Comparative Glossary for Core Terms of Disaster Reduction

Hazard ◇ Vulnerability ◇ Exposure ◇ Coping Capacity ◇ Resilience ◇ Risk Hazard ◇ Vulnerability ◇ Coping Capacity ◇ Resilience ◇ Risk

In disaster reduction the collaboration among multiple disciplines and sectors is of the essence. But it is hampered by the lack of common terminology and concepts.

Knowing how different definitions of the same term can be is crucial for a collaboration free of misunderstanding and can be a step on the way towards a harmonization of definitions and concepts.

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Core Terminology of Disaster Reduction

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Introduction

The extent of disasters and their foreboding trend of increase 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 that have been spawned over the last years, disaster reduction has gained a lot of momentum and attention. The tolls that disasters are and will be taking have repercussions on countries' development, economies, and environment in all regions of the world. Human Security and livelihoods are severely compromised.

The Paradigm Shift

There has been a paradigm shift in some vital concepts evolving around the human livelihood. More and more the human being is moved into the centre of attention. The general understanding of Security has shifted from the more nationalistic and militaristic perspective to a more individual, humanitarian one, Human Security. Another paradigm shift has taken place 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 [17].

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

Integrated disaster reduction depends on the collaboration and exchange 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 applied 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 terms. As a consequence, communication within the disaster reduction community is often encumbered and misunderstandings are common.

"Babylonian Confusion"

A shared language and shared concepts are crucial stepping stones in the process of widening the understanding and effectiveness of disaster reduction. The definition of a term intends to explain its content and context in a logically consistent way while ensuring the widespread acceptance of peers. Definitions of terms have simultaneously and homogeneously grown in many disciplines. However, multi-disciplinarity often results in the same term being defined in different ways by the various disciplines involved. Most of these sometimes colliding definitions are valid in their respective contexts and cannot be discarded. But in order to enable collaboration and communication free of misunderstanding it is crucial to make the different definitions known across the disciplines and, in the long-term, to facilitate the emergence of a common vocabulary and preferably that of unique, well formulated definitions and concepts.

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 [25].
Before working on disaster risk reduction differing perceptions, interests, and methodologies have to be recognized and a broad consensus on targets, strategies and methodolo-

gies has to be reached. [17] That shows that 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. [15]

The Moral Aspect of Disaster Reduction

To an unknown extent the exacerbation of the environment and climate change has been brought about by today's developed countries and the developing countries are in the very act of repeating the same processes and harmful activities only exponentiated by the sheer size of their population. The resulting increase of disaster frequencies should alarm all countries alike but the developed countries are facing this situation with a heightened responsibility for the poor countries because it is the population of the developing countries that suffer most from disasters.

If the Millennium Development Goals carry any clout, the direct link between poverty and disaster impact implies a moral obligation for the international community to address both 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." Quoted in [17].

Risk usually involves a decision by the person at risk (to take the risk or not) always presuming the individual knows about the risk. According to Cardona [15], 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 understand their risk. Another objective inevitably is to see to it that people are in a situation to make choices and that 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, group to group etc. [26].

UNU-EHS' stance

EHS as a member institute of the UNU forms a bridge between the UN and the academic world, is a think tank for the UN, and provides a platform for dialogue and 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 pre-requisites for a focussed scientific debate, interdisciplinary approaches and ultimately for improved disaster reduction. In front of this background UNU-EHS has started to compile a comparative glossary in a peer review process in co-operation with the UN ISDR.

The Glossary

In this first draft a list of core terms from the cause-and-effect chain of disasters has 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 …). However, they generally lack the juxtaposition of the definitions of various disciplines because they want spell out the definitions they are using and this way they probably attempt to put an end to a situation often perceived as a "Babylonian confusion". This comparative glossary in contrast aims at informing experts of 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 vital to make those differences in terminology known across the disaster reduction community to avoid misunderstandings and to enhance knowledge, mutual understanding and efficiency of disaster reduction.

The outcome will be a glossary of terms with definitions as concise as possible and as diverse and elaborate as necessary. It does not claim to be exhaustive; it rather focuses on a selection of terms that are typically used across multiple disciplines and that are central to the cause-and-effect chain of disaster reduction.

