Glossary of terms related to Risk Assessment and Management:

Compiled by Cees van Westen, April 2007

Sources:

A: Local risk management. Ideas and notions relating to concept and practice. CEPREDENAC & UNDP. This document is based on an original contribution prepared by Omar Darío Cardona. The debates and exchanges which have led to the drawing up of this glossary were carried out between Alan Lavell, Omar Dario Cardona and Elizabeth Mansilla.
Source: http://www.undp.org/bcpr/disred/english/publications/regions/lac.htm

B: ICG. International Center for Geohazards (Norway) Source: http://www.geohazards.no/

C: Reducing Disaster Risk Handbook UNDP.
Source: http://www.undp.org/bcpr/disred/english/publications/publications.htm

D: FEMA, www.FEMA.gov

E: UNDP, DMTP, Vulnerability and Risk Assessment.
Source: http://www.undmtp.org/modules.htm

F: ISDR Living with Risk.
Source: http://www.undp.org/bcpr/disred/english/publications/publications.htm

For each definition the source is indicated.

Acceptable Risk: The possible social and economic consequences a society or sector of society implicitly or explicitly assumes or tolerates, considering intervention to be unnecessary, untimely or impossible given the existing economic, social, political, cultural and technical context. The notion of acceptable risk is of formal and technical relevance in conditions where sufficient and adequate information exists and when a certain level of formal rationalization in the decision-making process can be exercised.(A)
Acceptable risk: A risk which everyone impacted is prepared to accept. Action to further reduce such risk is usually not required unless reasonably practicable measures areavailable at low cost in terms of money, time and effort. (B)
Acceptable risk: The level of loss a society or community considers acceptable given existing social, economic, political, cultural and technical conditions. *In engineering terms, acceptable risk is also used to describe 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.(F)*

Adaptability: The capacity or ability of an individual or social group to adjust to changes in their external, natural and constructed environment in order to guarantee survival and sustainability. (A)

ALARP (As Low As Reasonably Practicable) principle: That principle which states that risks, lower than the limit of tolerability, are tolerable only if risk reduction is impracticable or if its cost is grossly IN disproportion (depending on the level of risk) to the improvement gained. (B)

Annual exceedance probability (AEP): The estimated probability that an event of specified magnitude will be exceeded in any year.(B)

Anthropogenic or Anthropic Hazard: Of human origin or relating to human activities, including those of a technological nature. (A)
A latent threat associated with economic production, commerce, transport, and consumption of goods and services and the construction and use of infrastructure and buildings. These comprise a wide range of threats
including different types of water, air and land pollution, fires, explosions, spills of toxic substances, accidents in transport systems, the rupture of dams, building collapse, etc.

Armed conflict: A contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battlerelated deaths. (C)

Bayes theorem: A theorem that provides the logical basis for updating a probability on the basis of new information. (B)

Biological hazard: Processes of organic origin or those conveyed by biological vectors, including exposure to
pathogenic micro-organisms, toxins and bioactive substances, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. *Examples of biological hazards: outbreaks of epidemic diseases, plant or animal contagion, insect plagues and extensive infestations.(F)*

Building codes: Ordinances and regulations controlling the design, construction, materials, alteration and
occupancy of any structure for human safety and welfare. Building codes include both technical and functional standards (F)

Capacities: A combination of community or organizational attributes and resources that may be positively directed towards risk management. (A)

Capacity: A combination of all the strengths and resources available within a community or organisation 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.(F)*

Capacity building: Efforts aimed to develop human skills within a community, organisation or institution needed to reduce the level of risk. *In extended understanding, capacity building also includes development of institutional, financial and other resources, such as technology at different levels and sectors of the society.(F)*

Chain, Serialized, Concatenated or Complex Hazards: Two or more dangerous physical phenomena occurring in chain reaction where one triggers off the other, and so on. An example may be seen with the possibility of an earthquake rupturing dams and dykes, leading to flooding, causing fires and the rupture of pipelines carrying volatile substances or pollutants and detonating landslides and severe modifications in the natural environment, all with direct and indirect negative repercussions on human beings
and other species of fauna and flora. (A)

Civil society: A realm of political action lying between the household and the state but excluding for profit private sector organisations. Civil society organisations are commonly exemplified by non-governmental and community-based developmental organisations, but also include a wide range of other groups including sports clubs, interest groups, trade unions etc. (C)

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 forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2001).(F)*

Conditional probability: The probability of an outcome, given the occurrence of some event. For example, given that a flood has reached the crest of an embankment dam, the probability of the dam failing is a conditional probability.(B)

Consequence: In relation to risk analysis, the outcome or result of a hazard being realised. (B)

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.(C)
The strengthening of coping capacities usually builds resilience to withstand the effects of natural and other hazards.(F)

Corrective Risk Management: A process aimed at reducing existing levels of risk within society. Examples of corrective management activities or instruments include the construction of dykes to protect population located in hazard prone zones, the seismic retrofitting of buildings, changes in cropping patterns to adapt to adverse environmental conditions, reforestation or watershed recuperation to reduce existing processes of erosion, landslides and floods (see RISK MITIGATION -REDUCTION- below). (A)

Countermeasures: All measures taken to counter and reduce a hazard or consequences of a hazard. They most commonly refer to engineering (structural) measures but can also include other non-structural measures and tools designed and employed to avoid or limit the adverse impact of natural hazards and related environmental and technological disasters.(B)

