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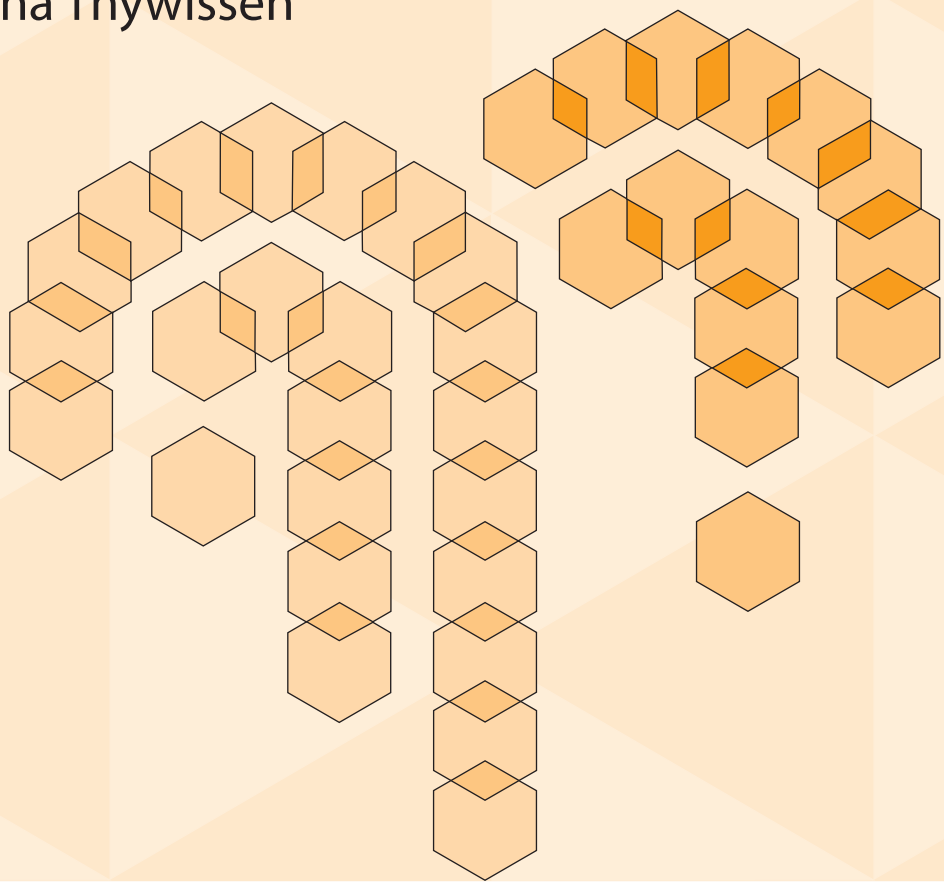
Components of Risk

A Comparative Glossary

Katharina Thywissen



SOURCE

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A Comparative Glossary

by
Katharina Thywissen
United Nations University –
Institute of Environment and Human Security

Foreword

During the scientific workshop held in October 2002 in Bonn, with the aim to advise the United Nations University (UNU) and the donor ministries about the scope of the, then to be created, UNU Institute for Environment and Human Security (UNU-EHS), deliberations revealed that the core terminology used by the participants of describing risk, vulnerability and related concepts, while common, many represented different definitions – and consequently connotations – depending on the various disciplinary background of the experts.

Interdisciplinary work is frequently characterised by the phenomena of either using different terms but meaning the same, or using the same words, but meaning different things. Consequently, it became evident that a new institute, dedicated to nurture interdisciplinary scientific exchange should make a significant contribution in developing tools, guides and other materials to facilitate this process.

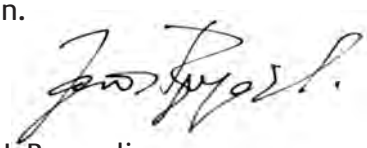
As one of the first activities of UNU-EHS, a project was launched in late 2004 with the aim to summarize the core terminology of disaster preparedness and reduction, that of risk management by collecting and comparing the various interpretations, definitions, and conventions used by the different scientific disciplines or professional communities. The present issue of SOURCE is the result of more than one year of research and consultation with stake holders, revisions and incorporation of expert advice. In that context the support of Dr. Maureen Fordham and Dr. Ben Wisner and their RADIX website as well as of Alberto Delgado (Electronic Communication and Information Exchange, ECIE) is greatly appreciated.

As far as the scientific objective to facilitate interdisciplinary collaboration is concerned, this comparative glossary compiled and edited by Dr. Katharina Thywissen of UNU-EHS serves the function of a dictionary cum mini encyclopaedia.

We believe that this publication is not only a useful reference before or even during an interdisciplinary meeting, but could also facilitate the reading of proceedings and books authored by experts of different professional backgrounds. Therefore, a slightly modified version of this present publication is also available in print as a chapter of the multi-authored book *Measuring Vulnerability*, edited by Dr. Jörn Birkmann (*Core Terminology of Disaster Reduction – A Comparative Glossary*. In: J. Birkmann (Ed.), Measuring Vulnerability to Hazards of Natural Origin – Towards Disaster Resilient Society). The book will be published by UNU Press in 2006.

Beyond its most likely frequent use in scholarly circles we are convinced that this comparative glossary of Dr. Thywissen is a very valuable contribution to the ongoing international professional debate and efforts towards improved disaster reduction. A year after the Hyogo Framework for Action, approved by the World Conference of Disaster Reduction in Kobe in January 2005, this publication is a timely contribution of UNU to the implementation of this international plan of action.

Neither language nor science are static. We are living in a rapidly changing world, where new concepts, ideas, and solutions are incessantly developed. Therefore, a glossary can not be else but a snap shot of this development process. Consequently, while proudly presenting this publication to its potential users, we also announce our intention to continue monitoring the evolution of interdisciplinary concepts and dialogues and may decide to re-publish a modified and extended version of this glossary at a later stage. Therefore, readers are strongly encouraged to send their comments to UNU-EHS, to become a not-so-secret co-author of a potential future edition.



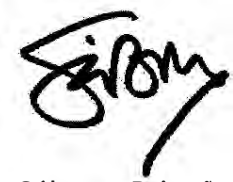
Janos J. Bogardi
Director UNU-EHS

Preface

In 2005, 91,900 people perished in 360 natural disasters that affected over 157 million people. In 2004, more than 240,000 people perished in natural disasters, and over 225,000 of these deaths were a result of the Indian Ocean tsunami hit 12 countries on 26 December 2004. The South Asia Earthquake and the tsunami and other disasters are a wake-up call to what should have been realised long ago. Disasters are undermining the world's development as never before. The case for disaster reduction is clear. Disaster risk concerns every person, every community, and every nation; indeed, disaster impacts are slowing down development, and their impact and actions in one region can have an impact on risks in another, and vice versa. Without taking into consideration the urgent need to reduce risk and vulnerability, the world simply cannot hope to move forward in its quest for reduction of poverty and sustainable development.

However, in order to successfully reduce the impact of disasters it is necessary that all actors in the various fields understand each other by using the same terminology. As the focal point on the United Nations for Disaster Reduction, the ISDR secretariat has always stressed the need on basic definitions on disaster risk reduction in order to promote a common understanding on this subject for use by the public, authorities and practitioners. Currently, the terms are based on a broad consideration of different international sources. This is a continuing effort, responding to a need expressed in several international venues, regional discussions and national commentaries. Feedback from specialists and other practitioners to improve these definitions are always very important.

It is therefore a pleasure to support United Nations University Institute for Environment and Human Security (UNU-EHS) and its work of Comparative Glossary Study. During the World Conference on Disaster Reduction (WCDR, Kobe, Hyogo, Japan, 18-22 January 2005), Governments agreed to implement the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. The Hyogo Framework sets out specific priorities, and one of them requests the updating and widely dissemination of international standard terminology related to disaster reduction for use in programme and institutional development, operations, research, training curricula and public information programmes. In this context, the UNU-EHS study is a valuable contribution to the implementation of the Hyogo Framework. I look forward to an increased collaboration between UNU-EHS and the ISDR secretariat on this and other endeavors to promote Disaster Risk Reduction worldwide.



Sálvano Briceño, Director
Secretariat of the
International Strategy for Disaster Reduction

About the Author

Katharina Thywissen is an Academic Officer at UNU-EHS. She holds a PhD in Geophysics (Seismology) from the GeoForschungsZentrum Potsdam/University of Potsdam in Germany and a MSc in Geology (Marine Geology) from the University of Hamburg, Germany. She was a researcher in the field of Seismology at the U.S. Geological Survey, Menlo Park, California, and has worked in the reinsurance industry in New York focussing on risk assessment, pricing and exposure control. Her work experience also includes activities in the field of early warning at the United Nations Environment Programme, Department for Early Warning and Assessment (UNEP/DEWA) in Nairobi, Kenya, as well as post-disaster damage assessment on the basis of satellite images for a French consultant company.

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1. Introduction

The extent of disasters and their foreboding trend to increase in frequency and severity imply that the problem of disasters will have to be addressed by the world community in the coming years. In the course of the IDNDR, the International Decade of Disaster Reduction (1990-1999), and of many other initiatives spawned over the last years, disaster reduction has gained a lot of momentum and attention. In addition, the World Conference on Disaster Reduction in Kobe, Japan (18-22 January, 2005) and the Boxing Day Tsunami (26 December, 2004) in the Indian Ocean exposed the need for action to a global audience.

Disasters take a devastating toll on countries' development, economies, and environment in all regions of the world and thereby severely compromise human security and livelihoods.

