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RESEARCH ARTICLE

SOCIO-ECONOMIC VULNERABILITY ASSESSMENT OF A DISASTER PRONE TOURIST TOWNSHIP OF INDIAN HIMALAYAN REGION

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Abstract

Indian Himalayan Region is experiencing a steep rise in tourism and at the same time is exposed to increasing risk for disasters due to several physical, environmental and socio-economic conditions. The purpose of this study is to investigate the socio-economic vulnerability of a popular tourist township - Nainital and suggest measures to increase community resilience. Extensive literature survey is conducted and 21 indicators of socio-economic vulnerability are identified which are relevant to the study area. Primary survey conducted in 300 households for obtaining data for these indicators. Weighted index method is used by applying appropriate weights to the categories of these indicators to find cumulative vulnerability values which are calculated for 13 wards of Nainital. It was observed that the areas on the eastern side of Naini lake are socio-economically less vulnerable, while those on the western side are more vulnerable. The overall socio-economic vulnerability for Nainital was found to be moderate. The environment vulnerability and physical vulnerability of built environment for Nainital township are not studied in this paper. The socio-economic vulnerability for Nainital, give an objective picture for developing practical strategies for vulnerability reduction. The recommendations suggested for reducing the socio-economic vulnerability of Nainital township would result in a more resilient community. The index presented in this paper could be a valuable tool in facilitating the development of a safer environment for populations living in disaster prone hilly tourist townships of India.

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Introduction:-

In the Indian Himalayan Region (IHR) tourism has been continuously rising over the last few decades to become one of the fastest growing economic sectors in India. This status is in line with predictions for the sector, which is expected to grow at an average annual rate of 7.9% from 2013 to 2023 (NITI Ayog, 2018). Nainital township of Uttarakhand state of India also has witnessed an extraordinary growth in tourism which has undeniably boosted the economy of Nainital and has provided employment potential, infrastructure and improved services to local population. All this has put an enormous pressure on the natural environment, hill ecosystem, physical infrastructure and socio-economic fabric. However, there is a very limited scope for further extension due to the lack of level land, the friable nature of rocks (such as shale and limestone) and the presence of many thrusts and fault zones within the valley, which makes the area geologically unstable (Joshi and Pant, 1990). This is further aggravated by large scale

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excavations and constant slope cutting for construction purpose – activities that now extend to most of the hill slopes that were formerly forested or unexplored. The entire region is now prone to earthquakes, landslides, forest fires, cloudbursts and flash-floods (DMMC, 2011). While planned urban development has not been able to keep pace with the rising demands, informal growth has resulted in people living in high risk zones and increased the level of risk of the city as whole. Until recently, economics and social sciences were not considered as a priority for disaster issues. This has changed in recent years as researchers have been analyzing disasters quantitatively in an effort to understand their social, economic and political dimensions (Sharma, 2010). Socio-economic vulnerability, more specifically, is the result of the risk exposure of population coupled with its socioeconomic characteristics and its ability to adequately respond to disasters so as to avoid declines below a certain benchmark of well-being (Triulzi et.al., 2003). Socio-economic vulnerability of Nainital Township is assessed through a number of variables indicating socio-economic characteristics of individuals and the population as a whole. The vulnerability described for all the indicators is quantified by assigning appropriate weights to categories of all the indicators and thus developing a socio-economic vulnerability index. The cumulative socio-economic vulnerabilities derived for the wards and for Nainital as a whole, give an objective picture of the socio-economic vulnerability of Nainital Township.