Cumulative distribution function (CDF): The integral of the probability density function calculated in the direction of increasing values of the random variable. Thus the probability that the random variable takes on values less than or equal to a particular value can be read from the CDF.(B)

Danger (Threat): The natural phenomenon described in terms of its geometry, mechanical and other characteristics. The danger can be an existing one such as a creeping slope or a potential one (such as a rockfall). The characterisation of a danger or threat does not include any forecasting.(B)

Dangerous Phenomenon (Event): A natural, socio-natural (see definition below) or humanly generated phenomenon which may cause damage to society. It is the materialization in time and space of a hazard. It is important to distinguish between a potential or latent phenomenon represented by the notion of hazard, and the phenomenon itself, once it occurs. (A)

Decision-maker: The person or organizational unit who decides on a course of action in relation safety.(B)

Deterministic: Describing a process with an outcome that is always the same for a given set of inputs, i.e. the outcome is "determined" by the input. Deterministic contrasts with random, which describes a process with an outcome that can vary even though the inputs are the same. Deterministic analysis contrasts with probabilistic analysis.(B)

Direct (Economic) Effects or Impacts: Effects or impacts that maintain a direct and immediate causal link with the occurrence of a physical phenomenon and which are usually represented in loss and damage to infrastructure, productive systems, goods, services and the environment. (see DIRECT AND INDIRECT HUMAN IMPACTS below). (A)

Disaster: A social crisis situation occurring when a physical phenomenon of natural, socionatural or anthropogenic origin negatively impacts vulnerable populations and their livelihoods, production systems infrastructure and historical heritage, causing intense, serious and widespread disruption of the normal functioning of the affected social unit. The impacts and effects can not be overcome with the resources autonomously available to the affected society. Impacts are expressed in different forms such as the loss of life, health problems, the destruction, loss or rendering useless of the totality or part of private or collective goods and severe impacts on the environment. These negative impacts require an immediate response from the authorities and from the population in order to attend the affected and to re-establish acceptable thresholds of wellbeing and life opportunities. (A)
Disaster: A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources. A disaster results from the combination of hazards, vulnerability, and insufficient

capacity or measures to reduce the negative consequences of risk.(B)

Disaster Risk: The probability of losses and damage which exceed the autonomous coping and response capabilities of the affected areas and populations and which lead to a serious disrupting of their routine functioning. (A)

Disaster Risk Management: A complex social process through which disaster risk is measured and evaluated, understood, reduced or predicted and controlled. It should be considered a dimension of sustainable development plans and actions and recognises different levels of intervention. These range from the global, integral, sectoral and macro-territorial levels through to the local, community and family levels. It also requires the existence of organizational and institutional structures which represent these levels and work as a coordinated and integrated whole. (A)
Disaster risk management: The systematic management of administrative decisions, organisation, operational skills and abilities to implement policies, strategies and coping capacities of the society or individuals to lessen the impacts of natural and related environmental and technological hazards.(C)

Disaster Risk Mitigation (Reduction): Intervention measures aimed at reducing or decreasing existing risk. Mitigation assumes that the total elimination of existing risk is neither possible nor feasible. In other words, it is not possible to totally prevent or avoid all damage and loss. Thus, mitigation must be guided by notions of acceptable risk (see above for definition). Disaster risk mitigation may involve the reduction or elimination of existing primary risks (see definition below) or an acceptance of these and, through preparedness measures, including early warning and evacuation systems, seek to reduce losses and damage resulting with the occurrence of a dangerous phenomenon. (A)
Disaster risk reduction: The systematic development and application of policies, strategies and practices to minimise vulnerabilities, hazards and the unfolding of disaster impacts throughout a society, in the broad context of sustainable development.(C)
Disaster risk reduction (disaster reduction): The systematic development and application of policies, strategies and practices to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) adverse impact of hazards, within the broad context of sustainable development.
The disaster risk reduction framework, as described in this review, is composed of:
- 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.(F)

Early warning: The provision of timely and effective information, through identified institutions, that allow individuals at risk of a disaster, to take action to avoid or reduce their risk and prepare for effective response.
Early warning systems consist of three elements

- *forecasting and prediction of impending events,*
- *processing and dissemination of warnings to political authorities and population, and*
- *undertaking appropriate reaction to warnings.(F)*

Ecosystem: Spatial unit comprising a group of physical and biotic components and processes which interact in an interdependent manner and which have created characteristic energy flows and cycles or movement of materials. (A)
A system of interacting living organisms together with their physical environment. *The boundaries of what could be called an ecosystem are somewhat arbitrary, depending on the*

focus of interest or study. Thus the extent of an ecosystem may range from very small spatial scales to, ultimately, the entire Earth (IPCC, 2001).(F)

Elements at risk: Population, buildings and engineering works, infrastructure, environmental features and economic activities in the area affected by a hazard.(B)

El Niño-southern oscillation (ENSO): An irregularly occurring pattern of abnormal warming of the surface coastal waters off Ecuador, Peru and Chile. This coupled atmosphere-ocean phenomenon is associated with the fluctuation of intertropical surface pressure pattern and circulation in the Indian and Pacific oceans, called the Southern Oscillation.
There have been a number of attempts to define El Niño, both quantitatively and qualitatively, but none has achieved universal recognition. This phenomenon triggers a shift in seasonal patterns of weather systems over many subtropical and midlatitude parts of the globe.
La Niña is the opposite of an El Niño event, during which waters in the west Pacific are warmer than normal and trade winds are stronger.(F)

