INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD ISSN: 2455-0620 Volume - 7, Issue - 8, Aug – 2021
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value: 86.87 Impact Factor: 6.719
Received Date: 28/07/2021 Acceptance Date: 15/08/2021 Publication Date: 31/08/2021

Assessing Disaster Mitigation among the Inhabitants of Srinagar City, Jammu and Kashmir with special reference to Earthquake Hazards

Sidrat Ul Muntaha Anees
Assistant Prof.
Department of Geography, Govt. College for Women,
M.A Road, Srinagar, Kashmir, J & K, India
Email - sidrathamdani@gmail.com

Abstract: *Natural hazards have occurred and will occur in future as it is beyond the control of human beings, but by taking proper steps the effect of these hazards on human lives can be reduced to a considerable level. Disaster mitigation refers to measures that can be taken to minimize destructive and disruptive effects of hazards and lessen the scale of a possible disaster. Mitigation of hazards is associated with attempts to reduce the intensity of a hazard or to make some other modification which is supposed to lessen its impact. For efficient and effective risk management, hazard and vulnerabilities should be assessed before a disaster strikes. Among different types of elements that may be present in hazard zones, human life is unquestionably the most important value to protect from disasters. Srinagar city of Jammu and Kashmir is seismically active earthquake prone area. The study aims to assess and statistically analyze the earthquake hazard mitigation among the residents of city. As per the results of study, the residents of city are neither prepared nor aware regarding the earthquake hazards and have not adopted any measures to respond and recover from the harmful effects of an earthquake disaster to a satisfactory level.*

Key Words: *Disaster Mitigation, Earthquakes, Srinagar City, Statistics.*

1. INTRODUCTION:

A natural hazard only becomes a disaster when it affects a human population that is exposed and vulnerable (Uitto 1998). Disasters disrupt normal life, leave tales of loss, misery and suffering behind them and create challenges for those engaged in public management (Kanwar 2001). Disasters have adversely affected humans since the dawn of our existence (Dar et al. 2013). The increase in the cost and frequency of disasters has huge impacts on societies, especially in developing and poor countries (Rezaei and Ghaderi 2013). There is a high risk of disaster when one or more natural hazards occur in a vulnerable situation. Natural disasters occur in places where the geographical coordinates of natural and human vulnerabilities converge (Ayala 2002). The global earthquake death rate (1990-2014) has shown an increasing trend. Earthquakes cannot be predicted by any method available so far (Goel and Kumar 2001).

For efficient and effective risk management, hazard and vulnerabilities should be assessed before a disaster strikes (Birkmann, 2007), which requires the creation and maintenance of baseline data as part of geospatial preparedness activities (Emrich et al. 2011). This is especially relevant in the case of earthquakes, whose damaging effects are compounded by the impossibility of accurate and timely forecasting (Geller 1997; Buchanan 2001; Guo 2010). Vulnerability is the degree to which a system acts adversely to the occurrence of a hazardous event (Timmerman 1981). It is defined as an aggregate of conditions and procedures determined by the physical, social, economic and environmental contributors that increase the susceptibility of a certain population to hazardous impacts (Gentile and Gonzales 2001; Kumpulainen 2006; Kienberger 2007; Asuero et al. 2012). The concept of vulnerability has been continuously widened and broadened towards a more comprehensive approach encompassing susceptibility, exposure, coping capacity and adaptive capacity, as well as different thematic areas, such as physical, social, economic, environmental and institutional vulnerability (Birkmann 2006, 2007).

Vulnerability indicators are potentially useful tools for identifying and monitoring vulnerability over time and space, for developing an improved understanding of the processes underlying vulnerability, for developing and prioritizing strategies to reduce vulnerability, and for determining the effectiveness of those strategies (Rygel et al. 2006). Regional earthquake vulnerability assessment plays an important role in emergency preparation, response, mitigation and recovery (Peng 2012). Vulnerability analysis plays a key role in disaster risk reduction, as the development of strategies on reduction and mitigation of losses and damages is crucial pre-condition for an effective disaster management (Muck et al. 2012). Among the different types of elements that may be present in hazard zones, human life is unquestionably the most important value to protect from disasters (Freire and Aubrecht 2012).

2. LITERATURE REVIEW:

Mitigation refers to efforts to reduce the actual or probable effects of a disaster on people, structures, economic and social systems and the environment. Mitigation seeks to reduce risk, that is, vulnerability to damage or

loss (Fernando 1999). Erdik and Durukal (2008) carried out earthquake risk and its mitigation in Istanbul. In their study, the physical and societal vulnerability to earthquakes and expected physical, social, economic, and industrial losses were outlined. Nateghi (2000) discussed the earthquake disaster mitigation strategies for the city of Tehran. The study focused on the policy framework for the disaster mitigation which involves: engineering and construction; physical planning; economic planning; policy guidance and public response. Fernando (1999) described about mitigation, its components and importance. The study also discussed the need for public awareness and training regarding mitigation and role of non-governmental organizations in disaster management. Aboagye, Dari and Koomson (2013) examined the relationship between demographic characteristics and mitigation strategies in the Savannah Region of Ghana. Uitto (1998) argued that a careful analysis of disaster vulnerability from a spatial or geographical perspective will improve disaster preparedness as well as facilitate both immediate and long term recovery.