Recent events that unfolded in the highly developed countries, such as Hurricane Katrina (landfall on 29 August, 2005) which devastated New Orleans and the snow storm in Germany (25 November, 2005) reminded us that all countries irrespective of their rank in human development are vulnerable to disasters. It became excruciatingly evident that the poor and marginalized groups bear the highest burden.

1.1 The Paradigm Shift

There has been a paradigm shift in some vital concepts evolving around the understanding of human livelihood. The human being is moving more and more into the centre of attention. General understanding of security has shifted from the nationalistic and militaristic perspective to a more individualistic and humanitarian one - human security (CHS, 2003). Another paradigm shift has taken place in the shift from income poverty (financial affluence) to human poverty (well-being). This shift has been paralleled in disaster management by a shift from seeing disasters as extreme events created by natural forces, to viewing them as manifestations of unresolved development problems (Yodmani, 2001).

Approaches in disaster reduction have become much more complex and emphasis has shifted from relief to mitigation. Consequently, vulnerability, resilience, and coping capacities have gained a more prominent role and more light is being shed on social, economic, political, and cultural factors.

Integrated disaster reduction depends on the collaboration and exchanges between experts from a multitude of disciplines and competencies. Those range from science over policy building and civil society to disaster relief and rehabilitation. Approaches can be quantitative in nature as well as qualitative or descriptive and many fields have cultivated their own understanding and, hence, their own definitions of disaster-related terms. As a consequence, communication within the disaster reduction community is often encumbered and misunderstandings are common.

1.2 "Babelonian Confusion"

A shared language and shared concepts are crucial stepping-stones in widening the understanding and effectiveness of disaster reduction. A term is defined in order to explain its content and context in a logically consistent way while ensuring the widespread acceptance of peers. Definitions of the same terms were developed simultaneously and homogeneously in multiple disciplines. As a result, multi-disciplinarity often results in the same term being defined in different ways. The resulting situation is often perceived as the proverbial *Babelonian Confusion*. Most of these sometimes colliding definitions are valid in their respective contexts and cannot be discarded. Therefore, in order to enable collaboration and communication free of misunderstanding, it is crucial to disseminate the different definitions across the

disciplines and with the goal that eventually a common vocabulary of unique, well formulated definitions and concepts will emerge.

Terms and concepts are not just an academic exercise but have real importance in the practical world. The language used by workers in the disaster field frames, focuses, and limits the kinds of questions they ask (Handmer and Wisner, 1998). Before working on disaster risk reduction differing perceptions, interests, and methodologies have to be recognised and a broad consensus on targets, strategies and methodologies has to be reached (Yodmani, 2001). Clearly, definitions and concepts are needed at every level of disaster reduction.

Common, coordinated, and consequent approaches to risk reduction can only be achieved if there is a common agreement as to the structure of the problem and as to the basic notions, concepts, and terms used in its definition (Lavell, 2003).

1.3 The Moral Aspect of Disaster Reduction

To an unknown extent the exacerbation of environmental deterioration and climate change has been brought about by today's developed countries, and the developing countries are repeating the same processes and harmful activities, only exponentially, due to the sheer size of their populations. The resulting increase of disaster frequencies should alarm all countries the same way, but the developed countries are facing this situation with a heightened responsibility for the poor countries because it is the people in developing countries, who suffer most from disasters. As the World Bank puts it, "...developing countries suffer the greatest costs when disaster hits: more than 95 percent of all deaths caused by disasters occur in developing countries; and losses due to natural disasters are 20 times greater (as a percent of GDP) in developing countries than in industrial countries." (World Bank, 2005). However, it seems that even developed countries are spurred to act upon, whether they signed the Kyoto Protocol or not. For Allen and Lord (2004) report that in July 2004 eight US states and New York City have filed charges against five US power companies for their contribution to climate change.

If the UN Millennium Development Goals (MDGs) carry any clout, the direct link between poverty and disaster impact implies a moral obligation for the international community to address both these concerns in a concerted way. Cannon (1994) points out that "it may be true that most of the suffering in disasters is experienced by poor people, it may not be the case that all poor suffer. Nor is it only the poor who suffer, but the impact of hazards may well be a factor in creating newly impoverished people."

Risk usually involves a decision by the person at risk (to take a certain risk or not), always presuming the individual knows about the risk. According to Cardona (2003) and Lavell (2003), risk must be associated with decision if it is to have any relevance as a notion and concept. Thus, one objective of disaster reduction is to raise awareness and make sure that people know their risk. Another objective is to see to it that people are in a situation to make choices, which directly leads to poverty reduction because poverty, by definition, reduces people's choices.

With risk also comes responsibility and the question of morality arises. However, there is no direct moral valuation of risk because the level of acceptable risk is highly subjective and highly variable. What complicates the matter further is the fact that the perception of probability connected with the risk varies from individual to individual, and group to group (Luhmann, 1993).

1.4 The UNU-EHS Stance

UNU-EHS (United Nations University – Institute for Environment and Human Security), as a member institute of the UNU, forms a bridge between the UN and the academic world, acts as

a think-tank for the UN, and provides a platform for dialogue and exchange of ideas. UNU-EHS aims to improve the in-depth understanding of the cause-effect relationships building up to disasters in order to find possible ways to increase human security. As an academic institution, UNU-EHS aims at strengthening the capabilities of individuals and institutions to address the potential impacts of hazards and their associated risks and vulnerabilities, turning research results into practical knowledge through training and other forms of human capacity building. Therefore, common terminology and definitions are essential prerequisites for a focussed scientific debate, interdisciplinary approaches and ultimately for improved disaster reduction.

1.5 The Comparative Glossary

In this glossary core terms from the cause-and-effect chain of disasters have been selected and their definitions put up for discussion among peers. There are already a number of listings of terms published (e.g. ISDR, UNDP, UNEP, IPCC, DKKV, BBK, CEDIM, NOAA). However, with the exception of NOAA's online glossary, they generally lack the juxtaposition of the definitions of various disciplines, because they want to spell out their definitions in the attempt to put an end to *Babelonian Confusion*. This comparative glossary, in contrast, aims to inform experts from different disciplines about the various, sometimes contradicting definitions currently used or referred to in the field of disaster mitigation. Even if some terms are defined differently by different disciplines, it is vitally important to make those differences in terminology known across the disaster reduction community in order to avoid misunderstandings and to enhance knowledge, mutual understanding and efficiency in disaster reduction.

This comparative glossary does not claim to be exhaustive; rather it focuses on a selection of terms that typically are used across multiple disciplines and that are central to the cause-and-effect chain of disaster reduction and are components of risk. The listing of definitions concludes with a concept that attempts to show the relationship between the main terms, while keeping the concept as concise as possible and as diverse and elaborate as necessary. These terms and definitions have been collected from the literature, including several reports that already offer glossaries of disaster reduction terms. Disciplines and sectors represented include: Insurance industry; United Nations; natural, social, and multidisciplinary sciences; economics; engineering; governance/policy; civil society; and disaster relief.

The first collection of terms and definitions was exposed to an online peer review process. For that purpose, the glossary was hosted by the RADIX website and the ECIE (Electronic Communication and Information Exchange) website. In this context the impeccable support by Maureen Fordham, Ben Wisner, and Alberto Delgado was greatly appreciated. The feedback provided by international experts in the course of this peer review process has been incorporated into this glossary and we thank all experts, who contributed with their comments. It also became quite obvious that the development in the field of disaster reduction is gaining momentum. Multi-disciplinarity is becoming a more integral part of the complex field of disaster reduction and as a consequence we observe a gradual change in the understanding of terminology and concepts. This development we would like to capture in the next edition of the glossary. To our knowledge the development of terminology and concepts in disaster reduction has not been captured as yet.

A good opportunity to gauge such a development is the annual meeting of the *Expert Working Group on Vulnerability (EWG)* that is regularly organized by UNU-EHS. An intriguing variety of the latest vulnerability concepts is summarized in the proceedings of the first meeting of the expert group: Birkmann, J. (Ed.) (2006): *Measuring Vulnerability to Hazards of Natural Origin – Towards Disaster Resilient Society.* UNU Press, Tokyo.

2. Terms and Definitions

Capacity

[Is]"The maximum amount of risk [in monetary terms] that can be accepted in insurance. One factor in determining capacity is government regulations that define minimum solvency requirements. Capacity also refers to the amount of insurance coverage allocated to a particular policyholder or in the marketplace in general." (Swiss Re, 2005)

Capacity

"A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster. Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability." (UN/ISDR, 2004)

Capacity, adaptive

"...defines adaptive capacity as a combination of a society's ex ante vulnerability to damages from natural hazards and its ex post resilience or ability to cope with the damages that result." (Dayton-Johnson, 2004)

Capacity, coping

"Refers to the manner in which people and organisations use existing resources to achieve various beneficial ends during unusual, abnormal, and adverse conditions of a disaster event or process. The strengthening of coping capacities usually builds resilience to withstand the effects of natural and other hazards." (Europ. Spatial Planning Observ. Netw., 2003)

Capacity, coping

"Is a function of: perception (of risk and potential avenues of action – the ability to cope is information contingent); possibilities (options ranging from avoidance and insurance, prevention, mitigation, coping); private action (degree to which special capital can be invoked); and public action" (e.g. Webb, and Harinarayan, 1999; Sharma et al. 2000) quoted in IPCC (2001). (IPCC, 2001)

Capacity, coping

"The means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster. In general, this involves managing resources, both in normal times as well as during crises or adverse conditions. The strengthening of coping capacities usually builds resilience to withstand the effects of natural and human-induced hazards." (UN/ISDR, 2004)

Capacity, coping

"The manner in which people and organisations use existing resources to achieve various beneficial ends during unusual, abnormal and adverse conditions of a disaster phenomenon or process." (UNDP, 2004)

Capacity, coping

"The ability to cope with threats includes the ability to absorb impacts by guarding against or adapting to them. It also includes provisions made in advance to pay for potential damages, for instance by mobilizing insurance repayments, savings or contingency reserves." (UNEP, 2002)

Capacity, coping & adaptive

"While the concept of coping capacity is more directly related to an extreme event (e.g. a flood or a winter storm), the concept of adaptive capacity refers to a longer time frame and implies that some learning either before or after an extreme event is happening. The higher the coping capacity and adaptive capacity, the lower the vulnerability of a system, region, community or household. Enhancement of adaptive capacity is a necessary condition for reducing vulnerability, particularly for the most vulnerable regions and socioeconomic groups." (Peltonen, 2006)

Catastrophe

"An event in which a society incurs, or is threatened to incur, such losses to persons and/or property that the entire society is affected and extraordinary resources and skills are required, some of which must come from other nations.