Emergency: A social crisis context directly related to the imminence or occurrence of a dangerous physical phenomenon and which requires an immediate response by State institutions, the media, civil society and the community in general. When the event is imminent, confusion, disorder, uncertainty and disorientation may exist among the population. The phase immediately after impact is characterized by the intense and serious disturbance of the normal functioning or operation of a community, zone or region and the minimum conditions necessary for the survival and functioning of the affected social unit are not satisfied. It is a phase or a component of disaster but is not a synonym for disaster, per se. While emergency conditions can exist without a disaster, all disasters experience an emergency phase or stage. (A)

Emergency management: The organisation, management of resources and responsibilities for dealing with all aspects of emergencies, in particularly preparedness, response and rehabilitation. *Emergency management involves the plans, structures and arrangements which are established to bring together the normal endeavours of government,voluntary and private agencies in a comprehensive and coordinated way to deal with the whole spectrum of emergency needs. This is also known as disaster management.* (F)

Emergency preparedness plan: Document which contains procedures for dealing with various emergencies which could result from a disaster.(B)

Empowerment: A process in which individuals learn by their own actions to become fully engaged in shaping their development potential.The process is necessarily self-led, but benefits from facilitation by supporting actors.(C)

Environmental Degradation (Deterioration): Processes induced by human actions and activities which damage the natural resource base or which adversely affect natural processes and ecosystems, thus reducing their quality and productivity. Potential effects are numerous and include the transformation of resources into socio-natural hazards. Environmental deterioration can be the cause of a loss in the ecosystems' capacity to recuperate following external impacts. This loss of recuperation capacity can in turn generate new hazards of a socio-natural type (see NATURAL ENVIRONMENTAL TRANSFORMATION). (A)
Processes induced by human behaviour and activities (sometimes combined with natural hazards), that damage the natural resource base or adversely alter natural processes or ecosystems. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards.
Some examples: land degradation, deforestation, desertification, wildland fires, loss of biodiversity, land, water and air pollution, climate change, sea level rise, ozone depletion.(F)

Environmental impact assessment (EIA): Study undertaken in order to assess the effect on a specified environment of the introduction of any new factor, which may upset the ecological balance.

EIA is a policy making tool that serves to provide evidence and analysis of environmental impacts of activities from conception to decision-making. It is utilised extensively in national programming and for international development assistance projects. An EIA must include a detailed risk assessment and provide alternatives solutions.(F)

Environmental risks: Risks to natural ecosystems or to the aesthetics, sustainability or amenity of the natural world. (B)

Event tree analysis: Inductive analysis process that utilises an event tree graphical construct that shows the logical sequence of the occurrence of events in, or states of, a system following an initiating event.(B)

Every Day or Chronic Risk: A series of living conditions which characterize (although not exclusively) poverty, under-development and structural human insecurity and which restrict or endanger sustainable human development. Examples of this can be found in poor health conditions, low life expectancy, malnutrition, lack of employment and income, lack of access to potable water, social and family violence, drug addiction/substance abuse, alcoholism and overcrowding of residential areas and individual housing. (A)

Expected value: The average or central tendency of a random variable. In risk analysis, the product of the probability of an event and of its consequences, aggregated over all possible values of the variable.(B)

Exposed Elements: Persons, resources, production, infrastructure, goods and services which may be directly affected by a physical phenomenon due to their location in its area of influence. (A)

Extreme event: Event, which has a very low annual exceedance probability (AEP). Sometimes defined as an event beyond the credible limit of extrapolation and herefore dependent on the length of record and the quality of the data available.(B)

Factor of Safety: The ratio of system resistance to the peak design loads, often calculated in accordance with established rules.(B)

Failure: The inability of a system, or part thereof, to function as intended. In the context of structural safety (including geotechnical structures), failure is generally confined to issues of structural integrity, and in some contexts to the special case of collapse of the structure or some part of it.(B)

Failure mode: A way that failure can occur, described by the means by which element or component failures must occur to cause loss of the sub-system or system function.(B)

Fault tree analysis: A systems engineering method for representing the logical combinations of various system states and possible causes which can contribute to a specified problematic (fault) event (called the top event).(B)

Forecast: Information regarding the probable future occurrence of a physical phenomenon and based on: the study of the physical generating mechanism, the monitoring of the perturbing system and/or the registering of past events. A forecast can be short term, generally based on the interpretation of precursors of the dangerous phenomenon; medium term, based on statistical parameters indicative of the potential occurrence of the phenomenon; and long term, based on the determination of the maximum probable or credible event likely to occur within a determined period of time. (A)
Definite statement or statistical estimate of the occurrence of a future event (UNESCO, WMO).
This term is used with different meaning in different disciplines, as well as “prediction”.(F)

f, N pairs: Refers to "f', the probability of life loss due to failure for each scenario studied, and "N", the number of lives expected to be lost in the event of such a failure scenario. The term

"N" can be replaced by any other quantitative measure of failure consequences, such as monetary measures.(B)

F-N curves: Curves relating the probability per year of causing N or more fatalities (F) to N. This is the complementary cumulative distribution function. Such curves may be used to express societal risk criteria and to describe the safety levels of particular facilities. (B)

Fragility curve: Defines the probability of failure as a function of an applied load level; a particular form of the more general system response. (B)

Frequency: A measure of likelihood expressed as the number of occurrences of an event in a given time or in a given number of trials (see also likelihood and probability).(B)

