HAZARD DEFINITION & CLASSIFICATION REVIEW

TECHNICAL REPORT

SENDAI FRAMEWORK
FOR DISASTER RISK REDUCTION 2015-2030

International Science Council
The global voice for science

UNDRR
UN Office for Disaster Risk Reduction

For additional information, please contact:
United Nations Office for Disaster Risk Reduction (UNDRR)
9-11 Rue de Varembé, 1202 Geneva, Switzerland, Tel: +41 22 917 89 08

Data disaggregated by region reflects the coverage of UNDRR's Regional Offices.

This report was supported by BMZ and USAID.

UNDRR and ISC would like to thank all those who contributed to this report for their time and expertise.

Cover Photograph: © iStock.com/Royyimzy
Design & Layout: Victoria Keingati

HAZARD DEFINITION & CLASSIFICATION REVIEW

TECHNICAL REPORT

SENDAI FRAMEWORK
FOR DISASTER RISK REDUCTION 2015-2030

International Science Council
The global voice for science

UNDRR
UN Office for Disaster Risk Reduction

GLOSSARY

CBRNE	Chemical, Biological, Radiation, Nuclear, Explosive
EM-DAT	Emergency Management Disasters Database
FAO	UN Food and Agriculture Organization
HIP	Hazard Information Profile
ICT	Information Communication and Technology
IFRC	International Federation of Red Cross and Red Crescent Societies
IRDR	Integrated Research on Disaster Risk
ISC	International Science Council
OIEWG	Open-ended Intergovernmental Expert Working Group
SDGs	Sustainable Development Goals (Agenda 2030)
SFM	Sendai Framework Monitor
STAG	Science, Technology and Advisory Group
TWG	Technical Working Group
UN	United Nations
UNDRR	United Nations Office for Disaster Risk Reduction
UNGA	UN General Assembly
UNISDR	United Nations International Strategy for Disaster Reduction
WHO	World Health Organization
WMO	World Meteorological Organization

Table of Contents

Foreword from the Chair

Whilst observing the complex yet fascinating negotiations for the Sendai Framework for Disaster Risk Reduction 2015–2030 as a member and then vice-chair of the United Nations International Strategy for Disaster Reduction (UNISDR) Scientific and Technological Advisory Group from 2011 to 2015 and where asked, supporting the UN Member States negotiators on scientific issues of all kinds, it was apparent that some paragraphs of the Framework would require more explanation. Thus, the reference to 'all hazards' identified in 'Priority 1 Understanding Disaster Risk' resulted in the need to ask the question: What does 'all hazards' mean?

To strengthen technical and scientific capacity to capitalize on and consolidate existing knowledge and to develop and apply methodologies and models to assess disaster risks, vulnerabilities and exposure to all hazards (Sendai Framework, §24j)

Following further meetings in later years it became more apparent that 'all hazards' was not clarified even through the Integrated Research on Disaster Risk (IRDR) Peril Classification and Hazard Glossary published in 2014 and the excellent work of the Open-ended Intergovernmental Expert Working Group (OIEWG) on indicators and terminology relating to disaster risk reduction. According to the OIEWG's report, published in 2016 and adopted by the UN General Assembly in 2017, a hazard is defined as:

A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.

Indeed, it was found that the UN Member States were mostly reporting on the natural hazards for the Sendai Framework Monitor in the meeting in 2018. After much discussion with many, the United Nations Office for Disaster Risk Reduction (UNDRR) and the International Science Council (ISC) jointly established a Technical Working Group (TWG) to identify the full scope of all hazards relevant to the Sendai Framework

Professor Virginia Murray, taken at the High-level Political Forum, United Nations, New York July 2019

and the scientific definitions of these hazards. To me, the honour to be invited to chair the TWG and this project has been enormous.

In May 2019 at the Global Platform, the all hazard project was formally started. To do this work, the TWG, the project secretariat and I have engaged with scientists in many organisations and UN agency scientific partners to find out how, via consensus building, an all hazard list could best be developed. In addition, at the Global Platform, all participants who joined an informal session were invited to join an advisory group, now consisting of 450 colleagues who contributed to the ISC review of the hazards survey undertaken in September–October 2019. I thank all who have engaged in this complex but fascinating task including all of our science colleagues in the scientific unions and those who work in the UN agencies. I also thank all those who have written the Hazards Information Profiles and those who have been or are volunteering to peer review these. I thank the UNDRR and ISC for the privilege of leading this project and finally I thank my colleagues on the TWG and particularly the secretariat based at Public Health England – especially Lucy Fagan, Natalie Wright and Lidia Mayner (Flinders University, Australia), as well as many others – without whom we could not have accomplished this work.

Virginia Murray
22 June 2020

The Sendai Framework for Disaster Risk Reduction 2015–2030 ('the Sendai Framework') was one of three landmark agreements adopted by the United Nations in 2015. The other two being the Sustainable Development Goals of Agenda 2030 and the Paris Agreement on Climate Change. The UNDRR/ISC Sendai Hazard Definition and Classification Review Technical Report supports all three by providing a common set of hazard definitions for monitoring and reviewing implementation which calls for "a data revolution, rigorous accountability mechanisms and renewed global partnerships".

Executive Summary

The COVID-19 pandemic is a timely reminder of how hazards within the complex and changing global risk landscape can affect lives, livelihoods and health. It provides a compelling case for an all- hazards approach to achieve risk reduction as a basis for sustainable development. The broad range of hazards of relevance to risk reduction and resilience building, and the increasingly interconnected, cascading and complex nature of natural and human-induced hazards, including their potential impact on health, social, economic, financial, political and other systems, are all interlinked in the discussions on sustainable development and climate change adaptation.

Hazard information when combined with exposure, vulnerability and capacity is fundamental to all aspects of disaster risk management, from multi-hazard risk assessments for prevention and mitigation to warnings and alerts, to disaster response and recovery, long-term planning and public awareness. Although understanding of hazards and their related impacts has evolved over recent decades, and lists of hazards are available at many levels from many organisations, a single overview that provides a full picture of hazards to help inform the policy, practice and reporting of disaster risk reduction and management within and across all sectors is not currently available. The need for a more systematic approach and standardised characterisation of hazards has been highlighted by both the policy and scientific communities.

The COVID-19 pandemic is a timely reminder of how hazards within the complex and changing global risk landscape can affect lives, livelihoods and health

This lack of a coherent view of hazards hampers disaster risk reduction in several ways: it compromises effective reporting by countries on aspects such as mortality, morbidity, economic loss, damage to basic infrastructure and disruption of basic services; it is a barrier to implementing a comprehensive and inclusive approach to the development of national and local disaster risk reduction strategies and related financing and regulatory frameworks; and it affects the capacity to develop and use multi-hazard early warning systems effectively and forecast events in the future.

In May 2019, the UN Office for Disaster Risk Reduction (UNDRR) and the International Science Council (ISC) jointly established a technical working group to identify the full scope of hazards relevant to the Sendai Framework as a basis for countries to review and strengthen their risk reduction policies and operational risk management practices. This report presents the first results of this international collaborative effort.

As a scientific undertaking, the technical working group was guided by the definition of 'hazard' adopted by the United Nations General Assembly (UNGA) in February 2017; namely, "a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation". This definition covers a broader scope of hazards than has traditionally been the case in the field of disaster risk reduction, and expands the definition of hazard to include processes and activities.

The initial hazard list was compiled from existing hazard glossaries and terminologies. To limit the potentially infinite scope of hazards addressed, a hazard was only included if it fulfilled each of three criteria: has the potential to impact a community; has measurable spatial and temporal components; proactive and reactive measures are available. The hazard list currently excludes complex human activities and processes where it was difficult to identify a single or limited set of hazards, compound and cascading hazards, and underlying disaster risk drivers (such as climate change).

The technical working group used an iterative process of developing and reviewing the hazards

listed through extensive consultation with over 500 technical experts from relevant science groups, UN organisations, the private sector and other partners. The hazard list comprises 302 hazards grouped according to eight clusters: meteorological and hydrological hazards, extraterrestrial hazards, geohazards, environmental hazards, chemical hazards, biological hazards, technological hazards, and societal hazards. Although this hazard list is considered to be the most useful at the present time, it is not a definitive list and needs regular review and updating.

Ultimately, this report takes stock of how our understanding of hazards is shifting as we move from managing disasters as events to managing risks...

Hazard definitions are sourced from the highest possible authority (such as the UN agency responsible for providing guidance on the hazard), reflect scientific consensus on the issues addressed, and are of broad international relevance. To help compile consistent definitions and descriptions for the hazards listed, the technical working group developed a common template to be applied to all hazards. A hazard information profile ('HIP') for each hazard has been completed for most of the hazards. The finalization of all HIPs will continue in the coming months.

This technical report, does not prescribe the list of hazards to be used for risk management in a given area or stakeholder group but rather provides a baseline of knowledge on hazards that can be used to engage government entities and stakeholders representing different risk management interests. Further development or prioritisation of hazards should be made in the context of the risk management objectives of each stakeholder, and the hazard list developed as part of this project can serve as a tool to help countries and communities investigate the potential sources of risk in their own context.

Ultimately, this report takes stock of how our understanding of hazards is shifting as we move from managing disasters as events to managing risks, as called for in the Sendai Framework by addressing the systemic drivers of risk in relation to climate change, health, sustainable development and resilience building. As hazards are expected to intensify with the effects of complex challenges, such as climate change and in the current COVID-19 pandemic, enhancing resilience to hazards is key for disaster risk reduction. This requires robust hazard and risk information as well as strengthening the science-policy-society interface to achieve better risk informed public and private decision-making and investment for long-term resilience. This UNDRR/ISC Sendai Hazard Definition and Classification Review will support and enhance this interaction.

Given its scope and complexity, this report raises important opportunities for further work. These are presented in a series of recommendations for consideration by the UN system, individual countries, the scientific community and other actors constituting the disaster risk reduction community.

Recommendation 1: Regular review and update

The development and regular review and updating of a standard set of classifications of hazards, and the development of an agreed process of identifying and defining hazards is a critical foundation for risk-based decision-making and action . It is recommended that the hazard list be reviewed by the proposed end-users reflecting the needs of those involved in disaster risk reduction, emergency management, climate change, and increasingly sectoral actors pursuing sustainable development. The latter being consistent with the stipulation of the Sendai Framework that the reduction of disaster risk is an all-of-society and all-of-State institutions engagement. In particular, it will be important to have a more detailed scientific review of the list and hazard information profiles (HIPs) for those hazards that are not currently routinely included in disaster risk management, such as societal hazards. With this review, it will be important to maintain the development of the HIPs, including the hazard definition and any additional scientific description. This involves developing the ownership of hazard definitions by bodies that have an intergovernmental process for agreeing on wording and definition for standardisation, with continuous engagement from the broader scientific community; and for these coordinating institutions to regularly review and update the list and hazard definitions. Risk by nature is dynamic – hazard definitions and terminologies must adapt to such a reality.

Recommendation 2: Facilitate the development of a multi-hazard information system

Enhancing the classification of hazards and facilitating access to the definition and description of hazards will be important. The next step should be the continuing development of hazard definitions as online resources, encoded following linked-data and open-science best practices. Through a meta-data approach, hazards could be tagged to allow for the list to be searched in multiple ways, thus accommodating diverse user needs. This will involve the development of a simple hazard definition schema to capture all the details of each individual hazard definition, including preferred and alternative names, relationships to other hazards (including parental or causality relationships), and citation of source material. Further alignments to related vocabularies covering the sustainable development goals (SDGs) of Agenda 2030 and some standard scientific vocabularies, as well as incorporating additional language functionality to encompass local hazard terminology, is recommended for future versions.

Recommendation 3: Engaging with users and sectors for greater alignment and consistency of hazard definitions.

Engagement with a range of users working in disaster risk reduction, emergency management, climate change, and increasingly sectoral actors pursuing sustainable development is needed to further develop hazard definitions. These users are likely to be representatives of Sendai Framework Focal Points and National Platforms for disaster risk reduction, regional economic and social commissions, policymakers, communities and practitioners within and across all sectors. By socialising this report, it will be possible to assess the value of the hazard terminology report and tool by users and sectors. The HIPs could also be used by the United Nations Statistics Division and the National Statistical Offices to ensure interoperability and standardisation of statistically relevant definitions of hazards across the Sendai Framework, Paris Agreement and the SDGs for use at local, national and international levels. This will ensure synchronisation among global and national statistical mechanisms and processes.

Recommendation 4: Use this hazard list to actively engage policymakers and scientists in evidence-based national risk assessment processes, disaster risk reduction and risk-informed sustainable development, and other actions aimed at managing risks of emergencies and disasters.

This includes supporting the uptake of the hazard list and HIPs as a tool for countries to investigate the potential sources of risk in their particular context, which requires developing further guidance for end-users. The guidance would elaborate for UN Member States on the efficient application of the hazard list in the implementation and monitoring of and reporting on the Sendai Framework and disaster risk-related SDGs, mainstreaming disaster risk reduction and resilience building with and across all sectors as agreed in Sendai Framework Global Target E. Relevant activities may include strengthening the science-policy interface for policy development, open-science research investments, setting evidence-based legislation and regulations, undertaking national and local risk and capacity assessments, plan-making, conducting exercise simulations, service delivery, infrastructure development, community mobilisation, education, monitoring and evaluation and other forms of capacity development.

Recommendation 5: Conduct further work to operationalise parameters for exposure, vulnerability and capacity, building on the UNGA definitions.

This is a much needed complementary exercise to the hazard definition process, which is the subject of this report. Exposure and vulnerability, and capacity, together with hazard, are the fundamental ingredients of risk, yet there is no agreed set of parameters for vulnerabilities or exposures. Much work has been done in defining and standardising parameters for exposure in the context of natural or geophysical hazards, and in defining indicators of vulnerability for disaster risk reduction, but no consensus exists in the definition or application of exposure or vulnerability for use in risk assessment across the list of hazards within the broad scope of this report. This is an undertaking that could be charged to the recently established Working Group on Vulnerability and Exposure of the Global Risk Assessment Framework (GRAF).

Recommendation 6: Address cascading and complex hazards and risks.

There is an urgent need to investigate further the direct and indirect linkages and effects of natural, biological, technological and other human-induced hazards to identify better and understand cascading and complex hazards and risks in a systematic way. The shift towards a broader view and a more context-dependent definition of hazards requires a systematic approach to risk that considers hazard, vulnerability, exposure and capacity together and better understands their complex interactions. The hazard list and associated HIPs may assist the activities of the GRAF, informing efforts to develop an enhanced understanding of the systemic nature of risk, including the management of systemic risks.

1 Introduction

1.1 Background

Understanding of hazards and their related impacts in disaster has evolved since the Yokohama Strategy for a Safer World (Anon, 1994) and Hyogo Framework for Action 2005–2015 (UNISDR, 2005), as demonstrated by the more comprehensive approach articulated in the Sendai Framework for Disaster Risk Reduction 2015–2030 (UNDRR, 2015) ('the Sendai Framework'). This evolution (see Figure 1.1) has focused on the scope of hazards, with the Sendai Framework identifying a wider set of hazards which covers "natural or man-made hazards, as well as related environmental, technological and biological hazards and risks" (Sendai Framework, §15).

The COVID-19 pandemic[1] has focused the world on the importance of addressing biological hazards and the increasing complexity of the global risk landscape. It has demonstrated the complex interplay and impacts that such hazards can have on lives, livelihoods and health, and brings into sharp focus the need for implementation of the Sendai Framework. This hazard spectrum and the increasingly interconnected, cascading and complex nature of natural and human-induced hazards, including their potential impact on health, social, economic, financial, political and other systems, are all interlinked in the discussions on sustainable development and climate change adaptation. Among others, community and country resilience is a focus area within several global policy discussions[2].

Yet, while several hazard definition lists exist or are under development in different sectors and are informed from different risk contexts (e.g., economic, social, political), there is currently no technical overview available that would provide a comprehensive picture of hazards to help inform the policy, practice and reporting of disaster risk

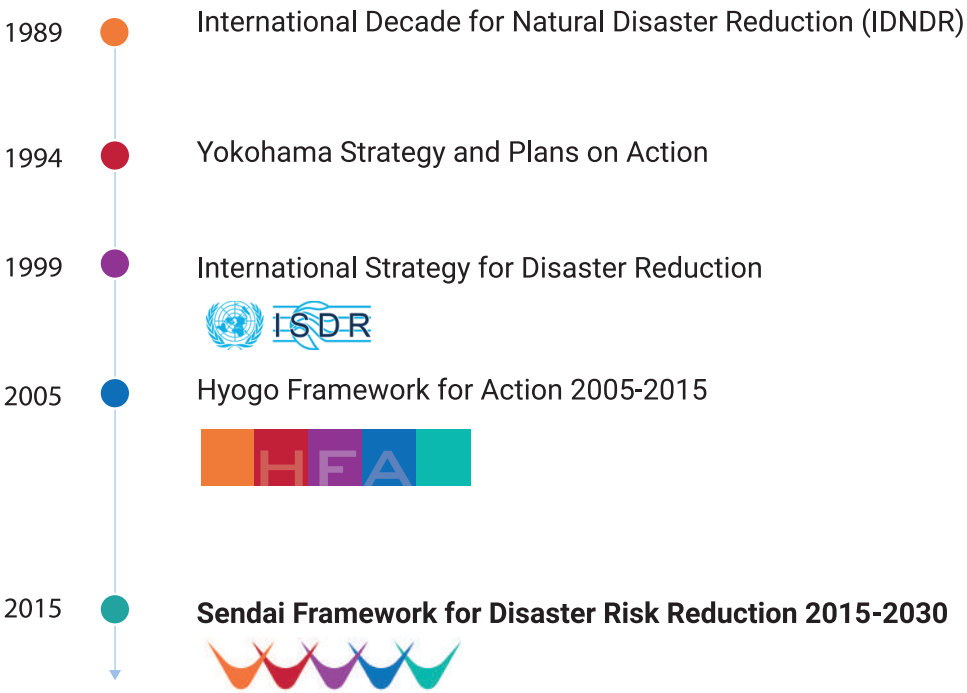

Figure 1.1 Twenty five years of international commitments to disaster risk reduction *Credit: UNISDR*

reduction and management, and so enable the implementation of global and regional framework agreements such as the Sendai Framework, the Sustainable Development Goals (SDGs)[3], the Paris Agreement on Climate Change[4], and the International Health Regulations (2005) (WHO, 2016). This lack of a coherent view of hazards, for example, compromises the effective reporting by UN Member States for the Sendai Framework Monitor (SFM) and the global targets on reduction of mortality, morbidity, economic loss and damage to basic infrastructure and disruption of basic services, some of which are also indicators for the SDGs. Not all countries, for example, are reporting on mortality and numbers of people affected by heatwaves, air pollution and waste-related hazards such as electronic waste, particularly if these have transboundary impacts. Lack of a comprehensive document on hazards is also a barrier to a comprehensive and inclusive approach to the development and sharing of national and local disaster risk reduction strategies (from 2020) which should help to proactively plan for the identification, enhanced understanding and effective management of risks associated with the range of hazards that a country or community faces (UNGA, 2016). It also affects the scoping, availability and access of multi-hazard early warning systems (by 2030).

The report provides a basis for countries to review and strengthen their risk reduction policies and operational risk management practices, including the assessment, monitoring and reporting of national capacities and damage and losses from hazardous events.

Hazard information when combined with exposure, vulnerability and capacity is fundamental to all aspects of disaster risk management, for example, for risk assessments (before, during and after events); policy development and review; planning and implementation of risk management measures; monitoring and reporting; and for documenting the losses and damage from hazardous events including disasters (WMO, 2014). As defined by the Open-ended Intergovernmental Expert Working Group (OIEWG) on indicators and terminology relating to disaster risk reduction, that was adopted by the UN General Assembly in 2017 (UNGA, 2017), a hazard is a "process, phenomenon or human activity that may cause loss of life, injury, or other health impacts, property damage, social and economic disruption or environmental degradation" (UNGA, 2016: p.18, 2017).

1.2 The Project

This report presents the results of an international scientific and technical process convened by the International Science Council (ISC) and the UN Office for Disaster Risk Reduction (UNDRR). The aim of the study is to define and describe hazards in order to facilitate more effective disaster risk management. The ultimate aim of the process is to contribute to "the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries" called for in the Sendai Framework. An initial list of hazards is presented in this report. The definition of each hazard is also included, all underpinned by the UNGA definition of 'hazard' which is an important step to building local, national, regional and internationally comparable risk and impact information; and will also promote and allow for a more consistent and scientific application of hazard information in all aspects of disaster risk management at the local, national, regional and global level. The definitions of the hazards in this report therefore draw from and leverage existing inter-governmental processes – as represented by agencies such as the World Meteorological Organization (WMO), the World Health Organization (WHO) and the UN Food and Agriculture Organization (FAO) – that have the mandate for identifying and defining such hazards as well as for developing and maintaining their technical standards over time.

The report provides a basis for countries to review and strengthen their risk reduction policies and operational risk management practices, including the assessment, monitoring and reporting of national capacities and damage and losses from hazardous events. It will support future work of the scientific community on improved understanding and reduction of complex, compound and cascading risks, as well as make substantive contributions to the Sendai Framework Monitor, the Global Assessment Report on Disaster Risk Reduction (UNDRR, 2019a), and the Global Risk Assessment Framework (GRAF)[5], the Integrated Prevention Platform of the UN Secretary-General[6], the SDGs, and disaster risk management within and across all sectors.

1.3 Technical working group

In May 2019, the UNDRR and ISC jointly established a technical working group (TWG) to identify the full scope of hazards relevant to the Sendai Framework and the scientific definitions of these hazards, drawing on the internationally agreed UN definitions and available scientific literature. This work was announced at the 2019 Global Platform for Disaster Risk Reduction held in Geneva, Switzerland, 13–17 May 2019: "Experts from science, the United Nations, and the private sector launched a new technical working group to develop a definitions' list for the Sendai Framework hazards." (UNDRR, 2019b: §14).

Drawing on the existing lists of hazards and technical expertise in various sectors, the UNDRR-ISC TWG on Sendai Hazard Definitions and Classification brings together technical experts from relevant science groups, UN agencies, the private sector and other partners to develop technical guidance on the full range of hazards covered in the scope of the Sendai Framework. The composition of the TWG is as listed at Annex 1.

The purpose of the review is to provide a technical and scientific working paper to inform and support a collaboration leading to a baseline of knowledge on hazards. It is provided for consideration and use by governments, practitioners and civil society in the area of disaster risk reduction, including but not limited to national disaster management agencies or national focal points for disaster risk reduction, national platforms for disaster risk reduction, local platforms for disaster risk reduction, multi-sectoral emergency/disaster management committees or equivalents, and especially the relevant government ministries of environment, health, climate change, and finance. The report has also been informed by and will be useful to others working in national statistical offices or equivalents, government scientific agencies, academia, universities, education and training bodies, research institutes, the private sector, the insurance industry, UN agencies and other international organisations, and communities including community groups, civil society organisations and networks.

This report does not prescribe the list of hazards which should be used for risk management applications for a given geographic area or stakeholder group because these will be determined by the risk context and objectives of each stakeholder group. Rather, the report provides a list of hazards which can be used to engage stakeholders representing different risk management interests. Further development or prioritisation of hazards should be made in the context of the risk management objectives of each stakeholder group.

---

[1] https://www.who.int/emergencies/diseases/novel-coronavirus-2019
[2] Including the follow-up and review of the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction, the Financing for Development process, the S.A.M.O.A. Pathway, the Paris Climate Change Agreement, the Warsaw International Mechanism for Loss and Damage, and the outcomes of the World Humanitarian Summit.
[3] https://www.un.org/sustainabledevelopment/sustainable-development-goals/
[4] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[5] https://www.preventionweb.net/disaster-risk/graf
[6] https://www.un.int/sites/www.un.int/files/Permanent%20Missions/delegate/attachment_the_vision_of_the_sg_on_prevention.pdf

2 Need for a hazard definition and classification

2.1 Current status

Lists of hazards are available at the international level from UN agencies, scientific and research bodies, the insurance industry and other entities. Furthermore, countries have their own terminology and definitions embedded in institutional, policy, legal and fiscal documents. There is no consistency in the scope or hazards in these lists nor in the definitions or descriptions that apply to the hazards. The WHO, for example, included a hazards classification table in the Health Emergency and Disaster Risk Management Framework in 2019 (WHO, 2019: p.22) that covers the range of hazards including geophysical, hydro-meteorological, biological, extraterrestrial, technological, societal and environmental degradation, all reflecting the role of public health in managing the health risks of all types of hazard.

2.1.1 Use of hazards in the Sendai Framework Monitor

As part of the initial development of the SFM, 74 hazards were identified and included based on the OIEWG definitions and the 2014 Peril Classification and Hazard Glossary by the Integrated Research on Disaster Risk (IRDR) programme (IRDR, 2014) (see Annex 2 for the full list as incorporated through a drop-down menu in the SFM system). The pull-down menu in the SFM also enables a member state to add other hazards relevant to its national context. In this process, countries add phenomena that they consider a hazard from their own country perspective. However, these additions are not necessarily made from a single standardised list that is scientifically categorised. Countries are expected to explain their choices, which are their prerogative. Hence the classification of hazards may make it easier for countries in making such selection for any purposes. In general, the technical SFM guidance (UNISDR, 2017) specifies that countries may choose to use any national methodology for calculations of compound indicators that are included in the 38 global indicators of the Sendai Framework indicator system (UNGA, 2016: p.5-9), as long as they are compliant with the specifications of the OIEWG report (UNGA, 2016). As outlined below, countries have interpreted the OIEWG specifications differently as per their national context including, for example, accounting for societal and other unclassified hazards.

The drop-down list of 74 pre-defined hazards thereby serves reporting against all Sendai Framework indicators (UNGA, 2016: p.10) where those data can be disaggregated by hazard (number of people affected, amount of economic losses, etc.). Importantly, the OIEWG also stipulates that all forms of disaggregation, including by hazard, will remain optional even though countries are encouraged to provide as much disaggregated information as possible.

Generally, SFM data are reviewed in April and October of each year. Based on hazard-related information extracted in October 2019, countries had reported on a total of 1200 separate hazards. This number includes hazards added with slightly different names, in different languages and according to other national specifics. The overall number of hazards reported on by region also differed widely. Including hazards in different languages is a major challenge, which may cause double- or undercounting. In the Arab States region, for example, one country may have reported a hazard in English while another may have recorded the same hazard in Arabic. However, it should be counted as one hazard only.