The emergency preparedness and disaster management in Hawaii was studied by Prizzia and Helfand (2001). Wisetjindawat, Ito, Fujita, and Hideshima (2013) proposed a model to evaluate and improve disaster response plans in Japan. The study carried out by Chakraborty, Tobin and Montz (2005) in Hillsborough County, Florida demonstrated the importance of evaluating both risk and vulnerability from several perspectives for emergency management purposes. The goal of the study was to facilitate effective emergency planning for the evacuation of populations in urbanized coastal areas. Perry and Lindell (2003) reviewed the concepts of community preparedness and emergency planning and their relationships with training, exercises and the written plan. The work carried out by Carvalho, Dias, Pinto, Cunha, Leote, Vilanova, Narciso, Borges, Ghose (2013) discussed about the earthquake mitigation in Lisbon and Lower Tagus valley area of Portugal. Stoppa and Berti (2013) discussed how to approach the problem of the social mitigation of seismic risk, in order to reduce damage and grief consequent to earthquakes from an Italian case history. Heping (2003) carried out a study on the earthquake disaster preparedness and reduction in China. Rocha and Christoplos (2001) conducted a study on the Disaster mitigation and preparedness in Nicaragua.

A study was conducted by Sharma (2001) which discussed some issues which emerged from that disaster on search and rescue, relief and rehabilitation, scientific and technical, communication and earthquake preparedness. Mishra, Fuloria and Bisht (2012) enhanced disaster management by mapping disaster proneness and preparedness in the state of Tamil Nadu. Kanwar (2001) discussed about the disaster management in India and its key issues including its prevention, mitigation, preparedness, response, relief and rehabilitation. Arya (2006) reviewed the risk of earthquake hazard in India and mitigative actions taken in the past and looked at the future directions of mitigating the earthquake risk. Srivastava, Hedge and Jayaraman (2007) described the emerging role of Information and communication technologies (ICTs) for disaster risk reduction in India and to highlight the emerging challenges in making the application of these technologies more effective.

2.1. STUDY AREA:

Srinagar city of Jammu and Kashmir State is seismically active earthquake prone area. It is located between 33º53´49´´- 34º17´14´´ North latitudes and 74º36´16´´- 75º01´26´´ East longitudes at a height of 1585 meters above sea level. It lies on the banks of the Jhelum River, a tributary of the Indus. The Kashmir region is seismically active earthquake prone area (Ghaffar and Abbas 2010). A few very destructive earthquakes have occurred in the state of Jammu and Kashmir in the last two hundred years (Husain 2000). Srinagar is 2nd most populous district out of total 22 districts in Jammu & Kashmir and it is 381st most populous district in India. As per 2011 census, Srinagar city has a population of about 11,80,570 people.

3. OBJECTIVES OF THE STUDY:

The study aims to assess and statistically analyze the earthquake hazard mitigation among the residents of Srinagar city on the basis of certain selected preparedness, awareness, response and recovery indicators.

Null Hypothesis (H_O): “The earthquake hazard mitigation among the residents of Srinagar city is satisfactory among the residents of Srinagar city”

Alternate Hypothesis (H_a): “The earthquake hazard mitigation among the residents of Srinagar city is not satisfactory among the residents of Srinagar city”

4. DATABASE AND METHODOLOGY:

After consulting various studies and as per the suitability and requirements of the concerned study area, certain variables were selected under the preparedness, awareness, response and recovery indicators in order to assess the earthquake hazard mitigation both at the locality as well as household level. Data was collected from both primary as well as secondary sources and Chi square test (Mahmood 2008) was used for the testing of the hypothesis. For the analysis of data, softwares like Microsoft excel and SPSS were used. The data was collected by filling a framed questionnaire. A total of 595 houses were considered for the collection of primary data. The secondary data used in the

study was collected from departments like Srinagar Municipal Corporation (SMC) and Census department, Srinagar. In order to analyze the earthquake hazard mitigation among the residents of Srinagar city, with the help of a framed hypothesis, the Chi-square test (Mahmood 2008) was used.

5. DISASTER MITIGATION:

It is almost impossible to prevent the occurrence of natural disasters and their damages. However, it is possible to reduce the impact of disasters by adopting suitable disaster mitigation strategies (Rao 2000). Mitigation seeks to reduce risk, i.e. vulnerability to damage or loss. It focuses on the hazard that causes the disaster and attempts to minimize the adverse impacts of the hazard on communities (Fernando 1999). Disaster mitigation refers to measures that can be taken to minimize destructive and disruptive effects of hazards and thus lessen the scale of a possible disaster (Kanwar 2001). Mitigation of hazards is normally associated with attempts to reduce the intensity of a hazard or to make some other modification which is supposed to lessen its impact. It is often a hazard-centered rather than people-centered approach (Cannon 1994). Hazard mitigation practices are one of the ways to reduce the physical impacts of disasters. These can be defined as preimpact actions that protect passively against casualties and damage at the time of hazard impact and include community protection works, land use practices and building construction practices (Lindell and Perry 2000). Of the four disaster phases, mitigation and recovery have been studied the least by social scientists; considerably less is known about these phases than about disaster preparedness and response. However, both mitigation and recovery have received increased attention in recent years (Tierney 1993).