Geological hazard: Natural earth processes or phenomena, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Geological hazard includes processes of a geological, neotectonic, geophysical, geomorphologic, geotechnical and hydrogeological nature.
Examples of geological hazards are: earthquakes,tsunamis; volcanic activity and emissions; massmovements (landslides, rockslides, rockfall, liquefaction, submarine slides, etc.); subsidence, surface collapse and geological fault activity.(F)

Geographic information systems (GIS): Computer programmes that combine a relational database with spatial interpretation and outputs in form of maps. A more elaborate definition is that of a system for capturing, storing, checking, integrating, analysing and displaying data about the earth that is spatially referenced. It is normally taken to include a spatially referenced database and appropriate applications software.
Geographical information systems are increasingly being utilised for hazard and vulnerability mapping and analysis, as well as for the application of disaster risk reduction measures and its management.(F)

Goods and Services: Tangibles and intangibles that have an economic value and provide benefits to those who possess them. Goods are susceptible to private or public appropriation, whilst services can only be consumed. (A)

Governance: Governance is the exercise of economic, political and administrative authority to manage a country's affairs at all levels. It comprises the mechanisms, processes and institutions, through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences.(C)

Greenhouse gas (GHG): A gas, such as water vapour, carbon dioxide, methane, chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), that absorbs and re-emits infrared radiation, warming the earth's surface and contributing to climate change (UNEP, 1998).(F)

Hazard: A latent threat associated with the probable occurrence of a physical phenomenon of natural, socionatural or anthropogenic origin that may be expected to have adverse effects on people, production, infrastructure, goods and services. Hazards are risk factors that are external to the exposed social elements and represent the probability that a phenomenon of determined intensity will occur at a specific location and within a defined period of time. (A)
Hazard: Probability that a particular danger (threat) occurs within a given period of time.(B)
Hazard: A potentially damaging physical event, phenomenon and/or human activity, which 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) and/or induced by human processes (environmental degradation and technological hazards). Hazards can be combined, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity, frequency and probability.(F)

Hazard Analysis Or Evaluation: The process by which the possible occurrence, magnitude, location and temporality of a damaging physical event is ascertained. (A)
Hazard analysis: Identification, studies and monitoring of any hazard to determinate its potentiality, origin, characteristics and behaviour.(F)

Human Disaster Impact: Deceased, missing persons, injured or sick resulting from the direct or indirect impact of a physical phenomenon. (A)

Hydrometeorological hazards: Natural processes or phenomena of atmospheric, hydrological or oceanographic nature, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. *Examples of hydrometeorological hazards are:* floods, debris and mud flows; tropical cyclones, storm surges, thunder/hailstorms, rain and wind storms, blizzards and other severe storms; drought, desertification, wildland fires, heat waves, sand or dust storms; permafrost and avalanches.(F)

Indirect (Economic) Effects Or Impacts: Effects or impacts that maintain a causal relationship with direct effects or impacts (see definition above). Quantified indirect impacts are normally those which have adverse affects in social and economic terms, for example, loss of production opportunities and future income, increases in the levels of poverty, increases in transport costs due to the loss of roads and bridges, etc. However, there will be cases of positive impacts when seen from the perspective of those individuals and private enterprises that are able to benefit from the negative impacts on others. (A)

Human factors: Human factors refer to environmental, organisational and job factors, and human and individual characteristics which influence behaviour in a way which can affect safety.(B)

Human 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.(C)

Income poverty: A status whereby a lack of financial resources limits the ability of an individual or household to meet basic needs. What is included in basic needs is culturally determined so that different levels of financial status may be described as conveying relative forms of income poverty.(C)

Individual risk: The increment of risk imposed on a particular individual by the existence of a hazard. This increment of risk is an addition to the background risk to life, which the person would live with on a daily basis if the facility did not exist.(B)

Intensity: A quantitative and qualitative measure of the severity of a phenomenon at a specific location. (A)

Involuntary risk: A risk imposed on people by a controlling body and not assumed by free choice of the people at risk.(B)

Joint probability: The probability that two or more variables will assume certain values simultaneously or within particular time intervals.(B)

Judgement: Contribution to decision-making which depends on a person's experience, technical know-how, and ethical or moral values.(B)

Land-use planning: Branch of physical planning that determines the means and assesses the values or limitations of various options in which land is to be utilised, with the corresponding effects on different segments of the population or interests of a community taken into account in resulting decisions. Land-use planning involves mapping, analysis of data acquired, formulation of alternative land-use decisions and design of a long-range plan for different geographical and administrative scales. Land-use planning can help to mitigate disasters and reduce risks by discouraging settlements and construction of key installations in

hazard prone areas, control of population density and expansion, and in the siting of life lines such as service routes for transport, power, water, sewage and other critical facilities. (B)
Land-use planning can help to mitigate disasters and reduce risks by discouraging settlements and construction of key installations in hazard prone areas, control of population density and expansion, and the siting of service routes in transport, power, water, sewerage and other critical facilities.

