Assessment of Natural hazards and Disaster Risk management using Remote Sensing and GIS

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ABSTRACT

In this world, most of the areas are revealed to various types of natural hazards, each with their specific features. The ecosphere has practiced a growing influence of disasters in the past eras. The chief reasons for this rise can be recognized to a higher frequency of dangerous hydro-meteorological actions, mostly associated to climate change, and to an increase in risky population. To decrease disaster victims more determinations should be completed on Disaster Risk Management, with a concentration on hazard assessment, elements-at-risk mapping, susceptibility assessment and threat assessment, which all have a significant spatial constituent. In a numerous threat assessment the associations between different hazards should be deliberated, particularly for concatenated or spilling hazards. Threat and danger assessments are carried out at different measures of study, extending from a global scale to a public level. Each of these levels has its own intentions and spatial data necessities for hazard lists, environmental data, prompting factors, and elements-at-risk. An outline is specified of the use of data with importance on remote sensing data, and of the methods used for hazard assessment. Exposure methods are conferred, with prominence on the several techniques used to define physical liability of structure standard and population, and indicator-based methods used for a complete approach, also integrating social, economic and environmental vulnerability, and capacity.

Keywords: *Disaster Risk Management, hazard assessment, elements-at-risk, environmental data, vulnerability*

1. INTRODUCTION

A disaster looks on the news captions almost every day. Most occur in distant places, and are promptly forgotten. Others retain the consideration of the world media for an elongated period of time. The actions that accept maximum media attention are those that hit promptly and cause widespread losses and human suffering, such as earthquakes, floods and hurricanes. Alternatively, there are many severe geomorphologic threats that have a slow inception such as famine, soil erosion, land deprivation, desertification, icy evacuation, sea level rise, loss of biodiversity etc.

They may cause much greater influences on the long run but obtain less medium thoughtfulness. Hazards can be distinct, consecutive or joined in their origin and effects. Each hazard is characterized by its location, area affected, and strength, speed of inception, period and frequency. Hazards can be categorized in numerous ways. A potential portion is between natural, human-tempted and man-made threats. Natural hazards are natural developments or occurrences in the earth's system that may create a destructive event (e.g. earthquakes, volcanic explosions, cyclones).

Human-tempted hazards are those ensuing from variations of natural processes in the earth's system instigated by human activities which hasten/heighten the destruction potential (e.g. land humiliation, landslides, forest fires). Man-made hazards initiate from technological or industrialized calamities, hazardous processes, infrastructure disappointments or assured human accomplishments, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Natural disasters occur in many parts of the world, although each type of hazard is restricted to certain regions. Global studies on the distribution of hazards indicate that geophysical disasters are closely related to plate tectonics. Earthquakes occur along active tectonic plate margins, and volcanoes occur along subduction regions.

The growth in the number of disasters, the losses and people affected cannot be explained only by better reporting methods and media coverage of disasters, lack of which probably made the number too low for the leading part of the last century. There are a number of aspects that guidance the rise in the number of disasters which can be segmented as those principal to a greater susceptibility and those important to a higher existence of dangerous events. The aggregate effect of natural disasters is also associated with the development of vastly sensitive technologies and the rising vulnerability of modern industrial humanities to failures in their organization.

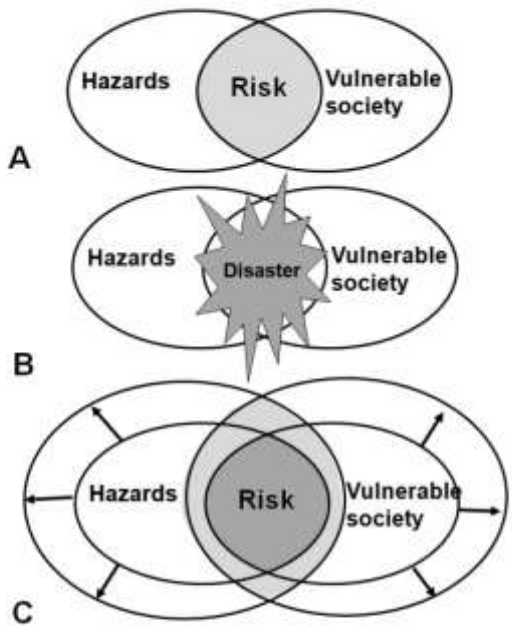

Fig.1: Schematic representation of the relation between hazards, vulnerable society, risk and disasters.