The disaster mitigation works mainly address the following: (i) minimize the potential risks by developing disaster early warning strategies, (ii) prepare and implement developmental plans to provide resilience to such disasters, (iii) mobilize resources including communication and medicinal services and (iv) to help in rehabilitation and post-disaster reduction (Rao 2000). Mitigation activities reduce or eliminate the damages from hazardous events. These activities can occur before, during and after a disaster and overlap all phases of emergency management. Structural mitigation pertains to actions such as constructing disaster resistant structures and retrofitting existing structures to withstand events. Non-structural mitigation activities include development of land use plans, zoning ordinance, sub division regulations and tax incentives and disincentives to discourage development in certain high hazard areas. Mitigation also includes education programs members of the public about the hazards to which their community is vulnerable, as well as importance of mitigation and how to prepare their property to withstand a disaster (Fernando 1999). Disaster mitigation strategies fall mainly into two categories: (a) Preparedness – to provide warning, establish contingency plans and develop capacity for emergency response. (b) Prevention/mitigation measures – to reduce vulnerability and risk on a long-term and permanent basis (Nateghi 2000).

Mitigation is essentially a social activity; specifically an attempt at planned social change (Tierney 1993). The vulnerability of a group can be reduced by changes in the different components of their vulnerability bundle and improvements in preparedness and mitigation measures are only one aspect (Cannon 1994). In any community, a sizeable segment of the population will require extra assistance in order to respond to a disaster. Emergency planners need to know who they are and where they are concentrated, particularly the location of group living facilities (Morrow 1999). Disaster events sometimes provide “windows of opportunity” that allow for the adoption of mitigation measures (Alesch and Petak 1986; Tierney 1993). Planners, community activists, and others need to be able to specify as precisely as possible the characteristics of groups of people, households, and individuals that make them vulnerable to disasters. Those concerned with mitigation of disaster at the grassroots need to be able to understand why certain members of the community are unable to avail themselves of this knowledge and practice. In other words, they need to be concerned with the vulnerability of people, not of systems. Public officials must geographically identify and realistically appraise the circumstances of the poorest areas and groups in their communities, thus allowing mitigation initiatives and response programmes to target their needs, it is becoming increasingly evident, however, that reducing community vulnerability in any meaningful way must ultimately address the underlying issues of economic stratification and poverty (Bolin and Stanford 1998; Morrow 1999). Since many urban areas are also subject to various hazards, and since growth in these areas can occur in a rapid and unregulated fashion, in the future even larger numbers of people will be at risk from disasters. Unless steps are taken to mitigate hazards in the urban environment, losses will escalate (Jones 1992; Tierney 1993).

Disaster mitigation measures consist of policies and actions taken before an event, which are intended to minimize the extent of damage when an event does occur (Drabek et al. 1983). Disaster prevention, mitigation and preparedness are emphasized as better option than disaster response in achieving the goals and objectives of vulnerability reduction. However all the measures of pre-earthquake (preparedness/preparation and planning), during earthquake (emergency and response) and post earthquake (recovery and rebuilding) should be a continuous and interlinked coordinated activity to achieve the maximum satisfactory result. Public education and community participation is the key to success of the implementation of reduction and mitigation programmes (Devi 2012). Government agencies can encourage the adoption of appropriate land use practices by establishing regulations that

prevent development in hazardous locations, providing incentives that encourage development in safe locations, or informing landowners about the risks and benefits of development in locations throughout the community. Finally, hazard mitigation can be achieved through building construction practices that make individual structures less vulnerable to natural hazards (Lindell and Prater 2003).

6. ASSESSING THE EARTHQUAKE HAZARD MITIGATION:

Natural hazards and calamities had occurred and will occur in future also as it is beyond the control of the human being, but by taking proper steps, the effect of these hazards on human lives can be reduced to a considerable level. Our endeavor should be to educate general public through media, television, seminars, etc. about the proper building material and technology and earthquake measures to be taken in construction (Narhari and Thanvi 2003). Some parameters to be considered when evaluating the vulnerability of urban fabrics against earthquakes include level of awareness and preparedness of the residents (Hosseini et al. 2009). Preparedness is a state of readiness to respond to environmental threats. It results from a process in which a community examines its susceptibility to the full range of environmental hazards, identifies human and material resources available to cope with these threats, and defines the organizational structures by which a coordinated response is to be made (Daines 1991; Buckle et al. 2000; Perry and Lindell 2003). It is believed that early warnings, as well as disaster preparedness, have significantly helped in reducing the death tolls in recent disasters (Fritz and Williams 1957; Abramovitz 2001; Kienberger 2007; Asuero et al. 2012). The level of disaster preparedness is a major factor in mitigation of natural disasters. Particularly preparedness measures need to be practiced periodically (Fernando 1999).