Likelihood: Conditional probability of an outcome given a set of data, assumptions and information. Also used as a qualitative description of probability and frequency.(B)

Limit: In relation to level of risk, that level which, when exceeded, is unacceptable.
Higher risks cannot be justified except in extraordinary circumstances (typically where the continuation of the risk has been authorised by government or a regulator in the wider interests of society).(B)

Life Lines (Networks): Basic or essential infrastructure. Energy: dams, substations, electric grid, fuel storage facilities, oil and gas pipelines. Transport: road networks, bridges, transport terminals, airports, river and coastal ports. Water: Treatment plants, water pipelines, sewage systems, irrigation and drainage canals. Communications: telephone networks and exchanges, radio and television stations, postal and public information offices. (A)

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.(C)

Local Disaster Risk Management: Respecting the logic and characteristics of Disaster Risk Management in general (see definition above), local management comprises a particular level of territorial intervention requiring full participation, appropriation and ownership by local stakeholders. (A)

Loss: Any negative consequence, financial or otherwise.(B)

Mitigation: Measures undertaken to limit the adverse impact of, for instance, natural hazards, environmental degradation and technological hazards.(B)
Mitigation: Sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.(D)
Mitigation: Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.(F)

Monte Carlo simulation: A procedure, which seeks to simulate stochastic processes by random selection of input values to an analysis model in proportion to their joint probability density function.(B)

Natural Environmental Transformation: The process by which nature or the natural environment transforms itself, including processes that have existed since the formation of the earth and which have moulded and changed its surface, its flora and fauna in a continuous manner. Reference is basically made to processes where nature interacts with other unmodified or essentially unmodified natural elements (ecosystems, rivers, mountains, slopes, coastal zones, etc). Examples can be found with the impacts of earthquakes on watersheds and slopes, hurricane impacts on forests and mangroves, or spontaneous fires that regenerate ecosystems. To speak of environmental destruction or environmental loss in these cases would be anti-evolutionary or anti-natural.
A more correct use of notions would suggest the idea of transformation, change or regeneration and not destruction or damage. These latter terms are the product of subjective and anthropocentric interpretations. Even when transformations affect society, reducing the quantity and quality of potential resources, these processes are in themselves natural and cannot be considered in the same way as direct event impacts on society, its goods, heritage or material structures. Thus, the frequently used notion of ecological or environmental vulnerability refers to a type of vulnerability which is quite different and in no

way comparable with social or human vulnerability. In fact, it is probably more convenient to speak of different levels of environmental resilience or fragility instead of vulnerability, and thus avoid confusions and contradictions. This argument also applies to the use of such notions as environmental disaster instead of more objective statements such as wide or large scale environmental change or transformation associated with the occurrence of large scale, natural physical events. In disaster risk and disaster studies confusions and contradiction are introduced when the same word, disaster, is employed to depict both social and natural scenarios. Natural phenomena which modify or transform other natural scenarios are inevitable and have occurred since the origins of the Earth. With very large scale phenomena society can do nothing to impede or change these. Intervention is thus essentially reduced to prediction adaptation and, eventually, response. On the other hand, with lower scale natural or environmental processes society frequently intervenes in order to modify them. This is the case, for example, with the control of the natural flooding of rivers, the control of spontaneous- natural fires, the modification of slopes in order to permit agriculture or construction and deforestation permitting expansion of the agricultural frontier. Here, the possibility of future negative impacts always exists as is the case where dykes and dams break, construction on land fill areas is subjected to greater seismic intensities or deforested areas generate increased flooding, landslide and drought patterns. Environmental change and transformation which takes place in highly intervened, modified or weakened ecosystems and environments constitutes a very distinct context and problem to that associated with purely natural transformations of the environment. In the case of direct social losses in modified natural environments, intervention processes have many times generated new socio-natural hazards or rendered the scale of natural physical events more powerful thus generating increasing losses once the event occurs. (A)

Natural disaster: A serious disruption triggered by a natural hazard causing human, material, economic or environmental losses, which exceed the ability of those affected to cope.(C)
Natural disaster, slow onset: A disaster event that unfolds alongside and within development processes. The hazard can be felt as an ongoing stress for many days,months or even years. Drought is a prime example.(C)
Natural disaster, rapid onset: A disaster that is triggered by an instantaneous shock.The impact of this disaster may unfold over the medium- or long-term. An earthquake is a prime example.(C)

Natural Hazard: A latent threat associated with the probable occurrence of a phenomenon of natural origin – for example, an earthquake, a volcanic eruption, a tsunami or a hurricane. The origins of such phenomenon may be found in the natural processes by which the Earth and the environment are transformed and changed. Natural hazards are often classified according to their origins in the biosphere, allowing the identification of geological, geomorphologic, climatologic, hydro-meteorological, oceanic and biotic threats, among others. (A)
Natural hazard: Natural process or phenomenon that may constitute a damaging event.Natural hazards can be classified by origin namely: geological, hydro-meteorological or biological.(B)
Natural hazards: Natural processes or phenomena occurring in the biosphere that may constitute a damaging event.(C)

Physical exposure: Elements at risk, an inventory of those people or artefacts that are exposed to a hazard.(C)

Population at risk: All those persons who would be directly exposed to the consequences of failure of a structure or facility if they did not evacuate.(B)

Preparedness: Activities and measures taken in advance to ensure effective response to hazards and their consequences.(B)
Preparedness: Activities to ensure that people are ready for a disaster and respond to it effectively. Preparedness requires figuring out what will be done if essential services break down, developing a plan for contingencies, and practicing the plan.(D)

Preparedness: Activities and measures taken in advance to ensure effective response to the impact of disaster, including the issuance of timely and effective early warnings and the temporary removal of people and property from a threatened location.(F)

