to draft and implement the strategies and policies required to urgently address disaster risk and climate change. The COVID-19 pandemic can be an opportunity for identifying relevant loss and damage indicators and to learn criteria on how to consistently monitor them in time and space. As it is necessary to have a comprehensive understanding of the impacts to really reduce risk in practice, efforts should also focus on recognising and analysing intangible impacts.

Uncovering this type of impacts would support building broader scenarios and more robust risk assessments, which would lead to a better prioritisation of prevention and mitigation action. All aspects of our livelihood are at risk but knowing how the impacts might evolve after a hazardous event helps us to timely prevent, prepare and respond to in early stages and stop their propagation. In a more connected world, where compound and cascading events would be the norm, the borders within the EU seem to face although the existence of two opposite movements: one that boosts for EU shared goals and another that is mainly concerned about national politics.

Big data is a valuable resource for the future of disaster risk management that should be promptly exploited, for which capacities and strategies should be developed to protect data and timely process it. At the same time, urban population is expected to continue increasing so particular efforts should be devoted to count with data at the lowest level possible to plan appropriate measures at city level. The technology for storing, manipulating and communicating big data can have negative effects on the environment that should be also addressed.

Citizens can take a wider role in the use of data and information. By engaging them in the interpretation and sharing of results, local knowledge would be easily integrated in the analysis of data while awareness would probably raise more easily among communities. New tools and products would need to be developed for the collection, storage and sharing of data and information on loss and damage but it is equally important to create and test innovative approaches to maximise the use of these in practice. The increasing diversity among communities and regions (in terms of age, educational studies, religion, language, place of origin, etc.) should be considered.

Several groups would be interacting in the DRM policy arena, with their own interests, possibilities and limitations, so resources should be allocated over time for networks and coordination mechanisms to allow innovation and ensure inclusiveness. As COVID-19 may intensity inequalities in our communities, it is urgent to tackle the power inequalities that may exist among the members of these partnerships and networks. All voices should be raised and considered for recognising the great range of effects related to disasters and for disclosing the benefits of the measures funded to manage risk.