Terms and definitions are collected from the literature including several reports that already offer glossaries of disaster reduction terms. The various definitions of different disciplines were collected and merged where possible.

Disciplines and sectors represented so far are:

Insurance Industry, UN System
Science (multidisciplinary)
Economics
Social Sciences
Psychology
Geoscience
Engineering
Policy Making
Civil Society
Disaster Relief

This collection of terms is the basis for peer review through an international, multi-disciplinary group of experts to add to or make recommendations and suggestions for those definitions listed.

Comments on the collected terms and definitions will be solicited during the "International Workshop on Water and Disasters", December 2004 in Canada. Further, the draft version of this glossary will be made available at the WCDR in Kobe, January 2005, to further solicit contributions and comments from scientists, risk practitioners, UN agencies and policy-makers. Continued peer review and revisions will follow until the end of 2005.

Term	Definition	Discipline
Capacity	The maximum amount of risk 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. [73]	Insurance Industry
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. [64]	United Nations
Capacity building	Efforts aimed to develop human skills or societal infrastructures within a community or organization needed to reduce the level of risk. In extended understanding, capacity building also includes development of institutional, financial, political and other resources, such as technology at different levels and sectors of the society. [64]	United Nations
Capacity, adaptive	The potential or ability of a system, region, or community to adapt to the effects or impacts of climate change. Enhancement of adaptive capacity represents a practical means of coping with changes and uncertainties in climate, including variability and extremes. In this way, enhancement of adaptive capacity reduces vulnerabilities and promotes sustainable development (Goklany, 1995; Burton, 1997; Cohen e t a l ., 1998; Klein, 1998; Rayner and Malone, 1998; Munasinghe, 2000; Smit et al., 2000). IPCC Report (p. 881) [47]	Science (multidisciplinary)
Capacity, adaptive	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) [47]	United Nations
Coping capacity	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. [66]	United Nations
Coping capacity	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. [64]	United Nations
Coping Capacity	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.	United Nations
Coping Capacity	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 & Harinarayan 1999, Sharma et al. 2000) in [47]IPCC?.	Science (multidisciplinary)
Coping Capacity	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. [29]	Science (multidisciplinary)
Climate Change	The climate of a place or region is changed if over an extended period (typically decades or longer) there is a statistically significant change in measurements of either the mean state or variability of the climate for that place or region. Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. Note that the definition of climate change used in the United Nations Framework Convention on Climate Change is more restricted, as it includes only those changes which are attributable directly or indirectly to human activity. [64]	United Nations

Climate change	Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the →Framework Convention on Climate Change (UNFCCC), in its Article 1, defines "climate change" as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". The UNFCCC thus makes a distinction between "climate change" attributable to human activities altering the atmospheric composition, and "climate variability" attributable to natural causes. [47]	United Nations
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, 1998a) in: [9] p. 5.	Science (multidisciplinary)
Cost	Means the measurable economic losses due to failures, such as the loss of crops that not irrigated on time or the production in a factory, and any other loss incurred by failure to supply an adequate quantity of good quality water at the time it is required. Losses are very difficult to measure and quantify, especially those associated with the quality of life of urban consumers. [85]	Engineering
Damage	Claims to be paid to policy holders as a consequence of a catastrophe.	Insurance Industry
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, pp. 12-13). In: ZEF dp46.pdf [9]	Disaster Relief
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. [30.11. 98 Report of the working group of the Permanent Conference on Disaster Reduction and Disaster Protection, DKKV Handbuch [40] p. 2.	Science (multi-disciplinary)
Disaster	External danger, the loss of development potential and the helplessness of the affected population [DKKV]; 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, UN DHA fremdzitat p1. UN DHA glossary]. [40] p.1]	United Nations/ DKKV
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. Synonym: catastrophe.[77]	Disaster Relief
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. [29]	Science (multi-disciplinary)