UNDRR harmonised the hazard list based on commonly selected hazards, differences in nomenclature owing to spelling, singular/plural dimension or multi-lingual origin. The hazards were then grouped as per the hazard typology provided in the OIEWG report. This resulted in a total of 318 hazards (Table 2.1). Nevertheless, several caveats must be noted:

- The list is not a scientific product but rather a guiding document. It was developed on the basis

Table 2.1 Distribution of hazards reported by countries in 2019 in the Sendai Framework Monitor according to OIEWG grouping (UNGA, 2016: p.19).

Hazard category	Number reported
Biological hazards	34
Environmental hazards	13
Geological or geophysical hazards	44
Hydrometeorological hazards	120
Technological hazards	79
Societal and other uncategorised hazards	28
Total	**318**

of UNDRR's own understanding and experience, without any pre-defined idea of the hazard classification and definitions.

- The data entry process for the hazards was less standardised than that used for the global indicators because the latter are already defined in the UN General Assembly Resolution (UNGA, 2016), where countries are free to add new hazards from their own country perspective. The reason for this is that indicator-based input is defined by the OIEWG with common parameters for all countries, while the choice of hazards was made by individual countries.

- It is possible that there are hazards that countries chose but did not use for the reporting, such as assigned loss data or Target (g) scoring that is related to early warning systems and associated risk information.

- Countries had the choice to enter the hazards in different UN languages.

2.1.2 DesInventar

DesInventar[7] is one of the most popular national level disaster loss databases. The software system was first developed in 1994 and follows an event-based recording mechanism with individual country databases being established as and when required. Since four of the seven global targets of the Sendai Framework are based on loss accounting, those countries that have disaster loss databases can more easily complete their reporting commitments on the SFM. DesInventar includes a basic list of hazards that is currently under review (UNDRR, 2020: p.41-45) to strengthen its alignment with the SFM. As is the case for the SFM, countries can add hazards specific to their national contexts in the DesInventar database. There should be alignment between DesInventar, the Sendai Framework Monitor on the hazards listed and the terminology used. This report can provide a common reference.

2.1.3 Lack of consistency across international loss databases

There are many groups with well-established loss databases and approaches for assessing losses and damage associated with hazard events, beyond those hazards traditionally of concern in disaster risk reduction. However, there is a lack of consistency across these data systems, including the Emergency Management Disasters Database (EM-DAT[8]), DesInventar, those used by global reinsurance groups, the World Bank[9], and the International Federation of Red Cross and Red Crescent Societies (IFRC[10]), as well as national-level databases. Losses and damage recorded include deaths, economic losses, and physical damage and losses for sectors such as the residential, commercial, industrial and infrastructure sectors. A comparison of five sources of disaster damage and loss data, including EM-DAT, revealed substantial differences. The database purpose, the reliability of data sources, and the methodology employed for analysis have significant impacts on the conclusions drawn regarding the overall cost of disasters, the relative costs of different hazards, and the distribution of losses across jurisdictions. There

are also difficulties with time series comparisons owing to what constitutes loss, how that loss is valued, and how loss changes over time (Ladds et al., 2017).

A comparative review of country-level and regional disaster loss and damage databases in 2013 (UNDP, 2013) identified several areas for improving disaster loss databases including:

- Developing country capacity for systematic disaster data collection, interpretation, use and clear policy/ operational benefit
- Improving the quality of disaster loss data (especially economic losses)
- Implementing quality control and validation procedures
- Defining a set of well-defined minimum parameters to be collected
- Completing and applying standards for hazard event recording and loss attribution
- Promoting disaster loss database use (especially policy applications)
- Exploring the use of new information communication and technology (ICT) for loss and damage assessment and damage-database.

2.2 Standardisation in nomenclatures of hazard information

The need for a more systematic approach and standardised characterisation of hazards has been raised by many intergovernmental and scientific fora. The Africa-Arab States Regional Platform 2018[11] highlighted the need for countries to "Accelerate efforts to ensure all African and Arab States systematically collect and account for disaster losses by 2020, using the Sendai Framework Monitor, to inform risk assessments to guide the investment decisions of development planners, business leaders, risk officers and finance ministries." The 2018 Cartagena Declaration[12] emphasised "the importance of increasing knowledge about the phenomena that cause the loss of lives and damage to infrastructure in our territories that do not recognize administrative, economic, social or environmental boundaries" and highlighted "the need to have information that supports decision making with respect to Disaster Risk Reduction, financial protection, preparation for disaster management and post-disaster recovery processes". The 2018 Ulanbataar Declaration[13] commits "to greater accountability for disaster risk reduction, including through systematically collecting and recording disaster damage and losses, conducting and sharing risk assessments and analysis to inform national and local strategies, establishing monitoring baselines, and using the Sendai Framework Monitor to assess progress in achievement of global and national targets".

The need for greater consistency in hazard terminology has also been highlighted by multiple international bodies and reports including: the Open-ended Intergovernmental Expert Working Group on indicators and terminology relating to disaster risk reduction; Counting on the World to Act (SDSN TRENDS, 2019); the UNDRR 2018 Technical Forum: Leveraging on the Sendai Framework Monitoring (SFM) process in support of the implementation of the 2030 Agenda and the Paris Agreement (UNDRR, 2018); and the Global Heat Health Information Network[14].

For the UN agency networks, the Sendai hazard definition and classification project has benefited from the revised UN Plan of Action on Disaster Risk Reduction for Resilience: Towards a Risk informed and Integrated Approach to Sustainable Development (UNDRR, 2017), which is the contribution by the UN system to ensure the implementation of the Sendai Framework contributes to a risk-informed and integrated approach to achieving the SDGs. The UN Plan of Action has addressed the need for coherence and mutual reinforcement of the UN's resilience building efforts, in part by aligning the scope of hazards. It notes that in the 2016 plan, revised after the adoption of the Sendai Framework, the plan provides for a stronger alignment of the UN's work in disaster risk reduction with other UN system-wide approaches on related issues.

2.3 Importance of defining hazards for risk-informed decision-making and risk reduction

Monitoring and reporting of events and their impacts, and making assessments of the risks that contribute to disasters are elements of an overall approach to risk reduction and management. Thus, in the broader domain of risk management, countries are applying the principles and practices of (disaster) risk management to a very wide range of risks. To measure and monitor these risks, it is essential to have clear definitions of the underlying hazards, that is, the processes, phenomena or human activities which, together with vulnerability, exposure and capacity, all contribute to disaster risk. Without this, while it is possible to monitor impacts, it is not possible to use this information effectively to understand or measure risk, and in turn to develop appropriate disaster risk management measures.

As an example, when the Indian Ocean Tsunami occurred in December 2004, there was little understanding of tsunami risk, particularly in the Indian Ocean region where an event of this scale had no historical precedent, and the knowledge base of tsunami impact was generally poor (Bernard and Titov, 2015). This event, however, gave rise to the rapid development of capability to provide warnings and to mitigate risks. Unfortunately, much of the modelling of potential impact was done without fully understanding the nature of the hazard, leading to many tsunami scenarios that were unrealistic. It was in this context that UNESCO published the first internationally recognised guidelines on tsunami risk assessment in 2009 (UNESCO, 2009). It is now well understood in the disaster management community that a tsunami is mainly caused by earthquakes that displace the sea floor, followed by volcanic eruptions/ collapse, landslides (that can be caused by earthquakes and volcanic activity), and asteroids. A better definition of the hazard sources paved the way to better understanding of tsunami behaviour/ likelihood, and in turn to more realistic scenarios for disaster management or disaster risk reduction strategies.

A standard definition of hazards provides the basis for establishing the relationships between the sources or triggers for disaster events worldwide. Furthermore, an international reference set of hazards together with standardised definitions is the foundation of a uniform database of loss data/ information, which in turn makes a useful contribution to the forecasting of future events. Such standardisation can then be used for all aspects of risk management, from multi-hazard risk assessments to warnings and alerts, to disaster response and recovery, long-term planning and public awareness. Thus, armed with better hazard and risk information that is consistent and appropriately combined worldwide, communities at local and national scales will be able to determine the best possible strategies for mitigating or reducing the impacts of future events.

Loss data are essential to validating estimates of risk. For extensive events (i.e., events that occur frequently at local scale) risks can be estimated through statistical models, built upon the relationships between hazard frequency and intensity and resulting impact (e.g., mortality or economic loss). Estimates of risk related to events that occur more rarely (i.e., intensive) require an aggregation of events and statistical analysis over broader areas or longer timeframes. Ultimately though, the risk of rare events can only be estimated if it is possible to understand how the related components of hazard, exposure, vulnerability and capacity are combined. For instance, some hazards are defined by factors such as magnitude, intensity, duration and spatial extent of the hazard source or phenomenon. The exposure constitutes the population, buildings or other assets that are vulnerable to damage or loss. If only the damage or loss data are accurately captured in the database, then the relationships between hazard, exposure and vulnerability, and the effect of the capacity to manage these risks, cannot be determined. It follows that without appropriate and consistent definitions and measurements of hazards, loss databases cannot be used to understand risk at any scale. As a starting point, better definitions will lead to better understanding and awareness and, in turn, to better measurement or monitoring of hazards so that critical information about hazards can be effectively captured in databases, for example, those designed for improved risk reduction and loss estimations. Information, including spatial extent or dispersion, rate of onset, frequency, duration, magnitude and intensity measurements, are critical. Thus, methodologies for measuring hazards must also be standardised as part of the longer-term process of developing information for enhanced disaster risk reduction.

The creation of a hazard list and associated standardisation of hazard names and definitions are fundamental to risk assessment, monitoring and management of associated risks. Not all hazards are relevant to all countries and the hazards that are reported upon by countries through loss databases or risk assessments should remain flexible. However, some hazards should be a part of standardised reporting requirements. For instance, all countries, should report on floods and earthquakes or disease outbreak, even if the history for such events is rare. Since although in any one location they may be rare, given that they are ubiquitous and occur with potentially catastrophic consequences, it is essential that they are monitored and their risks be assessed globally (e.g., the risk of pandemic as exemplified by COVID-19). In contrast, some hazards do have a very specific local context and may not be meaningfully assessed and reported outside that context. An example is Dzud, which is a sudden change in temperature or extended conditions of extreme temperature (Fernández-Giménez et al., 2012). Dzud is a significant hazard in Mongolia, where the name originates, but is not a commonly recognised hazard globally.

Thus, it is recommended that stakeholders and organisations should use the hazard list to identify which hazards will require risk management. They should also consider which hazards are obligatory for monitoring and reporting, versus those that may be considered optional or specific to certain conditions, depending on the application or purpose for hazard or loss monitoring and reporting. Such considerations should also include changing risk landscapes, possibly induced or exacerbated by climate change or environmental degradation, as well as the potential for rare events such as earthquakes or heat waves in places with no previous recorded history of such events.

2.4 Hazard event characterisation

There is a distinction between a hazard and a hazard event. While a hazard "may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation", a (hazard event or) hazardous event is the "manifestation of a hazard in a particular place during a particular period of time"(UNGA, 2016).

The characterisation of a hazard event varies from one type of hazard to another. For example, some natural hazard events can be characterised in terms of variables such as duration, magnitude, location, and timing. Internationally-accepted standards exist for characterising some hazards in these terms, but not all of them, and many hazards do not occur as well-defined events including many biological, technological and societal hazards. Drought is an example of a creeping phenomenon that has slow onset, unlike a flash flood with sudden onset and which exhibits in various forms (e.g., hydrological, agricultural). Some hazards are routinely observed and reported by government institutions or scientific networks while others are not, such as soil erosion or household air pollution. Extreme flooding and drought events are usually well recorded but newly emerging risks accompanying climate variability and climate change are often not well captured or framed (such as what constitutes a heat wave in areas where they have not previously been recorded). Hazard events are also sometimes difficult to isolate precisely, such as three weeks of widespread, intermittent heavy rainfall associated with a spatially- and temporally-extensive atmospheric low-pressure system. One hazard event can also trigger another (referred to as a 'compound hazard'). For example, heavy rainfall leading to a landslide, or a volcanic eruption leading to a landslide that triggers a tsunami with limited observation and no early warning for such a case in place. These challenges make hazard event definition for the purpose of risk reduction and loss or damage attribution genuinely challenging. Guidelines for addressing these challenges have been proposed (Below et al., 2009) but are not universally applied, except for the International Health Regulations 2005 (WHO, 2016) which are globally agreed and legal binding via the ministries of health and the WHO. Although such guidelines may reflect international standards for hazard characterisation where such exist, except for the International Health Regulations (2005), the guidelines themselves do not currently enjoy formal international standard status. The WMO is working on the standardisation of data and meta-data for more than 20 meteorological, hydrological and climate-related hazards for enhanced disaster

risk reduction, as well as geo-referencing the loss and damage data as one of its key aspects.

The issue of loss and damage has become an important consideration within the UN Framework Convention on Climate Change[15]. In this context, climate-related losses and damage can include those associated with long-term, incremental processes (often referred to as slow-onset events such as droughts) as well as extreme hazard events (e.g., floods). Incremental loss and damage such as coral bleaching, salinisation, desertification and coastal erosion could be annualised rather than reported on an event-by-event basis. Incorporating these types of losses would, however, require an expanded set of parameters, and the degree to which these could be standardised would need further investigation. Applying unique event numbers in this context would also need reconsidering. The types of losses and damage associated with incremental processes (often referred to as slow-onset events) are otherwise comparable to those associated with hazard events, provided they can be attributed to an environmental change or process and the unit of losses and their economic equivalencies can be estimated.

[7] https://www.desinventar.net/
[8] https://www.emdat.be/
[9] https://www.worldbank.org/
[10] https://www.ifrc.org/en/who-we-are/the-movement/ifrc/
[11] https://www.preventionweb.net/files/57759_communiqueofthechair.pdf
[12] https://eird.org/pr18/docs/cartagena-declaration.pdf
[13] https://www.preventionweb.net/files/56219_ulaanbaatardeclarationfinal.pdf
[14] https://www.ghhin.org/
[15] https://unfccc.int/topics/adaptation-and-resilience/workstreams/loss-and-damage-ld/warsaw-international-mechanism-for-loss-and-damage-associated-with-climate-change-impacts-wim

3 Conceptual framework for identifying hazards

3.1 Hazard and the other dimensions of risk

As a scientific endeavour, the TWG has been guided by the definition of 'hazard' adopted by the UNGA in February 2017: "a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation" (UNGA, 2016, 2017; see also Annex 3). Historically, there was a tendency to associate the term 'hazards' with 'natural phenomena', often with a sudden or acute impact, and 'hazardous materials'. The UNGA definition, however, reflects the evolution over several decades of the field of disaster risk reduction to a broader scope of hazards leading to events with both short- and long-lasting effects. This wider view is reflected in the Sendai Framework and in the policy and practice of various sciences, sectors and organisations (e.g., non-governmental organisations and community-based organisations) involved in disaster risk management.

It is important to recognise that the expanded definition of hazard as a process, phenomenon or human activity, requires an examination of the relationship between the concepts of hazard, exposure, vulnerability and capacity, where 'hazard' is the potential occurrence of an event within a prescribed time and space; 'exposure' constitutes the assets of interest and at risk (such as the environment, the economy, buildings, or people); 'vulnerability' is the susceptibility of those assets to damage or impact to a hazard; and 'capacity' is the "combination of all the strengths, attributes and resources available within an organisation, community or society to manage and reduce disaster risks and strengthen resilience" (UNGA, 2016). In this construct, a hazard event can occur without human consequences (e.g., a tree falling in the woods when no-one is there or a magnitude 9 earthquake occurring in a desert where no-one is living). Including human activities as potential hazards, means now considering hazards that potentially conflate the previous concepts of hazard, vulnerability and exposure. For instance, urban infrastructure systems failure would be considered a vulnerability from the point of view of possible impacts of an earthquake, but may also be considered a hazard from the perspective of a systems engineer, who may see the potential failure itself as the hazard (with multiple sources). In the latter case, the risk would correspond to the impact on the exposed population (e.g., due to lack of water or power) and, in turn, the vulnerability would be the relationship between that failure and its impact on the population. The concepts of hazard, vulnerability and exposure remain, but may be applied differently depending on the context of the problem. Flooding provides another example of how the context and perspective of different actors can affect the perception of a hazard. To many farmers, normal flooding is an essential part of maintaining soil fertility and wetlands, while to road users it is a dangerous hazard; a flood may therefore be characterised as both a benefit and a hazard depending on context.

3.2 Applying the UNGA definition of hazard in this project

A range of views emerged within the TWG and among stakeholders consulted on the types of hazard that should be considered within the scope of this project and that meet the UNGA definition of hazard (see Section 3.1). A long list of hazards were considered, including those that reflect contemporary and future challenges in society such as cybersecurity.

As the UNGA definition offered the potential for a wide and varied interpretation and an expansive, almost infinite, list of hazards depending on the scope and granularity being considered, the TWG developed a set of boundary criteria for including and excluding hazards. These criteria do not redefine hazards but were developed to keep the project focused and

feasible, while recognising that there could be many other phenomena, activities and processes that could arguably meet the UNGA definition of hazard but that might be better considered for future work. The inclusion and exclusion criteria were developed and modified through consensus and consultation within the TWG and with a wider group of stakeholders.

Initial discussions centred on identifying which of the proposed hazards did not meet the UNGA definition or should not be included in this project for some other reason. The complexity of hazards was recognised at an early stage. In some cases, there is complex interplay within a group of hazards which converge and result in a hazard event. For example, a global financial crisis is difficult to describe and define as a specific hazard, and was considered too complex to be included. Many biological hazards that would not have the potential to cause even a small-scale emergency or disaster and that would normally only require routine management procedures were also excluded.

This discussion informed the development of the following inclusion criteria:

1. **The hazard has the potential to impact a community:** this criterion puts the focus on those hazards that may have an effect at the population or community level and thus require system-wide risk management measures, as distinct from hazards that may have serious consequences for individuals concerned and where risk management measures tend to be focused at the individual level.

2. **Proactive and reactive measures are available:** this criterion reflects the need to implement practical risk management measures to prevent new and reduce existing and residual risks (i.e., before, during and after hazardous events), and to address the dynamic nature of evolving risks. It also implies that proactive and reactive measures could be developed or applied in future.

3. **The hazard has measurable spatial and temporal components:** this criterion reflects that hazardous events, including disasters, are manifestations of hazards and have temporal and spatial dimensions.

The inclusion criteria were defined for the purpose of this project to manage the potentially infinite scope of hazards to consider under the UNGA definition. Their definition is part of an iterative and deliberative process towards a systematic approach to hazard identification, description and classification that should be refined over time. The TWG applied the inclusion criteria to a set of potential hazards that had been compiled from a wide range of sources and stakeholders. To be included in the hazard list for this project, the hazard had to fulfil all of the inclusion criteria. Table 3.1 provides four examples of the application of operationalising criteria.

Complex human activities and processes where it was difficult to identify a single or limited set of hazards were excluded. Compound and cascading hazards, also fell outside the scope of this project, but are recommended for attention in future activities. Underlying disaster risk drivers, defined as "processes or conditions, often development-related, that influence the level of disaster risk by increasing levels of exposure and vulnerability or reducing capacity" (UNGA, 2016: p.24) were also excluded.

Climate change is an example of an underlying disaster risk driver. As defined by the Intergovernmental Panel on Climate Change, climate change refers to "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use" (IPCC, 2013). As defined by the WMO (WMO, 2011), the standard period for averaging weather-related variables at a location (e.g., temperature, precipitation, wind) to what is then termed 'climate' is 30 years, which is a broader form of measurement than most hazard-specific definitions and their resultant impact (e.g., physical damage, loss of life).

Other examples of underlying disaster risk drivers can be found in vulnerabilities or the level and type of capacities available. These risk drivers may include poverty and inequality (UNGA, 2016); weak governance; weak alignment and coherence in policy, financial instruments and institutions; lack of disaster risk considerations in land use planning (Sudmeier-Rieux et al., 2015; UNDRR, 2019c) and in natural resource management and use; declining ecosystems; unplanned and rapid urbanisation; non-disaster risk-informed policy; lack of regulations and incentives for private disaster risk reduction investment; demographic change; complex supply chains; and limited, or increased, availability of technology.(UNGA, 2016).

Table 3.1 Examples of the application of operationalising criteria

	CRITERIA					DECISION
	Is it a hazard according to the UNGA definition?	**Does it have an impact on the functioning of a community?**	**Are proactive and reactive measures available to manage the hazard?**	**Does the hazard have measurable spatial and temporal components?**	**Is it a complex hazard?**	
Measles	YES. Measles infection can lead to serious health complications, including death.	YES. Measles is highly contagious thus outbreaks can easily occur, particularly in unvaccinated communities, which can lead to epidemics, associated with serious health and economic consequences.	YES. Effective vaccination programmes are available.	YES. Epidemics are distinct in place and time. They are limited by the infectious period of measles and the degree and number of contacts with susceptible individuals.	NO. Multiple factors can influence the risk of acquiring measles infection, but the infection itself has a single cause – the rubella virus.	Include
E-waste (Electronic waste)	YES. E-waste was recognised as hazardous waste in the Basel Convention. It can cause severe damage to human health and the environment through contamination of soil, groundwater and air with toxic materials.	YES. Contamination of the surrounding environment can lead to population-level health problems such as adverse perinatal and natal effects.	YES. Formal infrastructure which ensures (for example) proper decontamination, recycling and recovery of items of economic value can significantly reduce harmful effects.	YES. The degree of the hazard is proportionate to the toxicity and volume of waste, and is concentrated in formal or informal disposal sites, although the effects can be widespread geographically.	NO. The underlying causes are well understood and clear.	Include
Thunderstorm asthma	YES. Thunderstorm asthma can trigger asthma attacks which can lead to serious health problems and occasionally death.	NO. Thunderstorm asthma tends to affect individuals rather than communities and is relatively uncommon.	NO. Specific proactive measures to manage thunderstorm asthma are unavailable.	YES. It is limited by the duration of the weather conditions triggering the symptoms.	NO. Thunderstorm asthma is specifically associated with thunderstorms.	Exclude It does not generally have community impact and there are no alerting processes or proactive measures to manage the hazard.
Self-directed violence	YES. Self-inflicted injuries are among the leading causes of death, ill-health and disability in young adults.	NO. Self-directed violence tends to occur as independent events and do not impact the community as does an epidemic.	YES. Approaches, such as community-based efforts, are directed to the prevention of self-directed violence through improvement of mental health.	YES. Cases of self-directed violence occur as distinct events in space and time.	YES. Self-directed violence is usually associated with the mental health state of the affected individuals.	Exclude It does not affect the functioning of a community.

3.3 Need to better account for the influence of human activity

Another consequence of allowing the inclusion of human activity in the definition of a hazard is that it recognises that some hazards are created or influenced by humans. Earthquakes are nominally considered a natural hazard, but can also be induced by human activity such as mining or fluid injection for enhanced oil recovery. Tropical cyclone frequencies can increase due to climate change, and floods may become more severe due to soil degradation from deforestation. Informal settlement can be seen as a vulnerability in the context of flood damage, but a hazard in the context of urban development.

Allowing hazards to be defined contextually, explicitly recognises that addressing hazards and associated disaster risk requires many actors operating from the natural to the human, societal and cultural context. In contemporary society, hazards have become increasingly complex, with triggers or cascading effects that turn what would be considered a hazard in one context into a risk in another, with different actors managing hazard risks in their respective contexts. In turn, by recognising the complexities of the hazard domain, it is important to remember to integrate them and understand the correlations or interactions between hazards. In this sense, the TWG has created the basis for a systematic approach to defining hazards which allows for linkages and interactions between hazards to be described in order to understand the behaviour of hazards and assess risks as a system.

4 Proposed hazard list

4.1 Main data sources

A review of existing hazard glossaries and terminologies (Annexes 4 and 5) was conducted in order to compile an initial hazard list (Annex 6), and to understand the gaps between available resources and the breadth of hazards encompassed within the Sendai Framework. For this project, the terminologies and definitions considered fall into one of the following three categories: approved through an intergovernmental process; approved through a scientific peer review process; and generally accepted by the expert community but not yet peer-reviewed or approved at the intergovernmental level. Examples of the third category include some commonly used wildfire and flood definitions. The sources used included, but were not restricted to:

- The United Nations, including the UNDRR and other UN bodies, programmes, funds and specialised agencies (published documents and official web sites)
- Authoritative scientific and technical sources such as DesInventar (see Section 2.1.1), the Global Assessment Report on Disaster Risk Reduction 2019 (UNDRR, 2019a), INFORM[16], EM-DAT[17], Evidence Aid[18], Swiss Re Sigma[19] and Glide[20], as well as other established sources, such as the Disaster Information Management Research Center[21], universities, scientific organisations and scientific journals.

The websites of key UN organisations, such as the WMO and WHO, were accessed systematically to identify published glossaries and hazard terminologies. All sources concerning disasters, emergencies, and hazards were considered. These were then used to compile an initial draft of the hazard list. The most useful sources were:

- IRDR Peril Classification and Hazard Glossary (IRDR, 2014)
- Report of the OIEWG on Indicators and Terminology Relating to Disaster Risk Reduction (UNGA, 2016)
- UNDRR Sendai Framework Monitor hazards reported by UN Member States (UNDRR, 2019d)
- UNDRR Prevention Web list of hazards (UNDRR, 2019c)
- WHO Health Emergency and Disaster Risk Management Framework (WHO, 2019), which includes a comprehensive list of hazards.

4.2 Consensus building

The hazards compiled from the review of existing glossaries was used as a basis for the first draft of the new hazards list. The TWG used an iterative process of developing and reviewing the list through an extensive consultation process involving relevant UN organisations and the wider disaster risk reduction scientific community (see Annex 7 for a summary of the process and methodology). An online survey of around 500 scientists was conducted early in the process to gather feedback on the draft list of hazards that had emerged from compiling the hazard glossaries. TWG members also used opportunities for consultation in relevant fora including the global and regional Science, Technology and Advisory Groups (STAGs) in Africa, Europe, Asia Pacific and the Arab States and the meeting of the scientific committee of the IRDR programme.

The UNDRR provided the opportunity via its regular UN focal point meetings to foster greater inter-agency consensus in support of the hazards project. Through this mechanism, they were able to facilitate extensive

and helpful interaction with relevant UN partners to determine, via the UN science and technical networks, where different UN agencies were involved in disaster risk reduction and management of the wide variety of hazards addressed in the hazard list. The engagement of scientists working within the UN system has been critical to the successful delivery of this work, particularly at the WMO, WHO, FAO, ITU[22], UNECE[23], and many other agencies.