Prevention: Activities to provide outright avoidance of the hazards and their consequences.(B)
Prevention: Activities to provide outright avoidance of the adverse impact of hazards and related environmental, technological and biological disasters.
Depending on social and technical feasibility and cost/benefit considerations, investing in preventivemeasures is justified in areas frequently affected by disasters. In the context of public awareness and education, prevention refers to changing attitude and behaviour towards a "culture of prevention".(F)

Primary Or Structural Risk: Risk conditions which exist in society under normal conditions, the product of skewed development processes fuelled and re-shaped to some extent by the accumulative impacts of prior disaster triggering physical phenomena and economic and social crises. (A)

Probabilistic: A description of procedures, which are based on the application of the laws of probability. Contrasts with deterministic.(B)

Probability: A measure of the degree of certainty. This measure has a value between zero (impossibility) and 1.0 (certainty). It is an estimate of the likelihood of the magnitude of the uncertain quantity, or the likelihood of the occurrence of the uncertain future event.
There are two main interpretations:

- *Statistical - frequency or fraction – The outcome of a repetitive experiment of some kind like flipping coins. It includes also the idea of population variability. Such a number is called an "objective" or relative frequentist probability because it exists in the real world and is in principle measurable by doing the experiment.*
- *Subjective probability (degree of belief) – Quantified measure of belief, judgement, or confidence in the likelihood of an outcome, obtained by considering all available information honestly, fairly, and with a minimum of bias. Subjective probability is affected by the state of understanding of a process, judgement regarding an evaluation, or the quality and quantity of information. It may change over time as the state of knowledge changes. (B)*

Probability density function: A function describing the relative likelihood that a random variable will assume a particular value in contrast to taking on other values.(B)

Prospective Risk Management: A process by which future risk is foreseen and intervened or controlled. Prospective management should be seen as an integral component of development planning and the planning cycle of new projects, whether these are promoted by the government, the private sector or civil society. The final aim of this type of management is to avoid new risks, guarantee adequate levels of sustainability of investments, and avoid having to take expensive corrective management measures in the future. (See RISK PREVENTION, below.) (A)

Public awareness: The processes of informing the general population, increasing their levels of consciousness about risks and how to take action to reduce their exposure to hazards. This is particularly important for public officials in fulfilling their responsibilities to save lives and property in the event of a disaster.
Public awareness activities support a change in behaviour leading towards a culture of prevention.This involves public information, dissemination,education, radio or television broadcasts and the use of printed media, as well as, the establishment of disaster information centres and networks.(F)

Public information: Information, facts and knowledge provided or learned as a result of research or study, which is public, open to the people as a whole.(F)

Random variable: A quantity, the magnitude of which is not exactly fixed, but rather the quantity may assume any of a number of values described by a probability distribution.(B)

Recovery: Activities necessary to rebuild after a disaster. Recovery activities include rebuilding homes, businesses and public facilities; clearing debris; repairing roads and bridges; and restoring water, sewer and other essential services. (D)

Recovery: Decisions and actions taken after a disaster with a view to restoring the living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk. *Recovery (rehabilitation and reconstruction) is an opportunity to develop and apply disaster risk reduction measures.* (F)

Recuperation: Process of re-establishing acceptable and sustainable living conditions through the rehabilitation, repair and reconstruction of destroyed, interrupted or deteriorated infrastructure, goods and services and the reactivation or promotion of economic and social development in affected areas. (A)

Regulatory agency (synonymous with Regulator): Usually a government ministry, department, office, directorate or other unit of government entrusted by law or administrative act with the responsibility for the general supervision of the safe design, construction and operations of structures or facilities, as well as any entity to which all or part of the executive or operational tasks and functions have been delegated by legal power.(B)

Reliability: Likelihood of successful performance of a given project element. Mathematically, Reliability = 1 - Probability of failure. See definitions of probability" and "failure".(B)

Relief / response: The provision of assistance and/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.(F)

Residual risk: The remaining level of risk at anytime before, during and after a program of risk mitigation measures has been taken.(B)

Resilience: The capacity of an ecosystem, society or community to assimilate a negative impact or to recuperate once it has been affected by a physical phenomenon. (A)
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.(C)

Response :Activities to address the immediate and short-term effects of an emergency or disaster. Response activities include immediate actions to save lives, protect property, and meet basic human needs.(D)

Retrofitting (or upgrading): Reinforcement of structures in order to be more resistant to the forces of natural hazards.
Retrofitting involves consideration of changes in the mass, stiffness, damping, load path and ductility and can involve radical changes such as the introduction of energy absorbing dampers and base isolation systems. Examples of retrofitting includes the consideration of wind loading to strengthen and minimize the wind force, or in earthquake prone areas, the strengthening of structures by adding shear walls.

Risk: Risk = Hazard * potential worth of loss. This can be also expressed as "Probability of an event times the consequences if the event occurs" (B)
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 (C)
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/capable conditions.
Conventionally risk is expressed by the equation Risk = Hazards x Vulnerability / Capacity.
Beyond expressing a probability of physical harm, it is crucial to appreciate that risks are always created or exist within social systems. It is important to consider the social contexts in which risks occurand that people therefore do not necessarily share the same perceptions of risk and their underlying causes. (F)

Risk Analysis: A projection of the probable social, economic and environmental impacts of future physical phenomenon on particular social and economic groups, areas or territories. This is achieved through an analysis of the hazards and vulnerabilities of exposed social and economic units. Changes in one or more of these parameters modify the levels of risk,
the total expected losses and the consequences for a given area. (A)
Risk analysis: The use of available information to estimate the risk to individuals or
populations, property or the environment, from hazards. Risk analyses generally contain the following steps: definition of scope, danger (threat) identification, estimation of probability of occurrence to estimate hazard, evaluation of the vulnerability of the element(s) at risk, consequence identification, and risk estimation. Consistent with the common dictionary definition of analysis, viz. "A detailed examination of anything complex made in order to understand its nature or to determine its essential features", risk analysis involves the disaggregation or decomposition of the system and sources of risk into their fundamental parts.