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. [ZEF dp46.pdf] [9]	Science (multi-disciplinary)
Disaster (Risk) Reduction	The conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development. The disaster risk reduction framework is composed of the following fields of action, as described in ISDR's publication 2002 "Living with Risk: a global review of disaster reduction initiatives", page 23: . Risk awareness and assessment including hazard analysis and vulnerability/capacity analysis; . Knowledge development including education, training, research and information; . Public commitment and institutional frameworks, including organisational, policy, legislation and community action; . Application of measures including environmental management, land-use and urban planning, protection of critical facilities, application of science and technology, partnership and networking, and financial instruments; . Early warning systems including forecasting, dissemination of warnings, preparedness measures and reaction capacities. [64]	United Nations
Disaster Mitigation	Disaster mitigation is the term used to refer to all actions to reduce the impact of a disaster that can be taken prior to its occurrence, including preparedness and long-term risk reduction measures. It includes both the planning and implementation of measures to reduce the risks associated with known natural and human-made hazards, and the process of planning for effective response to disasters which do occur. [UNDP, Disaster Mangm. Training Guide, 1994]	United Nations
Disaster Risk Management	The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to a void (prevention) or to limit (mitigation and preparedness) adverse effects of hazards. [Living w. Risk] [64]	United Nations
Early Warning	The provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response. Early warning systems include a chain of concerns, namely: understanding and mapping the hazard; monitoring and forecasting impending events; processing and disseminating understandable warnings to political authorities and the population, and undertaking appropriate and timely actions in response to the warnings. [Living w. Risk] [64]	United Nations
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. [29]	Science (multi-disciplinary)
Exposure	The number of risks or the amount of insured value that are potentially affected by a disaster (hazard event). KT	Insurance Industry
Exposure	Elements at risk, an inventory of those people or artefacts that are exposed to a hazard. [UNDP] [66]	United Nations
Exposure	People, values or any other elements of a functional society that are potentially affected by a disaster. KT	
Forecasting	Definite statement or statistical estimate of the occurrence of a future event (UNESCO, WMO). This term is used with different meanings in different Disciplines. [64]	United Nations
Hazard	A property or situation that under particular circumstances could lead to harm. More specific, a hazard is a potentially	Science

	damaging physical event, phenomenon or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity and probability.[29]	(multi-disciplinary)
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. [64] [Living w. Risk]	United Nations
Hazard	The probability of occurrence associated with an extreme event that can cause a failure. UNDRO quoted in Plate [78]	United Nations
Hazard	The probability of the occurrence of a disaster caused by a natural phenomenon (earthquake, cyclone), or by failure of man-made sources of energy (nuclear reactor, industrial explosion) or by uncontrolled human activity (overgrazing, heavy traffic, conflicts).-UNDRO Some authors use the term in a broader sense, including vulnerability, elements at risk and the consequences of risk. [http://pdm.medicine.wisc.edu/vocab.htm] [77]	United Nations/ Science (multi-disciplinary)
Hazard, natural	Natural processes or phenomena occurring in the biosphere that may constitute a damaging event. [UNDP] [66]	United Nations
Hazard, natural	Natural hazards are dynamic phenomena that involve people not only as victims but also as contributors and modifiers (Kates 1996) quoted in [6]	Science (multi-disciplinary)
Hazard	"HAZARD is the probability that the state of a system is altered naturally or through human activity so that it generates an extraordinary event." (UNU-EHS)	Science (multi-disciplinary)
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. Kofi Anan, Towards a Culture of Peace. [10]	United Nations
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. Hans van Ginkel, UNU [10]	United Nations
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. Anne Hammerstad, UNHCR. [10]	United Nations
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. Steve Lonnergan, Gustavson, Carter: The Index of Human Security. [10]	United Nations
Human Security	To protect the vital core of all human lives in ways that enhance human freedoms and human fulfilment protecting fundamental freedoms, protecting people from critical and pervasive threats and situations, using processes that build	United Nations