The ISC leveraged its unique role as the global voice for science to facilitate access to scientists based in key networks and international scientific unions and associations. Notably, these include the IRDR network, the Committee on Data for Science and Technology[24], the Group on Earth Observations[25], the Global Earthquake Model Foundation[26] and other networks. The role of the private sector was also recognised as critical to this work, and for this reason the Insurance Development Forum was invited to become a partner. The Insurance Development Forum[27] is a public-private partnership led by the insurance industry and supported by international organisations, with the aim of optimising the use of insurance and its related risk management capabilities to build greater resilience and protection for people, communities, businesses, and public institutions that are vulnerable to disasters and their associated economic shocks. An additional network partner invited to join this work on hazards was the IFRC as it is the world's largest humanitarian network with 192 national societies and over 13.7 million volunteers. Their involvement ensured the views and needs of communities were not forgotten.

This project has enabled extensive consultation via a survey run by the ISC, a workshop involving the scientific committee and other experts of the IRDR[28] programme, and collaboration across the UN system and with the scientific community from a wide range of disciplines and sectors to address the breadth of possible hazards and leverage existing resources and expertise to support more coordinated and holistic efforts to understand and address disaster risk. In addition to wide engagement with a range of stakeholders throughout the process, a short survey was circulated to over 500 expert individuals from the wider advisory group (comprising academic researchers, scientists and practitioners employed in the private sector or in non-governmental organisations, and policy specialists), the IRDR network and the international scientific unions. Feedback from this survey resulted in specific suggestions for improvement to the draft hazard list and these were used to inform the final list.

4.3 Overall hazard list

The 2014 IRDR Peril Classification and Hazard Glossary (Annex 8; IRDR, 2014) was a major effort to develop a hazard glossary and contributed to the Hyogo Framework for Action 2005–2015 (UNISDR, 2005) by improving information on key hazards and their impacts. The IRDR Peril glossary focused on natural hazards (geophysical, hydrological, meteorological, climatological) with the addition of the categories [types] biological and extraterrestrial. In keeping with the Sendai Framework (UNDRR, 2015) which adopted an all-hazards approach and the UNGA definition (UNGA, 2016), this project led to the consideration of natural, biological, man-made/technological, chemical, societal, and environmental hazards. In addition, all categories in the IRDR Peril glossary have been expanded, especially the biological and extraterrestrial categories. These were identified as gaps from the outset of this project given the diversity of biological hazards for humans, animals and plants, and the associated risks to societies worldwide.

Hazards were clustered by type (e.g., environmental, hydrological, meteorological). Overall, the types reflect the categorisations of hazards encompassed by the Sendai Framework, with the addition of 'societal' hazards. The TWG chose to develop a 'flat', that is, non-hierarchical list recognising that a hierarchical classification does not adequately capture the complex interplay between different hazards. However, to aid readability, the TWG decided to represent the hazards in a grouped structure with hazard types and hazard clusters. The TWG also decided on a high level of granularity in the specification of hazards (e.g., different types of flood, chemical, disease) to enable multiple uses of the hazard list and associated hazards definition. The clustering of hazards in this report is not to be prescriptive as to the relationships of one hazard to another hazard or to many hazards.

In total, 302 hazards were included in the list (see Annex 6) with 88 biological hazards, 60 hydrometeorological hazards, 53 technological hazards, 35 geohazards,

25 chemical hazards, 24 environmental hazards, 9 extraterrestrial hazards and 8 societal hazards.

The hazard list compiled in this report is open-ended. It is not intended to be a final or definitive list. Experts from different scientific disciplines and sectors, different parts of the world, as well as different users and policymakers in the hazards arena, among many other potential users of this material, will have their own view on how a hazard should be classified and even whether it should be included. For example, acid rain is categorised in this hazard list as a meteorological/ hydrological precipitation-related hazard. It can also be caused by volcanic emissions, for instance around Kilauea volcano in Hawaii. These are all legitimate ways of looking at hazards. As a result, while the TWG considers the list to be the best that can be produced under the circumstances, it is not a definitive statement and should be regularly reviewed and updated through consensus at the international level. The emphasis is on agreeing scientific definitions for the identified hazards that then allows for enhanced risk reduction and their characterisation and links to loss data. The list is a tool to help countries investigate the potential sources of risk in their context.

4.4 Description of hazard clusters

4.4.1 Meteorological and hydrological hazards

Meteorological and hydrological hazards are those resulting from the state and behaviour of the Earth's atmosphere, its interaction with the land and oceans, the weather and climate it produces, and the resulting distribution of water resources. According to EM-DAT, from 1979 to 2019, 50% of all recorded disasters (including technological and 'complex' disasters), 56% of deaths and 75% of economic losses are attributed to weather, climate and water-related hazards. Some of the most devastating hazards include tropical cyclones, drought, riverine floods, and heatwaves. These hazards are observed, monitored, and forecasted by the national meteorological and hydrological services of each country.

4.4.2 Extraterrestrial hazards

Extraterrestrial hazards are those originating outside the Earth, such as asteroid and meteorite impacts or solar flares. Solar flares have the potential to cause widespread disruption and damage to communications satellites and to electric power transmission, resulting in large economic losses. Asteroid impacts may cause significant local damage, and are capable of catastrophic destruction, including mass extinction on a global scale (extremely rarely).

4.4.3 Geohazards

Geohazards are hazards with a geological origin. They have been divided into three hazard clusters, two of which – seismogenic and volcanogenic – are the result of Earth's internal geophysical processes, and a third – shallow geohazards – are the result of surface or near-surface processes, generally resulting in erosion or some type of mass movement. Seismogenic hazards, commonly referred to as earthquakes, give rise to specific hazards such as ground shaking, subsidence or ground rupture, but can also trigger hazards such as tsunami or rockfall. Volcanogenic hazards give rise to a wide range of hazards from lava flow and rockfall to ashfall and ground gases. Some geohazards may be partially induced or exacerbated by human activity, such as earthquakes or sinkholes from mining activity, or coastal erosion from deforestation.

4.4.4 Environmental hazards

Environmental hazards arise through degradation of the natural systems and ecosystem services upon which humanity depends. Ecosystem services including air, water, land, biodiversity, and some key earth processes are threatened by environmental degradation, here defined as loss of utility. Degradation can be a very gradual process and be hard to discern on a day-today basis. This includes biodiversity loss, land salination, loss of permafrost, and the marine equivalents – including loss of sea ice. Globally distributed contaminants in the atmosphere and oceans are having major impacts on the Earth's climate systems and food chains, and plastics are now a major cause of environmental degradation. Degradation can also be very rapid as with sudden contamination, deforestation or other disturbance.

Degradation may also be accelerated by human activity. Storm surge impacts are exacerbated by the destruction of coastal and marine ecosystems (e.g., coral, mangroves and sea grass) and sand mining in rivers affects currents and lowers the water table, causing changes in flood and drought patterns. The impacts of environmental degradation are often seen most clearly through other hazards. For example, landslide susceptibility is increased by deforestation and the intensity and frequency of floods, droughts and heat waves are influenced by changes in climate and land cover.

4.4.5 Chemical hazards

Use of chemicals has increased dramatically in many sectors, including industry, agriculture and transport, with people exposed to chemicals both of natural and human origin in the environmental and technological domain. The CAS register[29] contains more than 160 million organic and inorganic chemical substances, including alloys, coordination compounds, minerals, mixtures, polymers and salts. The TWG considered it important to include chemical hazards that have immediate (acute) effects, as well as chronic effects, often resulting from long-term exposures with adverse health outcomes, such as damage to the nervous and immune systems, impaired reproductive function and development, cancer and organ-specific damage (Prüss-Ustün et al., 2011). Toxicovigilance is the active process of identifying and evaluating toxic risks in a community, and evaluating measures taken to reduce or eliminate them. Few chemical hazards have been included in the Hazard Information Profiles and most relate to the WHO's ten chemicals of major public health concern (WHO, 2010), as well as to persistent organic chemicals and more generic hazards such as chemical fires. The CBRNE (chemical, biological, radiation, nuclear, or explosion) hazard cluster is wider than military weapons, and includes endemic diseases, epidemics, industrial chemicals, explosion hazards, pollution, and terrorist threats. Corrosive, flammable, and toxic chemicals pose several types of hazard.

4.4.6 Biological hazards

Biological hazards, which cover a range of hazards of organic origin, can cause significant loss of life, affecting people and animals at the population level, as well as plants, crops, livestock, and endangered fauna and flora, and can lead to severe economic and environmental losses (Wannous et al., 2017). They include pathogenic microorganisms, and toxins and bioactive substances that occur naturally or are deliberately or unintentionally released. Bacteria, viruses, parasites, venomous animals and mosquitoes carrying disease-causing agents are also examples of biological hazards. Exposure to zoonotic pathogens is often the source of emerging infectious diseases in humans, which puts a focus on risk assessment and risk management measures at the human-animal-environment interface. Many biological hazards have not been considered within the scope of this initiative as they do not conform to inclusion and exclusion criteria or meet the additional criteria that have been applied. These include being specifically referenced in the International Health Regulations (2005) (WHO, 2016), appearing in the list of notifiable diseases of several countries, causing disease at the national or global level, and having epidemic potential. Many biological hazards have been grouped into clusters, while other more prominent hazards have been identified individually, such as locusts. For example, a single outbreak of desert locust can affect as many as 65 of the world's poorest countries, and up to 20% of the Earth's land mass (Cressman et al., 2016). Pathogenic microorganisms and toxins have unique characteristics that can make them particularly challenging to identify and manage, such as agent diversity (many different microorganisms and toxins) and different routes of transmission (airborne and droplet, infestation, ingestion, animal vectors and blood borne). These hazards may also pose a high risk for epidemics and pandemics, particularly from microorganisms that are highly virulent. Other disasters, such as from natural hazards, may exacerbate conditions for biological hazards, including damage to water infrastructure and the introduction of a novel pathogen to a susceptible community. Biological hazards may also increase in incidence and lethality, and in geographic localisation and seasonal patterns due to sensitivity to climate or changes in land use (Wannous et al., 2017). Examples of recent large outbreaks, epidemics or pandemics include COVID-19 (from 2019), Ebola in the Democratic Republic of Congo (2018–2020) and West Africa (2013–2016), and the Zika virus in the Americas and Pacific regions (2015–2016).

4.4.7 Technological hazards

A characteristic of technological systems is their complexity, with many dependent subsystems. Thus, failure of one element within this system has impacts that spread throughout the chain. However, impacts can also occur outside the system, with a wide spectrum of impacts ranging from national interests

such as state security, to economics, health, and basic human needs. Technological hazards arise from the possibility of failure of an existing technology as well as from emerging technologies. These are increasing due to the scope of technological expansion and are relatively untested and subject to unintended uses. Technological hazards involve all transport systems (land, sea, air) and can affect the infrastructure that supports these systems as public and private services. Radiation and nuclear materials can lead to hazards, including accidents at nuclear power plants, industrial radiation device accidents, and mis-use of nuclear weapons. Conventional explosive hazards include millions of landmines not yet located, as well as improvised explosive devices used in mining activities. They can cause trauma and burns and may pose long-term risks for survivors, including infections, kidney damage and adverse mental health effects. A new set of emerging technological risks under the Sendai Framework include ICT-related hazards. There is continuous and growing dependency on information and communication technology to support essential infrastructure operations such as health, banking, transportation, energy, education and many other services that are an important component of emerging smart cities and village development concepts, businesses, and homes. With high levels of data flow and communication performance levels, the network architectures underlying these developments are interconnected and growing in scale and complexity which are then exposed to cyber security threats (Liu and Ji, 2009; Hasegawa and Uchida, 2019). Cybersecurity threats are increasing year-by-year, these drivers can be described as cyber-related viruses, worms, Trojan horses, spoofing attacks and identity theft. Cyber hazards can include the illegal disclosure of stolen data, data that have been altered by illegal means or malware, unexpected loss of data, and contamination of data. Other related issues include non-performance of components, wireless communication connectivity issues, malware, attacks, misconfiguration due to human error, power failure, natural hazards and disasters (Erjongmanee and Ji, 2011; Djatmiko et al., 2013; Arif and Wang, 2018). The TWG recognised the critical importance of cyber and other technological hazards and agreed to include them in the Sendai Framework review of definitions.

4.4.8 Societal hazards

Societal hazards are brought about entirely or predominantly by human activities and choices, and have the potential to endanger exposed populations and environments. They are derived from socio-political, economic activity, cultural activity and human mobility and the use of technology, but also of societal behaviour – either intentional or unintentional. Societal hazards also have the potential to result in disasters and cause significant numbers of deaths, illness, injury, disability and other health effects, disruption to societal systems and services, and social, economic and environmental impacts. As this is a very broad category that includes technological and chemical hazards, a more restricted type is needed to include some societal processes and phenomena. The scope of the societal hazards considered by this review was determined from the initial identification and review of existing hazard glossaries and terminologies (Annexes 4 and 5). This showed that some hazard glossaries did include terminology specifically related to violence and conflict, and that such hazards were also being reported under the SFM by some member states. While recognising the potential sensitivities in this area, the TWG agreed that this warranted further consideration from a scientific perspective. The Sendai Framework does not include terms referring to 'armed conflict', 'social instability or tension'. However, these hazards are recognised under international humanitarian law and national legislation. There is evidence that some regional and national disaster risk reduction strategies adopt definitions of hazards that encompass terminology associated with terms such as 'violence' and 'armed conflict' (Peters et al., 2019). This is also true for some individual agency definitions of a hazard, such as those of the IFRC and WHO, as well as various risk management indexes, such as the Index for Risk Management – INFORM (De Groeve et al., 2015). Terms related to violence and conflict are included here as part of all-hazard considerations and ensure commonly agreed definitions for any hazard, regardless of the subsequent action that might result from different policy frameworks. The expanded scope of the societal hazards in this list serves to reflect the conceptualisation of a hazard as defined by governments, agencies and end users – reflecting its intended use across sectors and at global, regional and national level. During the hazard review process, it became clear that more research was needed to inform our understanding of the full scope of societal hazards that should be considered under the Sendai Framework, since there is not an established corpus of scientific knowledge in the field of societal hazards. This is recommended as an area for future work (see Section 7, Recommendation 1).

4.5 Scientific description of individual hazards

From the project outset, it was agreed that hazard definitions would be sourced from the highest possible authority (such as a UN body), and should be scientifically robust, and of broad international relevance. It was also agreed that the TWG would develop a common template to be applied to all hazards to aid the compilation of consistent definitions and descriptions across the hazard list. Once the template was agreed, a 'hazard information profile' (HIP) was completed for each hazard by a scientific expert in that field. The HIP includes a definition of the specific hazard and in annotations: synonyms, metrics and numerical limits, key UN conventions and multilateral treaties. In a non-exhaustive manner, it also indicates examples of drivers, outcomes and risk management measures. The HIPs were reviewed by subject-matter experts from the scientific community and/or from relevant UN agencies to check that the hazard descriptions are scientifically robust and reflect the latest scientific consensus on the issues under consideration. Annex 9 provides further details on the review process for the HIPs, with a full list of authors and reviewers included in Annex 1.

4.6 Need for user-driven classifications

The TWG deliberately chose not to propose a fixed hierarchy but rather to take a more flexible relational approach (i.e., ontology), which recognises that hazards can change identity depending on context. However, it is desirable to group the hazards into a set of categories to aid identification, reporting, and allocation of effort. A long list is commonly arranged in a hierarchy, usually a single hierarchy, such that each item (hazard) appears in one place within a 'decision' tree. However, there are multiple potential axes of classification, all of which may be useful to support different functions. These include:

- broad families (biological, meteorological, economic, etc.)
- genesis (i.e., the causative event, such as earthquake, cyclone, pandemic)
- participation (e.g., the specific material, chemicals, pathogens involved)
- scale (e.g., local, regional, national, international). For example, global pandemic vs local flash flood.

Alongside classifications, there are also conceptual relationships between hazards, in particular specialisation (broader-narrower) relationships (e.g., SARS and COVID-19 are both coronavirus infections; riverine-, coastal- and flash-floods are all special types of flood).

If a single hierarchy (tree) is desired, choices must therefore be made about how to nest these, as well as where 'best' to locate items within the tree. For example, mass-flows can be caused by earthquakes, volcanoes, rainfall, or subsidence. Usually only a subset of the axes can be used coherently. Furthermore, the semantics of the relationships often change going downwards – classifications at the upper levels of the tree slide over into specialization at the bottom, with different depths and transitions in different branches of the tree.

Modern knowledge organisation and management systems overcome these challenges by enabling each item, in this case each hazard, to belong to more than one category. Items are classified in multiple dimensions allowing user-defined searches, known as 'facetted searches'[30], rather than a single pre-defined hierarchical tree. This approach is widespread in online library collections and retail, among other areas. Furthermore, specialisation (of broader-narrower relationships) is distinct from classification. While presentation of these in a conventional linear document is more complicated, functionality is much better.

Previous hazard and peril classifications have used various combinations of these approaches to classification. A basic clustering has been used in the development of the new hazard definition set, primarily to support the allocation of experts in the review cycle. But a more complete set of classifications should be introduced when the hazard list is put online.

[16] https://www.europe.undp.org/content/geneva/en/home/partnerships/inform--index-for-risk-management-.html
[17] https://www.emdat.be/
[18] https://www.evidenceaid.org/evidence-collections/
[19] https://www.swissre.com/institute/research/sigma-research.html
[20] http://glidenumber.net/glide/public/search/search.jsp
[21] https://disasterinfo.nlm.nih.gov/disaster-lit
[22] https://www.itu.int/en/Pages/default.aspx
[23] https://www.unece.org/info/ece-homepage.html
[24] https://codata.org/
[25] https://www.earthobservations.org/index.php
[26] https://www.globalquakemodel.org/
[27] https://www.insdevforum.org/
[28] http://www.irdrinternational.org/what-we-do/overview/
[29] https://www.cas.org/about/cas-content
[30] Facetted search is used in many e-commerce sites, such as e-Bay and Amazon – classifiers selected on the left of the page generate different result sets.

5 Potential applications

The hazard list and associated descriptions are fundamental to the needs of a holistic multi-hazard risk assessment and risk reduction process. The hazard list establishes a common basis for monitoring and cataloguing hazard information, and for informing disaster risk reduction and loss data collection, disaster warnings and response, risk mitigation and reduction, and risk communication, including public awareness. This section highlights some of the potential applications of the approach developed as part of this project and the resulting list and definitions of hazards.

5.1 Use at national and global level

The hazard list is designed to help improve national reporting and ability to measure specific hazards in a more standardised way. National bodies and scientific agencies use a variety of standards for hazard measurement, recording, and archiving in hazard databases. For example, U.S. hazard-focused agencies such as the National Oceanic and Atmospheric Administration[31] (NOAA), National Aeronautics and Space Administration[32], Federal Emergency Management Agency[33], United States Geological Survey[34] and Centers for Disease Control and Prevention[35], among others, may find this hazard list useful in refining existing and future hazard-focused data sets and products. In the United States, there are numerous major databases such as NOAA's Storm Data (NOAA, 2018) and the U.S. Billion-dollar Weather and Climate Disasters (NOAA, 2020) that have different hazard definitions. A standardised hazard set, with definitions and metadata, can help improve research synergy across existing and future hazard databases.

One area that would benefit countries is in using the HIPs for international hazard identification. For example, the HIPs may be useful to coordinate data collection and standards for a North American flood methodology currently under development. This effort seeks to develop a standardised approach for costing of flood damage and losses in Canada, Mexico and the United States. Development of the HIPs supports a need for a glossary of terminology offering global (UN-agreed) definitions and standard international metrics/ measures, as defined in the HIPs. The HIP guidance could be particularly useful for flood hazard definitions, as there are many types of flood hazard (flash flood, fluvial flood, groundwater flood, ice jam flood, snowmelt flood etc.) for which definitions may vary by country.

National-level standardisation then feeds into the regional and global levels if hazard nomenclature is used from the international level. As a result, there is standardisation and comparability at the national, regional and global level to facilitate improved hazard reporting to the Sendai Framework, the SDGs and the Paris Climate Agreement. In addition, the hazard list is both granular and not too expert-orientated for most statistical purposes and for the output/user perspective. This design reflects the Best Practice Guidelines for Statistical Classification (UNSD, 2013). Additional perspectives may be useful from groups such as the United Nations Statistical Division (UNSD) Expert Group on Statistical Classification to widen usage of the classification beyond specialists in disaster-risk.

5.2 Cataloguing loss and damage

The frequency and intensity of disasters from hazard events have been increasing over time for a number of reasons (e.g., increased exposure and vulnerability) and the hazards themselves are expected to intensify with the effects of a range of 'complex wicked challenges' (Funtowicz and Ravetz, 1993), including climate change. Enhancing resilience to hazards is key for disaster risk reduction.

The WMO has approved a methodology (WMO, 2019) that will provide national partners with the ability to more systematically and accurately attribute risks and impacts (loss and damage) of hazards to causal phenomena (hazards). The methodology centres on an event-unique identifier that includes parameters that detail the event hazard name, temporal and spatial information, and linkage to other events as well as specific contextual information that will aid stakeholders in loss and damage accounting in attributing losses to the causal phenomena. The two central parameters of this methodology are the hazard name and linkages.

It is important to ensure that event names (hazards) are standardised globally to ensure comparison of events regionally and globally. In this regard, the WMO has approved an initial list of hazards to be used with its cataloguing initiative. This comprises hazards under the WMO mandate for which their names and definitions have been agreed by its members (countries). This initiative by UNDRR/ISC is a building block for a reference list of hazard (event) names for a wide range of hazards as envisioned by the Sendai Framework.

The linking parameter is an innovation that provides the capability to cluster events according to larger-scale phenomena (e.g., heavy rain, strong winds, storm surge flooding and landslides to a tropical cyclone) as well as linking of cascading events. This feature makes this methodology scalable from local (micro-event) to larger phenomena, including the climate time-scales.

5.3 Multi-hazard early warning systems

The Sendai Framework recognises the significant benefits of multi-hazard early warning systems (MHEWS) in saving lives and livelihoods. It urges a paradigm shift in the way risk information is developed, assessed and used within MHEWS, disaster risk reduction strategies, and government policy.

In 2017, the United Nations agreed on the definition of an early warning system as "An integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events" (UNGA, 2016: p.17). In other words, a MHEWS is designed to cope with multiple hazards occurring simultaneously or cumulatively over time, and any potential cascading impacts and provides relevant impact and risk information to enable individuals, communities and organisations threatened by a hazard to prepare and act appropriately and in sufficient time to reduce the possibility of harm or loss. A MHEWS warning uses and incorporates impact and risk information in its warning services, integrates social and financial capacities and technical systems through coordination mechanisms among multidisciplinary stakeholders, and ensures that effective feedback and improvement mechanisms are in place. Impact information refers to hazard warning messages that address the possible impacts of hazard events on lives and livelihoods. Risk information refers to information that is derived from risk assessment(s).

Understanding the hazard and its associated risk depends on reliable quality assured data and information including historical loss and damage data. This information is a major building block for the development of impact-based warnings transitions from focusing only on the accuracy of hazard-based forecasting to also outlining the potential impacts of a forecast – an evolution from 'what the weather will be' to 'what the weather will do'. This requires a paradigm shift for stakeholders in disaster risk reduction at the national level to establish common platforms or mechanisms for sharing the different aspects of risk information (hazard, exposure, vulnerability) (Figure 5.1).

Multi-hazard early warning systems take advantage of this information through the conduct of multi-risk analysis which is then translated into hazard warnings that detail possible impacts on specific at-risk people, communities and economic sectors (Figure 5.2).