Response activities occur during or immediately following the disaster and include time-sensitive activities such as search and rescue operations, evacuation, emergency medical care, food and shelter programmes (Fernando 1999). In many seismic events, large urban areas need to be evacuated. There have been reported events, where the injuries or even deaths caused during the evacuation process are significantly larger compared to the ones caused by the earthquake alone (Sorensen et al. 1987; Tufekci and Kisko 1991; Lindell and Perry 1991; Stern and Stern 1993; Kontoes et al. 2012). Allocating the safe evacuation places before an earthquake can reduce the vulnerability level of urban fabrics (Hosseini et al. 2009). Recovery activities are emergency management actions that begin after the disaster, as urgent needs are met (Fernando 1999). A careful analysis of disaster vulnerability from a spatial or geographical perspective will improve disaster preparedness as well as facilitate both immediate and long-term recovery (Uitto 1998). Because of the devastating impact disasters have on livelihoods of the poor, recovery programming may combine poverty targeting and disaster risk reduction (Sinha 2008). As per the reviewed literature, certain variables were selected for assessing the preparedness, awareness, response and recovery against earthquake hazards among the inhabitants of Srinagar city at household as well as locality level (Fogelman and Parenton 1956; Fritz and Williams 1957; Friedsam 1962; Hill and Hansen 1962; Drabek et al. 1975; Drabek and Key 1976; Erickson et al. 1976; Bolin and Trainer 1978; Bolin 1982; Nigg and Perry 1988; ECLAC 1991; Cannon 1994; Peacock and Girard 1997; Fernando 1999; George and Dar 1999; Morrow 1999; Lindell and Perry 2000; Abramovitz 2001; Britton 2001; Kanwar 2001; Lindell and Prater 2003; Rashed and Weeks 2003; Chakraborty et al. 2005; GOI-UNDP 2002-2007; Kienberger 2007; Hosseini et al. 2009; Eidsvig et al. 2011; Asuero et al. 2012; Devi 2012; Khan 2012; Petrucci 2012; Smith et al. 2012; Cardwell and Elliott 2013; Futane 2013).

Table 1: Preparedness at the Locality/Household level

S.No.	Statement	Yes (%)	No (%)
1.	Sufficient level of awareness and preparedness of the family members	47.8	52.2
2.	Earthquake early detection and warning systems	3.1	96.9
3.	Basic or detailed earthquake hazard maps of the locality	1.7	98.3
4.	Specialized equipment and well-trained rescue services	9.2	90.8
5.	Good coordination between the residents of your locality	71.5	28.5
6.	Emergency preparedness practices, plans and procedures	19.0	81.0
7.	Sufficient supplies of medical, transport and communication facilities	53.2	46.8
8.	Proper guidelines for housing constructions and land-use activities	38.3	61.7
9.	School earthquake awareness programmes through rallies, competitions like essay, debate, drawing, etc	43.1	56.9
10.	Increased capability of women in First Aid, Shelter management, Search and rescue, trauma counseling, etc	14.6	85.4
	X^2 = 720.29 df: 9 p: 0.0001		

Table 2: Preparedness at the Household level

S.No.	Statement	Yes (%)	No (%)	Planning to do so (%)	Don't care for it (%)
1.	Purchasing of property on the basis of adequate information about hazard vulnerability of the area	19.3	53.6	16.9	10.2
2.	Distribution of assets over other locations and other forms of financial sources (e.g., savings accounts, insurance, stocks/bonds)	38.0	45.4	10.5	6.1
3.	Adoption of any hazard adjustment to limit losses if an earthquake were to strike	12.9	64.4	19.0	3.7
4.	Generation of awareness about earthquake vulnerability and possible preventive actions	16.9	61.0	18.6	3.4
5.	Securing of the household items that can cause injury or damage during an earthquake disaster (such as water heaters, bookcases and other appliances)	40.7	42.0	14.9	2.4
6.	Development of an earthquake preparedness plan for the household, such as creating a savings account for house, communication capability and 72-hour food availability in case of an earthquake event	22.4	53.2	16.6	7.8
	X^2 = 131.42 df: 15 p: 0.0001				

Table 3: Awareness at the Household/Locality level

S.No.	Statement	Yes (%)	No (%)
1.	Awareness through Newspapers	73.6	26.4
2.	Awareness through Radio	58.6	41.4
3.	Awareness through Posters	9.5	90.5
4.	Awareness through Television	85.4	14.6
5.	Awareness through Workshops	8.8	91.2
6.	Awareness through Seminars	13.9	86.1
7.	Awareness through Training	2.0	98.0
8.	Awareness from None of the above	4.7	95.3
9.	Large scale public education and training	27.5)	72.5
10.	Regular studies, research and workshops	24.1	75.9
11.	Warning dissemination (awareness generation)	31.5	68.5
12.	Preparation of preparedness and response plans	16.3	83.7
13.	Awareness campaigns for the residents and community at large	24.4	75.6
14.	Development of manuals and training modules, education and communication materials	19.3	80.7
	X^2 = 1256.3 df: 13 p: 0.0001		

Table 4: Response at the Locality/Household level

S.No.	Statement	Yes (%)	No (%)
1.	Access to emergency assistance and availability of emergency help and management centers	25.8	74.2
2.	Preparation of community-based response plans	17.3	82.7
3.	Support and assistance from neighbors, relatives and friends	79.0	21.0
4.	Availability of mass emergency shelters	28.1	71.9
5.	Sufficient food, water, shelter and necessary things made available by the government and other concerned authorities	32.5	67.5
6.	Proper and enough search and rescue operations for the people	28.5	71.5
7.	Availability of safe evacuation places such as mosques or schools	67.8	32.2