	on people's strength and aspirations, creating political, social, environmental, economic, military, and cultural systems that together give people the building blocks of survival, livelihood and dignity. Human Security Commission. [10]	
Indicator	An indicator is the representation of a trend. It trends measurable change in some social, economic, or environmental system over time. Generally an indicator focuses on a small, manageable, and telling piece of a system to give people a sense of the bigger picture. [http://www.communitiescount.org/indicator_descrip.htm] [79]	Civil Society
Indicator	Indicators are statistical measurements, rates, and indices of financial and social trends, used to help economists and financial analysts determine the business growth patterns and the overall direction of the economy. [80]	Economics
Indicator	Indicators, in a simple way, can be defined as surrogates or proxy measures of some abstract, multi-dimensional concepts. [23]	Science (multidisciplinary)
Indicator	An indicator provides evidence that a certain condition exists or certain results have or have not been achieved (Brizius & Campbell, p.A-15). Indicators enable decision-makers to assess progress towards the achievement of intended outputs, outcomes, goals, and objectives. As such, indicators are an integral part of a results-based accountability system. [81]	Policy Making
Livelihood	The means by which an individual or household obtains assets for survival and self-development. Livelihood assets are the tools (skills, objects, rights, knowledge, social capital) applied to enacting the livelihood. [UNDP]	United Nations
Mitigation	Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards. [Living w. Risk] [64]	United Nations
Mitigation	Intervention in the measurement system in order to achieve the desired level of resilience can be defined as mitigation [8]	Geoscience
Preparedness	Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations. [Living w. Risk] [64]	United Nations
Prevention	Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters. Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters. In the context of public awareness and education, related to disaster risk reduction changing attitudes and behaviour contribute to promoting a "culture of prevention". [Living w. Risk] [64]	United Nations
Recovery	Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk. Recovery (rehabilitation and reconstruction) affords an opportunity to develop and apply disaster risk reduction measures. [64]	United Nations
Relief / response	The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration. [64]	United Nations
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 Report(p.89)*[47]	United Nations
Resilience	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. [66]	United Nations

Resilience	Resilience is a measure of the recovery time of a system. [Correira, Santos, Rodrigues: Engineering Risk in Regional Drought Studies. From Duckstein & Plate, Engineering Reliability and Risk in Water Resources.]	Engineering
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, P. (2000) [21]	Disaster Relief/ Social Science
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 [13].	Social Sciences/ Science (multidisciplinary)
Resilience	The capacity of a group or organization to withstand loss or damage or to recover from the impact of an emergency or disaster [27]. The higher the resilience, the less likely damage may be, and the faster and more effective recovery is likely to be.	Disaster Relief
Resilience	The capacity that people or groups may possess to withstand or recover from emergencies and which can stand as a counterbalance to vulnerability. [28]	Disaster Relief
Resilience	A measure of how quickly a system recovers from failures (Emergency Mngm. Australia, 1998) quoted in [21]	Disaster Relief
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. [[64]	United Nations
Resilience	Details of Resilience might be inherently unknowable – especially in the case of complex communities undergoing constant change. [20]	Disaster Relief
Resilience	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. [21]	Disaster Relief
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." [8] from Mileti 1999. Systems that maintain their integrity and remain stable when subject to a disturbance in the measure of the system's resilience. from Holling 1973	Geosciences
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. [77]	Science (multidisciplinary)
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 as in Shresta, Duckstein, and Stakhiv (1996). Bijaya P. Shresta: Uncertainty in risk analysis of water resources systems under climate change. From	Engineering
Risk	$Risk = f(hazard, vu\ln erability, exp osure)$ KT	Insurance Industry
Risk	The possibility to sustain a loss (DKKV); is the result of hazard and vulnerability (translated from DKKV)	DKKV
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 Industry

	insurance practitioners to indicate the property insured or the peril insured against. [SwissRe] [73]	
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] [66]	United Nations
Risk	Risk can be defined as the probability that a system is not in a satisfactory state. [Correira, Santos, Rodrigues: Engineering Risk in Regional Drought Studies. From Duckstein & Plate, Engineering Reliability and Risk in Water Resources. [38]	Engineering
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. [GEO3] [68]	United Nations
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.pdf paper] [45]	Geosciences
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. [29]	Science (multidisciplinary)
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. [6]	Geosciences
Risk	Is the probability of sustaining harm from a catastrophic event. It is dependant on the hazard, vulnerability, exposure, and resilience of the person, environment, community, society or object at risk. $Risk = f(\text{hazard, vulnerability, exposure, resilience})$	United Nations/ Science (multidisciplinary)
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. [SwissRe Book Tiedemann] [74]	Insurance Industry
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. [77]	Science (multidisciplinary)
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 & Sinha, R. & Goyal, A., [57], [71]	Science (multidisciplinary)
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. [13]	Social Sciences
Risk, acceptable	The level of loss a society or community considers acceptable given existing social, economic, political, cultural, technical	United Nations