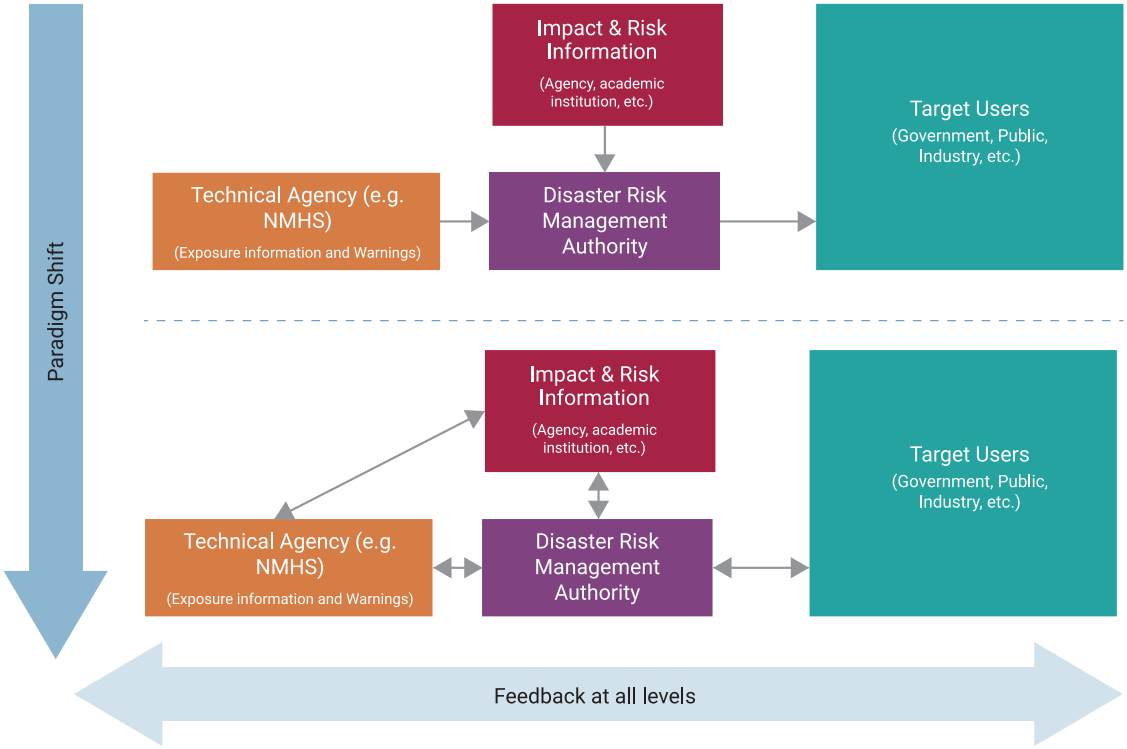

Figure 5.1 Paradigm shift of how risk information is communicated and used *Credit: WMO.*

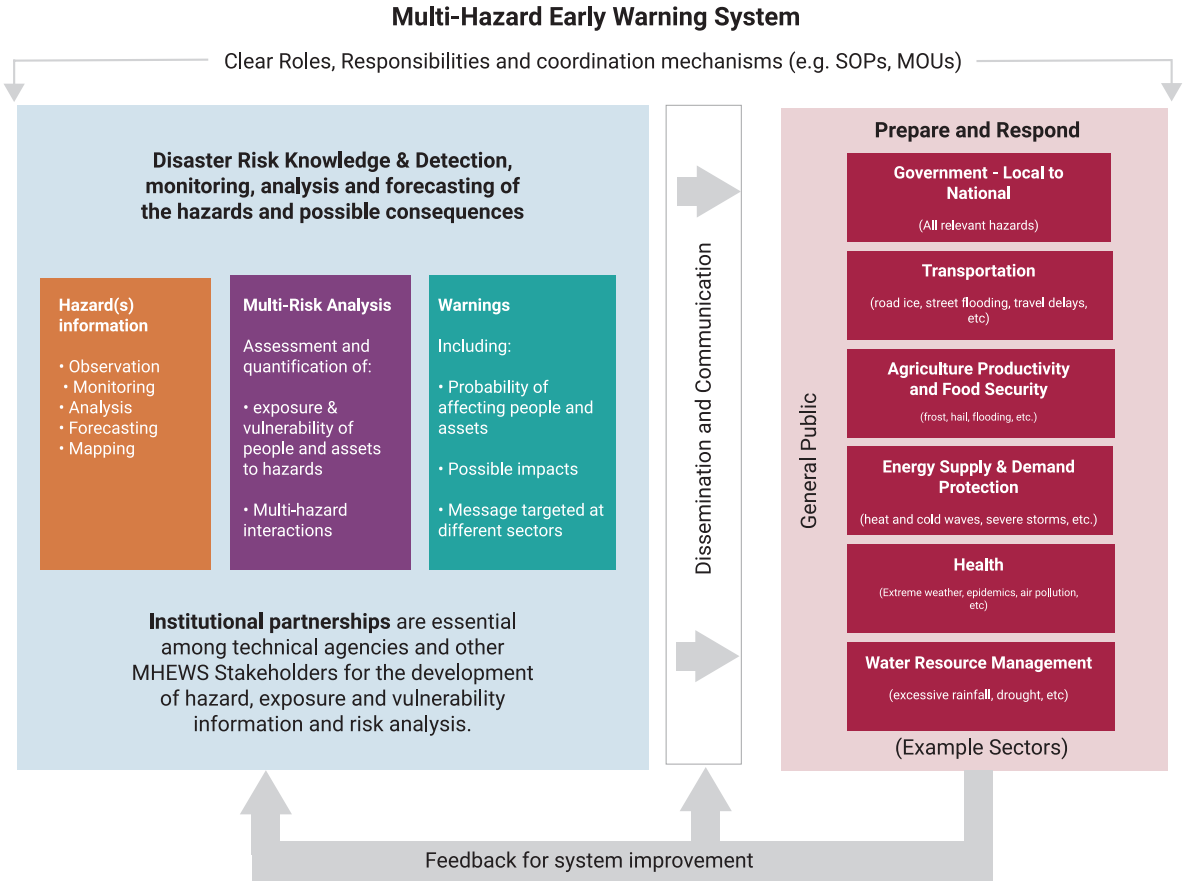

Figure 5.2 Use of risk information in multi-hazard early warning systems is key to the development of impact informed hazard warnings and information (WMO, 2018). *Credit: WMO.*

5.4 Need to strengthen the science-policy interface

Multiple and diverse aspects of hazards, exposure, vulnerability, resilience and capacity to prevent, prepare for, respond and recover from disasters are studied by a variety of scientific disciplines and specialised scientific centres that may not have a direct mandate in disaster risk reduction (De Groeve and Casajus Valles, 2015). Likewise, disaster risk reduction policies are developed and implemented by a range of agencies involving not only those in charge of emergency management but also of finance, health, economy, environment, agriculture, and land-use planning, among others. This leads to a complex science-policy interface. Science plays a significant role in monitoring, analysing, understanding emerging risks, developing information on hazards and their impacts, and developing early warning. In addition, science has a major role to play at the interface between science, policy and practice to inform the development of plans and regulations and jointly construct knowledge through exchange and co-evolution between scientists and decision-makers, which is currently limited (De Groeve and Casajus Valles, 2015). Knowledge is often generated in collaboration to increase its practicability (Weichselgartner and Kasperson, 2010; De Groeve and Casajus Valles, 2015). In order to bridge decision-makers and scientists, disaster risk needs to be treated in a science-policy context, in the overlapping space of scientific research and political decision-making and public action (White et al., 2010; De Groeve and Casajus Valles, 2015).

[31] https://www.noaa.gov/
[32] https://www.nasa.gov/
[33] https://www.fema.gov/
[34] https://www.usgs.gov/
[35] https://www.cdc.gov/

6 Scientific debates and limitations

6.1 Scientific debates

The precise definition of the term 'hazard', as shown in the previous sections, varies by discipline and sector. The disaster risk reduction sector has until recently viewed a hazard as a distinct phenomenon emanating from nature, such as an earthquake or lightning strike. This is the approach taken in the IRDR Peril Glossary (IRDR, 2014), although it broadens inclusion to biohazards. Based on the Sendai Framework and the report of the OIEWG (UNGA, 2016), the definition of 'hazard' in the disaster risk reduction context has been broadened considerably to include phenomena, processes, and activities. The debate applies especially to the definitions of man-made hazards, and understanding of environmental, technological, and biological risks as mentioned in paragraph 15 of the Sendai Framework (UNDRR, 2015). This applies particularly to hazards not traditionally listed as such in the natural hazards field. This broader approach to defining a hazard is well reflected in other areas of policy and science.

The International Standards Organisation (ISO) defines a hazard as a "source with a potential to cause injury and ill health" (ISO/DIS 45001: definition 3.19). In safety and health-related areas, the definition of hazard is generally consistent with the ISO, and is defined broadly to include all (or most) factors that could result in harm. This also aligns with the all-hazards approach set out in the Sendai Agreement. For example, the Canadian Centre for Occupational Health and Safety states that: "General examples [of workplace hazards] include any substance, material, process, practice, etc. that has the ability to cause harm or adverse health effect to a person or property (CCOHS, 2017)."

While there is general agreement that the term hazard should be defined broadly, there is debate about the boundaries of the concept, with some arguing for example, that potential process control failures are not hazards (SIA, 2012). However such arguments do not detract from the general view in safety-related policy and practice and its supporting science that a hazard includes mis-use of substances (such as a toxin), phenomena, processes, activities and behaviours. In the safety arena this broad definition often extends to social hazards including violence, for example, by including workplace harassment and violence (Government of Western Australia, 2020) and other social issues such as cyber security and crime. This contemporary practice aligns with the definition used in this report.

Key debates also concern the definitions of specific hazards, which carry linguistic and cultural challenges. Hazard definitions may be different in different languages, both national and local, and indigenous communities may have completely new hazard definitions. Finding a way to capture the full spectrum of regional and local hazard terminology is a major challenge, but important to address.

6.2 Limitations

There are several important limitations to this review, namely the consultation process, the comprehensiveness of the list of hazards, and variations in the granularity for different hazards.

The consultation process. There are two aspects to the limitation on the consultation process: the size of the scientific and UN community subset consulted, and its representativeness. In terms of size, significant

efforts were made to engage the scientific community throughout the project, both formally (as members of the TWG and/or respondents to the scientific consultation survey) and informally (at key meetings such as the Global Platform). Over 500 scientists were engaged. Although a large number, this represents a small subset of the vast global scientific and UN expert community. In terms of the representativeness of the subset consulted, one of the key aims of the project was to make clearer the broadened scope of hazards that Sendai asks governments to consider for disaster risk reduction, beyond the traditional focus, to include those of a societal, biological or technological nature. Traditional disaster risk reduction networks, by definition, do not necessarily have members from these areas. Inclusion of experts on these less traditional hazards was a challenge. In particular, there was insufficient expertise on societal hazards. Other groups not fully represented in the consultation process were UN Member States and policymakers (whose involvement was considered outside the technical and scientific scope of the project from the outset, but who have been identified among the prime users of the hazard list) as well as other non-scientific and non-technical individuals and groups with local, regional and national levels of expertise. Although efforts were made to engage at the regional level (for example, through presence and discussion at the UNDRR European Science and Technology Advisory Group) these groups were under-represented overall, not least due to language bias given that the project was undertaken solely in English. This has had various consequences, including a lack of regional terminology in the hazard list presented in this report.

Comprehensiveness of the hazard list: A second key limitation of this project is that the list of hazards identified is far from comprehensive. However, this was not the intention anyway as a fully comprehensive list might not be possible even with increased time and resources. Plus, what is to be included and why, should be subject to ongoing revision. Although the development of inclusion parameters was crucial to operationalising an all-hazard approach, there are inevitable shortcomings. And so, rather than providing a comprehensive overview of all hazards globally, the hazard list may be more accurately described as providing a living, operational overview of hazards globally. Indeed, the parameters were agreed by consensus of the TWG, without the goal of making it comprehensive or optimal. In accordance with Recommendation 1 (Section 7), further work should consider a review (by UN Member States and other users of this report) of the inclusion criteria as part of an ongoing review of hazards that are not currently included, in acknowledgement that this is a dynamic and ever-evolving catalogue.

Level of granularity. The potential for inconsistency in the level of granularity from one ‘type’ of hazard to another is another major limitation. Attempts were made to mitigate this following the results of the scientific stakeholder survey, however a full overview of all included hazards is inevitably limited by individual expertise. As such, it is important to recognise that there may be discrepancy in the level of detail across different hazard types and clusters. Revisiting levels of granularity is therefore another important part of future revisions of the hazard list.

7 Recommendations

The current COVID-19 outbreak shows the importance of embedding the identification and definition of hazards into a dynamic, and multidisciplinary process that enables the inclusion of new and emerging hazards, and to capture interactions between different hazards. Emergency and disaster risk management actors have an important role to play in engaging a wide range of actors and integrating knowledge across disciplines and sectors to improve understanding and management of risk.

This report describes the preliminary results of a scientific and technical process (Figure 7.1) to define and describe hazards in order to facilitate more effective disaster risk management. Given its scope and complexity, the work raises important questions and opportunities for further work. These are presented in the following recommendations to the UN system, countries, scientific community and other actors constituting the risk community.

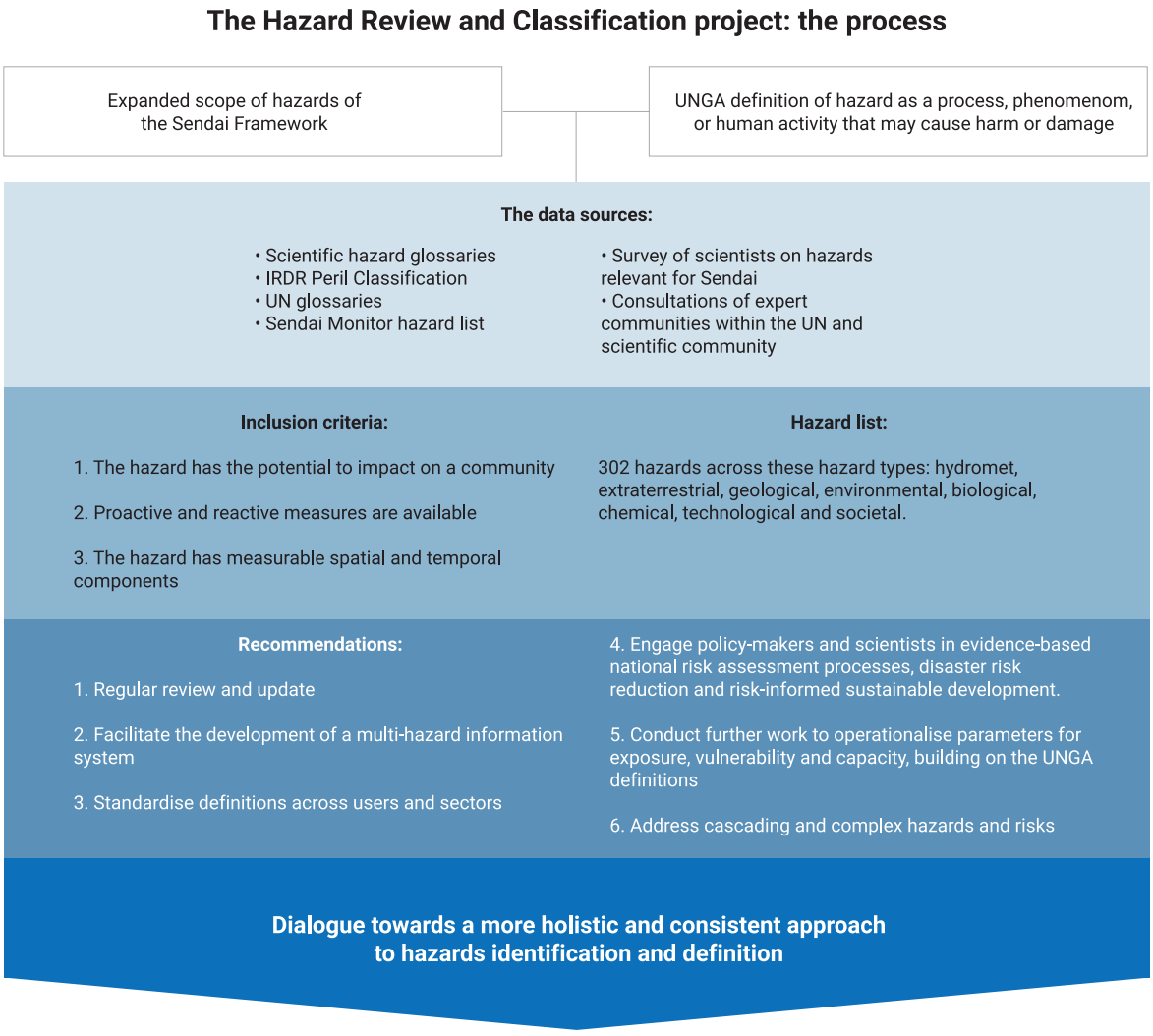

Figure 7.1 Schematic overview of the UNDRR / ISC Sendai Hazard Definition and Classification Review

Recommendation 1: Regular review and update.

The development and regular review and updating of a standard set of classifications of hazards, and the development of an agreed process of identifying and defining hazards is a critical foundation for risk-based decision-making. It is recommended that the hazard list be reviewed by the proposed end-users reflecting the needs of those involved in disaster risk reduction, emergency management, climate change, and increasingly sectoral actors pursuing sustainable development. The latter being consistent with the stipulation of the Sendai Framework that the reduction of disaster risk is an all-of-society and all-of-State institutions engagement. In particular, it will be important to have a more detailed scientific review of the list and hazard information profiles (HIPs) for those hazards that are not currently routinely included in disaster risk management, such as societal hazards. With this review, it will be important to maintain the development of the HIPs, including the hazard definition and any additional scientific description. This involves developing the ownership of hazard definitions by bodies that have an intergovernmental process for agreeing on wording and definition for standardisation, with continuous engagement from the broader scientific community; and for these coordinating institutions to regularly review and update the list and hazard definitions. Risk by nature is dynamic – hazard definitions and terminologies must adapt to such a reality.

Recommendation 2: Facilitate the development of a multi-hazard information system.

Enhancing the classification of hazards and facilitating access to the definition and description of hazards will be important. The next step should be the continuing development of hazard definitions as online resources, encoded following linked-data and open-science best practices. Through a meta-data approach, hazards could be tagged to allow for the list to be searched in multiple ways, thus accommodating diverse user needs. This will involve the development of a simple hazard definition schema to capture all the details of each individual hazard definition, including preferred and alternative names, relationships to other hazards (including parental or causality relationships), and citation of source material. Further alignments to related vocabularies covering the sustainable development goals (SDGs) of Agenda 2030 and some standard scientific vocabularies, as well as incorporating additional language functionality to encompass local hazard terminology, is recommended for future versions.

Recommendation 3: Engaging with users and sectors for greater alignment and consistency of hazard definitions.

Engagement with a range of users working in disaster risk reduction, emergency management, climate change, and increasingly sectoral actors pursuing sustainable development is needed to further develop hazard definitions. These users are likely to be representatives of Sendai Framework Focal Points and National Platforms for disaster risk reduction, regional economic and social commissions, policymakers, communities and practitioners within and across all sectors. By socialising this report, it will be possible to assess the value of the hazard terminology report and tool by users and sectors. The HIPs could also be used by the United Nations Statistics Division and the National Statistical Offices to ensure interoperability and standardisation of statistically relevant definitions of hazards across the Sendai Framework, Paris Agreement and the SDGs for use at local, national and international levels. This will ensure synchronisation among global and national statistical mechanisms and processes.

Recommendation 4: Use this hazard list to actively engage policymakers and scientists in evidence-based national risk assessment processes, disaster risk reduction and risk-informed sustainable development, and other actions aimed at managing risks of emergencies and disasters.

This includes supporting the uptake of the hazard list and HIPs as a tool for countries to investigate the potential sources of risk in their particular context, which requires developing further guidance for end-users. The guidance would elaborate for UN Member States on the efficient application of the hazard list in the implementation and monitoring of and reporting on the Sendai Framework and disaster risk-related SDGs, mainstreaming disaster risk reduction and resilience building with and across all sectors as agreed in Sendai Framework Global Target E. Relevant activities may include strengthening the science-policy interface for policy development, open-science research investments, setting evidence-based legislation and regulations, undertaking national and local risk and capacity assessments, plan-making, conducting exercise simulations, service delivery, infrastructure development, community mobilisation, education, monitoring and evaluation and other forms of capacity development.

Recommendation 5: Conduct further work to operationalise parameters for exposure, vulnerability and capacity, building on the UNGA definitions.

This is a much needed complementary exercise to the hazard definition process, which is the subject of this report. Exposure and vulnerability, and capacity, together with hazard, are the fundamental ingredients of risk, yet there is no agreed set of parameters for vulnerabilities or exposures. Much work has been done in defining and standardising parameters for exposure in the context of natural or geophysical hazards (e.g., Silva et al., 2018), and in defining indicators of vulnerability for disaster risk reduction (e.g., Beccari, 2016), but no consensus exists in the definition or application of exposure or vulnerability for use in risk assessment across the list of hazards within the broad scope of this report. This is an undertaking that could be charged to the recently established Working Group on Vulnerability and Exposure of the Global Risk Assessment Framework (GRAF).

Recommendation 6: Address cascading and complex hazards and risks.

There is an urgent need to investigate further the direct and indirect linkages and effects of natural, biological, technological and other human-induced hazards to identify better and understand cascading and complex hazards and risks in a systematic way. The shift towards a broader view and a more context-dependent definition of hazards requires a systematic approach to risk that considers hazard, vulnerability, exposure and capacity together and better understands their complex interactions. The hazard list and associated HIPs may assist the activities of the GRAF, informing efforts to develop an enhanced understanding of the systemic nature of risk, including the management of systemic risks.

References

Anon, 1994. Yokohama Strategy and Plan of Action for a Safer World Guidelines for Natural Disaster Prevention, Preparedness and Mitigation World Conference on Natural Disaster Reduction Yokohama, Japan, 23-27 May 1994. https://www.ifrc.org/Docs/idrl/I248EN.pdf

Arif A, Wang Z, 2018. Distribution network outage data analysis and repair time prediction using deep learning. 2018 IEEE International Conference on Probabilistic Methods Applied to Power Systems (PMAPS). p. 1-6. 10.1109/PMAPS.2018.8440354

Beccari B, 2016. A comparative analysis of disaster risk, vulnerability and resilience composite indicators. PLOS Currents Disasters. doi: 10.1371/currents.dis.453df025e34b682e9737f95070f9b970.

Below R, Wirtz A, Guha-Sapir D, 2009. Disaster Category Classification and peril Terminology for Operational Purposes. Centre for Research on the Epidemiology of Disasters (CRED) and Munich Reinsurance Company (Munich RE).

Bernard E, Titov V, 2015. Evolution of tsunami warning systems and products. Philosophical Transactions of the Royal Society A. https://doi.org/10.1098/rsta.2014.0371

CCOHS, 2017. OHS Answers and Fact Sheets: Hazard and Risk. Canadian Centre for Occupational Health and Safety (CCOHS). https://www.ccohs.ca/oshanswers/hsprograms/hazard_risk.html

Cressman K, Van der Elstraeten A, Pedrick C, 2016. eLocust3: An Innovative Tool for Crop Pest Control. UN Food and Agriculture Organization (FAO), Rome, Italy.

De Groeve T, Casajus Valles A, 2015. Science policy interfaces in disaster risk management in the EU: Mapping the support provided by science in the EU Civil Protection Mechanism. Publications Office of the European Union, Luxembourg.

De Groeve T, Poljansek K, Vernaccini L, 2015. Index for Risk Management – INFORM. Concept and Methodology. European Commission (EC), Luxembourg.

Djatmiko M, Schatzmann D, Friedman A, Dimitropoulos X, Boreli R, 2013. Privacy preserving distributed network outage monitoring. 2013 IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS), Turin, pp. 69-70. 10.1109/INFCOMW.2013.6970742

Erjongmanee S, Ji C, 2011. Large-scale network-service disruption: dependencies and external factors. IEEE Transactions on Network and Service Management. p. 375-386. 10.1109/TNSM.2011.110311.110106

Fernández-Giménez M, Batjav B, Baival B, 2012. Lessons from the dzud: adaptation and resilience in Mongolian pastoral socio-ecological systems. World Bank, Washington DC.

Funtowicz S, Ravetz, J 1993. Science for the post-normal age. Futures, 25:739-755.

Government of Western Australia, 2020. What is a Hazard and What is Risk. http://www.dmp.wa.gov.au/Safety/What-is-a-hazard-and-what-is-4721.aspx

Hasegawa Y, Uchida M, 2019. Predicting network outages based on Q-drop in optical network. 2019 IEEE 43rd Annual Computer Software and Applications Conference (COMPSAC), pp. 258-263. 10.1109/COMPSAC.2019.00045

IPCC, 2013. Annex III: Glossary. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

IRDR, 2014. Peril Classification and Hazard Glossary. IRDR DATA Publication No. 1. Integrated Research on Disaster Risk (IRDR), Beijing.

Ladds M, Keating A, Handmer J, Magee L, 2017. How much do disasters cost? A comparison of disaster cost estimates in Australia. International Journal of Disaster Risk Reduction, 21:419-429.

Liu G, Ji C, 2009. Scalability of network-failure resilience: analysis using multi-layer probabilistic graphical models. IEEE/ACM Transactions on Networking. pp. 319-331. 10.1109/TNET.2008.925944

NOAA, 2018. NOAA Storm Data Directive. National Oceanic and Atmospheric Administration (NOAA). https://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf

NOAA, 2020. NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2020). National Oceanic and Atmospheric Administration (NOAA). https://www.ncdc.noaa.gov/billions/

Peters K, Peters LR, Twigg J, Walch C, 2019. Disaster Risk Reduction Strategies: Navigating Conflict Contexts. Overseas Development Institute, London, UK.

Prüss-Ustün A, Vickers C, Haefliger P, Bertollini R, 2011. Knowns and unknowns on burden of disease due to chemicals: a systematic review. Environ Health, 10:9. doi:10.1186/1476-069X-10-9

SDSN TRENDS, 2019. Counting on the World to Act: A Roadmap for Governments to Achieve Modern Data Systems for Sustainable Development. Sustainable Development Solutions Network Thematic Research Network on Data and Statistics (SDSN TReNDS).

SIA, 2012. Hazard as a Concept: Core body of knowledge for the generalist OHS professional. Safety Institute of Australia Ltd (SIA). https://www.ohsbok.org.au/wp-content/uploads/2013/12/15-Hazard-as-a-concept.pdf

Silva V, Henshaw P, Huyck C, O'Hara M, 2018. Global Exposure Database for Multi-Hazard Risk Analysis. The Global Earthquake Model Foundation (GEM), Italy. https://www.globalquakemodel.org/publications

Sudmeier-Rieux K, Fra Paleo U, Garschagen M, Estrella M, Renaud FG, Jaboyedoff M, 2015. Opportunities, incentives and challenges to risk sensitive land use planning: Lessons from Nepal, Spain and Vietnam. International Journal of Disaster Risk Reduction, 14:205-224.

UNDP, 2013. A Comparative Review of Country-level and Regional Disaster Loss and Damage Databases. Bureau for Crisis Prevention and Recovery (BCPR), United Nations Development Programme (UNDP). https://www.undp.org/content/undp/en/home/librarypage/crisis-prevention-and-recovery/loss-and-damage-database.html

UNDRR, 2015. Sendai Framework for Disaster Risk Reduction 2015-2030. United Nations Office for Disaster Risk Reduction (UNDRR). https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf

UNDRR, 2017. United Nations Plan of Action on Disaster Risk Reduction for Resilience: Towards a Risk-informed and Integrated Approach to Sustainable Development. United Nations Office for Disaster Risk Reduction (UNDRR). https://www.recoveryplatform.org/assets/publication/Publication2016/49076_unplanofaction.pdf

UNDRR, 2018. Technical forum: Leveraging on the Sendai Framework Monitoring (SFM) process in support of the implementation of the 2030 Agenda and the Paris Agreement. United Nations Office for Disaster Risk Reduction (UNDRR). https://www.preventionweb.net/events/view/60756?id=60756

UNDRR, 2019a. Global Assessment Report on Disaster Risk Reduction, Geneva, Switzerland. United Nations Office for Disaster Risk Reduction (UNDRR). https://gar.unisdr.org/sites/default/files/reports/2019-05/full_gar_report.pdf

UNDRR, 2019b. Co-Chair's Summary. Resilience Dividend: Towards Sustainable and Inclusive Societies. United Nations Office for Disaster Risk Reduction (UNDRR). https://www.preventionweb.net/files/58809_chairsummary.pdf

UNDRR, 2019c. Hazards. United Nations Office for Disaster Risk Reduction (UNDRR). https://www.preventionweb.net/english/hazards/ Accessed 16 December 2019.

UNDRR, 2019d. Sendai Framework Monitor data now publicly available. United Nations Office for Disaster Risk Reduction (UNDRR). https://www.preventionweb.net/news/view/63059 Accessed 16 December 2019.

UNDRR, 2020. DesInventar Sendai 10.1.2. User Manual on Analysis Module. January 2020. United Nations Office for Disaster Risk Reduction (UNDRR). https://desinventar.net/documentation/Desinventar_Sendai_Data_management.pdf

UNESCO, 2009. Tsunami Risk Assessment and Mitigation for the Indian Ocean: Knowing your tsunami risk – and what to do about it. Intergovernmental Oceanographic Commission (IOC), Manual and Guides No. 52. United Nations Educational, Scientific and Cultural Organization (UNESCO).