8.	Availability of evacuation spaces like parks or playgrounds	51.9	48.1
9.	Proper distribution of warning, search and rescue operations, first aid	30.5	69.5
10.	Satisfactory transportation facilities available	49.5	50.5
11.	Enough number of lanes leading out of the house for immediate rescue	53.9	46.1
12.	Enough width of roads for arrival of ambulance and medical facilities and rescue of large number of people avoiding crowding	53.9	46.1
13.	Proper utilization and better coordination of relief materials during crisis	28.8	71.2
14.	Special rescue arrangements for disaster weak population (e.g. children, elderly and handicapped people)	19.3	80.7
15.	Availability of signs of warning for the people keeping in view the needs for people with disabilities (e.g. posters for deaf, announcements for blind, etc.)	15.3	84.7
X^2 = 644.87 df: 14 p: 0.0001			

Table 5: Recovery at the Household level

S.No.	Statement	Yes (%)	No (%)	Planning to do so (%)	Don't care for it (%)
1.	Sufficient levels of savings and insurance funds for the family	35.9	33.6	21.0	9.5
2.	Special care and recovery arrangements for elderly people and children	42.7	41.0	11.2	5.1
3.	Arrangements for persons with physical or mental disabilities	24.7	57.3	10.8	7.1
4.	Enough strength of social networks of the family	56.9	29.5	7.8	5.8
5.	Sufficient income and material resources for the family	58.6	27.5	9.8	4.1
6.	Possession of assets (property e.g. land, orchards, fields, etc.) that are undamaged by the earthquake hazard	36.6	47.8	9.2	6.4
7.	Assistance from friends, relatives, neighbors, and coworkers through financial contributions	56.3	27.5	8.5	7.8
X^2 = 170.41 df: 18 p: 0.0001					

Table 6: Recovery at Household level as provided by the Government

S.No.	Statement	Yes (%)	No (%)
1.	Tax reductions by local government	15.9	84.1
2.	Existence of Government sponsored disaster funds	18.3	81.7
3.	Assistance from a variety of sources e.g. NGOs	32.5	67.5
4.	Financial assistance from regional governments and national governments through grants that do not need to be repaid by the victims	16.6	83.4
X^2 = 33.136 df: 3 p: 0.0001			

7. RESULTS AND SUGGESTIONS:

In order to assess the Earthquake Hazard Mitigation among the residents of the city, on the basis of the selected indicators of preparedness, awareness, response and recovery and with the help of a framed hypothesis ("The earthquake hazard mitigation among the residents of Srinagar city is satisfactory among the residents of Srinagar city"), the Chi-square test (Mahmood 2008) was used. The responses collected from the households within the city were analyzed for their frequencies and percentages so that the Chi square test could be carried out. As per the results of the test carried out on the selected variables of preparedness, awareness, response and recovery as depicted in Tables 1 to 6, the p-value is < 0.05 which means that we accept our alternate hypothesis which states that "The earthquake hazard mitigation among the residents of Srinagar city is not satisfactory among the residents of Srinagar

city" and hence H_a stands accepted at a confidence level of 99.99%. Therefore it can be concluded that the residents of city are neither prepared nor aware regarding the earthquake hazards and have not adopted any measures to respond and recover from the harmful effects of an earthquake disaster to a satisfactory level. Information regarding hazards and the related precautionary measures to be taken should be a part of the academic curriculum of students. Earthquake mock drills for emergency response should be included in the learning process too. Teachers should be well trained so that they understand the likely effects of earthquakes and the precautions that should be taken and hence can guide the students properly. Further studies and research should be conducted on the earthquake vulnerability analysis, even at the ward level and the findings of such studies should be made public through newspaper and magazine articles, or preparation of manual for the general public awareness.