An example would be the 1985 Earthquakes in Mexico City and other Mexican cities. Thousands of people – estimates vary markedly – died and tens of thousands were injured. At least 100,000 building units were damaged; reconstruction costs exceeded five billion dollars (with some estimates running as high as $10 billion). Over sixty donor nations contributed to the recovery through programs coordinated by the League of Red Cross and Red Crescent Societies." (Drabek, 1996; quoted in Blanchard, 2005)

Catastrophe

". . .an event that causes $25 million or more in insured property losses and affects a significant number of property-casualty policyholders and insurers." (Insurance Services Office, 2005)

Catastrophe

"In the English speaking world a differentiation is sometimes made between disaster and catastrophes. In the latter, most or all people living in a community are affected, as are the basic supply centers, so that help from neighbours is largely impossible (the affected people helping each other is a general phenomenon in disasters with a lower degree of severity)." (Quarantelli, 1998)

Catastrophe

"In a catastrophe compared to a disaster:

1. Most or all of the community built structure is heavily impacted. [...] In addition, in catastrophes, the facilities and operational bases of most emergency organizations are themselves usually hit. [...] While in a major disaster some such facilities may be directly impacted, the great majority typically survive with little or no damage. [...]

2. Local officials are unable to undertake their usual work role, and this often extends into the recovery period.[...] One overall consequence is that because local personnel are casualties and/or usual community resources are not available, many leadership roles may have to be taken by outsiders to the community. [...]

3. Help from nearby communities cannot be provided. [...] In short, catastrophes tend to affect multiple communities, and often have a regional character. [...] In a disaster there is usually only one major target for the convergence after a disaster. In a catastrophe many nearby communities not only cannot contribute to the inflow, but they themselves can become competing sources for an eventual unequal inflow of goods, personnel, supplies and communication.

4. Most, if not all, of the everyday community functions are sharply and concurrently interrupted. Even in major disasters, there is no such massive-across the board disruption of community life even if particular neighborhoods may be devastated [...].

5. The mass media system especially in recent times socially constructs catastrophes even more than they do disasters.

6. Finally, because of the previous five processes, the political arena becomes even more important." (Quarantelli, 2005)

Catastrophe

". . .for a given society might be defined as an event leading to 500 deaths or $10 million in damages. These figures, however, are arbitrary since levels of impact mean different things to different people in different situations. Furthermore, we cannot ignore the element of scale. It would be a catastrophe for a small community if every building were totally destroyed by flooding (as occurred in 1993 in Valmeyer, Illinois), but at the global scale, it would be an insignificant event if only 350 houses were involved. . .Similarly, $10 million in damage to some communities would be devastating. . ., especially in less wealthy societies, but others would be able to cope relatively easily."

". . .a catastrophe not only disrupts society, but may cause a total breakdown in day-to-day functioning. One aspect of catastrophes, is that most community functions disappear; there is no immediate leadership, hospitals may be damaged or destroyed, and the damage may be so great and so extensive that survivors have nowhere to turn for help (Quarantelli, 1994). In disaster situations, it is not unusual for survivors to seek help from friends and neighbors, but this cannot happen in catastrophes. In a disaster, society continues to operate and it is common to see scheduled events continue. . ." (Tobin and Montz, 1997; quoted in Blanchard, 2005)

Disaster

"A disaster is an unusually severe and/or extensive event that usually occurs unexpectedly and has such a severe impact on life and health of many people and/or causes considerable

material damage and/or impairs or endangers the life of a large number of people for a long period of time to such an extent that resources and funding available at local or regional level cannot cope without outside help. The disaster qualifies as such when it becomes apparent that the available resources and funding are inadequate for the necessary and prompt relief. Relief provision systems that are capable of evolving from every day use and which integrate all the necessary components are required for effectively managing disasters." From: 30.11.1998 Report of the working group of the Permanent Conference on Disaster Reduction and Disaster Protection, DKKV Handbuch. (DKKV, 2002)

Disaster

"External danger, the loss of development potential and the helplessness of the affected population; a serious disruption of the functioning of a society causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using only its own resources." (DKKV, 2002)

Disaster

"A serious disruption of the functioning of society, causing widespread human, material or environmental losses, which exceed the ability of affected society to cope using only its own resources. Disasters are often classified according to their cause (natural or man-made)." (EEA, 2005)

Disaster

"A hazard might lead to a disaster. A disaster by itself is an impact of a hazard on a community or area – usually defined as an event that overwhelms the capacity to cope with it." (Europ. Spatial Planning Observ. Netw., 2003)

Disaster

"Disasters combine two elements: events and vulnerable people. A disaster occurs when a disaster agent (the event) exposes the vulnerability of individuals and communities in such a way that their lives are directly threatened or sufficient harm has been done to their community's economic and social structures to undermine their ability to survive. A disaster is fundamentally a socio-economic phenomenon. It is an extreme but not necessarily abnormal state of everyday life in which the continuity of community structures and processes temporarily fails. Social disruption may typify a disaster but not social disintegration" (IFRC, 1993)

Disaster

"For a disaster to be entered into the database of the UN's International Strategy for Disaster Reduction (ISDR), at least one of the following criteria must be met:

- a report of 10 or more people killed
- a report of 100 people affected
- a declaration of a state of emergency by the relevant government
- a request by the national government for international assistance" (IRIN/OCHA, 2005)

Disaster

"The result of a vast ecological breakdown in the relations between man and his environment, a serious and sudden event (or slow, as in drought) on such a scale that the stricken community need extraordinary efforts to cope with it, often with outside help or international aid." (Journ. of Prehospital and Disaster Medicine, 2004)

Disaster

". . .a disaster is at some basic level a social construction, its essence to be found in the organization of communities, rather than in an environmental phenomenon with destructive or disruptive effects for a society."

". . .a process involving the combination of a potentially destructive agent(s) from the natural, modified and/or constructed environment and a population in a socially and economically produced condition of vulnerability, resulting in a perceived disruption of the customary relative satisfactions of individual and social needs for physical survival, social order and meaning."

"A disaster is made inevitable by the historically produced pattern of vulnerability, evidenced in the location, infrastructure, sociopolitical structure, production patterns, and ideology, that characterize a society. The society's pattern of vulnerability is an essential element of a disaster." (Oliver-Smith, 1998)

Disaster

"Disaster is defined as the set of adverse effects caused by social-natural and natural phenomena on human life, properties and infrastructure within a specific geographic unit during a given period of time." (Serje, 2002)

Disaster, remarks on

"In summary, it can be determined that there is a problem of definition which affects the interpretation of vulnerability to disasters. Therefore, a list of important questions often cannot be answered clearly: When does a disaster begin? Who decides about shortcomings in the coping capacity of a society? When does the disaster end? What are the appropriate indicators for disasters? In addition, many definitions do not take differing vulnerabilities of population groups into account." (Feldbrügge and von Braun, 2002)

Exposure

"Exposure is another component of disaster risk, and refers to that which is affected by natural disasters, such as people and property." (ADRC, 2005)

Exposure

"Exposure describes the number of people, and the value of structures and activities that will experience hurricane hazards and may be adversely impacted by them." (Davidson and Lambert, 2001; quoted in Blanchard, 2005)

Exposure

"The process of estimating or measuring the intensity, frequency, and duration of exposure to an agent. Ideally, it describes the sources, pathways, routes, magnitude, duration, and patters of exposure; the characteristics of the population exposed; and the uncertainties in the assessment." (EEA, 2005)

Exposure

"The economic value or the set of units related to each of the hazards for a given area. The exposed value is a function of the type of hazard." (Europ. Spatial Planning Observ. Netw., 2003)

Exposure

"People, property, systems, or functions at risk of loss exposed to hazards." (Multihazard Mitigation Council, 2002)

Exposure

"The degree to which a risk or portfolio of risks is subject to the possibility of loss; basis for calculating premiums in (re)insurance." (MunichRe, 2002)

Exposure

"Elements at risk, an inventory of those people or artefacts that are exposed to a hazard." (UNDP, 2004)

Hazard

"A Hazard is an extreme geophysical event that is capable of causing a disaster. 'Extreme' in this case signifies a substantial departure in either the positive or the negative direction from a mean or a trend [...]. The fundamental determinants of hazards are location, timing, magnitude and frequency. Many hazardous phenomena are recurrent in time and predictable in terms of location. (...) we define natural hazards as extreme events that originate in the biosphere, lithosphere, hydrosphere or atmosphere." (Alexander, 2000)

Hazard

". . .natural and social systems interact to produce a hazard. . ."

"Hazards always result from interaction of physical and human systems. To treat them as though they were wholly climatic or geologic or political or economic is to risk omission of components that must be taken into account if sound solutions for them are to be found".

". . .nature is neutral, and. . .the environment event becomes hazardous only when it intersects with man. The event leads to disaster when (1) it is extreme in magnitude, (2) the population is very great, or (3) the human-use system is particularly vulnerable."