2. Disaster Risk Management

Disaster Risk Management (DRM) is defined as the efficient process of using organization a assessments, organization, operational skills and capacities to implement procedures, approaches and managing capacities of the society and societies to reduce the effects of natural hazards and associated ecological and technological disasters. It is intended at disaster risk reduction, which refers to the theoretical framework of elements deliberated with the opportunities to reduce susceptibilities and disaster risks within the broad circumstance of ecological improvement.

The change was also from a method that was committed predominantly on the hazard as the main essential part for risk, and the failure of the risk by corporeal protection processes to a concentration on susceptibility of societies and ways to decrease those through awareness and early warning. Later also the capabilities of local societies and the local managing approaches were given more consideration. Disaster inhibition is attained through risk management. Risk exploration usually comprises the resulting steps: hazard identification, threat assessment, elements-at-risk/exposure analysis, susceptibility assessment and risk evaluation.

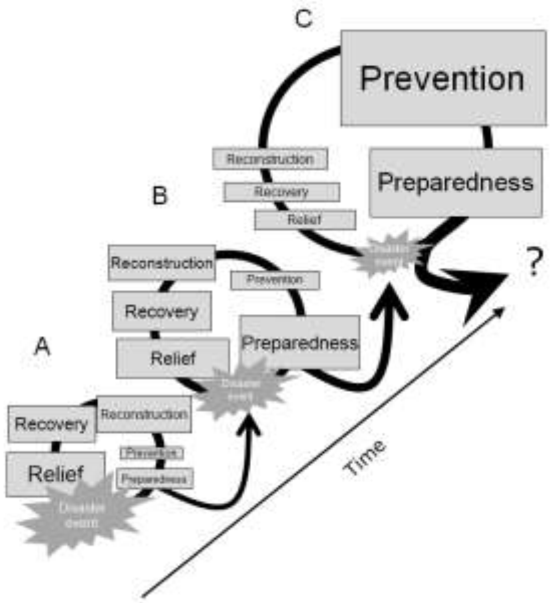

Fig.2: Disaster cycle and its development

Risk assessment is the period at which principles and verdicts enter the resolution process, obviously or indirectly, by comprising concern of the significance of the assessed risks and the related social, ecological, and commercial significances, so as to recognize a range of substitutes for decreasing the hazards. In the wide-ranging risk management structure, spatial information plays a vital role, as the threats are spatially dispersed, along with the susceptible elements-at-risk.

The use of earth observation products and geo information systems has become a combined, powerful and prosperous tool in disaster risk management. Innovative GIS methods, in specific, are modernizing the possible ability to investigate threats, weakness and dangers, and plan for disasters. GIS software bundles are used for information loading, situation exploration and modeling. Disaster risks management welfares importantly from the use of GIS technology since spatial approaches can be fully discovered during the assessment process.

3. Risk analysis framework

Risk analysis frameworks have some significant constituents in risk analysis: hazards, vulnerability and elements-at-risk. They are categorized by both spatial and non-spatial features. Hazards are considered by their sequential probability and concentration derived from frequency magnitude exploration. Intensity articulates the brutality of the hazard, e.g flood depth, flow velocity, and duration in the event of flooding. The hazard component in the equation actually refers to the probability of occurrence of a hazardous phenomenon with a given intensity within a specified period of time.

Hazards also have a significant constituent, both related to the initiation of the hazard and the spreading of the hazardous phenomena. Elements-at-risk are the inhabitants, possessions, economic actions, comprising public services, or any other defined values showing to risks in a given area. They are also denoted to as "effects". Elements-at-risk also have spatial and non-spatial features. The way in which the quantity of elements-at-risk is considered (e.g. as number of constructions, number of individuals, commercial value or the area of qualitative classes of significance) also describes the way in which the risk is offered. The interface of elements-at-risk and hazard describes the exposure and the susceptibility of the elements-at-risk. The relations of elements-at-risk and hazard describes the exposure and the susceptibility of the elements-at-risk. Revelation designates the degree to which the elements-at-risk are essentially situated in an area exaggerated by a specific hazard.