REFERENCES

1. Aboagye, D., Dari, T. and Koomson, J. (2013) Risk Perception and Disaster Management in the Savannah Region of Ghana, *International Journal of Humanities and Social Science*, 3 (3): 85-96.
2. Abramorvitz, J. (2001) Unnatural Disasters. World Watch Paper 158, World Watch Institute.
3. Alesch, D.J. and Petak, W.J. (1986) The Politics and Economics of Earthquake Hazard Mitigation: Unreinforced Masonry Buildings in California. Boulder, CO: University of Colorado, Institute of Behavioral Science, Program on Environment and Behavior Monograph 43.
4. Arya, A.S. (2006) Earthquake Risk Mitigation in India: Retrospect and Prospects, *Disaster and Development*, 1 (1): 27-46.
5. Asuero, M.P., Nelson, G.L.M., Espaldon, M.V.O., Acosta-Michlick, L.A., Macandog, D.M., Lalican, N.M., Abucay, E.R., Malenab, M.C.T. and Talubo, J.P.P. (2012) Social Characteristics and Vulnerabilities of Disaster-Prone Communities in Infanta, Quezon, Philippines, *Journal of Environmental Science and Management*, 15 (2): 19-34.
6. Ayala, D.D. and Speranza, E. (2002) An Integrated Procedure for the Assessment of Seismic Vulnerability of Historic Buildings, *12th European Conference on Earthquake Engineering*, London: *Elsevier*, Paper Reference 561.
7. Birkmann, J. (2006) *Measuring Vulnerability to Natural Hazards -Towards Disaster-Resilient Societies*, Tokyo, New York: UNU Press.
8. Birkmann, J. (2007) Risk and vulnerability indicators at different scales: Applicability, usefulness and policy implications, *Environmental Hazards*, 7: 20-31.
9. Bolin, R.C. (1982) *Long-Term Family Recovery from Disaster*, University of Colorado, Boulder.
10. Bolin, R.C. and Stanford, L. (1998) The Northridge Earthquake: Community-based Approaches to Unmet Recovery Needs, *Disasters*, 22 (1): 21-38.
11. Bolin, R.C. and Trainer, P. (1978) "Modes of Family Recovery following Disaster: A Cross National Study", In *Disasters: Theory and Research* (ed.) Quarantelli, E.L., London: Sage.
12. Britton, N. (2001) A New Emergency Management for the Millenium?, *Aust. J. Emerg. Manage*., 16: 44-54.
13. Buchanan, M. (2001) Ubiquity – Why catastrophes happen, New York, USA: Three Rivers Press.
14. Buckle, P., Mars, G. and Smale, S. (2000) New Approaches to Assessing Vulnerability and Resilience, *Australian Journal of Emergency Management*, 15: 8-14.
15. Cannon, T. (1994) "Vulnerability Analysis and the Explanation of 'Natural' Disasters", In *Disasters, Development and Environment* (ed.) Varley, A., London: John Wiley & Sons Ltd. p. 13-30.
16. Cardwell, F.S. and Elliott, S.J. (2013) Making the links: do we connect climate change with health? A qualitative case study from Canada, *BMC Public Health*, 13 (208): 1-12.
17. Carvalho, J., Dias, R., Pinto, C., Cunha, T., Leote, J., Vilanova, S., Narciso, J., Borges, J. and Ghose, R. (2013) Earthquake Mitigation in the Lisbon and Lower Tagus Valley area, Portugal, *13th International Congress of the Brazilian Geophysical Society*, p. 1-6.
18. Chakraborty, J., Tobin, G.A. and Montz, B.E. (2005) Population Evacuation: Assessing Spatial Variability in Geophysical Risk and Social Vulnerability to Natural Hazards, *Natural Hazards Review*, 6 (1): 23-33.
19. Daines, G.E. (1991) "Planning, Training and Exercising", In *Emergency Management* (ed.) Drabek, T. and Hoetmer, G., Washington: International City/County Management Association.
20. Dar, M.A., Dar, A.R., Qureshi, A. and Raju, J. (2013) A Study on Earthquake Resistant Construction Techniques, *American Journal of Engineering Research (AJER)*, 2 (12): 258-264.
21. Devi, T.K. (2012) Seismic Hazard And Its Mitigation, A Review, *International Journal of Emerging Technology and Advanced Engineering*, 2 (11): 517-522.
22. Drabek, T.E., Key, W.H., Erickson, P.E. and Crowe, J.L. (1975) The Impact of Disaster on Kin Relationships, *Journal of Marriage and the Family*, p. 481-494.
23. Drabek, T.E. and Key, W.H. (1976) The Impact of Disaster on Primary Group Linkages, *Mass Emergencies*, 1: 89-105.
24. Drabek, T.E., Mushkatel, A.H. and Kilijanek, T.S. (1983) Earthquake Mitigation Policy: The Experience of Two States, Boulder, CO: University of Colorado, Institute of Behavioral Science, Program on Environment and Behavior Monograph 37.
25. ECLAC (Economic Commission for Latin America and the Caribbean's) (1991) Manual for estimating the socio-economic effects of Natural disasters.
26. Eidsvig, U.M.K., McLean, A., Vangelsten, B.V. and Kalsnes, B. (2011) Socio-economic vulnerability to natural hazards – proposal for an indicator-based model, *ISGSR*, 141-147.