(Burton, 1993; quoted in Blanchard, 2005)

Hazard

"Natural hazard: the probability of occurrence, within a specific period of time in a given area, of a potentially damaging natural phenomenon."

[...]

In general, the concept of hazard is now used to refer to latent danger or an external risk factor of a system or exposed subject. Hazard can be expressed mathematically as the probability of occurrence of an event of certain intensity, in a specific site and during a determined period of exposure time." (Cardona, 2003)

Hazard

"A hazard, in the broadest term, is a threat to people and the things they value. Hazards have a potentiality to them (they could happen), but they also include the actual impact of an event on people or places. Hazards arise from the interaction between social, technological, and natural systems." (Cutter, 2001; quoted in Blanchard, 2005)

Hazard

"A threatening event, or the probability of occurrence of a potentially damaging phenomenon within a given time period and area." (EEA, 2005)

Hazard

"Hazard ... reflects a potential threat to humans as well as the impact of an event on society and the environment. ... hazards are ... in part socially constructed by people's perceptions and their experiences. Moreover, people contribute to, exacerbate, and modify hazards. Thus, hazards can vary by culture, gender, race, socioeconomic status, and political structure as well." (Mitchell and Cutter, 1997)

Hazard

"An act or phenomenon that has the potential to produce harm or other undesirable consequences to some person or thing". (Multihaz. Mitigation Council, 2002)

Hazard

"The term 'risk' is often confused with 'hazard'. A high voltage power supply, a sample of radioactive metal, or a toxic chemical may present a hazard, meaning that they present the potential for harm. Concentrated acids, for example, clearly present the hazard to the user of serious burns if they are handled incorrectly.

The risk is the probability or chance that the hazard posed by the chemical will lead to injury. Thus, concentrated sulfuric acid is a hazardous chemical; because it is very corrosive and reactive. However, provided it is handled in an appropriate way the risks it poses may be small.

It is thus evident that hazards are something we can do little about. The hazards posed by a carcinogen, a concentrated acid or an explosive substance are inherent properties of the material. The risks they pose, however, can be (and should be!) minimised by initially preparing a suitable risk assessment, and then following the procedures laid down in that assessment." (Oxford University, 2005)

Hazard

"The probability of occurrence associated with an extreme event that can cause a failure." (UNDRO, 1991; Plate, 2002)

Hazard

"...there is a distinction between an event, a hazard, and a disaster. A natural event, whether geological, climatological, etc., is simply a natural occurrence, whereas a hazard, geological or otherwise, is the potential danger to human life or property." (Rahn, 1996)

Hazard

"Hazards are defined as threats to a system, comprised of perturbations and stress (and stressors), and the consequences they produce. A perturbation is amajor spike in pressure (e.g., a tidal wave or hurricane) beyond the normal range of variability in which the system operates. Perturbations commonly originate beyond the system or location in question. Stress is a continuous or slowly increasing pressure (e.g., soil degradation), commonly within the range of normal variability. Stress often originates and stressors (the source of stress) often reside within the system. Risk is the probability and magnitude of consequences after a hazard (perturbation or stress)." (Turner et al., 2003)

Hazard

"A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity, frequency and probability." (UN/ISDR, 2004)

Hazard, natural

"Natural hazards are dynamic phenomena that involve people not only as victims but also as contributors and modifiers." (Kates, 1996; quoted in Rashed and Weeks, 2002)

Hazard, natural

"Natural processes or phenomena occurring in the biosphere that may constitute a damaging event." (UNDP, 2004)

Human Security

"Human Security can no longer be understood in purely military terms. Rather, it must encompass economic development, social justice, environmental protection, democratization, disarmament, and respect for human rights and the rule of law." (Annan, 2005)

Human Security

"The Commission on Human Security's definition of human security: to protect the vital core of all human lives in ways that enhance human freedoms and human fulfilment. Human security means protecting fundamental freedoms – freedoms that are the essence of life. It means protecting people from critical (severe) and pervasive (widespread) threats and situations. It means using processes that build on people's strengths and aspirations. It means creating political, social, environmental, economic, military and cultural systems that together give people the building blocks of survival, livelihood and dignity." (Comm. Hum. Sec., 2003)

Human Security

"In policy terms, human security is an integrated, sustainable, comprehensive security from fear, conflict, ignorance, poverty, social and cultural deprivation and hunger, resting upon positive and negative freedoms." (van Ginkel and Newman, 2000)

Human Security

"Human Security is about attaining the social, political, environmental and economic conditions conducive to a life in freedom and dignity for the individual." (Hammerstad, 2000)

Human Security

[To achieve] "... human security, recognizing the inter linkages of environment and society, and acknowledging that that our perceptions of our environment and the way we interact with our environment are historically, socially, and politically constructed. In this context human security is achieved when and where individuals and communities:

→ have the options necessary to end, mitigate, or adapt to threats to their human, environmental, and social rights;

→ have the capacity and the freedom to exercise these options; and

→ actively participate in attaining these options.

Human security embodies the notion that problems must always be addressed from a broader perspective that encompasses both poverty and issues of equity (social, economic, environmental, or institutional) as it is these issues that often lead to insecurity and conflict." (Lonergan et al., 2000)

Resilience

"The ability to resist downward pressures and to recover from a shock. From the ecology literature: property that allows a system to absorb and use (even benefit from) change. Where resilience is high, it requires a major disturbance to overcome the limits to qualitative change in a system and allow it to be transformed rapidly into another condition. From the sociology literature: ability to exploit opportunities, and resist and recover from negative shocks." (Alwang et al., 2001)

Resilience

"The capacity that people or groups may possess to withstand or recover from emergencies and which can stand as a counterbalance to vulnerability." (Buckle, 1998)

Resilience

"Qualities of people, communities, agencies, infrastructure that reduce vulnerability. Not just the absence of vulnerability rather the capacity to 1) prevent, mitigate losses and then if damage occurs 2) to maintain normal living conditions and to 3) manage recovery from the impact." (Buckle et al., 2000)

"A measure of how quickly a system recovers from failures." (Emergency Mngm. Australia, 1998, quoted in Buckle et al., 2000).

"Not just the absence of vulnerability. Rather it is the capacity, in the first place, to prevent or mitigate losses and then, secondly, if damage does occur to maintain normal living conditions as far as possible, and thirdly, to manage recovery from the impact." (Buckle et al., 2000)

Resilience

"Resilience is a measure of the recovery time of a system." (Correira et al., 1987)

Resilience

"The capacity of a group or organization to withstand loss or damage or to recover from the impact of an emergency or disaster. The higher the resilience, the less likely damage may be, and the faster and more effective recovery is likely to be." (Department of Human Services, 2000)

Resilience

"The ability of an organization to absorb the impact of a business interruption, and continue to provide a minimum acceptable level of service." (Disaster Recov. Journal, 2005)

Resilience

"Details of Resilience might be inherently unknowable – especially in the case of complex communities undergoing constant change." (Handmer, 2002)

Resilience

"Resilience is the flip side of vulnerability – a resilient system or population is not sensitive to climate variability and change and has the capacity to adapt." (IPCC, 2001)

Resilience

"The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organising itself to increase its capacity for learning from past disasters and improving risk-reduction measures." (IRIN/OCHA, 2005)

Resilience

"The concept [of resilience] has been used to characterize a system's ability to bounce back to a reference state after a disturbance and the capacity of a system to maintain certain structures and functions despite disturbance.[...] resilience of the system is often evaluated in terms of the amount of change a given system can undergo (e.g., how much disturbance or stress it can handle) and still remain within the set of natural or desirable states (i.e., remain within the same 'configuration' of states, rather than maintain a single state)." (Turner et al., 2003)

Resilience

"The capacity of a system, community or society potentially exposed to hazards to adapt by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures." (UN/ISDR, 2004)

Resiliency

"Pliability, flexibility, or elasticity to absorb the event. Resiliency is offered by types of construction, barriers, composition of the land (geological base), geography, bomb shelters, location of dwelling, etc. As resiliency increases, so does the absorbing capacity of the society and/or the environment. Resiliency is the inverse of vulnerability."
(Journ. of Prehospital and Disaster Medicine, 2004)

Resiliency

"Resiliency to disasters means a locale can withstand an extreme natural event with a tolerable level of losses. It takes mitigation actions consistent with achieving that level of protection." (Mileti, 1999)

Resiliency

"Resiliency is thought of as a characteristic of systems that offers flexibility and scope for adaptation whilst maintaining certain core functions (for example, access to basic needs and social stability)." (Pelling, 2003)

Risk

"In general, "risk" is defined as the expectation value of losses (deaths, injuries, property, etc.) that would be caused by a hazard. Disaster risk can be seen as a function of the hazard, exposure and vulnerability as follows; Disaster Risk = function (Hazard, Exposure, Vulnerability)" (ADRC, 2005)

Risk

"Risk can be defined as the likelihood, or more formally the propbability, that a particular level of loss will be sustained by a given series of elements as a result of a given level of hazard.The elements at risk consists of populations, communities , the built environment, the natural environment, economic activities and services, which are under threat of disaster in a given area." (Alexander, 2000)

Risk

(In this definition risk and hazard are used as synonyms) "Risk is characterized by a known or unknown probability distribution of events. These events are themselves characterized by their magnitude (including size and spread), their frequency and duration, and their history." (Alwang et al., 2001)

Risk

"Risk: the expected number of lives lost, persons injured, damage to property and disruption of economic activity due to a particular natural phenomenon, and consequently the product of specific risk and elements at risk.

[...]