	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. [64]	
Risk, acceptable	The acceptable probability of losing one's life from an action or an event based on equation: $P_{Epj}(x_d) \leq P_{PAcc} = \frac{\beta_i \cdot 10^{-4} / year}{v_{ij}}$. [82] p. 218.	Engineering
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. [77]	Science (multidisciplinary)
Risk Assessment	Risk assessment has 2 parts: "Objective" risk assessment of experts and "Subjective" risk assessment of lay people, called risk perception. Experts base their risk assessment on objective and quantifiable data (probabilities, severity of consequences). Lay people base their risk perception on subjective characteristics: voluntarism, potential consequences on future generations, catastrophicity, dread, number of people exposed , known by science and/or people exposed. In addition, the subjective risk assessment depends on the risk target (children, women, personal, family, world, etc.). [Chauvin, p. 2] [75]	Psychology
Risk Assessment	Risk assessment of natural disasters is defined as the assessment on both the probability of natural disaster occurrence and the degree of danger caused by natural disasters. [45]	Geosciences
Risk management	Risk management is a methodology for giving rational considerations to all factors affecting the safety or the operation of large structures or systems of structures. It identifies, evaluates, and executes, in conformity with other social sectors, all aspects of the management of the system, from identification of loads to the planning of emergency scenarios for the case of operational failure, and of relief and rehabilitation for the case of structural failure. [E. Plate: Risk management for hydraulic systems. [78] p. 211	Engineering
Risk management	The culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects (AS/NZS 4360:1999:4). The Standard. from:[2]	Science (multidisciplinary)
Risk management	*IFI/P draft (p.4):* risk management - includes prevention, mitigation, preparedness, response, and recovery. UNESCO&WMO	United Nations
Risk management process	*The Standard* defines the process of risk management as 'the systematic application of management policies, procedures and practices to the tasks of establishing the context, identifying, analysing, evaluating, treating, monitoring and communicating risk' (AS/NZS 4360:1999:4). The Standard . From [2]	Science (multidisciplinary)
Sustainability	Sustainability is the ability of a locality to tolerate – and overcome – damage, diminished productivity, and reduced quality of life from an extreme event without significant outside assistance. [8] from Mileti 1999	Geosciences
Sustainability	In general, there is a consensus that sustainability should encompass social equity, economic growth and environmental protection. Some of the most widely quoted definitions include: • "Meeting the needs of the present without compromising the ability of future generations to meet their own needs" (UNCED, 1987) • "Improving the quality of human life while living within the carrying capacity of supporting ecosystems"	United Nations

	(IUCN/UNEP/WWF, 1991) • "To equitably meet developmental and environmental needs of present and future generations" (UNCED, 1992) [23]	
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs. [66]	United Nations
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs. (Brundtland Commission, 1987). Sustainable development is based on socio-cultural development, political stability and decorum, economic growth and ecosystem protection, which all relate to disaster risk reduction. [64]	United Nations
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 (Figure 1-2). [47] p.89	United Nations
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. [64]	United Nations
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. [38]	Engineering
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. [68]	United Nations
Vulnerability	Vulnerability should be recognized as a key indicator of the seriousness of environmental problems such as global warning (Adger et. Al. 2001). Quoted in [68]	Science (multidisciplinary)
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. [6]	Science (multidisciplinary)
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.pdf] [60]	Science (multidisciplinary)
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). [9] p.11	Science (multidisciplinary)
Vulnerability	Determinants of disaster vulnerability: · demographic factors: population growth, urbanization, settlements near coastal	Science (multidisciplinary)

	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. [9] p. 14	
Vulnerability	Vulnerability concept consists of two opposing forces: On one hand, the processes that cause vulnerability that can be observed;11 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, pp. 21-26). [9]	Social Sciences
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. Compare to or see elements at risk, hazard, natural hazard, risk, risk indicator, risk map. [77]	Science (multidisciplinary)
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 [6] The adaptive and coping capacities that determine the extent to which a society can tolerate damage from extreme events without significant outside assistance. [6] from Mileti 1999.	Science (multidisciplinary)
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.) [18].	Social Sciences
Vulnerability	The vulnerability increases with the number of people affected by the impact of a natural hazard, given by the formula:	Engineering