27. Emrich, C., Cutter, S.L. and Weschler, P.J. (2011) "GIS and Emergency Management", In *The SAGE Handbook of GIS and Society* (ed.) Nyerges, T., Couclelis, H. and McMaster, R.B., SAGE Publications, p. 321-343.
28. Erdik, M. and Durukal, E. (2008) Earthquake risk and its mitigation in Istanbul, *Natural Hazards*, 44: 181-197.
29. Erickson, P.E., Drabek, T.E., Key, W.H. and Crowe, J.L. (1976) Families in Disaster: Patterns of Recovery, *Mass Emergencies*, 1: 203-216.
30. Fernando, W.B.J. (1999) Disaster Mitigation, *International Conference on Disaster Management: Cooperative Networking in South Asia*, Papers Vol. 1: 61-72.
31. Fogelman, C. and Parenton, V. (1956) Disaster and Aftermath: Selected Aspects of Individual and Group Behavior in Critical Situations, *Social Forces*, 38 (130).
32. Freire, S. and Aubrecht, C. (2012) Integrating population dynamics into mapping human exposure to seismic hazard, *Natural Hazards and Earth System Sciences*, 12: 3533-3543.
33. Friedsam, H.J. (1962) "Older Persons in Disaster", In *Man and Society in Disaster* (ed.) Baker, G.W. and Chapman, D.W., New York: Basic Books.
34. Fritz, C.E. and Williams, H.B. (1957) The Human Being in Disasters: A Research Perspective, *The ANNALS of the American Academy of Political and Social Science*, 309 (42).
35. Futane, P.R. (2013) Women and Children: Double Victims of Disasters, *International Research Wisdom*, 1 (3): 1-3.
36. Geller, R.J. (1997) Earthquake prediction: a critical review, *Geophys. J. Int*., 131: 425-450.
37. Gentile, E. and Gonzales, S. (2001) Social Vulnerability to Floods in Buenos Aires City (Argentina): The Cases of La Boca Neighborhood and the Basin of Maldonado.
38. George, J. and Dar, V. (1999) Disaster Management Information System: Why and How, *International Conference on Disaster Management: Cooperative Networking in South Asia*, Papers Vol. 1: 73-84.
39. Ghaffar, A. and Abbas, S.F. (2010) An Overview of Past History Based on Seismicity Pattern of Kashmir Region, An Interpretation from 2005 Earthquake, *The Journal of Animal and Plant Sciences*, 20 (4): 297-304.
40. Goel, S.L. and Kumar, R. (2001) "Issues in Disaster Management", In *Disaster Management*, New Delhi: Deep & Deep Publications Pvt. Ltd, p. 3-7, 18-19.
41. GOI-UNDP (2002-2007) Urban Earthquake Vulnerability Reduction Project, *GOI-UNDP Disaster Risk Management Programme*, p. 1-14.
42. Guo, H. (2010) Understanding global natural disasters and the role of earth observation, *Int. J. Digital Earth*, 3: 221-230.
43. Heping, Z. (2003) Earthquake Disaster Preparedness and Reduction in China, *Regional Development Dialogue*, 24 (1): 41-48.
44. Hill, R. and Hansen, D.A. (1962) "Families in Disaster", In *Man and Society in Disaster* (ed.) Baker, G.W. and Chapman, D.W., New York: Basic Books.
45. Hosseini, K.A., Hosseini, M., Jafari, M.K. and Hosseinioon, S. (2009) Recognition of Vulnerable Urban Fabrics in Earthquake Zones: A Case Study of the Tehran Metropolitan Area, *JSEE*, 10 (4): 175-187.
46. Husain, M. (2000) *Systematic Geography of Jammu and Kashmir*, Delhi: Rawat Publications, p. 73-79.
47. Jones, B.G. (1992) "Population Growth, Urbanization and Disaster Risk and Vulnerability in Metropolitan Areas: A Conceptual Framework", In *Environmental Management and Urban Vulnerability*, Washington, D.C.: The World Bank, p. 51-76.
48. Kanwar, R. (2001) Disaster Management, *Prashasnika*, 28 (1): 29-43.
49. Khan, S. (2012) Disasters: contributions of hazardscape and gaps in response practices, *Natural Hazards and Earth System Sciences*, 12: 3775-3787.
50. Kienberger, S. (2007) Assessing the Vulnerability to Natural Hazards on the Provincial/Community Level in Mozambique: The Contribution of GIScience and Remote Sensing, Center for Geoinformatics, Salzburg University, Salzburg, Austria.
51. Kontoes, C., Herekakis, T., Ieronymidi, E., Keramitsoglou, I., Fokaefs, A., Papadopoulos, G.A., Paralikidis, S., Aifantopoulou, D., Deflorio, A.M., Iasillo, D. and Kiranoudis, C.T. (2012) Mapping Seismic Vulnerability and Risk of Cities: The MASSIVE Project, *Journal of Earth Science and Engineering*, 2: 496-513.
52. Kumpulainen, S. (2006) Vulnerability Concepts in Hazard and Risk Assessment, Center for Urban and Rural Studies CURS, Helsinki University of Technology, Luolamiehentie. Finland
53. Lindell, M.K. and Perry, R.W. (1991) Understanding evacuation behavior: An editorial introduction, *International Journal of Mass Emergencies and Disasters*, 9: 133-136.
54. Lindell, M.K. and Perry, R.W. (2000) Household adjustment to earthquake hazard: A review of research, *Environ. Behav.*, 32: 590-630.
55. Lindell, M.K. and Prater, C.S. (2003) Assessing Community Impacts of Natural Disasters, *Natural Hazards Review*, 4 (4): 176-185.
56. Mahmood, A. (2008) "Measurements of Disparities", In *Statistical Methods in Geographical Studies*, New Delhi: Rajesh Publications, p. 89-90.
57. Mishra, V., Fuloria, S. and Bisht, S.S. (2012) Enhancing Disaster Management by Mapping Disaster Proneness and Preparedness, *Disasters*, 36 (3): 382-397.
58. Morrow, B.H. (1999) Identifying and Mapping Community Vulnerability, *Disasters*, 23 (1): 1-18.
59. Muck, M., Taubenbock, H., Post, J., Wegscheider, S., Strunz, G., Sumaryono, S. and Ismail, F.A. (2012) Assessing building vulnerability to earthquake and tsunami hazard using remotely sensed data, *Natural Hazards*.