The capacity of a system, community or society to resist or to change in order that it may obtain an acceptable level in functioning and structure. This is determined by the degree to which the social system is capable of organising itself, and the ability to increase its capacity for learning and adaptation, including the capacity to recover from a disaster." (Cardona, 2003)

Risk

"...risk is when you know the possible range of things that may happen following a choice; uncertainty is when you don't. ...Risk in its general form is when it is possible, at least in principle, to estimate the likelihood that an event (or set of events) will occur; the specific forms of those estimates are the probabilities of adverse consequences."
(Clarke, 1999; quoted in Blanchard 2005)

Risk

"Risk' is the probability of a loss, and this depends on three elements, hazard, vulnerability, and exposure. If any of these three elements in risk increases or decreases, then the risk increases or decreases respectively." (Crichton, 1999)

Risk

"Potential for exposure to loss. Risks, either man-made or natural, are constant. The potential is usually measured by its probability in years." (Disaster Recovery Journal, 2005)

Risk

Risk is "the probability of an event multiplied by the consequences if the event occurs." (Einstein, 1988)

Risk

"A combination of the probability or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence. More specific, a risk is defined as the probability of harmful consequences, or expected loss (of lives, people, injured, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards." (Europ. Spatial Planning Observ. Netw., 2003)

Risk

"The following formula is used to calculate disaster risk: Disaster Risk = Hazard x Vulnerability

In this equation risk is the product of the two factors, hazard and vulnerability. Therefore, it is clear that a risk exists only if there is vulnerability to the hazard posed by a natural event." (Garatwa and Bollin, 2002)

Risk

"The risk associated with flood disaster for any region is a product of both the region's exposure to the hazard (natural event) and the vulnerability of objects (society) to the hazard. It suggests that three main factors contribute to a region's flood disaster risk: hazard, exposure, and vulnerability." (Hori et al., 2002)

Risk

"The objective (mathematical) or subjective (inductive) probability that the hazard will become an event. Factors (risk factors) can be identified that modify this probability. Such risk factors are constituted by personal behaviours, life-styles, cultures, environmental factors, and inherited characteristics that are known to be associated with health-related questions. Risk is the probability of loss to the elements at risk as the result of the occurrence, physical and societal consequences of a natural or technological hazard, and the mitigation and preparedness measures in place in the community. Risk is the expected number of lives lost, persons injured, damage to property and disruption of economic activity due to a particular natural phenomenon, and consequently the product of specific risk and elements at risk. – UNDRO." (Journ. of Prehospital and Disaster Medicine, 2004)

Risk

"Risk and uncertainty relate to situations where there is more than one possible outcome.

F. Knight (1921) first formally distinguished between risk and uncertainty:

Risk: We can identify the probability of each possible outcome.

Uncertainty: We can identify the outcome, but not the corresponding probabilities" (Knight, 1921, quoted in Bieri, 2006)

Risk

"[...] the chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood. (In disaster risk management – a concept used to describe the likelihood of harmful consequences arising from the interaction of hazards, communities and the environment.)" (Natural Disaster Risk Management, 2001)

Risk

"Risk indicates the degree of potential losses in urban places due to their exposure to hazards and can be thought of as a product of the probability of hazards occurrence and the degree of vulnerability." (Rashed and Weeks, 2002)

Risk

"The probability of harmful consequences or expected losses resulting from a given hazard to a given element at danger or peril over a specified time period."
(Schneiderbauer and Ehrlich, 2004)

Risk

"Risk of a system may be defined simply as the possibility of an adverse and unwanted event. Risk may be due solely to physical phenomenon such as health hazards or to the interaction between man-made systems and natural events, e.g. a flood loss due to an overtopped levee. Engineering risk for water resources systems in general has also been described in terms of a figure of merit which is a function of performance indices, say for example, reliability, incident period, and reparability... ." (Shrestha, 2002)

Risk

"Risk is an integral part of life. Indeed, the Chinese word for risk 'weij-ji' combines the characters meaning 'opportunity/chance' and 'danger' to imply that uncertainty always involves some balance between profit and loss. Since risk cannot be completely eliminated, the only option is to manage it." (Smith, 1996; quoted in Blanchard, 2005)

Risk

"Used in an abstract sense to indicate a condition of the real world in which there is a possibility of loss; also used by insurance practitioners to indicate the property insured or the peril insured against." (Swiss Re, 2005)

Risk

"The expected number of lives lost, persons injured, damage to property and disruption of economic activities due to a particular natural phenomenon, and consequently the product of specific risk and element at risk. Specific risk: The expected degree of loss due to a particular natural phenomenon and as a function of both, natural hazard and vulnerability." (Tiedemann, 1992)

Risk

"The probability of harmful consequences, or expected loss of lives, people injured, property, livelihoods, economic activity disrupted (or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions. Risk is conventionally expressed by the equation: Risk = Hazard x Vulnerability." (UNDP, 2004)

Risk

"The probability of exposure to an event, which can occur with varying severity at different geographical scales, suddenly and expectedly or gradually and predictably, and to the degree of exposure." (UNEP, 2002)

Risk, acceptable

"One definition of acceptable risk that has been widely accepted in environmental regulation, although is not relevant to microbiological parameters, is if lifetime exposure to a substance increases a person's chance of developing cancer by one chance in a million or less."

"A risk is acceptable when:

- it falls below an arbitrary defined probability
- it falls below some level that is already tolerated
- it falls below an arbitrary defined attributable fraction of total disease burden in the community
- the cost of reducing the risk would exceed the costs saved
- the cost of reducing the risk would exceed the costs saved when the 'costs of suffering' are also factored in
- the opportunity costs would be better spent on other, more pressing, public health problems
- public health professionals say it is acceptable
- the general public say it is acceptable (or more likely, do not say it is not)
- politicians say it is acceptable."

"In the strict economic sense a risk is acceptable if the economic savings arising out of action to reduce a risk outweigh the cost of such action. This approach is, in effect, a simple cost-benefit analysis." (Sloman, 1994)

"This approach to determining acceptable risk is based on what is acceptable to the general public. In other words, a risk is acceptable when it is acceptable to the general public." (Hunter and Fewtrell, 2001)

Risk, acceptable

"The probability of occurrences of physical, social, or economic consequences of an earthquake that is considered by authorities to be sufficiently low in comparison with the risks from other natural or technological hazards that these occurrences are accepted as realistic reference points for determining design requirements for structures, or for taking social, political, legal, and economic actions in the community to protect people and property."
(Journ. of Prehospital and Disaster Medicine, 2004)

Risk, acceptable

"Degree of humans and material loss that is perceived as tolerable in actions to minimize disaster risk". (Blanchard, 2005)

Risk, acceptable

"The concept of acceptable risk is not particular easy to define. It is essentially a measure of the risk of harm, injury or disease arising from a chemical or process that will be tolerated by a person or group."

"Whether a risk is 'acceptable' will depend upon the advantages that the person or group perceives to be obtainable in return for taking the risk, whether they accept whatever scientific and other advice is offered about the magnitude of the risk, and numerous other factors, both political and social." (Oxford University, 2005)

Risk, acceptable

"Risk tolerance.

Given that the provision of absolute safety is impossible, there is great sense in trying to determine the level of risk which is acceptable for any activity or situation. Thus, when a hazard is being managed, the financial and other resources allocated to the task should theoretically match the degree of threat posed by the hazard, as indicated by the rank of the risk. [...]

One must always specify acceptable to whom and that implies a conscious decision based on all the available information. [...]

The 1993 floods in the upper Mississippi river basin had an estimated return period of more than one in 200 years, yet some people who were flooded asserted that this event should now be regarded as an unacceptable risk. Such arguments ignore both the economic and social benefits derived by those communities from their floodplain location over the previous 100 years or so, when few flood losses occurred, and the cost to the taxpayer implied in protecting floodplain basins against a flood of the 1993 magnitude." (Smith, 1996)

Risk, acceptable

"The level of loss a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions. In engineering terms, acceptable risk is also used to assess structural and non-structural measures undertaken to reduce possible damage at a level which does not harm people and property, according to codes or 'accepted practice' based, among other issues, on a known probability of hazard." (UN/ISDR, 2004)

Risk, acceptable

"The acceptable probability of losing one's life from an action or an event based on equation:

PE_j (xd) $\leq$ *PAcc* = (10 − 6 / *year*) / v_{ij},

with PEj being the exceedance probability at location *j*, xd is the design event PAcc is the acceptable probability, and v_{ij} is the vulnerability of an individual i at location j." (Vrijling et al., 1995)

Risk, seismic

"Seismic risk consists of the components seismic hazard, seismic vulnerability, and value of elements at risk (both, in human and economic terms)." (Wahlström et al., 2004)

Vulnerability

"Vulnerability should be recognized as a key indicator of the seriousness of environmental problems such as global warning." (Adger et al., 2001)

Vulnerability

"[...] 'vulnerability' to the natural phenomenon must be present for an event to constitute a natural disaster. Vulnerability is defined as a condition resulting from physical, social, economic, and environmental factors or processes, which increases the susceptibility of a community to the impact of a hazard." (ADRC, 2005)

Vulnerability

"If risk is one side of the coin, its other side is vulnerability, which we may loosely define as potential for losses or other adverse impacts. People, buildings, ecosystems or human activities threatened with disaster are vulnerable. [...] Essentially, vulnerability refers to the potential for casualty, destruction, damage, disruption or other form of loss with respect to a particular element. Risk combines this with the probable size of impact to be expected from a known magnitude of hazard. [...] Many authors [...] have confused vulnerability with exposure: in reality they are two complementary components of risk." (Alexander, 2000)

Vulnerability

"The insecurity of the well-being of individuals, households or communities in the face of a changing environment". (Moser and Holland, 1989; quoted in Alwang et al., 2001).