UNGA, 2016. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Note by the Secretary-General. United Nations General Assembly (UNGA). Document No. A/71/644. https://undocs.org/A/71/644

UNGA, 2017. Resolution adopted by the General Assembly on 2 February 2017. 71/276. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. United Nations General Assembly (UNGA). https://www.unisdr.org/files/resolutions/N1702972_en.pdf

UNISDR, 2005. Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. World Conference on Disaster Reduction, 18–22 January, 2005. Kobe, Hyogo, Japan. UN International Strategy for Disaster Reduction (UNISDR).

UNISDR, 2017. Technical Guidance for Monitoring and Reporting on Progress in Achieving the Global Targets of the Sendai Framework for Disaster Risk Reduction: Collection of Technical Notes on Data and Methodology. UN International Strategy for Disaster Reduction (UNISDR).

UNSD, 2013. Best Practice Guidelines for Developing International Statistical Classifications. United Nations Statistics Division (UNSD), Expert Group on International Statistical Classifications.

Wannous C, Smallwood C, Abrahams J, Ancia A, Ciotti M, Suk J, Espinosa L, Jansa J, Tsolova S, Severi E, Derrough T, Fraser G, 2017. Biological hazards risk assessment. In: National Disaster Risk Assessment: Governance System, Methodologies, and Use of Results. pp. 45-59. https://www.unisdr.org/files/52828_nationaldisasterriskassessmentwiagu.pdf

Weichselgartner J, Kasperson R, 2010. Barriers in the science-policy-practice interface: Toward a knowledge-action-system in global environmental change research. Global Environmental Change, 20:266-277.

White D, Wutich A, Larson KL, Gober P, Lant T, Senneville C, 2010. Credibility, salience, and legitimacy of boundary objects: water managers' assessment of a simulation model in an immersive decision theater. Science and Public Policy, 37:219-232.

WHO, 2010. Preventing Disease through Healthy Environments: Action is needed on Chemicals of Major Public Health Concern. World Health Organization (WHO), Geneva. https://www.who.int/ipcs/features/10chemicals_en.pdf?ua=1

WHO, 2016. International Health Regulations (2005). Third Edition. World Health Organization (WHO), Geneva. https://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf;jsessionid=333ECBB306F0413DA034219E0EA56317?sequence=1

WHO, 2019. Health Emergency and Disaster Risk Management Framework. World Health Organization (WHO), Geneva. Licence: CC BY-NC-SA 3.0 IGO.

WMO, 2011. Guide to Climatological Practices. Rep. No. WMO-No. 100. World Meteorological Organization (WMO).

WMO, 2014. Risk Information: Documenting Loss and Damage Associated with Natural Hazards and Extreme Climate Events. Bulletin No. 63 (2). World Meteorological Organization (WMO).

WMO, 2018. Multi-hazard Early Warning Systems: A Checklist. Outcome of the first multi-hazard early warning conference, 22 to 23 May 2017, Cancún, Mexico. World Meteorological Organization (WMO).

WMO, 2019. World Meteorological Congress: Abridged Final Report of the Eighteenth Session. 3-14 June 2019, Geneva. World Meteorological Organization (WMO).

Annexes

ANNEX 1

Technical Working Group members, contributors and reviewers

TWG members

Chair: Virginia Murray, Integrated Research for Disaster Risk/Public Health England

Jonathan Abrahams, World Health Organization

Chadi Abdallah, UNDRR Arab STAG (Lebanese National Council for Scientific Research)

Lucille Angles, United Nations Educational, Scientific and Cultural Organization

Djillali Benouar, UNDRR Africa STAG (University of Science & Technology Houari Boumediene)

Alonso Brenes Torres, Integrated Research for Disaster Risk

Chang Hun Choe, International Federation of Red Cross and Red Crescent Societies

Simon Cox, Committee on Data for Science and Technology (CODATA)

James Douris, World Meteorological Organization

Qunli Han, Integrated Research for Disaster Risk

John Handmer, International Institute for Applied Systems Analysis; Integrated Research on Disaster Risk programme; School of Science, RMIT, Australia University

Simon Hodson, Committee on Data for Science and Technology (CODATA)

Wirya Khim, Food and Agriculture Organization of the United Nations

Nick Moody, Insurance Development Forum Risk Modelling Steering Group

Osvaldo Luiz Leal Moraes, UNDRR Panama Office Science Group (Brazilian Early Warning Monitoring Centre for Natural Disasters)

Michael Nagy, United Nations Economic Commission for Europe

James Norris, Group on Earth Observations Secretariat

Urbano Fra Paleo, UNDRR European STAG

Pascal Peduzzi, UN Environment

Aslam Perwaiz, UNDRR Asia-Pacific STAG (Asian Disaster Preparedness Center)

Katie Peters, Overseas Development Institute

Jack Radisch, Organisation for Economic Co-operation and Development

Markus Reichstein, Knowledge Action Network on Emergent Risks and Extreme Events

John Schneider, Global Earthquake Model Foundation

Adam Smith, UNDRR North America STAG (National Oceanic and Atmospheric Administration)

Claire Souch, Insurance Development Forum Risk Modelling Steering Group

Annisa Triyanti Young Scientist, UNDRR Global STAG (Utrecht University)

Co-facilitators

Anne-Sophie Stevance, International Science Council

Irina Zodrow, United Nations Office for Disaster Risk Reduction

Project support team

Project support lead: Lucy Fagan, Public Health England

Paula Gabriela Villavicencio Arciniegas, Public Health England - supported by the Universities of Excellence Scholarship from the Ecuadorian Government (November – December 2019)

Sonny Greenley, Public Health England (August 2019)

Lidia Mayner Flinders University, Adelaide, South Australia (May – December 2019)

Rajinder Sagoo, supported by UNDRR (September – December 2019)

Olga Shashkina-Pescaroli, supported by International Science Council, (September – December 2019)

Zhenya Tsoy, International Science Council

Robert Verrecchia, Public Health England (April- September 2019)

Sarah Walker, Public Health England (April - August 2019)

Natalie Wright, Public Health England (September 2019 – March 2020)

Library services courtesy of Knowledge & Library Services of Public Health England and Evidence Aid

Claire Allen, Evidence Aid

Anne Brice, Public Health England

Caroline De Brún, Public Health England

Mike Clark, Queens University, Belfast

Emma Farrow, Public Health England

Benjamin Heaven Taylor, Evidence Aid

Lidia Mayner, Flinders University, Australia

Authors of the Hazard Information Profiles (HIPs)

Thorkild Aarup, Intergovernmental Oceanographic Commission

Chadi Abdallah, UNDRR Arab STAG (Lebanese National Council for Scientific Research)

Sarah Adamczyk, Overseas Development Institute

Bernadette Abela-Ridder, World Health Organization

Jonathan Abrahams, World Health Organization

Irina Ardeleanu, Coventry University

Kiran Attridge, Public Health England

Djillali Benouar, UNDRR Africa STAG (University of Science & Technology Houari Boumediene)

Costanza Bonadonna, University de Genève

Gracia Brisco, Food and Agriculture Organization of the United Nations
Sarah Cahill, Food and Agriculture Organization of the United Nations
Emily Campbell, Massey University
Zhanat Carr, World Health Organization
Denis Chang-Seng, Intergovernmental Oceanographic Commission
Callum Chapman, Public Health England
Lorcan Clarke, London School of Economics and Political Science
Paul D Cole, University of Plymouth
Simon Cox, CODATA
Shoki Al Dobai, Food and Agriculture Organization of the United Nations
Sophie Von Dobschuetz, Food and Agriculture Organization of the United Nations
James Douris, World Meteorological Organization
Eleonora Dupouy, Food and Agriculture Organization of the United Nations
Fazil Dusunceli, Food and Agriculture Organization of the United Nations
Maged El-Kahky, Food and Agriculture Organization of the United Nations
Tina Endricks, Public Health England
Lucy Fagan, Public Health England
Esther Garrido Gamarro, Food and Agriculture Organization of the United Nations
Robin Gee, Global Earthquake Model Foundation
Johann Goldammer, Global Fire Monitoring Center
Baogen Gu, Food and Agriculture Organization of the United Nations
John Handmer, Integrated Research for Disaster Risk
Claire Horwell, Durham University
Maria van Hove, National Institute for Health and Care Excellence
Emma Hudson-Doyle, Massey University
Ko Ida, Public Health England
Ahmed El Idrissi, Food and Agriculture Organization of the United Nations
Evgenia Ilyinskaya, Leeds University
Lydia Izon-Cooper, Public Health England
Susanna Jenkins, Earth Observatory Singapore
Akiko Kamata, Food and Agriculture Organization of the United Nations
Elizabeth Kaussman, European Commission Joint Research Center
Geunhye Kim, World Meteorological Organization
Gael Lamielle, Food and Agriculture Organization of the United Nations
Jostacio Lapitan, World Health Organization
Ronald Law, Department of Health, Philippines
Esteban Leon, United Nations Human Settlements Programme
Dina Mansour-Ille, Overseas Development Institute
Pablo Tierz Lopez, British Geological Survey
Susan Loughlin, British Geological Survey
Juan Lubroth, Food and Agriculture Organization of the United Nations

Lidia Mayner, Flinders University, Australia

Peter McGowran, King's College London

Samia Metwally, Food and Agriculture Organization of the United Nations

Nick Moody, Insurance Development Forum Risk Modelling Steering Group

Peter F. Moore, Food and Agriculture Organization of the United Nations

Susan Loughlin, British Geological Survey

Osvaldo Luiz Leal Moraes, UNDRR Panama Office Science Group (Brazilian Early Warning Monitoring Centre for Natural Disasters)

Virginia Murray, Public Health England

Felix Njeumi, Food and Agriculture Organization of the United Nations

James Norris, Group on Earth Observations

Pascal Peduzzi, UN Environment

Aslam Perwaiz, UNDRR Asia-Pacific STAG (Asian Disaster Preparedness Center)

Gianluca Pescaroli, University College London

Katie Peters, Overseas Development Institute

Laura Elizabeth Peters, Oregon State University

Jeremy Phillips, University of Bristol

Julio Pinto, Food and Agriculture Organization of the United Nations

Eran Raizman, Food and Agriculture Organization of the United Nations

Melba Reantaso, Food and Agriculture Organization of the United Nations

Andriy Rozstalnyy, Food and Agriculture Organization of the United Nations

Rajinder Sagoo, UN Office for Disaster Risk Reduction, Independent Consultant

Rita Der Sarkissian, Lebanon National Council for Scientific Research,

Shiroma Sathyapala, Food and Agriculture Organization of the United Nations

John Schneider, Global Earthquake Model Foundation

Chloe Sellwood, NHS England

Olga Shashkina-Pescaroli, International Science Council

Adam Smith, UNDRR North America STAG (National Oceanic and Atmospheric Administration)

Richard Styron, Global Earthquake Model Foundation

Elisabetta Tagliatti, Food and Agriculture Organization of the United Nations

Shinji Takarada, Japanese National Institute of Advanced Industrial Science and Technology

Annisa Triyanti Young Scientist, UNDRR Global STAG (Utrecht University)

Robert Verrecchia, Public Health England

Paula Villavicencio, Public Health England

Ian Walker, Public Health England

Sarah Wallace, Public Health England

David Williams, World Health Organization

Mark Woodhouse, University of Bristol

Natalie Wright, Public Health England

Weining Zhao, Food and Agriculture Organization of the United Nations

Review of the HIPs

Review coordinator: Anda Popovici, International Science Council

Reviewers:

Kathryn Alberti, World Health Organization

Javed Ali, Centre national de la recherche scientifique (CNRS)

Trevor Allen, Geoscience Australia

Craig Arthur, Geoscience Australia

Barbara Bannister, Honorary Consultant, Royal Free Hospital

Tom Beer, Safe System Solutions, Australia

Lynette Bettio, Australian Bureau of Meteorology

Alex Blackburn, United Nations Economic Commission for Europe

Peter Bridgewater, University of Canberra

Francesca Cenni, Basel, Rotterdam and Stockholm Conventions

Jean-Luc Chotte, Institut de recherche pour le développement (IRD)

Raffaello Cioni, Università degli Studi di Firenze

Emanuela Corsini, Università degli Studi di Milano

Fuqiang Ciu, World Health Organization

Kim Currie, University of Otago

Maral Dadvar, Stuttgart Media University

John Henderson Duffus, The Edinburgh Centre for Toxicology

Alexandra Fleischmann, World Health Organization

Kaushal Raj Gnyawali, Himalayan Risk Research Institute

Bernd Grambow, IMT Atlantique

Dave Griggs, Monash University

Martin Guard, UN Environment Programme

Santosh Gurung, World Health Organization

Michael Hapgood, RAL Space

David Heymann, Chatham House

Stefan Hoyer, World Health Organization

Qudsia Huda, World Health Organization

Salmaan Inayat-Hussain, Petroliam Nasional Berhad (PETRONAS)

Yvan Hutin, World Health Organization

Hélène Jacot des Combes, National Disaster Management Office of the Republic of the Marshall Islands

Gary Jones, UNAIDS

René Kastner, Disaster Competence Network Austria

Hannes Kern, IRIS - Industrial Risk and Safety Solutions

Hwirin Kim, World Meteorological Organization

Paul Kovacs, ICLR – The Institute for Catastrophic Loss Reduction

Mike Long, University College Dublin

Melanie Marti, World Health Organization

Holly Michael, University of Delaware

Margaret Montgomery, World Health Organization

Osvaldo Moraes, Centro Nacional de Monitoramento e Alertas de Desastres Naturais (CEMADEN), Brazil

Brayton Noll, University of Twente

Elizabeth Mumford, World Health Organization

David Olson, World Health Organization

Peter Olumese, World Health Organization

Orhan Osmani, International Telecommunication Union

Ursula Oswald Spring, Universidad Nacional Autónoma de México

Ana Ake Patolo, Tonga National Emergency Management Office

Edmund Penning-Rowsell, Middlesex University

Laura Elizabeth Peters, Oregon State University

Ingrid Rabe, World Health Organization

Christian Resch, Disaster Competence Network Austria

Olivier Ronveaux, World Health Organization

Cathy Roth, DFID

Linda Rowan, UNAVCO

Rita Der Sarkissian, Lebanon National Council for Scientific Research

Michael Schwenk, In den Kreuzäckern 16/1; IUPAC

Jane Sexton, Geoscience Australia

Jana Sillmann, CICERO Center for International Climate Research

Devendra Narain Singh, Indian Institute of Technology, Bombay

Anthony Solomon, World Health Organization

Christoph Steffen, World Health Organization

Val Swail, Emeritus Scientist, Environment and Climate Change Canada

Kuniyoshi Takeuchi, University of Yamanashi

Graham Tallis, World Health Organization

Norbert Tchouaffé, University of Dschang, Cameroon

Alan Thomson, British Geological Survey

Richard Thornton, Bushfire and Natural Hazards CRC

Martin Le Tissier, University College Cork

Andrea Vacca, University of Cagliari

Daniel Vallero, Duke Civil and Environmental Engineering

Raman Velayudhan, World Health Organization

Martin Visbeck, GEOMAR Helmholtz Centre for Ocean Research Kiel

Emilia Wahlstrom, UN Environment Programme

Susan Wang, World Health Organization

Abel Wilson Walekhwa, Africa Youth Advisory Board for Disaster Risk Reduction

Soichiro Yasukawa, UNESCO Disaster Risk Reduction

Wenqing Zhang, World Health Organization

Review of the technical report

Anne Bardsley, University of Auckland, Center for Informed Futures, New Zealand

Melody Brown Burkins, Dartmouth, United States

Andrew Hancock, Chair, UN Expert Group on International Statistical Classifications

Willi Harz, Federal Statistical Office of Germany

Alik Ismail-Zadeh, Karlsruhe Institute of Technology, Germany

David Johnston, Massey University, New Zealand

Coleen Vogel, University of Witwatersrand, South Africa

UNDRR Asia Pacific Science Technology and Academia Advisory Group

Thanks to Advisory Group

Over 400 colleagues volunteered to join the UNDRR/ISC Sendai Hazard Definition and Classification Review Advisory Group and have been very engaged, committed and supportive of the work – we thank them for their support.

ANNEX 2

Pre-defined hazards in the Sendai Framework Monitor

1	Animal incidents
2	Ash fall
3	Avalanche
4	Aviation accident
5	Blizzard
6	Chemical spill
7	Coastal erosion
8	Coastal flood
9	Cold wave
10	Convective storm
11	Cyclone surge
12	Cyclonic rain
13	Cyclonic wind
14	Debris flow
15	Derecho
16	Drought
17	Dust
18	Earthquake
19	Epidemics
20	Epizootics
21	Eruption
22	Explosion
23	Extra-tropical storm
24	Extreme temperature
25	Fire
26	Flash flood
27	Flood
28	Fog
29	Freeze
30	Frost
31	Glacial lake outburst
32	Hail
33	Heat wave
34	Ice
35	Impact
36	Industrial disaster
37	Insect infestation
38	Lahar
39	Landslide
40	Lava flow
41	Lightning
42	Mine disaster
43	Mud flow
44	Navigation accident
45	Nuclear incident
46	Oil spill
47	Pandemics
48	Pest
49	Plague
50	Pollution
51	Ponding flood
52	Power outage
53	Pyroclastic flow
54	Radiation contamination
55	Rail accident
56	Rain
57	Riverine flood
58	Road accident
59	Rock fall
60	Sand
61	Shoreline change
62	Snow
63	Space accident
64	Space weather
65	Structural collapse
66	Subsidence
67	Tornado
68	Tropical cyclone
69	Tsunami
70	Urban flood
71	Volcanic activity
72	Wave action
73	Wildfire
74	Wind

ANNEX 3

Definitions adopted by the UN General Assembly (UNGA)

Report of the Open-ended Intergovernmental Expert Working Group on indicators and terminology relating to disaster risk reduction. Definitions of 'hazard', 'disaster', 'exposure' and 'vulnerability'. 'capacity'.

HAZARD

A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.

Annotations: Hazards may be natural, anthropogenic or socionatural in origin. **Natural hazards** are predominantly associated with natural processes and phenomena. **Anthropogenic hazards**, or human-induced hazards, are induced entirely or predominantly by human activities and choices. This term does not include the occurrence or risk of armed conflicts and other situations of social instability or tension which are subject to international humanitarian law and national legislation. Several hazards are socionatural, in that they are associated with a combination of natural and anthropogenic factors, including environmental degradation and climate change.

Hazards may be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity or magnitude, frequency and probability. Biological hazards are also defined by their infectiousness or toxicity, or other characteristics of the pathogen such as dose-response, incubation period, case fatality rate and estimation of the pathogen for transmission.

Multi-hazard means (1) the selection of multiple major hazards that the country faces, and (2) the specific contexts where hazardous events may occur simultaneously, cascadingly or cumulatively over time, and taking into account the potential interrelated effects.

Hazards include (as mentioned in the Sendai Framework for Disaster Risk Reduction 2015-2030, and listed in alphabetical order) biological, environmental, geological, hydrometeorological and technological processes and phenomena.

Biological hazards are of organic origin or conveyed by biological vectors, including pathogenic microorganisms, toxins and bioactive substances. Examples are bacteria, viruses or parasites, as well as venomous wildlife and insects, poisonous plants and mosquitoes carrying disease-causing agents.

Environmental hazards may include chemical, natural and biological hazards. They can be created by environmental degradation or physical or chemical pollution in the air, water and soil. However, many of the processes and phenomena that fall into this category may be termed drivers of hazard and risk rather than hazards in themselves, such as soil degradation, deforestation, loss of biodiversity, salinization and sea-level rise.

Geological or geophysical hazards originate from internal earth processes. Examples are earthquakes, volcanic activity and emissions, and related geophysical processes such as mass movements, landslides, rockslides, surface collapses and debris or mud flows. Hydrometeorological factors are important contributors to some of these processes. Tsunamis are difficult to categorize: although they are triggered by undersea earthquakes and other geological events, they essentially become an oceanic process that is manifested as a coastal water-related hazard.

Hydrometeorological hazards are of atmospheric, hydrological or oceanographic origin. Examples are tropical cyclones (also known as typhoons and hurricanes); floods, including flash floods; drought; heatwaves and cold spells; and coastal storm surges. Hydrometeorological conditions may also be a factor in other hazards such as landslides, wildland fires, locust plagues, epidemics and in the transport and dispersal of toxic substances and volcanic eruption material.

Technological hazards originate from technological or industrial conditions, dangerous procedures, infrastructure failures or specific human activities. Examples include industrial pollution, nuclear radiation, toxic wastes, dam failures, transport accidents, factory explosions, fires and chemical spills. Technological hazards also may arise directly as a result of the impacts of a natural hazard event.

DISASTER

A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.

Annotations: The effect of the disaster can be immediate and localized but is often widespread and could last for a long period of time. The effect may test or exceed the capacity of a community or society to cope using its own resources, and therefore may require assistance from external sources, which could include neighbouring jurisdictions, or those at the national or international levels.

Emergency is sometimes used interchangeably with the term disaster, as, for example, in the context of biological and technological hazards or health emergencies, which, however, can also relate to hazardous events that do not result in the serious disruption of the functioning of a community or society.

Disaster damage occurs during and immediately after the disaster. This is usually measured in physical units (e.g., square meters of housing, kilometres of roads, etc.), and describes the total or partial destruction of physical assets, the disruption of basic services and damages to sources of livelihood in the affected area.

Disaster impact is the total effect, including negative effects (e.g., economic losses) and positive effects (e.g., economic gains), of a hazardous event or a disaster. The term includes economic, human and environmental impacts, and may include death, injuries, disease and other negative effects on human physical, mental and social well-being.

For the purpose of the scope of the Sendai Framework for Disaster Risk Reduction 2015-2030 (para. 15), the following terms are also considered:

- Small-scale disaster: a type of disaster only affecting local communities which require assistance beyond the affected community.
- Large-scale disaster: a type of disaster affecting a society which requires national or international assistance.
- Frequent and infrequent disasters: depend on the probability of occurrence and the return period of a given hazard and its impacts. The impact of frequent disasters could be cumulative, or become chronic for a community or a society.
- A slow-onset disaster is defined as one that emerges gradually over time. Slow-onset disasters could be associated with, e.g., drought, desertification, sea-level rise, epidemic disease.
- A sudden-onset disaster is one triggered by a hazardous event that emerges quickly or unexpectedly. Sudden-onset disasters could be associated with, e.g., earthquake, volcanic eruption, flash flood, chemical explosion, critical infrastructure failure, transport accident.

EXPOSURE

The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.

Annotation: Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability and capacity of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.

VULNERABILITY

The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.

Annotation: For positive factors which increase the ability of people to cope with hazards, see also the definitions of “Capacity” and “Coping capacity”.

CAPACITY

The combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience.

Annotation: Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management.

Coping capacity is the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during disasters or adverse conditions. Coping capacities contribute to the reduction of disaster risks.

Capacity assessment is the process by which the capacity of a group, organization or society is reviewed against desired goals, where existing capacities are identified for maintenance or strengthening and capacity gaps are identified for further action.

Capacity development is the process by which people, organizations and society systematically stimulate and develop their capacities over time to achieve social and economic goals. It is a concept that extends the term of capacity-building to encompass all aspects of creating and sustaining capacity growth over time. It involves learning and various types of training, but also continuous efforts to develop institutions, political awareness, financial resources, technology systems and the wider enabling environment.