Literature Review:-

Sahana et.al. (2019) have analysed socio-economic vulnerability of Indian Sunderban Biosphere Reserve. The authors mention that regular exposure to cyclones and storm surges, inadequate infrastructure, weak social structure are major obstructions to overall socio-economic upliftment of communities. Consolidated infrastructural setup, proper early warning system, disaster monitoring centers, better transport connectivity within remote islands, better livelihood opportunities, education, and awareness may help in improving the socio-economic conditions of the communities. Mazumdar and Paul (2016) have investigated the vulnerability of eastern coastal states of India for cyclones. The variables included in the study are extracted from Census of India 2011, which are reduced to smaller number of factors by using factor analysis, specifically principal component analysis that represents the socioeconomic and infrastructural vulnerability to potential cyclone. Subsequently, the factor scores have been mapped for spatial analysis. DeSilva and Kawasaki (2018) have investigated the relationship between disaster risk, poverty, and the related vulnerability of people from North Central province of Sri Lanka. Cross tabulation and regression analysis conducted for the collected data showed that households depended heavily on natural resources for their livelihoods, and that those with low income suffered greater losses from floods and droughts than households with high income. On the other hand flood impact was higher on households that depended heavily on natural resources for their livelihood, and having lower income. Ahsan and Warner (2014) have developed a Socioeconomic Vulnerability Index (SeVI) for climate change affected communities in seven unions of Koyra upazilla in south-western coastal Bangladesh. The SeVI collected data from 60 households and used a composite indicator index, where a relative weight is assigned to each indicator with a view of obtaining weighted average index scores for different vulnerability domains in different unions. The authors opine that this pragmatic approach is useful to figure out and monitor socioeconomic vulnerability and/or assess potential adaptation-policy effectiveness in data scarce regions by incorporating scenarios into the SeVI for baseline comparison. Sorg et. al. (2018) have developed a transparent and comprehensive indicator-based approach which is flexible in terms of data availability. As per the authors, susceptibility, coping and adaptation are the main elements of a modular hierarchical structure to understand the societal sphere of vulnerability. Authors suggest two methods, first based on official census data and the other based on field surveys. The results are analysed for the city of Genoa, Italy. Triulzi et.al. (2003) states that 'socio-economic vulnerability should be understood, first, as a group of characteristics and tools that a particular unit (e.g. household, community, region, country, etc.) possesses. In this sense, we can call socio-economic vulnerability the endogenous inability of the unit to face shocks. This endogenous inability is a function of risk exposure and other socio-economic factors. Zorrilla, S. O., (2007) defines socioeconomic vulnerability as the susceptibility of an economic agent to absorb external shocks (hazards) negatively, given its assets possession and entitlements system (coping capacity), as well as its implemented risk management and protection measures (adaptive capacity). The author opines that though being poor does not necessarily imply being vulnerable, but poverty makes individuals relatively more vulnerable to a given hazard. Adverse economic conditions make individuals less able to invest in all items, including those to manage risk and increase disasters protection. The author also mentions the fact that developing countries have historically been more severely damaged as compared to developed countries. The Organization for Economic Co-operation and Development (OECD 2003) defined indicator as a value derived from parameters, which points to, provides information about, and describes the state of a phenomenon or environment of area, with a significance extending beyond that directly associated with parameter values. Wisner (2008) has suggested the use of indicators across the range of four themes

used to frame the TRIAMS (Tsunami Recovery Impact Assessment and Monitoring System) project. The four themes are social factors, institutions, livelihoods and infrastructure. The author states that definition of vulnerability implies that overcoming vulnerability requires access to educational opportunities, access to communications and early warning, available means of risk mitigation (social and personal protection), economic surplus available for preparedness, social assets (networks) available for preparedness, savings and other buffers and resources (social and personal) for reconstruction and recovery. The author has identified and discussed six indicators which may help in assessment of the impact of tsunami recovery activities on social vulnerability/ capacity or resilience. These six indicators are: safety of schools, exposure to future natural hazards, diversification of household livelihoods, local organizational & social capital, exposure to violence, abuse and homelessness.

Study Area:

Nainital, one of the most charismatic hill stations of India, has earned the epithet of 'Lake District of India' (Fig 1). It is located in Uttarakhand state in Northern India (Fig 2). The district possesses some of the most scenic lakes in India spread over an area of 4251 sq.kms. Nainital city, located at an altitude of 1,938 meters around Naini Lake. Township of Nainital is the headquarters of Nainital Lake District and Kumaon Mandal. Nainital, known for its salubrious climate and scenic beauty, is a popular destination in the northern tourist circuit. Nainital attracts thousands of tourists round the year. Nainital is also an important administrative town in the State having the High Court and well known institutions such as Academy of Administration, Aryabhata Research Institute of Observational Sciences (ARIES), Office of Kumaon Mandal Vikas Nigam and Kumaon University. The total area of the Nainital Township is 11.73 sq.km and the population of Nainital was 41,377 as per Census of India 2011. The city is divided into 13 wards (Fig 3). Nainital has about 10 slums scattered over the city, providing shelter to more than 9,000 population, which forms 21% of urban population within Nainital Nagar Palika Parishad (NNPP).