Vulnerability

"Summarizing livelihood and environmental literature: vulnerability is the exposure of individuals or groups to livelihood stress as a result of environmental change." (Alwang et al., 2001)

Vulnerability

"The characteristics of a person or a group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood is put at risk by a discrete or identifiable event in nature or society.

[...]

Vulnerability concept consists of two opposing forces: On one hand, the processes that cause vulnerability that can be observed; on the other hand, the physical exposure to hazards (earthquakes, storms, floods, etc.). Vulnerability develops then from underlying reasons in the economic, demographic and political spheres into insecure conditions (fragile physical environment, instable local economy, vulnerable groups, lack of state or private precautions) through the so-called dynamic processes (e.g., lack of local institutions, under-developed markets, population growth, and urbanization)." (Blaikie et al., 1994)

Vulnerability

"Vulnerability concerns the complex social, economic, and political considerations in which peoples' everyday lives are embedded and that structure the choices and options they have in the face of environmental hazards. The most vulnerable are typically those with the fewest

choices, those whose lives are constrained, for example, by discrimination, political powerlessness, physical disability, lack of education and employment, illness, the absence of legal rights, and other historically grounded practices of domination and marginalization." (Bolin and Stanford, 1998)

Vulnerability

"The degree of loss to a given element at risk or set of such elements resulting from the occurrence of a natural phenomenon of a given magnitude and expressed on a scale from 0 (no damage) to 1 (total loss) or in percent of the new replacement value in the case of damage to property." (Buckle et al., 2000)

Vulnerability

"Vulnerability (in contrast to poverty which is a measure of current status) should involve a predictive quality: it is supposedly a way of conceptualizing what may happen to an identifiable population under conditions of particular risk and hazards. Is the complex set of characteristics that include a person's:

initial well-being (health, morale, etc.);

self-protection (asset pattern, income, qualifications, etc.);

social protection (hazard preparedness by society, building codes, shelters, etc.);

social and political networks and institutions (social capital, institutional environment, etc.)" (Cannon et al., 2004)

Vulnerability

"Vulnerability: the degree of loss to a given element at risk or set of such elements resulting from the occurrence of a natural phenomenon of a given magnitude and expressed on a scale from 0 (no damage) to 1 (total loss).

[...]

On the other hand, vulnerability may be understood, in general terms, as an internal risk factor, mathematically expressed in terms of the feasibility that the exposed subject or system will be affected by the phenomenon that characterizes the hazard." (Cardona, 2003)

Vulnerability

"Vulnerability, therefore, is a human-induced situation that results from public policy and resource availability/distribution, and it is the root cause of many disaster impacts. Indeed, research demonstrates that marginalized groups invariably suffer most in disasters. Higher levels of vulnerability are correlated with higher levels of poverty, with the politically disenfranchised, and with those excluded from the mainstream of society." (Chakraborty et al., 2005)

Vulnerability

"Vulnerability expresses the severity of failure in terms of its consequences. The concern is not how long the failure lasts but how costly it is." (Correira et al., 1987)

Vulnerability

"Is a broad measure of the susceptibility to suffer loss or damage. The higher the vulnerability, the more exposure there is to loss and damage." (Department of Human Services, 2000)

Vulnerability

"The degree of loss to a given element at risk (or set of elements) resulting from a given hazard at a given severity level" In contrast to the concept of risk, here the probability of the occurrence of a hazard is not considered." (from: UNDP/UNDHA, 1994, pp. 38-39; see also UNDHA, 1992). [...] "Vulnerability has process character and is not static."
(Feldbrügge and von Braun, 2002)

Vulnerability

"Vulnerability (V) = Hazard – Coping,

with Hazard = H (Probability of the hazard or process; shock value; predictability; prevalence; intensity/strength); and

Coping = C (Perception of risk and potential of an activity; possibilities for trade; private trade, open trade)."

[...]

"Determinants of disaster vulnerability:

demographic factors: population growth, urbanization, settlements near coastal areas, etc.,

the state of economic development: poverty, modernization processes,

environmental changes: climate changes, degradation and depletion of resources (straightening the courses of rivers, deforestation, etc.);

political factors,

an increase in tangible assets, which leads to an increase in damages,

effects of disaster protection structures and research, and

the interactions of the causes of disasters." (Feldbrügge and von Braun, 2002)

Vulnerability

"Vulnerability denotes the inadequate means or ability to protect oneself against the adverse impacts of natural events and, on the other hand, to recover quickly from their effects." (Garatwa and Bollin, 2002)

Vulnerability

"The likelihood that some socially defined group in society will suffer disproportionate death, injury, loss or disruption of livelihood in an extreme event, or face greater than normal difficulties in recovering from a disaster." (Handmer and Wisner, 1998)

Vulnerability

"The characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard." (IFRC, 1999)

Vulnerability

"Vulnerability is defined as the extent to which a natural or social system is susceptible to sustaining damage from climate change. Vulnerability is a function of the sensitivity of a system to changes in climate (the degree to which a system will respond to a given change in climate, including beneficial and harmful effects), adaptive capacity (the degree to which adjustments in practices, processes, or structures can moderate or offset the potential for damage or take advantage of opportunities created by a given change in climate), and the degree of exposure of the system to climatic hazards." (IPCC, 2001)

Vulnerability

"The potential loss in value of an element at risk from the occurrence and consequences of natural and technological hazards. The factors that influence vulnerability include: demographics, the age and resilience of the built environment, technology, social differentiation and diversity, regional and global economies, and political arrangements. Vulnerability is a result of flaws in planning, siting, design, and construction. Vulnerability is the degree of loss to a given element at risk, or set of such elements, resulting from the occurrence of a natural phenomenon of a given magnitude and expressed on a scale from 0 (= no damage) to 1 (= total loss). -UNDRO." (Journ. of Prehospital and Disaster Medicine, 2004)

Vulnerability

"Vulnerability is provisionally defined as the degree to which a system is sensitive to and unable to cope with adverse impacts of global change stimuli. Vulnerability is therefore a function of a system's exposure to global change stimuli and its adaptive capacity, that is, its ability to cope with these stimuli." (Klein, 2003)

Vulnerability

"Vulnerability is a pervasive socio-economic condition; it is the reason why the poor and disadvantaged are the predominant victims of disaster." (Lewis, 1997, quoted in Musser, 2002)

Vulnerability

"Vulnerability defines the inherent weakness in certain aspects of the urban environment with are susceptible to harm due to social, biophysical, or design characteristics."
(Rashed and Weeks, 2002)

Vulnerability

2Is the predisposition of being susceptible to injuries, attacks or to have difficulties to reconstitute a compromised state of health. All depends on the vulnerable components placed at the centre of our system:

1.) vulnerability of human beings to natural hazards of the planet, depending on their systems, behaviours and reactions of individuals.

2.) formally more or less fragile natural environments that have been settled, often in excess, and that have become vulnerable due the increase human activity.

3.) Nature itself.

4.) vulnerabilities: Man, goods, activities, and the environment.

(Translated from Reveau, 2004).

Vulnerability

"We propose the term 'susceptibility' for 'vulnerability' in the pre-event phase and 'resilience' for 'vulnerability' in the post-event phase. [...] Susceptibility would be predominantly determined by physical features, 'resilience' by socio-economic characteristics." (Schneiderbauer and Ehrlich, 2004)

Vulnerability

"Vulnerability is usually defined as the capacity of a system to be wounded from a stress or perturbation. It is a function of the probability of occurrence of the perturbation and its magnitude, as well as of the ability of the system to absorb and recover from such perturbation." (Suarez, 2002)

Vulnerability

"The degree to which different classes in society are differentially at risk, both in terms of the probability of occurrence of an extreme event and the degree to which the community absorbs the effects of extreme physical events and helps different classes to recover." (Susman et al., 1983)

Vulnerability

"Vulnerability is the degree to which a system, subsystem, or system component is likely to experience harm due to exposure to hazard, either a perturbation or stress/stressor." (Turner et al., 2003)

Vulnerability

"The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards. For positive factors, which increase the ability of people to cope with hazards, see definition of capacity." (UN/ISDR, 2004)

Vulnerability

"A human condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard." (UNDP, 2004)

Vulnerability

"Vulnerability is expressed as the degree of expected damage (i.e., the cost of repair divided by the cost of replacement) given on a scale of 0 to 1, as a function of hazard intensity (or magnitude, depending on the convention used)." (UNDRO, 1991)

Vulnerability

"Represents the interface between exposure to the physical threats to human well-being and the capacity of people and communities to cope with those threats." (UNEP, 2002)

Vulnerability

Vulnerability is the intrinsic and dynamic feature of an element at risk (community, region, state, infrastructure, environment etc.) that determines the expected damage/harm resulting from a given hazardous event and is often even affected by the harmful event itself. V. changes continuously over time and is driven by physical, social, economic and environmental factors. (UNU-EHS, personal communication, 2004)

Vulnerability

"The vulnerability increases with the number of people affected by the impact of a natural hazard, given by the formula: $v_{ij} = 10\text{-}3 \geq nj^2$, for $n \geq 10$ casualties", where v_{ij} is the vulnerability of an individual i at location j. (Vrijling et al., 1995)

Vulnerability

"This definition [by Chambers, 1989] suggests three basic co-ordinates:

1.) the risk of exposure to crises, stress and shocks

2.) the risk of inadequate capacities to cope with stress, crises and shocks; and

3.) the risk of severe consequences of, and the attendant risks of slow or limited poverty (resiliency) from, crises, risk and shocks." (Watts and Bohle, 1993; based on Chambers, 1989)

Vulnerability (Urban)

"Urban vulnerability to natural hazards such as earthquakes is a function of human behaviour. It describes the degree to which socioeconomic systems and physical assets in urban areas are either susceptible or resilient to the impact of natural hazards. Vulnerability is independent from any particular magnitude from a specific natural event but dependent on the context in which it occurs. The characteristic of the urban community that can be assessed through a combination of ecological factors associated with the physical conditions of the population in that place. The physical and social conditions are inextricably bound together in many disaster situations that we can use the former as indicative of the latter. V. is continuously modified by human actions and therefore it varies over space and time. V cannot be assessed in absolute terms; the performance of the urban place should be assessed with reference to specific spatial and temporal scales (Rashed and Weeks, 2002). The adaptive and coping capacities that determine the extent to which a society can tolerate damage from extreme events without significant outside assistance." (Mileti, 1999)

3. Conclusions

This comparative glossary demonstrates just how widely the definitions of a single term can range. Many terms are tightly interwoven and are even used interchangeably. The listing informs the reader about the multiple definitions in use across various disciplines and sectors, which is an important stepping stone to dispelling the often lamented misunderstandings that arise in discussions of disaster reduction. What the above listing fails to offer is a harmonized concept of core terms that is precise enough to delineate the terms from each other, yet flexible and broad enough so as to be applicable across sectors, disciplines, and scales on which disaster reduction operates.