60. Narhari, N.N. and Thanvi, S.D. (2003) Earthquake Resistant Construction – Role of Building Centre in Rehabilitation Programme, *Shelter*, 6 (2): 1-6.
61. Nateghi-A, F. (2000) Disaster Mitigation Strategies in Tehran, Iran, *Disaster Prevention and Management*, 9 (3): 205-211.
62. Nigg, J.M. and Perry, R.W. (1988) Influential First Sources: Brief Statements with Long Term Effects, *International Journal of Mass Emergencies and Disasters*, 6 (3): 311-343.
63. Peacock, W.G. and Girard, C. (1997) Ethnic and racial inequalities in Hurricane Damage and insurance settlements, In *Hurricane Andrew: Ethnicity, gender and the sociology of disasters* (ed.) Peacock, W.G., Morrow, B.H. and Gladwin, H., London: Routledge, p. 171-190.
64. Peng, Y. (2012) Regional earthquake vulnerability assessment using a combination of MCDM methods, *Springer* (Ann Oper Res).
65. Perry, R.W. and Lindell, M.K. (2003) Preparedness for Emergency Response: Guidelines for the Emergency Planning Process, *Disasters*, 27 (4): 336-350.
66. Petrucci, O. (2012) "The Impact of Natural Disasters: Simplified Procedures and Open Problems" In *Approaches to Managing Disaster – Assessing Hazards, Emergencies and Disaster Impacts* (ed.) Tiefenbacher, J., Croatia: InTech Janeza Trdine 9, p. 109-132.
67. Prizzia, R. and Helfand, G. (2001) Emergency Preparedness and Disaster Management in Hawaii, *Disaster Prevention and Management: An International Journal*, 10 (3): 173-182.
68. Rao, D.P. (2000) Disaster Management, *GIS@development*, 4 (3): 28-35.
69. Rashed, T. and Weeks, J. (2003) Assessing vulnerability to earthquake hazards through spatial multicriteria analysis of urban areas, *International Journal of Geographical Information Science*, 17 (6): 547-576.
70. Rezaei, A. and Ghaderi, S. (2013) Linking of Natural Disaster Risk and Environmental Degradation in Developing Countries, *1st International Conference on Environmental Crisis and its Solutions*, ICECS-EN-1673-97: 458-467.
71. Rocha, J.L. and Christoplos, I. (2001) Disaster Mitigation and Preparedness on the Nicaraguan Post-Mitch Agenda, *Disasters*, 25 (3): 240-250.
72. Rygel, L., O'Sullivan, D. and Yarnal, B. (2006) A Method for Constructing a Social Vulnerability Index: An Application to Hurricane Storm Surges in a Developed Country, *Mitigation and Adaptation Strategies for Global Change*, 11: 741-764.
73. Sharma, V.K. (2001) Gujarat Earthquake – Some Emerging Issues, *Disaster Prevention and Management: An International Journal*, 10 (5): 349-355.
74. Sinha, A.K. (2008) Pre-Disaster Planning for Post-Disaster Recovery, *Journal of South Asia Disaster Studies*, 1 (1): 107-137.
75. Smith, F., Jolley, E. and Schmidt, E. (2012) Disability and disasters: The importance of an inclusive approach to vulnerability and social capital, In *Addressing Inequalities: The Heart of the Post-2015 Development Agenda and the Future We Want for All*, Global Thematic Consultation, p. 1-17.
76. Sorensen, J.H., Vogt, B.M. and Mileti, D. (1987) Evacuation: An Assessment of Planning and Research, Oak Ridge National Laboratory ORNL-6376, Tennessee.
77. Srivastava, S.K., Hedge, V.S. and Jayaraman, V. (2007) Integrating Technological Interventions and a Community-Centric Approach for Disaster-Risk Reduction, *Disaster and Development*, 1 (2): 111-118.
78. Stern, Z.S. and Stern, E. (1993) Simulating the evacuation of a small city: The effects of traffic factors, *Socio-Economic Planning Sciences*, 27: 97-108.
79. Stoppa, F. and Berti, C. (2013) Reducing seismic risk by understanding its cultural roots: Inference from an Italian case history, *Natural Science*, 5 (8): 78-91.
80. Tierney, K.J. (1993) Disaster preparedness and response: Research findings and guidance from the social science literature (Preliminary Paper No. 193), Newark: University of Delaware Disaster Research Center.
81. Timmerman, P. (1981) Vulnerability, resilience and the collapse of society, *Environmental Monograph 1*, Toronto: Institute for Environmental Studies.
82. Tufekci, S. and Kisko, T.M. (1991) Regional evacuation modeling system REMS: A decision support system for emergency area evacuations, Computers and Industrial Engineering, 21: 89-93.
83. Uitto, J.I. (1998) The geography of disaster vulnerability in megacities – A theoretical framework, *Applied Geography*, 18 (1): 7-16
84. Wisetjindawat, W., Ito, H., Fujita, M. and Hideshima, E. (2013) Modeling Disaster Response Operations including Road Network Vulnerability, *Proceedings of the Eastern Asia Society for Transportation Studies*, 9.