> Qualitative risk analysis: An analysis which uses word form, descriptive or numeric rating scales to describe the magnitude of potential consequences and the likelihood that those consequences will occur.
> Quantitative risk analysis: An analysis based on numerical values of the probability, vulnerability and consequences, and resulting in a numerical value of the risk. (B)

Risk assessment: The process of making a decision recommendation on whether existing risks are tolerable and present risk control measures are adequate, and if not, whether alternative risk control measures are justified or will be implemented. Risk assessment incorporates the risk analysis and risk evaluation phases.(B)
Risk Assessment. The scientific quantification of risk from data and understanding of the processes involved.
Risk assessment/analysis: A process to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability/ capacity that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.
The process of conducting a risk assessment is based in a review of both technical features of hazards such as their location, intensity, frequency, and probability, and also the analysis of the physical, social and economic dimensions of vulnerability, while taking particular account of the coping capabilities pertinent to the risk scenarios.(F)

Risk-based decision-making: Decision-making, which has as a main input the results of risk assessment. It involves a balancing of social and other benefits and the residual risks. (B)

Risk communication:

Risk Continuum: An expression of the dynamic and changing nature of risk within defined territorial, social and temporal circumstances (see PRIMARY RISK above and SECONDARY OR DERIVED RISK, below). (A)

Risk control: The implementation and enforcement of actions to control risk, and the
periodic re-evaluation of the effectiveness of these actions.(B)

Risk evaluation: The stage at which values and judgement enter the decision process,

explicitly or implicitly, by including consideration of the importance of the estimated risks and the associated social, environmental, and economic consequences, in order to identify a range of alternatives for managing the risks.(B)
Risk Evaluation. The social and political judgement of the importance of various risks by the individuals and communities that face them. This involves trading off perceived risks against potential benefits and also includes balancing scientific judgements against other factors and beliefs.

Risk management: The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, assessing, mitigating and monitoring risk. (B)
Risk management: The systematic management of administrative decisions, organisation, operational skills and responsibilities to apply policies, strategies and practices for *disaster risk reduction.(F)*

Risk Management Plan: A coherent and organized series of strategies, programmes and plans drawn up to guide risk reduction and control and recuperation in the case of disaster. By guaranteeing appropriate levels of security in the face of a variety of existing risks and by reducing material loss and the social consequences of disasters, the quality of life of the population is maintained and sustainability is increased. (A)

Risk mitigation: A selective application of appropriate techniques and management principles to reduce either likelihood of an occurrence or its adverse consequences, or both.(B)

Risk perception:

Risk Prevention: Anticipatory measures and actions which seek to avoid future risks. This means working with probable future hazards and vulnerabilities. Seen from this perspective, risk prevention is a facet of Prospective Risk Management, while risk mitigation or reduction relates to Corrective Management. Given that total prevention is rarely possible, prevention has a semi-utopian connotation and should be seen in the light of considerations as regards socially determined acceptable risk levels.(See ACCEPTABLE RISK, above) (A)

Risk Reduction: See RISK MITIGATION Above. (A)

Risk reduction measures: The development and application of policies, procedures and capacities of the society and communities to lessen the negative impacts of a possible impact of natural hazards and related environmental and technological disasters. This includes structural and non structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse impact of hazards, as well as the development of coping capabilities.(F)

Risk Scenarios: An analysis of the dimensions and types of risk that affect defined territories or social groups and presented in written, mapped or other graphic forms using quantitative and qualitative techniques and based on participatory methods. This implies a detailed analysis of hazards and vulnerabilities. Risk scenarios provide a basis for decision making on risk reduction, preparedness and control. Recent developments of the notion of risk scenarios include a parallel understanding of causal social processes and of the social actors that contribute to existing risk conditions. A risk scenario is the result of an integral risk analysis process. (A)

Safety coefficient: See " Factor of Safety"

Scenario: A unique combination of states. A scenario defines a suite of circumstances of interest in a risk assessment, for example loading scenarios or failure scenarios.(B)

Secondary Or Derived Risk: Specific risk conditions that arise more or less abruptly with the impact of a dangerous physical phenomenon on society. Examples are the risk of illness and death, malnutrition and severe food insecurity, the lack of access to drinking water, rape and

mistreatment of women and children in shelters. These risks are built on primary risk conditions and vulnerabilities that exist prior to impact, allowing us to refer to a disaster risk process or continuum. If secondary or derived risks are not adequately resolved through disaster response mechanisms they will contribute in accumulative fashion to future primary risks. (A)

Sensitivity analysis: An analysis to determine the range over which the result varies, given unit change in one or more input parameters.(B)

Social Appropriation: The process by which organizations and institutions that represent development and risk stake holders assume the challenges of management, guaranteeing continuity and sustainability. (A)

Social capital: A shorthand term used to describe a combination of social norms (such as trust), relationships (such as reciprocity) and ties (such as hierarchical clientalism or horizontal group bonds) held by an individual or predominant within a social arena.(C)