Terms such as “vulnerability” and “risk” are envelopes for complex and interconnected parameters and processes. A paradigm shift has taken place that puts more and more emphasis on non-natural science issues. These are harder to conceptualize since they are often not tangible, or of qualitative nature, e.g. coping capacity, resilience, institutional frameworks, cultural and social aspects.

Terms of such complexity are not easily defined in an exhaustive way. No matter – it is more important to agree on their key characteristics. That way, it is possible to create a conceptual frame whose content will vary with context, geographic scale, and time scale. Here the author describes the characteristics of some central terms in such a way that they all fit into a logically coherent framework. Once the basic framework is established, each term can always be defined more precisely to fit the specific context, use, and scale.

3.1 Hazard

Every disaster starts with a hazard – known or unknown. There are many ways to characterize hazards, e.g. natural, technical, man-made, nuclear, ecological. The categories are probably as diverse as the disciplines and sectors involved. But they all have in common the potential to cause the severe adverse effects that lie at the bottom of every emergency, disaster, and catastrophe.

A hazard can be as general as “flood” or “storm” and, as such, stand for groups of potentially harmful events of variable severity. In other words, the hazard “storm” refers to all potential wind speeds that can be expected in a given region. A hazard can also be formulated more specifically as a magnitude 7.2 earthquake in Los Angeles or a category 5 Hurricane hitting the Philippines. In that case we are dealing with a specific hazard scenario. One important feature of hazard is that it has the notion of probability, or a likelihood of occurring. A hazard is a threat, not the actual event. Any hazard can manifest itself in an actual harmful event. In other words, if it can be measured in terms of real damage or harm it is no longer a hazard but has become an event, disaster or catastrophe.

Every specific hazard magnitude is attached to a usually empirically derived return period, which is site-specific. The return period of a category 5 hurricane is different for New Orleans compared to the Philippines. If hazard is pegged out more broadly such as “epidemic”, “drought” or “flood”, it is characterized by all possible magnitudes. In order to quantify hazard, each magnitude is tied to a specific return period or its inverse, frequency. The latter ensemble is the magnitude-frequency relationship of a particular hazard and it is always an inherent characteristic of a specific locality or region.

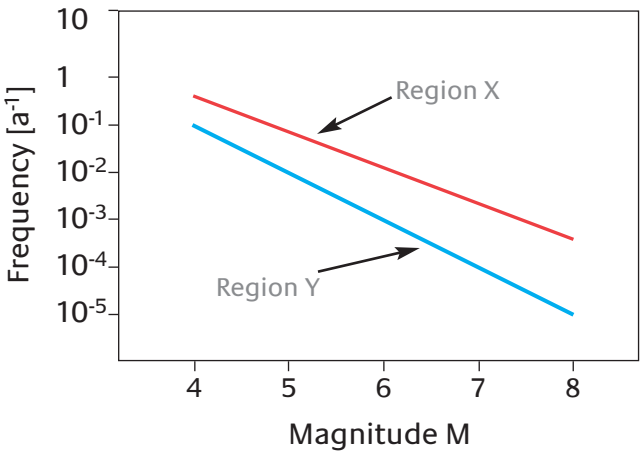

Figure 1. For earthquake hazard, the two lines represent the different magnitude-frequency relationships for two different fictitious regions, region x and region y. The two lines are region-specific.

3.2 Vulnerability

Another prerequisite for a disaster besides hazard is vulnerability. Vulnerability is a dynamic, intrinsic feature of any community (or household, region, state, infrastructure or any other element at risk) that comprises a multitude of components. The extent to which it is revealed is determined by the severity of the event.

Vulnerability indicates a damage potential and is a forward looking variable. Or as Cannon et al. (2004) characterized it, "vulnerability (in contrast to poverty, which is a measure of current status,) should involve a predictive quality: it is supposedly a way of conceptualizing what may happen to an identifiable population under conditions of particular risk and hazards." Determining vulnerability means asking what would happen if certain event(s) impacted particular elements at risk (e.g. a community).

Vulnerability is an intrinsic characteristic of a community that is always there even in quiescent times between events. It is not switched on and off with the coming and going of events; rather, it is a permanent and dynamic feature that is revealed during an event to an extent that depends on the magnitude of the harmful event. This means that vulnerability can often only be measured indirectly and retrospectively, and the dimension normally used for this indirect measure is damage or more general harm.

What is normally seen in the aftermath of a disaster is not the vulnerability per se, but the harm done. Seeing the damage pattern of a community without knowing the magnitude of the event does not allow conclusions regarding the community's vulnerability. In that sense the magnitude-damage relationship reflects the vulnerability of an element at risk (community, household, nation, infrastructure etc.).

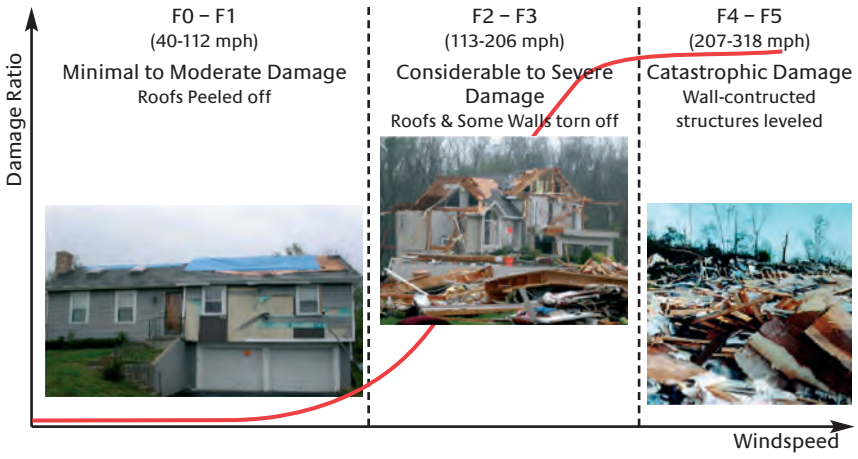

Figure 2. Sample residential damage function for the hazard of tornado illustrates the progression of wind damage. Source: Doggett (2003). Tornado intensities are marked from F0 to F5 on the Fujita Scale. The full relationship between windspeed and damage characterizes the physical vulnerability of a certain building type.

Vulnerability changes continuously over time and is usually even affected by the harmful event itself. It can increase, for example, if poverty has been heightened by a disaster, so that the next disaster will have an even more devastating effect on the impoverished community. A small event, however, can raise the awareness of the community and in that way decrease its vulnerability.

Vulnerability is a function of the sensitivity or susceptibility of a system (community, household, building, infrastructure, nation etc.). It is "independent from any particular magnitude from a specific natural event but dependent on the context in which it occurs. Vulnerability cannot be assessed in absolute terms; the performance of the urban place should be assessed with reference to specific spatial and temporal scales" (Rashed and Weeks, 2002).

For practical reasons a vulnerability analysis will often limit itself to a certain scenario, i.e. event magnitude, for which an analysis is carried out. This is usually an appropriate approach to assessing vulnerability, but the choice of the event scenario is a subjective one. What scenario should be chosen: The 100 year event, 200 year event, the largest event that has occurred in the living memory, or the 5 m flood level?

In earthquake engineering this susceptibility is often quantified by means of a damage ratio that can vary between no damage (0%) and total destruction (100%). But vulnerability has many dimensions – physical (built environment), social, economic, environmental, institutional, and human – and many of them are not easily quantifiable.

The complexity of vulnerability is not only given by its multiple dimensions but also by the fact that it is site-specific and that its parameters change with geographic scale. The parameters that determine vulnerability are different on the household-, community-, and country-level. In the economic dimension of the household-level, parameters such as the amount and diversity of income of single persons are relevant, whereas on a country-level, inflation rate and GDP are more appropriate.

The limitations of vulnerability theory in addressing complex and dynamic reality are noted in Duryog Nivaran's book: *Understanding Vulnerability.* He says that "vulnerability is too complicated to be captured by models and frameworks. There are so many dimensions to it: economic, demographic, political, and psychological. There are so many factors making people vulnerable: not just a range of immediate causes but – if one analyses the subject fully – a host of root causes too ... investigations of vulnerability are investigations into the workings of human society, and human societies are complex – so complex and diverse that they easily break out of any attempts to confine them within the neatly drawn frameworks, categories, and definitions. They are also dynamic, in a state of constant change, and, because they are complex and diverse, all the elements within societies are moving, so that these changes occur in different parts of society, in different ways and at different times (Twigg, 1998)". On a more optimistic note, every vulnerability analysis requires adaptation to its specific objectives and scales. Professionals in that field must be aware that there are many answers to the question of vulnerability. One potential answer to the question of vulnerability is given in Birkmann (2006), who defines vulnerability in a more encompassing way so that it includes exposure and coping capacities of a community.