ANNEX 4

Scientific glossaries

Prepared by Lidia Mayner and Virginia Murray (June 2019) updated November 2019. Results from Prevention website when asking for glossary; subdivided into categories namely by theme and hazard. www.preventionweb.net/search/pw#query=hazard+glossary&hits=20&sortby=default&view=pw

Hazard category	Number of hits
Glossaries by Theme	
Disaster risk management	623
Climate change	391
Governance	292
Water	206
Glossaries by Hazard	
Flood	**226**
Earthquake	**180**
Drought	**143**
Tsunami	**141**
Cyclone	**107**
Storm surge	**46**
Landslide	**33**
Wild fire	**32**
Volcano	**31**
Heat wave	**17**
Epidemic Pandemic	**14**
Avalanche	**10**
Technical disaster	**9**
Cold wave	**5**
Insect infestation	**5**
Tornado	**3**
NBC (Nuclear, biological, chemical)	**3**

List 1 Compiled from pdf files by Virginia Murray and Lidia Mayner and websites accessed in June 2019

Glossary name Author	Year	URL / Topics covered
Climate change IPCC	2012	Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/
Climate change glossary BBC		www.bbc.com/news/science-environment-11833685
Climate change guide		www.climate-change-guide.com/climate-change-glossary.html See site for extensive list of hazards Droughts and Floods, Dust Storms, Heat Waves, Hurricanes, Malaria, Dengue Fever, salmonella and other diseases/viruses, Tornadoes, Tropical Storms, Wildfires, Desertification, Ocean Acidification, Melting of Glaciers, Melting of Polar Ice Caps, Rising Sea Levels, Shortages of food and water, Shrinking Lakes, Extinction of species, Wars over natural resources
US Global Change Research Program		www.globalchange.gov/climate-change/glossary
A taxonomy of threats for complex risk management Cambridge Centre for Risk Studies, University of Cambridge Judge Business School	2014	www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/risk/downloads/crs-cambridge-taxonomy-threats-complex-risk-management.pdf
Cambridge Risk Framework - Developments and Objectives Simon Ruffle	2015	www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/risk/downloads/showcase_presentation_ruffle.pdf
Cambridge risk framework API & dashboard technology Simon Ruffle	2017	www.cbr.cam.ac.uk/fileadmin/user_upload/research/centres/risk/downloads/170622-slides-ruffle.pdf
Tsunami Disaster Risk – Past Impacts and Projections CRED +UNISDR	2016	www.preventionweb.net/files/50825_credtsunami08.pdf
Tsunami Glossary IOC; ITIC; UNESCO	2016 2019	www.preventionweb.net/publications/view/60890 PDF: itic.ioc-unesco.org/images/stories/about_tsunamis/tsunami_glossary/309_16_Tsunami%20Glossary%20E_errata_20160907.pdf
International Glossary of Hydrology	2012	WMO-No 385 library.wmo.int/pmb_ged/wmo_385-2012.pdf
International Meteorological Vocabulary, WMO-No. 182.	1992	https://library.wmo.int/doc_num.php?explnum_id=4712
International Cloud Atlas	2017	https://cloudatlas.wmo.int/
Glossary of Terms | Civil Aviation Safety Authority Air Safety Support International (ASSI)	2018	www.airsafety.aero/About-ASSI/Glossary.aspx
Aviation abbreviations and acronyms Civil Aviation Safety Authority (CASA)		www.casa.gov.au/about-us/site-information/aviation-abbreviations-and-acronyms
Glossary of civil aviation and air travel terminology Airodyssey.net		airodyssey.net/reference/glossary/
FM 10-67-2 Glossary	2008	PDF file Glossary of air safety
Report: Technical Glossary of a Multi Hazard Related Vulnerability and Risk Assessment Language – Final version ARMONIA and Philipp Schmidt-Thomé, Johannes Klein, Raili Aumo, Jani Hurstinen	2007	Report: Technical Glossary of a Multi Hazard Related ...forum.eionet.europa.eu/eionet-air-climate/library/public/2010_citiesproject..
Geonet		www.geonet.org.nz/ Earthquakes www.geonet.org.nz/earthquake/glossary Landslide www.geonet.org.nz/landslide/glossary Tsunami www.geonet.org.nz/tsunami/glossary Volcano www.geonet.org.nz/volcano/glossary
Multi lingual landslide glossary International Geotechnical Societies' / UNESCO	1993	www.cgs.ca/pdf/heritage/Landslide%20Glossary.pdf

Forces of Nature Environmental Hazards See Web site for individual hazards listed National Geographic		www.nationalgeographic.org/interactive/forces-nature/ www.nationalgeographic.org/topics/resource-library-environmental-hazards/?q=&page=1&per_page=25 Drought, Natural disasters and Climate Change, Oil and Bird population + marine wildlife, Earthquakes, Floods, Extreme weather, Hurricanes, wild fires, oil platform explosion, nuclear plant meltdowns, Tsunami, storm surges
Glossary Watson, D, Adams, M.	2012	onlinelibrary.wiley.com/doi/10.1002/9781118259870.gloss Design for Resilience to Flooding and Climate Change
Glossary of Terms – American Avalanche Institute		Avalanches- Forces of Nature Avalanche Terms
National Geographic Education Resource library		www.cgs.ca/pdf/heritage/Landslide%20Glossary.pdf List includes avalanches, extreme natural events, hazard pyroclastic flows, human and environmental impacts of volcanic ash
US Geological Survey (USGS) Earthquake Glossary		earthquake.usgs.gov/learn/glossary/
Physical Science Glossary		silvergrovescience.angelfire.com/OnlineIntegratedScience/PhysicalScienceGlossary.htm
CDEMA Earthquake Readiness		www.weready.org/earthquake/index.php?option=com_glossary&Itemid=66
SMS Tsunami Warning + Earthquakes		www.sms-tsunami-warning.com/pages/earthquake-glossary#.XRLQnndul-I
Washington State Earthquake Hazards Linda Noson, et al.		
Glossary of Key terms Ch 11		Earthquakes
Glossary of Earthquake and Related Terminology USGS		
UUSS – earthquakes University of Utah Seismograph Station		quake.utah.edu/regional-info/earthquake-glossary
AUSTRALIAN EMERGENCY MANAGEMENT TERMS THESAURUS EMA	1998	doms.csu.edu.au/csu/file/78a6c5d7-fd8b-ff7e-fff3-2ffb78764ebe/1/resources/manuals/Manual-04.pdf
EM Terms & Definitions FEMA		training.fema.gov/hiedu/termdef.aspx training.fema.gov/hiedu/docs/terms%20and%20definitions/terms%20and%20definitions.pdf
Glossary of Emergency Management Terms Blanchard, W Guide to emergency management and related terms, definitions, concepts, acronyms, organizations, programs, guidance, executive orders & legislation. Blanchard, B. W	2008	training.fema.gov/EMIWeb/edu/docs/terms%20and%20definitions/Terms%20and%20Definitions.pdf
Emergency Management acronyms and abbreviations		www.allacronyms.com/emergency_management/abbreviations
Emergency Management Glossary and acronyms Larson		
Penultimate Glossary of Emergency Management Terms Simeon Institute, Pacific Emergency Management Center	2005	9th Ed 2017 - Book
Emergency Planning – Glossary of Terms Principles of emergency planning and management David Alexander	2002	9th Ed 2017 - Book
Glossary of Emergency Preparedness Terms City of Chicago		www.chicago.gov/city/en/depts/oem/supp_info/alertrespond/glossary.html
Australian Disaster Resilience Glossary Australian Institute for Disaster Resilience		/knowledge.aidr.org.au/glossary/?wordOfTheDayId=&keywords=&alpha=&page=1&results=50&order=AZ
Indicators for Disaster Risk Management	2005	www.preventionweb.net/files/1082_1056indicatorsofdranddm.pdf

Terms and definitions suggested in ISO/IEC CD Guide 73 (under development 2008)	2008	
ISO Guide 73: 2009 - Risk management – Vocabulary	2016	www.iso.org/standard/44651.html Preview: www.iso.org/obp/ui/#iso:std:iso:guide:73:ed-1:v1:en
Glossary of civil protection for EU citizens SIPROCI		
Glossary of Terms EUR-Lex		eur-lex.europa.eu/summary/glossary/democratic_deficit.html?locale=en
Components of Risk – A comparative Glossary K. Thywissen	2006 2013	Book: Measuring Vulnerability to Natural Hazards ed J. Birkman, 2nd ed 2013 Ch 23, Marre K. (nee Thywissen) p569-618
Disaster Dictionary Biby, DJ	2005	The definitive guide to related terms, acronyms, and concepts for emergency planning and operations, K & M Publishers Inc., Tulsa Oklahoma, USA
Dictionary of Disaster Medicine and Humanitarian Relief Gunn, SWA	2013	
The Dictionary of Homeland Security and Defense O'Leary, M.	2006	
Health Disaster Management: Guidelines for Evaluation and Research in the Utstein Style Sundnes, KO; Birnbaum, ML	2003	Prehospital and Disaster Medicine, Vol. 17, supplement 3, pp:144-161
Glossary of terms – Pandemic flu SMC		
Centers for Disease Control and Prevention (CDC)		www.cdc.gov/flu/about/glossary.htm
Glossary of Terms and Acronyms		www.health.gov.au/internet/publications/publishing.nsf/Content/fluborderplan-toc~glossary-of-terms-and-acronyms National Pandemic Influenza Airport Border Operations Plan.
CSRC		//csrc.nist.gov/glossary/term/Pandemic-Influenza
UNISDR	2016	Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction
ISDR	2008 2004	Terminology: Basic terms of disaster risk reduction
UNISDR	2017	Terminology on disaster risk reduction
Disaster Lexicon	2008	
Community Glossary		www.st.nmfs.noaa.gov/st5/publication/communities/Glossary_Communities.pdf
Mercury Disposal Ochoa, G S	2011	Glossary of terms relevant to discussion of mercury storage and disposal
Peril Classification and Hazard Glossary IRDR	2014	
Sphere Glossary	2019	spherestandards.org/wp-content/uploads/Sphere-Glossary-2018.pdf
Radiation Glossary Health Physics Society		www.radiationanswers.org/radiation-resources/glossary.html
Glossary of Terms Nuclear Accident Independent Investigation Commission		
Full-Text Glossary US Nuclear Regulatory Commission	2017	ww.nrc.gov/reading-rm/basic-ref/glossary/full-text.html
Glossaries related to Business and Technology (4)		www.techtarget.com/search/query?q=glossary
DRI International Glossary for Resilience DRI	2018	
Disaster Management Center NIH and NLM		disasterinfo.nlm.nih.gov/

List 2 Compiled by Lidia Mayner in 2014. Disaster related glossaries from the Disaster Information Management Research Center (DIMRC), National Library of Medicine; Bethesda, MD.

Ref #	Source	Electronic copy	Listing	
			2012	2014
1: Chemicals and Toxic Substances				
1A	Chemical/Biological/Radiological Incident Handbook. Section G. Glossary of Chemical Terms. Central Intelligence Agency. www.cia.gov/library/reports/general-reports-1/cbr_handbook/cbrbook.htm#8 accessed 28_01_2014	Yes	x	x
1B	Glossary of Terms. Agency for Toxic Substances and Disease Registry, Centers for Disease Control and Prevention. /www.atsdr.cdc.gov/glossary.html accessed 28_01_2014	Yes	x	x
1A_ OLD	From 2009 DIMRC listing. www.ilo.org/legacy/english/protection/safework/cis/products/safetytm/glossary.htm	Yes	NO	NO
2: Climate and Weather				
2A	National Oceanic and Atmospheric Administration's National Weather Service Glossary w1.weather.gov/glossary/ accessed 28_01_2014 Glossary not downloaded as each letter must be downloaded separately.	NO	x	x
3: Disaster and Emergency Management				
3A	Accommodating Individuals with Disabilities in the Provision of Disaster Mass Care, Housing and Human Services. VII. Glossary of Terms. Federal Emergency Management Authority. www.fema.gov/vii-glossary-terms accessed 28_01_2014	Yes	x	x
3B	Acronyms and Glossary of Terms. National Capital Region Homeland Security Program www.ncrhomelandsecurity.org/ncr/glossary.asp accessed 28_01_2014	Yes	x	x
3C	CEDIM (Centre for Disease Management and Risk Reduction Technology) – Glossary. Terms and Definitions of Risk Sciences. Karlsruhe Institute of Technology www.cedim.de/download/glossar-gesamt-20050624.pdf accessed 28_01_2014	Yes	x	x
3D	Online Disaster Dictionary. Suburban Emergency Management Project. Only SEMP home page is printed. Typed in web address on printed page, but it brought up an unrelated site. NOTE: Dictionary is in older listing, not 2014 one. As online Disaster Dictionary (as per 2012 listing) could not be located electronically definitions must be taken from Simon's Excel file. A Google search brought up link to a different dictionary by same author which was saved as Reference 51. U.S. Department of Homeland Security (2012) DHS (Department of Homeland Security) Risk Lexicon. Available at www.dhs.gov/dhs-risk-lexicon Glossary Web site www.dhs.gov/xlibrary/assets/dhs-risk-lexicon-2010.pdf Accessed 18/ 11/ 2014	No YES	X	NO YES
3E	Emergency Response Safety and Health Database Glossary. National Institute for Occupational safety and Health, Centers for disease Control and Prevention www.cdc.gov/NIOSH/ershdb/glossary.html accessed 28_01_2014	Yes	x	x
3F	Glossary and Acronyms of Emergency Management Terms Office of Emergency Management, Department of Energy orise.orau.gov/emi/training-products/files/glossary-emt.pdf accessed 30_01_2014	Yes	x	x
3G	Institute for Crisis, Disaster, and Risk Management (ICDRM) Emergency Management Glossary of Terms, George Washington University. Link from NLM list brings up message 'page not found' and so name of webpage cannot be saved, nor webpage accessed. Note: 2010 version is saved as Reference 37 and has different definitions.	Yes	x	x
3H	Internationally Agreed Glossary of Basic Terms Related to Disaster Management United Nations Department of Humanitarian Affairs reliefweb.int/report/world/internationally-agreed-glossary-basic-terms-related-disaster-management webpage accessed 30_01_2014	Yes	x	x

3I	Medical Surge Capacity and Capability Handbook. Appendix D: Glossary Office of the Assistant Secretary for Preparedness and Response, U.S. Department of Health and Human Services www.phe.gov/Preparedness/planning/mscc/handbook/Pages/appendixd.aspx accessed 30_01_2014	Yes	x	x
3J	National Emergency Training Center (NETC) Thesaurus of All-Hazards Terms Federal Emergency Management Agency, U.S. Department of Homeland Security	Yes	x	x
3K	National Incident Management System (NIMS). (2008) U.S. Department of Homeland Security, Washington , DC, USA Glossary of Key Terms, page 135, and Acronyms, page 151 Federal Emergency Management Agency, www.fema.gov/pdf/emergency/nims/NIMS_core.pdf accessed 30_01_2014	Yes	x	x
3L	National Incident Management System (NIMS). Resource Centre – Glossary U.S. Federal Emergency Management Agency Note: in 2012 listing, not 2014. Not accessible electronically. Federal Emergency Management Agency, U.S. Department of Homeland Security (2008) National Response Framework. Glossary and Acronyms www.fema.gov/pdf/emergency/nrf/nrf-glossary.pdf Accessed 18 11 2014	Yes	x	NO
3M	National Response Framework. Glossary and Acronyms Federal Emergency Management Agency, U.S. Department of Homeland Security www.fema.gov/pdf/emergency/nrf/nrf-glossary.pdf accessed 30_01_2013	Yes	x	x
3N	Search & Rescue and Disaster Glossary and Acronyms United States Search and Rescue Task Force www.ussartf.org/glossary_acronyms.htm accessed 30_01_2014	Yes	x	x
3O	NOTE: Former Reference 3O (printed copy in folder) is now called Reference 3A_OLD as it is from 2009 DIMRC listing, not 2012 or 2014 2009 Emergency Management Program Guidebook. Chapter 14 – Supplemental Information. Glossary and Acronyms United States Department of Veterans Affairs Note: in 2012 listing, not 2014 www.va.gov/VHAEMERGENCYMANAGEMENT/Documents/EMPG_Mar-2011.pdf accessed 30_01_2014	Yes	x	NO
3A_NEW	DHS (Department of Homeland Security) Risk Lexicon. U. S. Department of Homeland Security www.dhs.gov/xlibrary/assets/dhs-risk-lexicon-2010.pdf accessed 28_01_2014 List of terms printed.	Yes	NO	x
3B_NEW	Guide to Emergency Management and Related Terms, definitions, Concept, Acronyms, Organizations, Programs, Guidance, Executive Orders & Legislation Federal Emergency Management Agency, U.S. Department of Homeland Security Not printed as 1366 pages long. Blanchard, B W: 2008, Guide to emergency management and related terms, definitions, concepts, acronyms, organizations, programs, guidance, executive orders & legislation. Available at http://training.fema.gov/EMIWeb/edu/docs/terms%20and%20definitions/Terms%20and%20Definitions.pdf Accessed 28 January 2014.	Yes	NO	x
3A_OLD	This glossary was printed in 2009 and in Folder of DIMRC files (called Reference 3O). It was then renamed Reference 3O_OLD then changed to Reference 3A_OLD for consistency in the naming. National Coastal Services Centre. Selected Emergency Management-Related Terms and Definitions, Blanchard, B. W. www.hsc.usf.edu/nocms/publichealth/cdmha/toolkit_dm/GLOSSARY/NOOA--Vulnerability%20Assessment%20Techniques%20and%20Applications.htm downloaded 11_02_2014 Note: It has many terms the same as 3B_NEW, but is not identical.	Yes	NO	NO
4: Earthquakes				
4A	Earthquake Glossary of Terms University of Utah Seismograph Stations www.seis.utah.edu/qfacts/glossary.shtml accessed 30_01_2014	Yes	x	x
4B	Earthquakes Hazards Program – Visual Glossary. US Geological Survey Note: In 2012 listing, not 2014 Google search (30_01_2014) brought up this webpage earthquake.usgs.gov/learn/glossary/ which is same link for Reference 4A_NEW. Reference 4A_NEW is a duplicate of Reference 4B. Use Reference 4B only.	Yes	x	NO

4c	Glossary of Earthquake and Related Terminology U.S. Geological Survey, U.S. Department of the Interior vulcan.wr.usgs.gov/Glossary/Seismicity/earthquake_terminology.html accessed 30/01/2014	Yes	x	x
4A_ NEW	Earthquake Glossary U.S. Geological Survey, U.S. Department of the Interior earthquake.usgs.gov/learn/glossary/ accessed 30_01_2014 Note: this is the same webpage accessed when searching for Reference 4B. 4B to be used	see 4B	NO	x
5: Emergency Preparedness and Disaster Reduction				
5A	Alphabetic List of MeSH Terms Used in Indexing Disaster-Related Journal Articles Disaster Information Management Research Center, U.S. National Library of Medicine sis.nlm.nih.gov/dimrc/mesh_disaster.html accessed 30_01_2014 Note: this reference was originally known as Reference 4. Reference 4 now incorporates all DIMRC glossaries, including MeSH terms.	Yes	x	x
5B	Components of Risk. A Comparative Glossary Institute for Environment and Human Security, United Nations University Note: This reference was also known as Reference 35 Thywissen, K: 2006, Components of Risk. A Comparative Glossary. Available at www.ehs.unu.edu/file/get/8335.pdf Accessed 2 November 2009.27/06/2019	Yes	x	x
5C	Disaster Nomenclature – A Functional Impact Approach: The PICE System Koenig KL, Dinerman N, Kuehl AE www.ncbi.nlm.nih.gov/pubmed/8816190 accessed 30_01_2014	Yes	x	x
5D	Glossary and Acronyms Used Be Safe Net www.besafenet.net/14,0,0,0,2-Glossary.aspx accessed 30_01_2014	Yes	x	x
5E	Ready America Glossary, Department of Homeland Security Note: reference is in 2012 listing, not 2014. www.getreadyforflu.org/new_pg_glossary.htm (accessed 30_01_2014)	Yes	x	NO
5F	UNISDR Terminology on Disaster Risk Reduction United Nations, International Strategy for Disaster Reduction www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf accessed 30_01_2014 Note: this was also known as Reference 5	Yes	x	x
6: Environmental Terminology				
6A	Environmental Terminology and Discovery Service European Environment Agency glossary.eea.europa.eu/ accessed 30_01_2014	links to letters, or access online	x	x
7: Humanitarian Relief				
7A	Glossary of Humanitarian Terms. ReliefWeb www.who.int/hac/about/reliefweb-aug2008.pdf accessed 30_01_2014 Note: This glossary is also known as Reference 38	Yes	x	x
8: Infectious Diseases and Bioterrorism (includes microbes, pathogens and general biology glossaries)				
8A	Chemical/Biological/Radiological Incident Handbook. Section H. Glossary of Biological Terms Central Intelligence Agency www.cia.gov/library/reports/general-reports-1/cbr_handbook/cbrbook.htm#9 accessed 30_01_2014 Section H is Glossary of Biological Terms. Document also includes a glossary of radiological terms (Reference 11A) and chemical terms	Yes	x	x
8B = 8C	Flu.gov Glossary, Department of Health and Human Services Note: reference is in 2012 listing, not 2014. Did Google search flu.gov glossary and got following webpage www.flu.gov/planning-preparedness/federal/pandemic-influenza-implementation.pdf accessed 30_01_2014, Appendix B, pp. 201-210 Note: This is same as Reference 8A_NEW (use 8B only)	Yes	x	NO
8C = 8B	Microbes – Glossary of Terms National Institute of Allergy and Infectious Diseases, National Institutes of Health www.niaid.nih.gov/topics/microbes/pages/glossary.aspx accessed 30_01_2014	Yes	x	x

8A_ NEW = 8C	National Strategy for Pandemic Influenza Implementation Plan. Appendix B – Glossary of Terms and Definition of Terms (2006) Homeland Security Council, Washington, USA www.flu.gov/planning-preparedness/federal/pandemic-influenza-implementation.pdf accessed 18 11 2014, (first accessed 10 12 2013) Appendix B, pp. 201-210 Note: this is the same document as Reference 8B (it just has a different title/ institution in the respective 2012/2014 listings). 8B to be used	see 8B	NO	x
9: Mental Health				
9A	Developing Cultural Competence in Disaster Mental Health Programs: Guiding Principles and Recommendations. Appendix E: Glossary Substance Abuse and Mental Health Services Administration, U.S. Department of Health and Human Services store.samhsa.gov/shin/content/SMA03-3828/SMA03-3828.pdf accessed 30_01_2014	Yes	x	x
10: Public Health (Note: 2014 does not include a listing for Public Health)				
10A	Preparedness Glossary, Yale School of Public Health Note: this reference listed in 2012, not 2014. The Yale Center for Public Health Preparedness does not appear to exist anymore. Note: was previously known also as Reference 24.	Yes	x	NO
10_NEW: Pharmaceutical Supplies				
10A_ NEW	Terminology RxResponse www.rxresponse.org/resource-center/terminology accessed 30_01_2014	Yes	NO	x
11: Radiation				
11A	Chemical/Biological/Radiological Incident Handbook. Section I. Glossary of Radiological Terms Central Intelligence Agency /www.cia.gov/library/reports/general-reports-1/cbr_handbook/cbrbook.htm#10 accessed 30_01_2014	Yes	x	x
11B	Glossary of Radiological Terms, Centers for Disease Control and Prevention Note: "Glossary of Radiological Terms" in 2012 listing, not 2014. Google search found this webpage: http://emergency.cdc.gov/radiation/glossary.asp accessed 30_01_2014 Note: In 2014 Centers for Disease Control and Prevention has listing under the title "Radiation Emergencies: Radiation Dictionary". However, the link to this brings up the same web-page as above. Therefore, not listed as separate glossary.	Yes	Listed as "Glossary of Radiological Terms"	x
11C	IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection 2007 Edition International Atomic Energy Agency www-pub.iaea.org/MTCD/publications/PDF/Pub1290_web.pdf accessed 30_01_2014	Yes	x	x
11D	Radiation Emergency Medical Management (REMM) Dictionary of Radiation Terms U.S. National Library of Medicine, National Institutes of Health www.remm.nlm.gov/dictionary.htm accessed 30_01_2014	Yes	x	x
11E	Radiation Glossary U.S. Environmental Protection Agency www.epa.gov/radiation/glossary/index.html accessed 30_01_2014	Access online	x	x
11F	Radiation Glossary (originally listed in 2012 as "Radiation Glossary of Terms) Harvard University www.ehs.harvard.edu/sites/ehs.harvard.edu/files/radiation_glossary.pdf accessed 30_01_2014	Yes	X	X
11G	Radiation Terms and Definitions Health Physics Society hps.org/publicinformation/radterms/ accessed 30_01_2014	Yes	X	X
11H	Full-Text Glossary (listed in 2012 as U.S. Nuclear Regulatory Commission Full-Text Glossary) U.S. Nuclear Regulatory Commission www.nrc.gov/reading-rm/basic-ref/glossary/full-text.html accessed 30_01_2014	Yes	X	X

12: Storms, Hurricanes and Floods				
12A	Comprehensive Glossary of Weather Terms for Storm Spotters National Oceanic and Atmospheric Administration, U.S. Department of Commerce www.srh.noaa.gov/oun/?n=spotterglossary accessed 30_01_2014	Access online	X	X
12B	Glossary of Flood Terms Association of [San Francisco] Bay Area Governments www.abag.ca.gov/bayarea/eqmaps/eqfloods/fglossry.html accessed 30_01_2014	Yes	X	X
12C	Glossary of Flooding Terms Flood Control District of Maricopa County, Arizona www.fcd.maricopa.gov/Education/Glossary.aspx?CHAR=%25 accessed 30_01_2014	Yes	X	X
12D	Glossary of Frequently Used FEMA/NFIP Terms – Acronyms Louisiana Sea Grant www.laseagrant.org/pdfs/FEMA_Glossary.pdf accessed 30_01_2014	Yes	X	X
12E	Glossary of Hurricane Terms Canadian Hurricane Centre, Environment Canada www.ec.gc.ca/ouragans-hurricanes/default.asp?lang=En&n=2A2FBAF1-1	Yes	X	X
12F	Glossary of National Hurricane Center Terms National Oceanic and Atmospheric Administration, U.S. Department of Commerce www.nhc.noaa.gov/aboutgloss.shtml accessed 30_01_2014	Yes	X	X
12G	Glossary of Tropical Cyclone Terms National Oceanic and Atmospheric Administration, U.S. Department of Commerce www.prh.noaa.gov/cphc/pages/glossary.php accessed 30_01_2014	Yes	X	X
12H	Water Science Glossary of Terms U.S. Geological Survey, U.S. Department of the Interior ga.water.usgs.gov/edu/dictionary.html accessed 30_01_2014	Yes	X	X
13: Tides, Currants, and Tsunamis				
13A	Glossary of Some Terms Related to Rip Currents National Oceanic and Atmospheric Administration, U.S. Department of Commerce www.srh.noaa.gov/ripcurrents/glossary.shtml accessed 30_01_2014	Yes	X	X
13B	Tide and Current Glossary National Oceanic and Atmospheric Administration, U.S. Department of Commerce co-ops.nos.noaa.gov/publications/glossary2.pdf accessed 31_01_2014	Yes	X	X
13C	Tsunami Glossary. International Tsunami Information Center Note: link did not bring up webpage (message 'Article not Found'). However, a Google search with the following terms (Tsunami Glossary International Tsunami Information Center), brought up the following webpage itic.ioc-unesco.org/images/stories/about_tsunamis/tsunami_glossary/tsunami_glossary_en_2013_web.pdf accessed 06_03_2014 Note: Same as Reference 36.	Yes	X	X
14: Volcanoes				
14A	Glossary of Volcano and Related Terminology U.S. Geological Survey, U.S. Department of the Interior vulcan.wr.usgs.gov/Glossary/volcano_terminology.html accessed 30_01_2014	Yes		
15: Wildfires				
15A	Assistance to Firefighters Grant Program. Glossary of Terms Federal Emergency Management Agency, U.S. Department of Homeland Security www.fema.gov/rules-tools/glossary-terms accessed 30_01_2014	Yes		
15B	Fire and Wildfire Glossary. Virginia Department of Forestry Note: In 2012 listing, not 2014.	Yes	X	NO
15C	Glossary of Wildland Fire Terminology National Wildfire Coordinating Group www.nwcg.gov/pms/pubs/glossary/pms205.pdf accessed 30_01_2014	Yes	X	X
15D	Wildland Firefighting Glossary, Terms & Definitions Penn Hills Wildland Crew, Pennsylvania Bureau of Forestry Division of Forest Fire Protection home.epix.net/~nooyawka/glossary.htm accessed 30_01_2014	Yes	X	X

ANNEX 5

UN funds, programmes, specialised agencies and others from UNDRR (2017)

Prepared by Lidia Mayner and Virginia Murray in June 2019.