	$v_{ij} = 10^{-23} \cdot n_j^2$, for n ≥ 10 casualties. [82] p. 218	
Vulnerability assessment	Vulnerability assessment measures the seriousness of potential threats on the basis of known hazards and the level of vulnerability of societies and individuals. It should identify the location of vulnerable populations, the threats to their well being and the extent of their vulnerability. [GEO3] [68]	United Nations
Vulnerability, financial	Consists of 3 elements: hazard presence, components at risk, vulnerability of these components	Economics
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] [66]	United Nations
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, p. 79). 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. (UNDP/UNDHA, 1994, pp. 38-39; see also UNDHA, 1992). Vulnerability has process character and is not static. [ZEF_dp46.pdf] [9]	United Nations
Vulnerability	The susceptibility as the possible "damage at the entry of an event, that is, the vulnerability of a system (building, complex, state, businesses, etc.) to external damaging effects." Münchener Rück (2000b) [ZEF_dp46.pdf] [9]	Insurance Industry
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. [74] and [21]	
Vulnerability	Le fait d'être sensible aux blessures, aux attaques ou d'éprouver des difficultés pour recouvrir une santé mise en péril. Tout dépend des éléments vulnérables que l'on place au centre du système : 1.) l'homme comme vulnérable aux aléas naturels de notre planète, suivant ses organisations, comportements et réactions individuelles. 2.) les espaces, à l'origine naturels, plus ou moins fragiles, ont été aménagés, souvent sur-aménagés, et sont ainsi devenus vulnérables à l'abondance d'acticités humaines ➔ vulnérabilité de L'environnement. 3.) La nature elle-même. 4 vulnérabilités: homme, biens, activités, environnement. [12]	Science (multidisciplinary)
Vulnerability	The insecurity of the well-being of individuals, households or communities in the face of a changing environment. Moser & Holland (1989 quoted in [13].	Social Sciences
Vulnerability	Is the characteristic of a person or a group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural disaster (Blakie et al. 1994 p.9 quoted in [13]. The Extent of a disaster cannot be measured without knowledge of the resilience of the affected groups; this resilience plays out over time [13].	Disaster management
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 [27].	
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. [25]	
Vulnerability	Summarizing livelihood and environmental literature: vulnerability is the exposure of individuals or groups to livelihood	

	stress as a result of environmental change. [13]	
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.	Science (multidisciplinary)

Conclusions

The above comparative listing of definitions demonstrates how wide the range of the definition of one term can be and that many terms are tightly interwoven. The listing informs the reader about the multiple definitions and that is already an important stepping stone in dispelling the often lamented misunderstanding in the discussion around 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 but flexible and broad enough that it is vastly applicable across sectors and disciplines.

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

Terms of such complexity are not easily defined in an exhaustive way. And they probably should not be - who can speak for all disciplines, contexts, and scales? It is more important to agree on the key characteristics. That way, a conceptual frame is created and what is put into that frame is flexible and will vary with context, geographic scale, and time scale.

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

A hazard can be as general as "flood" or "storm" or as specific as a magnitude 7.2 earthquake in Los Angeles or a category 5 Hurricane hitting Miami. One important feature of hazard is that it has the notion of probability, in other words a likelihood of happening. Any hazard can manifest itself in an actual harmful event. In other words, if it can be measured in 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 Porte-au-Prince. If hazard is pegged out more general such as "an epidemic" or "a drought" it is characterized by all possible magnitudes tied to a specific return period or frequency (its inverse). The latter ensemble is called a magnitude-frequency relationship of a particular hazard.

<u>Vulnerability:</u>
Another prerequisite for a disaster is vulnerability. It is a dynamic, intrinsic characteristic of a community (or household, region, state, infrastructure or any other element at risk) that consists of a multitude of components. The extent to which it is revealed is determined by the magnitude 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."[18]. Determining vulnerability means to ask what would happen if certain event(s) hit particular elements at risk (e.g. a community). When we speak about the vulnerability of a community in an absolute sense we normally don't have a specific event in mind but rather think of vulnerability towards a certain hazard which can manifest itself in a range of magnitudes (e.g. minor to severe floods, droughts, storms, epidemics etc.).