3.3 Exposure

Together with vulnerability and hazard exposure is another pre-requisite of risk and disaster. Here, exposure is understood as the number of people and/or other elements at risk that can be affected by a particular event. In an uninhabited area the human exposure is zero. No matter how many hurricanes will affect an uninhabited island, the human exposure, and hence the risk

of human loss, remains zero. While the vulnerability determines the severity of the impact an event will have on the elements at risk, it is the exposure that drives the final tally of damage or harm. So in its economic dimension, vulnerability is depicted by the projection that, in a given event, a family will probably lose 50% of its assets. How many families will be affected and lose 50% of their assets is captured by the exposure. In an overly simplified example, the poverty of a community will determine the degree to which it will be affected by an event of a certain magnitude (à susceptibility) and the number of the community members represents the exposure. In that sense a densely populated area is at higher risk then a sparsely populated one, all other conditions being equal.

3.4 Coping Capacity and Resilience

In real life the harm done does not only depend on hazard, vulnerability and exposure, but also on the coping capacity and the resilience of the element at risk. In the literature most definitions show a large overlap between coping capacity and resilience and are often used as synonyms. These two dimensions of a harmful event are not easily separated from each other.

Here, coping capacity encompasses those strategies and measures that act directly upon damage during the event by alleviating or containing the impact or by bringing about efficient relief, as well as those adaptive strategies that modify behaviour or activities in order to circumvent or avoid damaging effects.

Resilience is all of these things, plus the capability to remain functional during an event and to completely recover from it. So resilience includes coping capacity but at the same time goes beyond it.

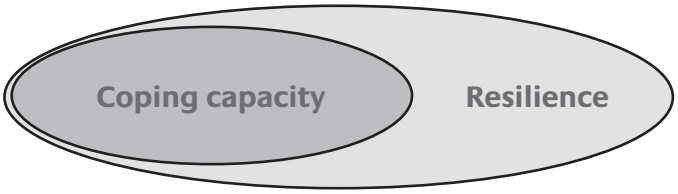

Figure 3. Coping capacity and resilience are hard to delineate. Resilience is understood to be the more encompassing term.

The difficult question that arises from this definition is: does vulnerability already account for coping capacity and resilience or are they separate and counteracting parameters? The answer depends on how we define the damage or harm caused. If the extent of the damage or harm is defined also by the duration of the adverse effects and by its repercussions on people's poverty, economy, or awareness, then vulnerability has to include coping capacity and resilience. This conclusion follows from the postulation that vulnerability describes susceptibility to damage or harm.

3.5 Risk

Vulnerability is measured in terms of expected harm/damage and so is risk. How can those terms be delineated from each other?

Risk always involves the notion of probability of occurrence. So information on "when" or on "how often" indicates we are talking about risk. That could be captured in a continuous damage-frequency relationship or just the definition of the return period for a particular event scenario. While vulnerability informs about the consequences of possible adverse events, risk also provides information on how often or with what probability those scenarios have to be expected.

For example: information on expected losses for an event during which the water level reaches 5 m above normal refers to hazard and vulnerability. Information on expected losses for a 200

year event during which the water level reaches 5 m above normal refers to risk. In another context: projecting the consequences of a 15 m tsunami is important but in order to make informed disaster management decisions it is necessary to know how often such an event can be expected. Disaster management decisions are based on risk and not only on hazard.

Despite all the known shortcomings of databases of historic events, they do provide some means to create a magnitude-frequency relationship over a range of event magnitudes. This magnitude-frequency relationship can be an important tool for supporting the decision-making process with respect to the level of acceptable risk. Responsible disaster managers have to decide for what type of event a community should be prepared. To get prepared for the biggest possible event would be the safest way to go but it is rarely economically feasible; such high levels of protection are simply unaffordable and the benefits would not justify the costs. In addition, maintenance and alertness would be unmanageable over such long periods of time because the largest events can only be expected to occur after many years of quiescence.

To summarise, risk is understood as a function of hazard, vulnerability, exposure, and resilience (see also the figure below):

Risk = f (hazard, vulnerability, exposure, resilience)

Figure 4. Risk seen as a function of hazard, vulnerability, exposure, and resilience, while the mathematical relationship between the variables is unknown.

The frequency or return period of adverse effects allows the individual or official decision maker to define a level of acceptable consequences. This is only possible if the decision maker understands what events to expect over time. Decisions will be different for a 10-year event as compared to a 5,000-year event. For decision making, information on the probability of occurrence is crucial.

Often the historical record is too short to provide reliable magnitude-frequency relationships for particular hazards and regions. In addition, climate change has started to alter those relationships. This can be seen in Germany where the return period of the 100-year event for the Rhine and the Danube had to be revised as a 20-year or even a 10-year event (Alt, 2002). Or in the US where the Missouri River has had six 100-year floods since 1946 (Albright Seed Company, 1998). Fluke of nature or real trend? It is hard to decide. But many scientists agree that the trend is strongly supported by data. In situations of uncertainty it would be most appropriate to heed the precautionary principle. After all, if we are not even prepared to deal with the current risk situation, how shall we cope with and adapt to a deteriorating situation due to climate change?

Acronyms

ADRC	Asian Disaster Reduction Center
BBK	Bundesamt für Bevölkerungsschutz und Katastrophenhilfe
CEDIM	Center for Disaster Management and Risk Reduction Technology
CHS	Commission on Human Security
DKKV	Deutsches Kommittee für Katastrophenvorsorge
ECIE	Electronic Communication and Information Exchange
EEA	European Environment Agency
EWG	Expert Working Group on Vulnerability
GDP	Gross Domestic Product
IDNDR	International Decade of Disaster Reduction
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
MDG	UN Millennium Development Goals
NOAA	National Oceanic & Atmospheric Administration
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OCHA/IRIN	OCHA Integrated Regional Information Networks
RADIX	Radical Interpretation of Disasters
UN	United Nations
UN/ISDR	International Strategy for Disaster Reduction
UNDP	United Nations Development Programme
UNDP/UNDHA	UNDP/United Nations Department of Humanitarian Affairs
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Programme
UNEP/DEWA	Department of Early Warning & Assessment
UNU	United Nations University
UNU-EHS	UNU Institute for Environment and Human Security
WCDR	World Conference on Disaster Reduction

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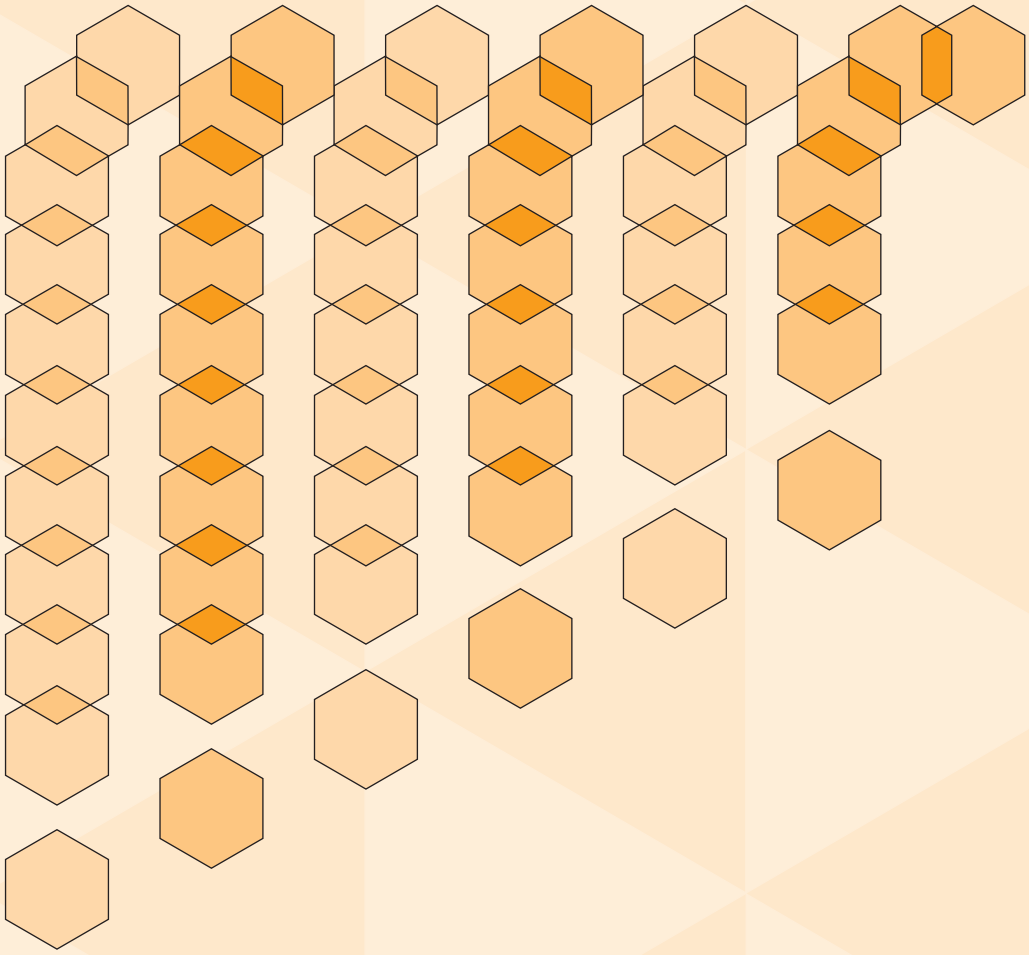

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