Fig 1:- Nainital Township (Source: UTDB, 2020).



Fig 2: Location of Nainital District



Fig 3: Ward Map of Nainital (Source: DMMC, 2010)

In recent years there has been an unprecedented expansion of tourism in Nainital and the surrounding areas. This has resulted in an unplanned growth in the tourism industry. This has undeniably boosted the economy of the region and has provided employment potential, infrastructure and improved services to the local population. The daily floating population of the town is around 20,000 to 50,000 during tourists season (March to June), where most of the tourists are Indian tourists from Northern India. According to UIDCL (2010) tourist population forms almost 50% of total population of Nainital. The main factors behind the popularity of Nainital as a hill station and tourist resort are presence of a splendid lake and its picturesque surroundings; an easy approach from the nearby plains of northern India, the great difference in temperature between the Indo-Gangetic plains and the adjoining Himalayan region during summers and political disturbance in many other popular hill stations like Srinagar.

In Nainital, local population is engaged in tourism related activities which has proved to be good source of continuous income (Fig 4). On account of this, development of social standard of living is also visible in terms of roads, communication systems, schools, libraries, hospitals, internet cafes, water quality and social amenities like food, clothing, etc. Moreover the local tradition and handicrafts are also made popular which may well have been on verge of extinction. Nainital is famous for candles. Many people especially women engage in small workshops at homes and make beautiful candles which are popular in Nainital market (Fig 5).



Fig 4a:- Running small eateries.



Fig 4b:- Taxi services for tourists.



Fig 4c:- Shops on Mall road, Nainital.



Fig 4d:- Boat rides for tourists.



Fig 4e:- Pony rides for tourists.



Fig 4f:- Employed in hotel business.

Fig 4:- Nainital population engaged in tourism related occupations.

However, it is also being observed that large number of tourists visiting Nainital also create economic problems by putting great stress on local resources. This means demand for the construction of hotels and other relative

infrastructure, which becomes a source of price rise of land in the region. Particularly the price of daily required goods like vegetables fruit milk and rice etc. climb up. The great rush of tourists produces unnecessary competition of electricity and water for the locals. The sharing of these amenities with the tourists creates unexpected shortage and price rise. The crowding in local markets, transport vehicles plus shopkeepers is visible in Nainital due to this crisis. Therefore in return of economic gain by tourism; locals generally lose the welfare of free access and use of other important social aspects (Beg et. al, 2015).



Fig 5a:- Women engaged in candle making.



Fig 5b:- Women engaged in candle making.



Fig 5c:- Candle shop for tourists.

Fig 5:- Candle business at Nainital Township.

Disaster Vulnerability:

In Uttarakhand State, landslides, cloudbursts, earthquakes and road accidents occur on regular basis. Entire Himalayan terrain falls in Zone V and Zone IV of Earthquake Zoning Map of India (IS 1893 (Part 1), 2002) that divides the Indian landmass into four distinct risk zones; Zone II to Zone V. Earthquake intensity can reach VIII on MSK Scale in Zone IV, while in Zone V it can reach IX or even more. The township is located in Zone IV of Earthquake Zoning Map of India. In the past thirty years Uttarakhand State has experienced two major earthquakes viz. Uttarkashi earthquake of October 1991 (magnitude 6.6) and Chamoli earthquake of March 1999 (magnitude 6.8). Uttarakhand state is traverse by major Himalayan tectonic discontinuities (Himalayan Frontal Fault; HFF, Main Boundary Thrust; MBT and Main Central Thrust; MCT) the State is often shaken by earthquakes of lesser

magnitude (Fig. 6). The township of Nainital falls in close vicinity of Main Boundary Thrust (MBT) across which the Lesser Himalayan meta sedimentary rocks override the sedimentary rocks of Siwalik Group (DMMC, 2010).