Owner	Glossary name / Author	Year	Topics covered
CEB	The Chief Executives Board		
	Glossary	2016	www.unsceb.org/content/glossary
	Financial terminology	1969 2016	www.unsceb.org/content/financial-terminology
	Web site lists 7 glossaries but only within the document not a glossary		www.unsceb.org/search/node/glossary
CTBTO	Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization		
	Web site lists documents that contain 'Map *Glossary'* but no glossary found.		www.ctbto.org/search
FAO	Food and Agriculture Organization of the United Nations		
	FAO term Portal Glossary on Right to Food The right of food - portal	2009	www.fao.org/faoterm www.fao.org/3/a-as994t.pdf www.fao.org/right-to-food/areas-of-work/en/
	Aquatic Sciences and Fisheries Thesaurus Fisheries & Aquaculture Dept (ASFIS)	1986 now 2009	www.fao.org/tempref/docrep/fao/011/k5032e/k5032e.pdf
	FAO Glossary on Organic Agriculture Glossary	May 2007	www.fao.org/fileadmin/templates/organicag/files/Glossary_on_Organic_Agriculture.pdf enhance food security, rural livelihoods and economic resilience and environmental integrity www.fao.org/organicag/oag-glossary/en/
	Other glossaries from FAO - URL for listing of glossaries		www.fao.org/search/en/?cx=018170620143701104933%3Aqq82jsfba7w&q=glossary&cof=FORID%3A9&siteurl=www.fao.org%2Fhome%2Fen%2F&ref=www.google.com.au%2F&ss=3486j2163150j10 NOTE also another glossary under Fisheries Glossary but the same as above. Glossary of biotechnology for food and agriculture – only terms www.fao.org/3/y2775e/y2775e07.htm GLOSSARY – only terms www.fao.org/docrep/005/y3427e/y3427e0c.htm

IAEA	International Atomic Energy Agency		
	Web site overall list		www.iaea.org/search/google/glossary
	IAEA Safety Glossary	2000 2007 now 2018	harmonize terminology and usage in the IAEA safety standards www-pub.iaea.org/MTCD/Publications/PDF/PUB1830_web.pdf
	IAEA Safeguards Glossary	2001	www-pub.iaea.org/MTCD/Publications/PDF/nvs-3-cd/Start.pdf
	Nuclear security glossary | IAEA	Nov 2015 V1.3	www.iaea.org/sites/default/files/18/08/nuclear-security-series-glossary-v1-3.pdf The Nuclear Security Series Glossary is a compilation of the terms and definitions used in guidance publications issued in the Nuclear Security Series
	Radioactive waste management glossary	2003	www-pub.iaea.org/MTCD/Publications/PDF/Pub1155_web.pdf “to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world”
	Glossary of Select Depositary Terms	1969	www.iaea.org/resources/legal/treaties/glossary-of-select-depositary-terms treaties.un.org/
IFAD	International Fund for Agricultural Development		
	Indigenous Peoples Glossary (English, French, Spanish) - second edition	2018	www.ifad.org/en/web/knowledge/publication/asset/39598160 www.ifad.org/documents/38714170/39144386/Indigenous+Peoples+Glossary.pdf/0509879e-54fc-477c-a465-aae53321ed34
ILO	International Labour Organization		
	Occupational Safety and Health Glossary Au: International Occupational Safety and Health Information Centre (CIS)	1993	Book 92-9016-002-0[ISBN] www.ilo.org/global/topics/safety-and-health-at-work/resources-library/publications/WCMS_113126/lang--en/index.htm www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/--safework/documents/publication/wcms_113126.pdf
IMO	International Maritime Organization		
	List of glossaries TRS LRIT Glossary (Only terms) LRIT Glossary for document MSC 83/6/2	 2009 2008	www.imo.org/en/_layouts/15/osssearchresults.aspx?u=http%3A%2F%2Fwww%2Eimo%2Eorg%2Fen&k=glossary www.imo.org/en/OurWork/Conferences/Documents/LRIT GLOSSARY (E,F,S).doc www.imo.org/en/OurWork/Conferences/Documents/LRIT Glossary for document MSC 83.6.2.doc
	Risk assessment and management framework for CO2 sequestration Has glossary at end relevant to hazard	2013	www.imo.org/en/OurWork/Environment/LCLP/EmergingIssues/CCS/Documents/CO2SEQUESTRATIONRAMF2006.doc
IOM	International Organization for Migration		
	Key Migration Terms		www.iom.int/key-migration-terms
ITU	International Telecommunication Union		
	Glossary	2018	www.itu-ilibrary.org/science-and-technology/digital-skills-toolkit_pub/8110cd77-9f7d9051-en
	ITU-T D.263 (05/2019): Costs, charges and competition for mobile financial services (MFSs) ITU-T Q.5050 (03/2019): Framework for solutions to combat counterfeit ICT devices ITU-T X.1277 (11/2018): Universal authentication framework LS/o on the work of ITU-T SG3 in relation to the Digital Financial Services (DFS)	2019 2019 2018 2018	All state have glossaries but no access

UNAIDS	Joint United Nations Programme on HIV/AIDS		
	Guidelines for using HIV testing technologies in surveillance: selection, evaluation and implementation	2001	www.unaids.org/en/resources/documents/2001/20010614_jc602-hivsurvguidel_en.pdf pdf of document www.unaids.org/sites/default/files/media_asset/jc602-hivsurvguidel_en_0.pdf
	NSP Full Document FINAL (pdf file)		www.unaids.org/en/file/112040/download?token=edigx--8
UNCCD	United Nations Convention to Combat Desertification		
	Two listed but could not see any glossaries within documents		knowledge.unccd.int/search?text=glossary&f%5B0%5D=type%3Aunccd_content
UNCTAD	United Nations Conference on Trade and Development		
	Competition Glossary AU: Philippe Brusick, UNCTAD MENA Programme Expert.	2016	This glossary of competition law and policy terminology unctad.org/en/PublicationsLibrary/ditcclp2016d4_en.pdf
	DEBT AND DMFAS GLOSSARY	2000	unctad.org/en/Docs/pogiddmfasm3r3.en.pdf
	Glossary	2018	unctad.org/meetings/en/Contribution/stat2018_em_iff0620_Glossary.pdf
	Glossary of terms and definitions	2011	unctad.org/en/Pages/GDS/Debt%20and%20Development%20Finance/Glossary-of-terms-and-definitions.aspx List of publications on DMFAS – not useful
	KEY TERMS AND CONCEPTS IN iias: A GLOSSARY	2004	unctad.org/en/Docs/iteiit20042_en.pdf
DESA OR UN DESA	United Nations Department of Economic and Social Affairs		
	Glossary – site under construction		www.unpan.org/Install/UnderConstruction.htm
	Index of /documents/organized-crime/Glossaries		www.unodc.org/documents/organized-crime/Glossaries/
	UN Comtrade Glossary 5 of these glossaries only 1 opens	2019	comtrade.un.org/db/mr/rfGlossaryList.aspx
UNDOCO	United Nations Development Operations Coordination Office		
	Goes to Prevention Web site or UNDOCO web site goes to UN ESCAP - No glossary found for UNDOCO		
	Sustainable transport pricing and charges	2001	Glossary at front www.unescap.org/sites/default/files/pricing_fulltext.pdf
	Guidelines for setting and monitoring the goals and targets of the Regional Action Framework on Civil Registration and Vital Statistics in Asia and the Pacific	2015	www.unescap.org/sites/default/files/CRVS_monitoring_guidelines_Version_1.pdf
	The Asia-Pacific Trade And Investment Agreements Database (APTIAD)		www.unescap.org/sites/default/files/APITAD%20guide.pdf artnet.unescap.org/databases/aptiad-glossary
UNDP	United Nations Development Programme		
	Lexicon of Electoral Terminology Only says Web based programme	2014	www.undp.org/content/undp/en/home/librarypage/democratic-governance/electoral_systemsandprocesses/lexicon-of-electoral-terminology.html
	Disaster-Conflict Interface	2011	www.undp.org/content/undp/en/home/librarypage/crisis-prevention-and-recovery/DisasterConflictInterface.html
	Reducing Disaster Risk, A Challenge for Development Chpt 2 is on Hazards + glossary at end	2004 or 2012	www.undp.org/content/undp/en/home/librarypage/crisis-prevention-and-recovery/reducing-disaster-risk--a-challenge-for-development.html

UNECE	United Nations Economic Commission for Europe		
	Many glossaries listed see Web site list		www.unece.org/unece/search?q=glossary&op=Search
	Glossary for Transport Statistics	2009	www.unece.org/trans/main/wp6/publications/stats_glossary.html
	Glossaries – Web site lists 5 – only 4 open		tfig.unece.org/contents/glossary.htm
	Glossary – International Trade Financing	2017	wordstodeeds.com/2017/11/28/glossary-international-trade-financing/
	Trade Facilitation Terms: An English - Russian Glossary	2012	www.unece.org/fileadmin/DAM/trade/Publications/ECE-TRADE-377EngRus.pdf
	WTO Glossary		www.wto.org/english/thewto_e/glossary_e/glossary_e.htm
	Glossary of international customs terms	2018	www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/instruments-and-tools/tools/glossary-of-international-customs-terms/glossary-of-international-customs-terms.pdf
	Glossary of Market Surveillance Terms		www.unece.org/tradewelcome/tradepublications/wp6/2011/glossary-of-market-surveillance-terms.html
	Glossary of terms for use with unece standards on fresh fruit and vegetables	2016	www.unece.org/fileadmin/DAM/trade/agr/standard/fresh/StandardLayout/Glossary_FFV_2016_E.pdf
UNEP	United Nations Environment Programme		
	Glossary of terms for negotiators of multilateral environmental agreements (on climate change)		www.unenvironment.org/resources/report/glossary-terms-negotiators-multilateral-environmental-agreements wedocs.unep.org/bitstream/handle/20.500.11822/7569/-Glossary%20of%20Terms%20for%20Negotiators%20of%20Multilateral%20Environmental%20Agreements-2007762.pdf?sequence=3&amp%3BisAllowed=
	Technical Presentations: Glossary		www.unenvironment.org/resources/report/technical-presentations-glossary could not download PP presentation
	Glossary of Terms on Storage and Disposal		www.unenvironment.org/resources/report/glossary-terms-storage-and-disposal Mercury Storage and Disposal – PP presentation
	Glossary Business Model		www.unenvironment.org/explore-topics/resource-efficiency/why-does-resource-efficiency-matter/glossary
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific		
	SUSTAINABLE TRANSPORT PRICING AND CHARGES Principles and Issues	2001	Glossary at front www.unescap.org/sites/default/files/pricing_fulltext.pdf
	The Economic Regulation of Transport Infrastructure Facilities and Services -- Principles and Issues, 2001	2001	www.unescap.org/resources/economic-regulation-transport-infrastructure-facilities-and-services-principles-and-issues
	Guidelines for setting and monitoring the goals and targets of the Regional Action Framework on Civil Registration and Vital Statistics in Asia and the Pacific	2015	www.unescap.org/sites/default/files/CRVS_monitoring_guidelines_Version_1.pdf
	THE ASIA-PACIFIC TRADE AND INVESTMENT AGREEMENTS DATABASE (APTIAD)	2016	www.unescap.org/sites/default/files/APITAD%20guide.pdf artnet.unescap.org/databases/aptiad-glossary
	Guidelines for developing eco-efficient and socially inclusive infrastructures: Complete version for planners	2014	www.unescap.org/resources/guidelines-developing-eco-efficient-and-socially-inclusive-infrastructures-complete www.unescap.org/sites/default/files/Guides%20for%20developing%20eco%20efficient%20infra_full.pdf

UNESCO	United Nations Educational, Scientific and Cultural Organization		
	SOCIAL AND HUMAN SCIENCES Glossary of Migration Related Terms		www.unesco.org/new/en/social-and-human-sciences/themes/international-migration/glossary/
	UNESCO Institute for Statistics (UIS) Data for SDG		uis.unesco.org/en/glossary
	Glossary of glacier mass balance and related terms Author: International Association of Cryospheric Sciences	2011	unesdoc.unesco.org/ark:/48223/pf0000192525
	Information Document Glossary of World Heritage Terms	1996	whc.unesco.org/archive/gloss96.htm
	Internet Governance Glossary (IGG)		en.unesco.org/internet-governance-glossary
	TVETipedia glossary		unevoc.unesco.org/go.php?q=TVETipedia+Glossary+A-Z
	Glossary of Adult Learning in Europe	1999	uil.unesco.org/adult-education/glossary-adult-learning-europe https://unesdoc.unesco.org/ark:/48223/pf0000128815
	Glossary on corruption in education | ETICO - Unesco IIEP		etico.iiep.unesco.org/en/glossary
UNFCCC	United Nations Framework Convention on Climate Change		
	unfccc.int/gcse?q=glossary		
	Glossary of climate change acronyms and term		unfccc.int/process-and-meetings/the-convention/glossary-of-climate-change-acronyms-and-terms
	UNFCCC Glossary		unfccc.int/resource/cd_roms/na1/ghg_inventories/english/8_glossary/Glossary.htm
	Glossary CDM terms	2009	cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf
UNFPA	United Nations Population Fund		
	Policy on Personnel: General Information	2016	www.unfpa.org/sites/default/files/admin-resource/DHR_Glossary.pdf
UN-HABITAT	United Nations Human Settlements Programme		
	Could not find a glossary		
UNHCR	United Nations High Commissioner for Refugees		
	NOTE 388 results under glossary		www.unhcr.org/en-au/search?query=glossary
	UNHCR Handbook for the Protection of Women and Girls: Glossary	2008	www.unhcr.org/en-au/protection/women/47cfad9e2/unhcr-handbook-protection-women-girls-glossary.html?query=glossary
	UNHCR Resettlement Handbook: Glossary	2011	www.unhcr.org/en-au/protection/resettlement/3d46515d4/unhcr-resettlement-handbook-glossary.html?query=glossary
	The 10-Point Plan in action: General References and Glossary	2012	www.unhcr.org/en-au/protection/migration/50a4c2789/10-point-plan-action-general-references-glossary.html?query=glossary
	Handbook for Self-reliance: Glossary and abbreviations	2005	www.unhcr.org/en-au/publications/operations/44bf3fc52/handbook-self-reliance-glossary-abbreviations.html?query=glossary
UNICEF	United Nations Children Fund		
	Glossary		www.unicef.org/sowc96/glossary.htm
	NUTRITION GLOSSARY A resource for communicators	2012	www.unicef.org/tokyo/jp/Nutrition_Glossary.pdf
	Glossary (IRC site)		www.unicef-irc.org/php/Thesaurus/Glossary_Display.php?GLOSS_ID=397&PoPuP=No
UNIDO	United Nations Industrial Development Organization		
	Could not find glossary		

UNISDR or UNDRR	United Nations Office for Disaster Risk Reduction		
	Web site lists 337 results for glossary		
	5 Other Glossary eng.qxd		www.unisdr.org/2003/campaign/english/5_Glossary_eng.pdf
	Terminology - UNDRR		www.unisdr.org/we/inform/terminology
	UNISDR terminology on disaster risk reduction	2009	www.unisdr.org/we/inform/publications/7817
UNITAR	United Nations Institute for Training and Research		
	New training manual on climate change for desk-officers and other relevant stakeholders in Uganda	2017	unitar.org/about/news-stories/news/new-training-manual-climate-change-desk-officers-and-other-relevant-stakeholders-uganda Glossary at the end
OCHA OR UN OCHA	United Nations Office for the Coordination of Humanitarian Affairs		
	Humanitarian Access Glossary of terms	2011	www.unocha.org/themes/humanitarian-access https://www.unocha.org/sites/unocha/files/dms/Documents/AccessMechanisms.pdf
OHCHR	United Nations Office of the High Commissioner for Human Rights		
	Human Rights Treaty Bodies - Glossary of technical terms related to the treaty bodies		www.ohchr.org/EN/HRBodies/Pages/TBGlossary.aspx
OHRLLS	United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States		
	Could not find a glossary		
UNOOSA	United Nations Office for Outer Space Affairs		
	ICG Glossary of GNSS Terms AU: Thomas vonDeak	2008	www.unoosa.org/documents/pdf/icg/activities/2008/icg3/40.pdf
	Safety Framework for Nuclear Power Source Applications in Outer Space	2013	Last page has glossary www.unoosa.org/pdf/publications/iaea-nps-sfrmwrkE.pdf
UNOPS	United Nations Office for Project Services		
	Could not find a glossary		
	United Nations Regional Commissions New York		
	Trade Facilitation Terms: An English-Russian Glossary		www.regionalcommissions.org/?s=glossary&x=9&y=6 www.unece.org/fileadmin/DAM/trade/Publications/ECE-TRADE-377EngRus.pdf
UNRWA	United Nations Relief and Works Agency for Palestine Refugees		
	BMU | glossary Two other glossaries listed one referred back to BMU other not glossary	2012	www.unrwa.org/newsroom/features/bmu-glossary www.unrwa.org/search/google/glossary
UNU	United Nations University		
	Could not find a glossary		
UNV	United Nations Volunteers		
	Could not find a glossary		
UN-WOMEN	United Nations Entity for Gender Equality and the Empowerment of Women		
	Turning Promises into Action: Gender Equality in the 2030 Agenda for Sustainable Development	2018	www.unwomen.org/en/digital-library/publications/2018/2/gender-equality-in-the-2030-agenda-for-sustainable-development-2018

UNWTO	United Nations World Tourism Organization		
	Understanding tourism: basic glossary	2009	cf.cdn.unwto.org/sites/all/files/docpdf/glossaryenrev.pdf Linked to the SDG's see www2.unwto.org/
UPU	Universal Postal Union		
	No glossary found		
WFP	World Food Programme		
	Same glossaries as FAO		
			www1.wfp.org/publications/glossary
WHO	World Health Organization		

3014 results when I asked for glossary on its Web site
www.who.int/search?query=glossary&page=1&pagesize=10&sortdir=desc&sort=relevance&default=AND&f.Countries.size=100&f.Lang.filter=en&f.RegionalSites.size=100&f.Topics.size=100&f.contenttype.size=100&f.doctype.size=101&facet.field=RegionalSites&facet.field=Topics&facet.field=doctype&facet.field=Countries&facet.field=contenttype&facet.field=Lang&tune=true&tune.0=3&tune.1=2&tune.2=2&tune.3=3&tune.4=180&tune.5=75&cname=campaigns&cname=emronew&cname=who&cname=euro&cname=afro&cname=amro&cname=pmnch&cname=searo&cname=workforcealliance&cname=wpro

WMO	World Meteorological Organization		
	International Glossary of Hydrology	2012	WMO-No 385 library.wmo.int/pmb_ged/wmo_385-2012.pdf
	Climate change: Key terms in 23 languages Au: European Commission	2011	bookshop.europa.eu/is-bin/INTERSHOP.enfinity/WFS/EU-Bookshop-Site/en_GB/
	Glossary of terms used in agrometeorology	1990	library.wmo.int/pmb_ged/wmo-td_391_en.pdf
	Glossary of scientific and technical meteorological terminology: English-Arabic	1987	library.wmo.int/pmb_ged/wmo-td_135.pdf
	National Weather Service Glossary Au: National Oceanic and Atmospheric Administration	2009	w1.weather.gov/glossary/
	Glossary of Meteorology AU: American Meteorological Society (United States)	2nd Ed	Weather Glossary for Storm Spotters www.weather.gov/oun/spotterglossary
WORLD BANK GROUP	The World Bank		
WBG	World Bank Group		
	List		www.worldbank.org/en/search?q=glossary
	Glossary | DataBank (Metadata glossary)		databank.banquemondiale.org/metadataglossary/all/series
	Glossary of Terms - ifc.org		www.ifc.org/wps/wcm/connect/9a9464804885598c8364d36a6515bb18/Glossary+of+Terms.pdf?MOD=AJPERES
UNFCCC	United Nations Framework Convention on Climate Change		
	List of glossaries (X10)		unfccc.int/gcse?q=Glossary

ANNEX 6

Initial hazard list

Hazard type	Hazard cluster	Specific hazard
METEOROLOGICAL and HYDROLOGICAL	Convective-related	Downburst
METEOROLOGICAL and HYDROLOGICAL	Convective-related	Lightning (Electrical storm)
METEOROLOGICAL and HYDROLOGICAL	Convective-related	Thunderstorm
METEOROLOGICAL and HYDROLOGICAL	Flood	Coastal flood
METEOROLOGICAL and HYDROLOGICAL	Flood	Estuarine flood
METEOROLOGICAL and HYDROLOGICAL	Flood	Flash flood
METEOROLOGICAL and HYDROLOGICAL	Flood	Fluvial (riverine flood)
METEOROLOGICAL and HYDROLOGICAL	Flood	Groundwater flood
METEOROLOGICAL and HYDROLOGICAL	Flood	Ice-jam flood including debris
METEOROLOGICAL and HYDROLOGICAL	Flood	Ponding flood
METEOROLOGICAL and HYDROLOGICAL	Flood	Snowmelt flood
METEOROLOGICAL and HYDROLOGICAL	Flood	Surface water flooding
METEOROLOGICAL and HYDROLOGICAL	Flood	Glacial lake outburst flood
METEOROLOGICAL and HYDROLOGICAL	Lithometeors	Black carbon (Brown clouds)
METEOROLOGICAL and HYDROLOGICAL	Lithometeors	Dust storm or Sandstorm
METEOROLOGICAL and HYDROLOGICAL	Lithometeors	Fog
METEOROLOGICAL and HYDROLOGICAL	Lithometeors	Haze
METEOROLOGICAL and HYDROLOGICAL	Lithometeors	Polluted air
METEOROLOGICAL and HYDROLOGICAL	Lithometeors	Sand haze
METEOROLOGICAL and HYDROLOGICAL	Lithometeors	Smoke
METEOROLOGICAL and HYDROLOGICAL	Marine	Ocean acidification
METEOROLOGICAL and HYDROLOGICAL	Marine	Rogue wave
METEOROLOGICAL and HYDROLOGICAL	Marine	Sea water intrusion

METEOROLOGICAL and HYDROLOGICAL	Marine	Sea ice (ice bergs)
METEOROLOGICAL and HYDROLOGICAL	Marine	Ice flow
METEOROLOGICAL and HYDROLOGICAL	Marine	Seiche
METEOROLOGICAL and HYDROLOGICAL	Marine	Storm surge
METEOROLOGICAL and HYDROLOGICAL	Marine	Storm tides
METEOROLOGICAL and HYDROLOGICAL	Marine	Tsunami
METEOROLOGICAL and HYDROLOGICAL	Pressure-related	Depression or cyclone (low pressure area)
METEOROLOGICAL and HYDROLOGICAL	Pressure-related	Extra-tropical cyclone
METEOROLOGICAL and HYDROLOGICAL	Pressure-related	Sub-tropical cyclone
METEOROLOGICAL and HYDROLOGICAL	Precipitation-related	Acid rain
METEOROLOGICAL and HYDROLOGICAL	Precipitation-related	Blizzard
METEOROLOGICAL and HYDROLOGICAL	Precipitation-related	Drought
METEOROLOGICAL and HYDROLOGICAL	Precipitation-related	Hail
METEOROLOGICAL and HYDROLOGICAL	Precipitation-related	Ice storm
METEOROLOGICAL and HYDROLOGICAL	Precipitation-related	Snow / Ice
METEOROLOGICAL and HYDROLOGICAL	Precipitation-related	Snow storm
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Cold wave
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Dzud
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Freeze
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Frost (hoar frost)
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Freezing rain
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Glaze
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Ground frost
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Heatwave
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Icing (including ice)
METEOROLOGICAL and HYDROLOGICAL	Temperature-related	Thaw
METEOROLOGICAL and HYDROLOGICAL	Terrestrial	Avalanche

METEOROLOGICAL and HYDROLOGICAL	Terrestrial	Mud flow
METEOROLOGICAL and HYDROLOGICAL	Terrestrial	Rock slide
METEOROLOGICAL and HYDROLOGICAL	Wind-related	Derecho
METEOROLOGICAL and HYDROLOGICAL	Wind-related	Gale (strong gale)
METEOROLOGICAL and HYDROLOGICAL	Wind-related	Squall
METEOROLOGICAL and HYDROLOGICAL	Wind-related	Subtropical storm
METEOROLOGICAL and HYDROLOGICAL	Wind-related	Tropical cyclone (cyclonic wind, rain [storm] surge)
METEOROLOGICAL and HYDROLOGICAL	Wind-related	Tropical storm
METEOROLOGICAL and HYDROLOGICAL	Wind-related	Tornado
METEOROLOGICAL and HYDROLOGICAL	Wind-related	Wind
EXTRATERRESTRIAL	Extraterrestrial	Airburst
EXTRATERRESTRIAL	Extraterrestrial	Geomagnetic storm (including energetic particles related to space weather, and solar flare radio blackout [R Scale])
EXTRATERRESTRIAL	Extraterrestrial	UV radiation
EXTRATERRESTRIAL	Extraterrestrial	Meteor impact
EXTRATERRESTRIAL	Extraterrestrial	Ionospheric storms
EXTRATERRESTRIAL	Extraterrestrial	Radio blackout
EXTRATERRESTRIAL	Extraterrestrial	Solar storm (= Solar radiation storm [S Scale])
EXTRATERRESTRIAL	Extraterrestrial	Space hazard / accident
EXTRATERRESTRIAL	Extraterrestrial	near-Earth object (meteorite)
GEOHAZARD	Seismogenic (earthquakes)	Earthquake
GEOHAZARD	Seismogenic (earthquakes)	Ground shaking (earthquake)
GEOHAZARD	Seismogenic (earthquakes)	Liquefaction (earthquake trigger)
GEOHAZARD	Seismogenic (earthquakes)	Surface rupture/fissuring
GEOHAZARD	Seismogenic (earthquakes)	Subsidence and uplift, including shoreline change (earthquake trigger)
GEOHAZARD	Seismogenic (earthquakes)	Tsunami (earthquake trigger)
GEOHAZARD	Seismogenic (earthquakes)	Landslide or debris flow (earthquake trigger)
GEOHAZARD	Seismogenic (earthquakes)	Ground gases (earthquake trigger)
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Lava flow
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Ash/ Tephra fall (physical and chemical)
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Ballistics (volcanic)
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Pyroclastic density current
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Debris flow/Lahar/Floods

GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Landslide (volcanic trigger)
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Ground shaking (volcanic earthquake)
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Ground gases (slow release) and Volcanic gases and aerosols (CH4, CO2, H2S, SO2 etc.)
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Tsunami (volcanic trigger)
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Lightning (volcanic trigger)
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Urban fire (during/following volcanic eruption)
GEOHAZARD	Volcanogenic (volcanoes and geothermal)	Subsidence and uplift, including shoreline change (magmatic/volcanic trigger)
GEOHAZARD	Shallow geohazard	Ground shaking (induced earthquake, reservoir fill, dams, cavity collapse, underground explosion, impact, hydrocarbon fields, shale exploration, etc.)
GEOHAZARD	Shallow geohazard	Liquefaction (groundwater trigger)
GEOHAZARD	Shallow geohazard	Ground fissuring
GEOHAZARD	Shallow geohazard	Subsidence and uplift, including shoreline change
GEOHAZARD	Shallow geohazard	Localized subsidence (e.g. due to swelling clays)
GEOHAZARD	Shallow geohazard	Sinkhole
GEOHAZARD	Shallow geohazard	Ground gases (CH4, Rn, etc.)
GEOHAZARD	Shallow geohazard	Riverbank / Coastal erosion
GEOHAZARD	Shallow geohazard	Sand encroachment
GEOHAZARD	Shallow geohazard	Aquifer recharge (systems failure/ outages)
GEOHAZARD	Shallow geohazard	Landslide or Debris flow, including submarine landslides
GEOHAZARD	Shallow geohazard	Rockfall
GEOHAZARD	Shallow geohazard	Landscape creep
GEOHAZARD	Shallow geohazard	Avalanche
GEOHAZARD	Shallow geohazard	Tsunami (submarine landslide trigger)
ENVIRONMENTAL	Environmental degradation	Household air pollution
ENVIRONMENTAL	Environmental degradation	Air pollution (outdoor - result of product combustion and other hazards)
ENVIRONMENTAL	Environmental degradation	Air pollution (outdoor / chronic) - poor air quality
ENVIRONMENTAL	Environmental degradation	Land degradation
ENVIRONMENTAL	Environmental degradation	Soil degradation
ENVIRONMENTAL	Environmental degradation	Runoff/ Non-point source pollution
ENVIRONMENTAL	Environmental degradation	Salinity
ENVIRONMENTAL	Environmental degradation	Biodiversity loss
ENVIRONMENTAL	Environmental degradation (Forestry)	Deforestation
ENVIRONMENTAL	Environmental degradation (Forestry)	Forest declines and diebacks