Social Participation: The process by which the subjects of development and risk take an active and decisive part in decision making and activities designed to improve their living conditions and reduce or prevent risk. Participation is the basis of empowerment and the development of social capital. (A)

Societal risk: The risk of widespread or large scale detriment from the realisation of a defined risk, the implication being that the consequence would be on such a scale as to provoke a socio/political response.(B)

Socio-Natural Hazard: Latent threat associated with the probable occurrence of physical phenomena, the existence and intensity of which is related to processes of environmental deterioration or human intervention in natural ecosystems. Examples of these can be found in floods and landslides related to deforestation and the degradation or deterioration of watersheds; coastal erosion due to mangrove logging; urban flooding due to the lack of adequate fluvial drainage systems. Socio-natural hazards are generated at the interface between nature and human activity and are the product of a process by which natural resources are converted into hazards. The new hazards associated with Global Climate Change represent the most extreme example of socionatural hazards. (A)

Standards-based approach: The traditional approach to engineering, in which risks are controlled by following established rules as to design events and loads, structural capacity, safety coefficients and defensive design measures.(B)

STAPLE: An acronym for the criteria that can be used by a community in selecting an appropriate mitigation strategy. (Social, Technical, Administrative, Political, Legal and Economic/Environmental) (D)

Structural measures: Engineering measures and construction of hazard-resistant and protective structures and Infrastructure (F)

Sustainable Development: Natural, economicsocial,cultural and institutional processes and changes that lead to an accumulative and durable increase in the quantity and quality of goods, services and resources, accompanied by social changes which tend to improve human security and quality of life. This must occur without excessive deterioration of the natural environment or a reduction in the possibilities for a similar level and type of development accessible to future generations. (A)
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.(C)

System response: How a system responds. May be expressed as a conditional probability of failure, to a given scenario of applied loads and concurrent conditions (see also fragility curve).(B)

Technological hazards: Danger originating from technological or industrial accidents, dangerous procedures, infrastructure failures or certain human activities, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.
Some examples: industrial pollution, nuclear activities and radioactivity, toxic wastes, dam failures; transport, industrial or technological accidents (explosions, fires, spills).(F)

Tolerable risk: A risk within a range that society can live with so as to secure certain net benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if possible.(B)

Uncertainty: Describes any situation without certainty, whether or not described by a probability distribution. Uncertainty is caused by natural variation and/or incomplete knowledge (lack of understanding or insufficient data). In the context of structural safety, uncertainty can be attributed to (i) *aleatory uncertainty:* inherent variability in natural properties and events, and (ii) *epistemic uncertainty:* incomplete knowledge of parameters and the relationships between input and output values.(B)

Voluntary risk: A risk that a person faces voluntarily in order to gain some benefit.

Vulnerability: The propensity of human beings and their livelihoods to suffer damage and loss when impacted by external physical phenomenon. Distinct levels of human and livelihood vulnerability may be explained by the incidence of diverse processes and conditions relating, amongst others, to the presence of insecure buildings and infrastructure, limited economic resources and incomes, lack of social protection, insecure livelihoods, poverty, inadequate educational, organizational and institutional arrangements and lack of well developed social and political capital. (A)
Vulnerability: The degree of loss to a given element or set of elements within the area affected by a hazard. It is expressed on a scale of 0 (no loss) to 1 (total loss). Also, a set of conditions and processes resulting from physical, social, economic, and environmental factors, which increase the susceptibility of a community to the impact of hazards.(B)
Vulnerability: The extent to which a community, structure, service, or geographic area is likely to be damaged or disrupted by the impact of a particular disaster hazard, on account of their nature, construction, and proximity to hazardous terrain or a disaster-prone area. For engineering purposes, vulnerability is a mathematical function defined as the degree of loss to a given element at risk, or set of such elements, expected to result from the impact of a disaster hazard of a given magnitude. It is specific to a particular type of structure, and expressed on a scale of 0 (no damage) to 1 (total damage). For more general socio-economic purposes and macro-level analyses, vulnerability is a less-strictlydefined concept. It incorporates considerations of both the intrinsic value of the elements concerned and their functional value in contributing to communal well-being in general and to emergency response and post-disaster recovery in particular. In many cases, it is necessary (and sufficient) to settle for a qualitative classification in terms of “high”, “medium”, and “low”; or explicit statements concerning the disruption likely to be suffered. (E)
Vulnerability: A set of conditions and processes resulting from physical, social, economical, and environmental factors, which increase the susceptibility of a community to the impact of hazards.
Positive factors, that increase the ability of people and the society they live in, to cope effectively with hazards, that increase their resilience, or that otherwise reduce their susceptibility, are considered as capacities.(F)

Vulnerability Evaluation: The process by which the susceptibility and predisposition to damage or loss is determined when faced with the possible occurrence of a dangerous physical phenomenon. This also includes an analysis of the factors and contexts which can

substantially impede or render difficult the subsequent recuperation, rehabilitation and reconstruction of the affected social unit using the resources autonomously available to it. (A)

WARNING (EARLY): An announcement or declaration, emitted by previously identified and responsible institutions, organizations and individuals, which allows the provision of adequate, precise and effective information prior to the manifestation of a dangerous phenomenon. This allows emergency organisations or groups to activate preestablished security procedures and the population to take specific precautions. In addition to informing the population of the hazard, early warnings are declared with the objective of permitting the population and institutions to adopt specific actions when faced with imminent danger. (A)