The spatial collaboration between the elements-at-risk and the threat footpaths are described in a GIS by map overlapping of the hazard map with the elements-at-risk map. Vulnerability refers to the circumstances resolute by physical, social, commercial and ecological factors or processes, which growth the vulnerability of a community to the influence of hazards. Vulnerability can be subdivided in physical, social, economic, and environmental vulnerability. The framework of risk analysis is depicted in fig.2.

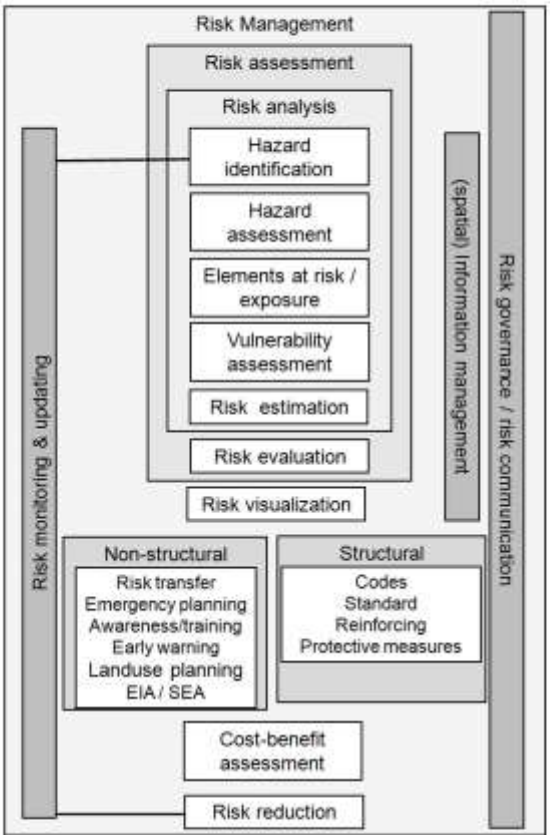

Fig.2: The framework of Risk analysis

4. HAZARD ASSESSMENT& VULNERABILITY

A hazard is defined as a possibly destructive physical event, occurrence or human movement that may cause the loss of life or damage, property destruction, communal and commercial interruption or ecological deprivation. Geomorphology is the knowledge of landforms and of the manners that have designed or reformed them. These developments that have designed the Earth's surface can be theoretically hazardous if they occur in inhabited regions and may cause influence to the susceptible humanities if they go above a definite threshold, e.g. they may effect in variability and erosion on slopes, overflowing in river- or coastal extents or earthquakes and volcanic outbreaks.

The goal of a hazard evaluation is to make a zonation of a part of the Earth's surface with esteem to different types, difficulties, and occurrences of hazardous developments. Dangerous manners are caused by assured initiates, who could be connected to volcanic explosions or earthquakes or exciting meteorological processes and the spatial level of the hazard is associated to a set of ecological features.

The straight effects may initiate ancillary effect, or subordinate hazards, such as avalanches caused by ground shuddering in hilly areas, landslides and floods happening in recently scorched areas or tsunamis caused by earthquake-induced surface movement in the sea. Ancillary hazards that are caused by others are also denoted to as concatenated hazards or tumbling hazards. It wishes to illustrate the interrelationships between the prompting factors, the crucial hazards and ancillary hazards. These relationships can be very complex, for example, the existence of floods as a result of the breaking of earthquake-induced landslide dams.

Various multi-hazard assessment method and consequent risk assessment are as

- Vulnerability and risk assessment at the universal scale is essentially planned to produce risk catalogues for specific countries, to link them to catalogues associated to socio-economic growth, and to make arrangements for maintenance by international organization

- The threat maps are produced using identical approaches, and are intended both at risk evaluation, early warning and post disaster destruction assessment.

- The assessment of multi-hazards and the consequent risk is a very data demanding procedure. The accessibility of assured types of information can be one of the main restrictions for carrying out specific types of analysis.

- Vulnerability and threat assessment at national scale cover areas stretching from miles to several kilometers, subject on the size of the country. Threat assessment is carried out at a domestic scale for spatial scheduling purposes, application of national disaster risk reduction strategies, early warning systems, disaster awareness and assurance.

- At a civic level, hazard and risk assessment are conceded out in contribution with local societies and confined establishments, as a means to obtain commitment for disaster risk reduction programs.

- A number of hazards satellite-based information is the foremost source for producing hazard lists, and hazard monitoring

- Systematic group of data from significant actions using public impact can suggest a very convenient factor for the growth of datasets to be used as input for risk studies at public level and as a basis for risk management and community development.