ENVIRONMENTAL	Environmental degradation (Forestry)	Forest disturbances
ENVIRONMENTAL	Environmental degradation (Forestry)	Forest invasive species
ENVIRONMENTAL	Environmental degradation (Forestry)	Wildfires
ENVIRONMENTAL	Environmental degradation	Desertification
ENVIRONMENTAL	Environmental degradation	Loss of mangroves
ENVIRONMENTAL	Environmental degradation	Wetland loss/degradation
ENVIRONMENTAL	Environmental degradation	Death of coral reefs (includes bleaching)
ENVIRONMENTAL	Environmental degradation	Compressible soils
ENVIRONMENTAL	Environmental degradation	Soil erosion
ENVIRONMENTAL	Environmental degradation	Coastal erosion and shoreline change
ENVIRONMENTAL	Environmental degradation	Permafrost loss
ENVIRONMENTAL	Environmental degradation	Sand mining
ENVIRONMENTAL	Environmental degradation	Sea-level rise
ENVIRONMENTAL	Environmental degradation	Eutrophication
CHEMICAL	Gases	Ammonia
CHEMICAL	Gases	Carbon monoxide
CHEMICAL	Heavy metals	Arsenic
CHEMICAL	Heavy metals	Cadmium
CHEMICAL	Heavy metals	Lead
CHEMICAL	Heavy metals	Mercury
CHEMICAL	Food safety	Levels of contaminants in food and feed
CHEMICAL	Persistent organic pollutants (POPs)	Pesticides - highly hazardous
CHEMICAL	Persistent organic pollutants (POPs)	Residue of pesticides including POPs
CHEMICAL	Persistent organic pollutants (POPs)	Hazardous pesticide contamination in soils
CHEMICAL	Persistent organic pollutants (POPs)	Insecticides
CHEMICAL	Persistent organic pollutants (POPs)	Fungicides
CHEMICAL	Persistent organic pollutants (POPs)	Dioxin and Dioxin-like substances
CHEMICAL	Persistent organic pollutants (POPs)	Microplastics
CHEMICAL	Persistent organic pollutants (POPs)	Phosphides
CHEMICAL	Persistent organic pollutants (POPs)	Chlorine
CHEMICAL	Hydrocarbons	Oil pollution
CHEMICAL	Hydrocarbons	Benzene
CHEMICAL	CBRNE	Chemical agents
CHEMICAL	Other chemical hazards and toxins	Asbestos
CHEMICAL	Other chemical hazards and toxins	Aflatoxins
CHEMICAL	Other chemical hazards and toxins	Fluoride (excess and inadequate)
CHEMICAL	Other chemical hazards and toxins	Methanol
CHEMICAL	Other chemical hazards and toxins	Counterfeit medicines
CHEMICAL	Aquaculture	Marine toxins
BIOLOGICAL	Aquaculture	Algal bloom
BIOLOGICAL	Insect Infestation	Insect pest infestation
BIOLOGICAL	Insect Infestation	Locust
BIOLOGICAL	Invasive species	Invasive weeds

BIOLOGICAL	Invasive species	Invasive species
BIOLOGICAL	Human-Animal interaction	Snake envenomation
BIOLOGICAL	Human-Animal interaction	Human-Animal conflict/interaction
BIOLOGICAL	CBRNE	Biological agents
BIOLOGICAL	Mental health	Suicide cluster
BIOLOGICAL	Food safety	Antimicrobial resistance
BIOLOGICAL	Food safety	Foodborne microbial hazards (including human enteric virus and foodborne parasite)
BIOLOGICAL	Infectious diseases (plant)	Bacterial plant disease
BIOLOGICAL	Infectious diseases (plant)	Fungal plant disease
BIOLOGICAL	Infectious diseases (plant)	Mycoplasma, viral and viroid plant disease
BIOLOGICAL	Infectious diseases (human and animal)	Anthrax
BIOLOGICAL	Infectious diseases (human and animal)	Airborne diseases
BIOLOGICAL	Infectious diseases (human and animal)	Blood borne viruses
BIOLOGICAL	Infectious diseases (human and animal)	Waterborne diseases
BIOLOGICAL	Infectious diseases (human and animal)	Foodborne diseases
BIOLOGICAL	Infectious diseases (human and animal)	Sexually transmitted Infections (human)
BIOLOGICAL	Infectious diseases (human and animal)	Neglected tropical diseases (human)
BIOLOGICAL	Infectious diseases (human and animal)	Vaccine-preventable diseases (human)
BIOLOGICAL	Infectious diseases (human and animal)	Vector borne diseases (human)
BIOLOGICAL	Infectious diseases (human and animal)	Viral haemorrhagic fevers (human)
BIOLOGICAL	Infectious diseases (human and animal)	Antimicrobial resistant microorganisms (human)
BIOLOGICAL	Infectious diseases (human and animal)	Animal diseases (not zoonoses)
BIOLOGICAL	Infectious diseases (human and animal)	Zoonotic diseases
BIOLOGICAL	Infectious diseases (human and animal)	Diarrhoeal diseases (human)
BIOLOGICAL	Infectious diseases (human and animal)	Prion diseases
BIOLOGICAL	Infectious diseases (human and animal)	Hepatitis B (human)
BIOLOGICAL	Infectious diseases (human and animal)	Hepatitis C (human)
BIOLOGICAL	Infectious diseases (human and animal)	HIV and AIDS (human)
BIOLOGICAL	Infectious diseases (human and animal)	COVID-19 (SARS-CoV-2) (human)
BIOLOGICAL	Infectious diseases (human and animal)	Cholera (human)
BIOLOGICAL	Infectious diseases (human and animal)	Cryptosporidium (human)

BIOLOGICAL	Infectious diseases (human and animal)	Paratyphoid fever (human)
BIOLOGICAL	Infectious diseases (human and animal)	Typhoid fever (human)
BIOLOGICAL	Infectious diseases (human and animal)	Hepatitis A (human)
BIOLOGICAL	Infectious diseases (human and animal)	Escherichia coli (STEC) (human)
BIOLOGICAL	Infectious diseases (human and animal)	Listeriosis (human)
BIOLOGICAL	Infectious diseases (human and animal)	Shigellosis (human)
BIOLOGICAL	Infectious diseases (human and animal)	Avian influenza (human and animal)
BIOLOGICAL	Infectious diseases (human and animal)	Pandemic influenza (human)
BIOLOGICAL	Infectious diseases (human and animal)	Seasonal influenza (human)
BIOLOGICAL	Infectious diseases (human and animal)	Cysticercosis
BIOLOGICAL	Infectious diseases (human and animal)	Leptospirosis (human)
BIOLOGICAL	Infectious diseases (human and animal)	Plague (human)
BIOLOGICAL	Infectious diseases (human and animal)	Leprosy
BIOLOGICAL	Infectious diseases (human and animal)	Chikungunya
BIOLOGICAL	Infectious diseases (human and animal)	Zika virus (human)
BIOLOGICAL	Infectious diseases (human and animal)	Diphtheria (human)
BIOLOGICAL	Infectious diseases (human and animal)	Measles (human)
BIOLOGICAL	Infectious diseases (human and animal)	Meningococcal meningitis (human)
BIOLOGICAL	Infectious diseases (human and animal)	Pertussis (human)
BIOLOGICAL	Infectious diseases (human and animal)	Polio (human)
BIOLOGICAL	Infectious diseases (human and animal)	Smallpox (human)
BIOLOGICAL	Infectious diseases (human and animal)	Varicella and herpes zoster (human)
BIOLOGICAL	Infectious diseases (human and animal)	Yellow fever (human)
BIOLOGICAL	Infectious diseases (human and animal)	Dengue (human)
BIOLOGICAL	Infectious diseases (human and animal)	Malaria (human)
BIOLOGICAL	Infectious diseases (human and animal)	Crimean-Congo Haemorrhagic Fever (human)
BIOLOGICAL	Infectious diseases (human and animal)	Ebola (human)
BIOLOGICAL	Infectious diseases (human and animal)	Lassa Fever (human)

BIOLOGICAL	Infectious diseases (human and animal)	Tuberculosis (human, animal)
BIOLOGICAL	Infectious diseases (human and animal)	Middle East Respiratory Syndrome (MERS) (human)
BIOLOGICAL	Infectious diseases (human and animal)	Monkeypox (human)
BIOLOGICAL	Infectious diseases (human and animal)	Rabies (animal and human)
BIOLOGICAL	Infectious diseases (human and animal)	SARS (human)
BIOLOGICAL	Infectious diseases (human and animal)	Rotavirus (human)
BIOLOGICAL	Infectious diseases (human and animal)	African swine fever(animal)
BIOLOGICAL	Infectious diseases (human and animal)	Bird plagues (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Brucellosis (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Classical swine fever (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Contagious bovine pleuropneumonia (CBPP) (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Contagious caprine pleuropneumonia (CCPP) (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Foot and mouth disease virus (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Lumpy skin disease (animal)
BIOLOGICAL	Infectious diseases (human and animal)	New World Screwworm (NWS) (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Newcastle disease virus (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Peste des petits ruminants (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Q fever
BIOLOGICAL	Infectious diseases (human and animal)	Rift Valley fever (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Trypanosomoses (animal)
BIOLOGICAL	Infectious diseases (human and animal)	West Nile Fever (animal)
BIOLOGICAL	Infectious diseases (human and animal)	Rinderpest
BIOLOGICAL	Infectious diseases (aquaculture)	Shrimp disease (viral)
BIOLOGICAL	Infectious diseases (aquaculture)	Shrimp disease (bacterial)
BIOLOGICAL	Infectious diseases (aquaculture)	Oyster disease aquaculture (animal/ plant)
TECHNOLOGICAL	Radiation	Radioactive waste
TECHNOLOGICAL	Radiation	Radioactive material
TECHNOLOGICAL	CBRNE	Radiation agents
TECHNOLOGICAL	CBRNE	Nuclear agents
TECHNOLOGICAL	Construction/ Structural failure	Building collapse
TECHNOLOGICAL	Construction/ Structural failure	Building, highrise, cladding

TECHNOLOGICAL	Construction/ Structural failure	Structural collapse (standing structure vs. underground structure)
TECHNOLOGICAL	Construction/ Structural failure	Bridge failure
TECHNOLOGICAL	Construction/ Structural failure	Dam failure
TECHNOLOGICAL	Infrastructure failure	Supply systems failure
TECHNOLOGICAL	Infrastructure failure	Infrastructure failure
TECHNOLOGICAL	Infrastructure failure	Nuclear plant
TECHNOLOGICAL	Infrastructure failure	Power outage / or blackout
TECHNOLOGICAL	Infrastructure failure	Emergency telecommunications failure
TECHNOLOGICAL	Infrastructure failure	Water supply failure
TECHNOLOGICAL	Infrastructure failure	Radio and other telecommunication failures
TECHNOLOGICAL	Cyber hazard	Misconfiguration of software and hardware
TECHNOLOGICAL	Cyber hazard	Non-conformity and Interoperability
TECHNOLOGICAL	Cyber hazard	Malware
TECHNOLOGICAL	Cyber hazard	Data breach
TECHNOLOGICAL	Cyber hazard	Data security-related hazards
TECHNOLOGICAL	Cyber hazard	Disrupt
TECHNOLOGICAL	Cyber hazard	Outage
TECHNOLOGICAL	Cyber hazard	PII breach
TECHNOLOGICAL	Cyber hazard	Internet of Things (IoT)-related hazards
TECHNOLOGICAL	Cyber hazard	Privacy and data security for citizens - supporting human mental health
TECHNOLOGICAL	Industrial failure / Non-compliance	Natech
TECHNOLOGICAL	Industrial failure / Non-compliance	Contamination
TECHNOLOGICAL	Industrial failure / Non-compliance	Explosions
TECHNOLOGICAL	Industrial failure / Non-compliance	Leaks
TECHNOLOGICAL	Industrial failure / Non-compliance	Spills
TECHNOLOGICAL	Industrial failure / Non-compliance	Fire
TECHNOLOGICAL	Industrial failure / Non-compliance	Mining hazards
TECHNOLOGICAL	Industrial failure / Non-compliance	Safety hazards associated with oil and gas extraction activities
TECHNOLOGICAL	Waste	Disaster waste
TECHNOLOGICAL	Waste	Solid waste
TECHNOLOGICAL	Waste	Wastewater
TECHNOLOGICAL	Waste	Hazardous waste
TECHNOLOGICAL	Waste	Plastic waste
TECHNOLOGICAL	Waste	Marine debris
TECHNOLOGICAL	Waste	E-waste
TECHNOLOGICAL	Waste	Healthcare risk waste
TECHNOLOGICAL	Waste	Landfilling
TECHNOLOGICAL	Waste	Tailings
TECHNOLOGICAL	Waste	Waste lagoons
TECHNOLOGICAL	Flood	Drain and sewer flooding

TECHNOLOGICAL	Flood	Reservoir flooding
TECHNOLOGICAL	Transportation	Air transportation accident
TECHNOLOGICAL	Transportation	Inland water ways
TECHNOLOGICAL	Transportation	Marine waters
TECHNOLOGICAL	Transportation	Rail accident
TECHNOLOGICAL	Transportation	Road traffic accident
TECHNOLOGICAL	CBRNE	Explosive agents
SOCIETAL	Conflict	International armed conflict
SOCIETAL	Conflict	Non-international armed conflict
SOCIETAL	Conflict	Civil unrest
SOCIETAL	Post-conflict	Explosive remnants of war (ERW)
SOCIETAL	Post-conflict	Environmental degradation from conflict
SOCIETAL	Behavioural	Violence
SOCIETAL	Behavioural	Stampede or crushing (human)
SOCIETAL	Economic	Financial shock

ANNEX 7

Methodology and process

Main data sources

Science-based glossaries

The Disaster Information Management Research Center (DIMRC) contained over 60 glossaries related to 15 different disaster-related categories, many of which reflected the hazards listed in this project. These glossaries were downloaded from the DIMRC NLM site between 2009 and 2012 and each was updated to the latest version. Another 60 glossaries related to disaster and hazards were found from other scientific based sources tabled in Annex 4. Hazards related to floods, earthquakes, drought, tsunami and cyclone had the greatest number of related glossaries.

UN-based glossaries

The UN publication entitled, the United Nations Plan of Action on Disaster Risk Reduction: Towards a Risk-Informed and Integrated Approach to Sustainable Development (UNDRR, 2017) listed 48 UN Agencies under the heading UN Funds, Programmes, Specialised Agencies and Others (UNDRR, 2017: p5-6), in total there were over 110 glossaries found. Some organisations had many glossaries listed under their agency, such as the WHO since the agency covers a wide spectrum of health-related issues and many reports from WHO contain glossaries within the reports. For this reason, WHO has over 3000 glossaries listed. The UN-based glossaries are tabled in Annex 5.

Consensus building

The list of hazards compiled from the review of existing glossaries was used as a basis for the development of a first draft of the new hazards list. The TWG began an iterative process of developing and reviewing the hazards listed with three primary constituencies: regular, virtual meetings of the TWG; a stakeholder survey of experts in fields related to identified hazards; and a workshop with the wider disaster risk reduction scientific community. The TWG also organised many additional meetings over this period with other scientific and UN partners to determine how all hazards could be addressed and to identify what further hazards should be considered. Once an initial draft of the hazard list was agreed, it was disseminated to the wider scientific community for consultation.

Paris Workshop (1–2 July 2019)

The TWG met in person at a two-day workshop in Paris, France in July 2019 at the ISC headquarters. Discussions were held concerning:

- Project scope
- Reaching scientific consensus on the definition of hazards
- Classification of hazards under the Sendai Framework
- Identification of gaps in scientific expertise within the TWG
- Project timeline and outputs.

Following this workshop, fortnightly, and later weekly, online meetings were held to review and refine the hazards list and define its parameters, as well as to ensure the project proceeded according to the scope and timeline agreed. Direct revisions to the hazards list were made by the secretariat; all revisions were sent to the TWG prior to each meeting, during which each was considered and a new revision was written to reflect the comments and inputs of the working group. By early September 2019, the list had expanded from 202 hazard-related terms to 289 terms. By the end of the month, it

included 590 terms – with the additional terms having been identified through ongoing deliberations between TWG members, as well as consultation with external experts and scientists within key UN agencies.

In summary, between March and December 2019, over 100 versions of the hazards list were written and reviewed. Version control was maintained by having one individual responsible for updating the hazard list and recording hazard terms that were removed or reformulated. For the duration of the review, only three people had responsibility for updating the hazard list.

During the development of the hazard list, it became apparent that there was a need to define clearly what hazards were included within the scope of the review and why. A draft paper was developed, setting out the parameters of the review and the criteria used to develop the hazard list. This paper was updated approximately 18 times between June and October 2019.

Scientific consultation survey

In September 2019, a short survey was circulated to over 500 individuals identified as stakeholders from the wider advisory group (comprising academic researchers, scientists and practitioners employed in the private sector or in NGOs, and policy specialists), the IRDR network and the International Scientific Unions that are members of the ISC. The aim of the consultation was to build a broad scientific consensus on the hazards list in terms of completeness, coherence, and relevance to progress reporting on national disaster risk reduction, as well as obtaining feedback on the draft inclusion parameters. Both closed and open-ended questions were included.

Five key themes were identified:

1. **Is it really a hazard?** – there was a need to distinguish between hazard sources, hazards, vulnerability, exposure, and risk.

2. **We need to specify** – terms are too broad and open to interpretation.

3. **The level of detail seems uneven** – there is a lack of consistency in the level of detail and number of sub-categories from one hazard type to another.

4. **Some of the hazards are misclassified** – exclusion criteria have been applied inconsistently.

5. **The list is comprehensive and relevant** – it will be useful at both national and global levels.

Sixty-one substantive survey responses were received (a response rate of ~12%) from 34 countries, of which 32 (~6% of the invited sample) contained qualitative feedback that could be further analysed. Over 100 terms not on the hazard list at the time were suggested for inclusion and 89 terms that were on the list were recommended for removal. In brief, this survey provided tangible and specific suggestions for improvement to the hazard list and recognized the importance and relevance of the project.

Wider consultation process

Wider consultation and communication with the scientific community was organised through national and regional fora. Specific consultations took place with the regional Science, Technology and Advisory Groups (STAGs) in Africa, Europe, Asia Pacific and the Arab States – facilitated by their respective TWG representative. Progress updates were also provided at several national meetings, including a briefing to the US Sub-committee on Disaster Reduction Interagency.

Working Group

Global disaster risk reduction experts were also consulted. In October 2019, a workshop was held during the 22nd IRDR Scientific Committee Meeting in Xiamen, China. The current iteration of the hazards list was reviewed, as well as key themes identified from the stakeholder survey. Approximately 20 disaster risk reduction experts participated in this workshop. Five key points were identified:

1. Purpose of the hazards list: The purpose should be firmly established, transparent, and effectively communicated to stakeholders and target users.

2. Clear inclusion criteria: Clear distinctions between and definitions of disaster, hazards, vulnerability, and exposure should be included.

3. Systematic thinking: A 'systems thinking' approach may be useful in understanding what is and what is not included in the list, and how hazards may be classified.

4. Dissimilarities across nations: A wide range of differing and competing terminologies may become a 'usability' issue and a solution for incorporating local knowledge or managing the range of terminologies should be established.

5. Review of the template: The template should be simple so as to avoid confusion and contradiction.

Geneva Workshop (22 -24th October 2019): Integration and final consensus of the TWG

The TWG reviewed and incorporated the results of the stakeholder survey and IRDR workshop, in addition to their ongoing fortnightly reviews, at a final, in-person workshop held in Geneva, Switzerland in October 2019. Selected experts from the wider advisory group were invited to join the TWG for this meeting; a total of 37 participants were present. The proposed hazard list was presented, key themes from the previous workshop and scientific stakeholder survey were discussed, and breakout sessions were held to allow participants to further explore ideas and concerns of interest.

During the workshop, the TWG considered the inputs from the various consultations and agreed on how to take the review forward. Key outcomes included defining an approach to operationalise the UNGA definition of 'hazard', reviewing the draft hazard list and agreeing on an approach to finalising it, and establishing consensus for the final version of the Hazard Information Profile.

The draft hazard list was circulated for consultation and the results of the consultative stakeholder survey were used as the basis for finalising the hazard list at the Geneva workshop. The TWG was divided into new subgroups according to areas of interest and expertise and were asked to review each entry in the list according to:

1. Fulfilling the UNGA definition of 'hazard'.

2. Meeting the operationalisation criteria.

The TWG were further asked to consider whether hazards were missing from the list, including reviewing proposals made for inclusion in respondent feedback to the stakeholder survey. Each subgroup produced a redrafted list of hazards within their assigned hazard cluster, which they then presented to the TWG for comment. Further edits were made following discussion and the various hazard lists were then amalgamated into a full list once again. This list was reviewed by the TWG over subsequent weeks, ensuring input from TWG members who had been unable to attend the Geneva workshop was included. A final version was agreed by the TWG in December 2019.

ANNEX 8

2014 IRDR Peril Classification

FAMILY	MAIN EVENT	PERIL
Geophysical	Earthquake Mass Movement Volcanic Activity	Ash Fall Fire Following EQ Ground Movement Landslide Following EQ Lahar Lava Flow Liquefaction Pyroclastic Flow Tsunami
Hydrological	Flood Landslide Wave Action	Avalanche: Snow, Debris Coastal Flood Coastal Erosion Debris/Mud Flow/Rockfall Expansive Soil Flash Flood Ice Jam Flood Riverine Flood Rogue Wave Seiche Sinkhole
Meteorological	Convective Storm Extratropical Storm Extreme Temperature Fog Tropical Cyclone	Cold Wave Derecho Frost/ Freeze Hall Heat Wave Lightning Rain Sandstorm/ Dust Storm Snow/ Ice Storm Surge Tornado Wind Winter Storm/ Blizzard
Climatological	Drought Glacial Lake Outburst Wildfire	Forest Fire Land Fire: Brush, Bush, Pasture Subsidence
Biological	Animal Incident Disease Insect Infestation	Bacterial Disease Fungal Disease Parasitic Disease Prion Disease Viral Disease
Extraterrestrial	Impact Space Weather	Airburst Collision Energetic Particles Geomagnetic Storm Radio Disturbance Shockwave

Figure 4 Peril classification at the Family, Main Event and Peril Levels. The association of perils with main events is solely a suggestion. Some perils may change their main event association based on the actual event and loss trigger.

ANNEX 9

Hazard terminology review project: Guidelines for reviewers

The Hazard Terminology and Classification Review, jointly facilitated by the International Science Council (ISC) and the United Nations Office for Disaster Risk Reduction (UNDRR) aims to define the full range of hazards that are covered by the Sendai Framework for Disaster Risk Reduction and provide a scientific definition of these hazards, drawing mostly on internationally agreed UN definitions. The work is led by a technical working group (TWG) which includes a core group of members from UN agencies, the scientific community and representatives from the insurance industry, and international humanitarian organisations.

The final outputs of the project will include:

1. A report on the methods and data sources, results and recommendations

2. A compilation of Hazard Information Profiles (HIPs)

3. An online repository of hazard definitions.

As part of the project, a two-step review process is being implemented. The first phase of the review took place in September 2019 when a draft list of hazards compiled by the TWG was reviewed with regard to its comprehensiveness and coherence. The second stage of the review concerns:

1. The suggested inclusion/exclusion criteria

2. The list of 'Sendai hazards' with regard to the application of these criteria

3. The HIPs (as far as already existing) which set out the scientific definition and description of each hazard.

Objective of the peer review

The review of the HIPs is led by the ISC. It will be rolled out between December 2019 and January 2020 and aims to ensure that the definition and description provided for each hazard are widely accepted within the scientific community, that the main issues are captured, and that the information is understandable for a non-technical audience.

Of note the authors have been asked to source the definitions of the hazard from the highest scientific authority (which may be from the UN where UN Member States may have already agreed these). This project aims to compile existing definitions and not produce new ones.

Enclosed please see the Guidance for Authors of the Hazard Information Profile.

Review questions

When reviewing the HIPs, reviewers are asked to address the following questions:

1. Is the hazard definition and description scientifically robust and does it reflect the broad scientific consensus on the issue, where this exists?

2. Does the definition of the specific hazard under consideration fit with the overarching hazard definition (UNGA definition of 'hazard' as modified by the TWG), i.e. can the issue under review be considered a hazard?

3. Are the annotations accurate and adequate?

4. Are the references sufficient, appropriate and balanced?

5. Do you have any other comments on the HIP?

Reviewers are asked to read through the entire hazard profile before addressing the questions.

Submitting review comments

Reviewers are asked to make their comments and suggestions using track changes and the reviewing function in Word. The annotated hazard description should be sent back to ISC as coordinator of the review process (anne-sophie.stevance@council.science; anda.popovici@council.science), with a copy to lucy.fagan@phe.gov.uk and the author of the template within the timeframe specified in the email accompanying the hazard description (typically within one week).

Next steps

Comments received will be considered by the author of the template, who will make revisions to the hazard description as appropriate and interact with the reviewers as necessary. General issues raised by reviewers will be discussed with all members of the working group and inform the final report.

All reviewers will be listed in the final report and compilation document but will not be named in relation to specific hazards.

Prepared by Anne-Sophie Stevance ISC. John Handmer IRDR Scientific Committee Chair and Virginia Murray, Chair of UNDRR/ISC Hazard Terminology and Classification Review Task Team.

25 November 2019