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 but rather a permanent but dynamic feature that is revealed during an event to an extent which depends on the magnitude of the harmful event. At the same time this implies that vulnerability can only be measured indirectly, and the dimension normally used for this indirect measure is damage or more generally harm.

What we normally see is not directly the vulnerability but the harm done. The amount of harm done depends on the vulnerability, the magnitude of the event, and the exposure. Seeing the damage pattern of a community without knowing the magnitude of the event does not allow conclusions regarding the vulnerability. In that sense the magnitude-harm function reflects the vulnerability of an element at risk (community, household, nation, infrastructure, etc.).

For practical reasons a vulnerability analysis will often limit itself to a certain scenario (i.e. event magnitude) for which the analysis is carried out. This is usually an appropriate approach to assess vulnerability but the choice of the event scenario is a subjective one. What scenario shall be chosen? The 100 year event, the largest event that has occurred in the living memory, or the 5 m flood level? Despite of all the known shortcomings of incomplete or databases of historic events they provide some means to create a magnitude-frequency relationship over a range of event magnitudes. The full vulnerability can be depicted with the continuous relationship between event magnitude and damage or harm.

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 a more devastating effect on the impoverished community. A small event, however, can raise the awareness of the community and that way decrease their 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" [6]. 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 quantified.

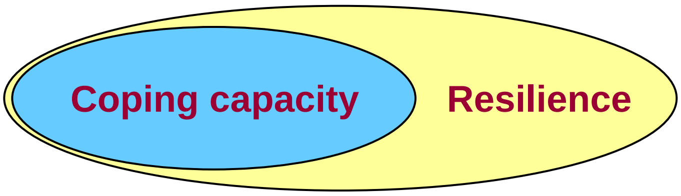
The complexity of vulnerability is not only given by its multiple dimensions but also by the fact that it is site-specific and that its parameters change with geographic scale. The parameters that determine vulnerability are different on the household-, community-, and country-level. In the economic dimension on 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.

Coping Capacity/adaptive capacity and resilience:

However, it gets even more complicated, because in real life the harm done also depends 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. Those two dimensions of a harmful event are not easily separated from each other.

Coping capacity encompasses those strategies and measures that act directly upon damage during the event by alleviation and containment of the impact or by bringing about efficient relief as well as those strategies that strive for adaptation, i.e. behaviour or activities that circumvent or avoid damaging effects.

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



The difficult question that arises from this definition is: does vulnerability already account for coping capacity and resilience or are they separate counteracting parameters? This is not easily answered. It depends on how we define the damage/harm. If the extent of the damage/harm is defined also by the duration of the adverse effects and by the repercussions in poverty, economy, awareness etc. then vulnerability has to include coping capacity and resilience.

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 is trying to tell us how often or with what probability we have to expect those scenarios.

For example: information on expected losses for an event during which the water level reaches 5 m above normal refers to a 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 15m tsunami is interesting but in order to spur (re)action to this information it is necessary to know how often such an event can be expected.

Another component of risk is exposure. While the vulnerability determines the severity of the impact event will have on the elements at risk, it is the exposure that will drive the final damage or harm. So in its economic dimension vulnerability is the depicted by the projection that a family will loose 50% of its assets. How many families will do so is captured by the exposure. In an overly simplifying example the poverty of a community will determine the degree to which it will be affected by an event of a certain magnitude (→ susceptibility) and the number of the community members represents the exposure. In that sense a densely populated area is more vulnerable then a sparsely populated one, all other conditions being equal.

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. In the notion of vulnerability the individual cannot put this information in context with the actual threat. Decisions will be different for a 10 year event as compared to a 5000 year event. For decision making information on the probability of occurrence is crucial. It will drive the decisions. Problematic is the fact that normally the historical record is too short to provide reliable magnitude-frequency relationships for particular hazards and regions. In addition global change has started to change those relationships.

This can be seen in Germany where for the Rhein and the Danube the return period of the 100-year event had to be revised to be rather a 20-year or even 10-year event [87]. Or in the US where the Missouri River has had 6 100-year floods since 1946 [88]. Fluke of nature or real trend? – Hard to decide. But most 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, 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?

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