Vulnerability is the most complex factor of risk assessment. It can be stated or offered in several ways. Those indices are based on signs of vulnerability and are mostly used for holistic vulnerability, capacity and resilience assessment. Susceptibility tables show the relation flanked by hazard strength and degree of injure in the form of a table. Susceptibility curves display the relation between hazard strength and degree of injure for a group of elements-at-risk.

5. MULTI HAZARD RISK ASSESSMENT

Hazards will affect different kinds of elements-at-risk, and it is consequently significant to estimate the risk for different segments, e.g. accommodation, agriculture, transportation, education, health, tourism, and mining and on the natural environment (secure areas, forests, marshlands etc). Risk assessment should comprise the appropriate shareholders which can be characters, commerce, organizations, and consultants. The level of analysis is also very significant in risk assessment. It can be accepted with a collection of approaches that can be mostly categorized into qualitative and assessable methods. Those methods for risk assessment are beneficial as a primary selection process to recognize threats and risks. They are also used when the supposed level of risk does not explain the time and effort of amassing the vast amount of data needed for a quantitative risk assessment, and where the possibility of attaining numerical data is restricted. Assessable methods typically monitors an engineering methodology and focus on the estimation of the direct physical victims subsequent directly from the influence of the hazard, for occurrence buildings that are submerged, or that collapse as a result of an earthquake, wind destruction to infrastructure. Specific also evaluate ancillary losses due to loss of function, for example, disruption of transport, business losses or offensive costs.

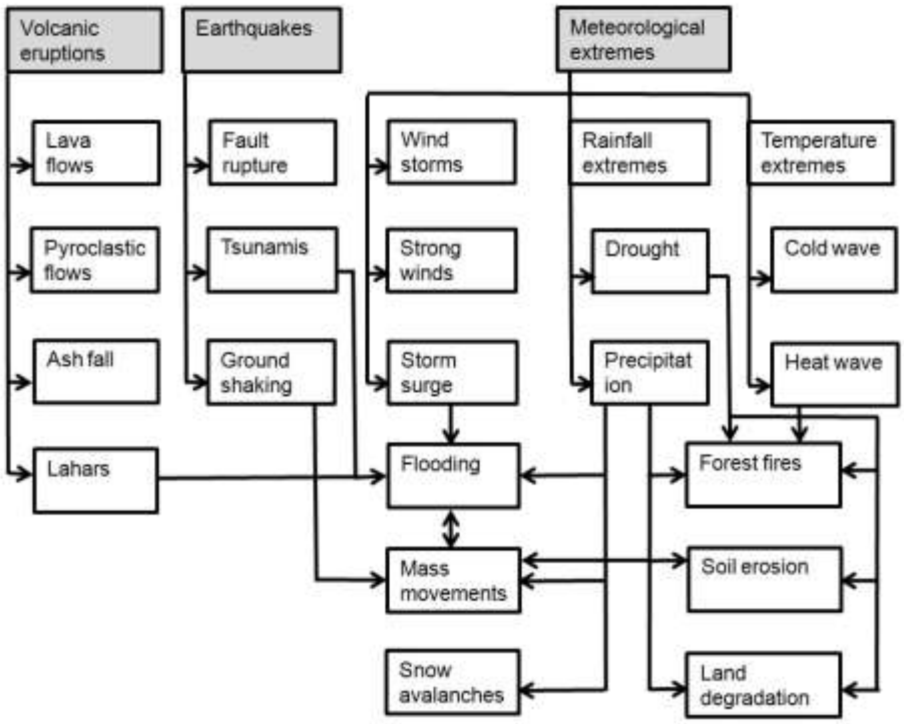

Fig.3: Multi-hazards and their interactions required for multi-hazard risk assessment.

CONCLUSION

Land use changes will take place as a importance of technological, socio-economic and political developments besides global ecological change. The assortment and effects of these changes will strongly depend on policy decisions. Many ecological problems are caused by accidental rapidly expanding urban areas. Impacts of natural hazards on the setting and on the society are still tackled by mono-disciplinary approaches.

The focus is reflected in the domains of scientific Research (single approach and tools for each type of hazard), in the existing organization tools and in the legislative origin of these activities. Consequently approaches are needed for integrating disaster risk evaluation in long term resource allocation and land use planning at all levels of management.

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