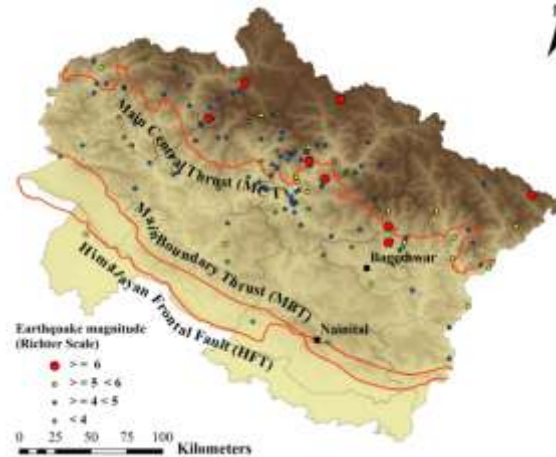


Fig 6:- Epicenters of the previous earthquakes in Uttarakhand and the trace of the major tectonic boundaries traversing through the Uttarakhand State (Source: DMMC, 2010).

Earthquake risk for any region is a direct function of the state of built environment or vulnerability of the building stock existing in that region. DMMC (2010) surveyed 2,865 buildings from all 13 wards in Nainital for their physical condition and engineering aspects with accounting for peak and lean occupancy of the residents of the surveyed buildings to generate a damage scenario for earthquake intensity VIII on MSK scale. The results show that 10,030 persons in Nainital can be considered as occupying the buildings falling in high probability of Grade 5 damage and very high probability of Grade 4 damage class. This population group would thus be highly threatened by the earthquake and would account for most victims. The expected casualties for this scenario would be around 1,003 in Nainital. (DMMC, 2010). This shows very high earthquake vulnerability of Nainital Township.

Landslides have been a recurring phenomenon in Nainital (Pande and Pande, 2008). Large tracts of Nainital town are located on stabilized ancient landslide debris. Nainital has a history of landslides. Several of these are recorded in the annals of Geological Survey of India (GSI). Surrounded by high ridges on all sides, Nainital is like a bowl with water at the base. Sher-ka-danda ridge runs Northwest-Southeast of the lake. In 1867 a landslide swept away part of a cottage and endangered the famous Nainital Club. Again in 1880 a heavy rain mobilized the Sher-ka-danda ridge and the landslide took toll of 193 people. The magnitude of the slide was such that a huge part of the lake was filled up. Massive mass movement from Naini peak overwhelmed many areas of Nainital township on 11 March, 1988 as also between 4 and 6 July, 1998 (DMMC, 2011). The heavy rainfall during the monsoon months usually trigger the debris flow and slope failure, endangering the lives of people and safety of infrastructures (Sah, et. al. 2018) Fig 7.



Fig 7:- Landslide prone access to Nainital Township.

Joshi et. al (2016) presented studies to assess the physico-chemical parameters of five Himalayan lakes located on the high altitude in Nainital District. The results indicate that the lakes with high human activities in the catchment are affecting the surface runoff to the lake. Authors opine that it has become a challenge, to preserve these natural sources, and same time look for the immediate sustainable options for the growing population, as these lakes have been moderately polluted due to increasing human interference.

Haphazard construction works, unplanned slope modification, blockade and obliteration of drains along the hill slopes, irresponsible debris disposal and blatant disregard to earthquake safety related aspects are continuously adding to disaster vulnerability of the people living in the lake city (DMMC, 2011). Apart from these road accidents consistently continue to add to the disasters in Nainital and the surrounding hilly regions.

Methodology:-

1. Review of literature is conducted which threw light on the initiatives being taken worldwide in this area and helped in identifying 21 indicators of socio-economic vulnerability which are relevant for Nainital Township.
2. Secondary data is collected in terms of maps, satellite images, census data, slum data, banks, availability of physical and social infrastructure, occupations, leadership, NGOs, CBOs, tourism data etc.
3. Pilot studies were carried out to assess the socio-economic condition of the residing population of Nainital to determine the general social structure in terms of occupations, incomes, religions and castes in different wards.
4. On the basis of pilot survey, secondary data and the satellite images, the 13 wards of Nainital were further divided into 19 smaller clusters to ensure that all sections of society would be covered in the primary survey.
5. Detailed questionnaires were developed which aimed at gathering information about all the identified parameters of socio-economic vulnerability of the local population.
6. Primary survey was carried out in total 300 households (1359 people) of Nainital Township proportionately from 13 wards of Nainital. Households were selected randomly from identified 19 clusters distributed in all 13 wards.
7. Database is developed and analysed in MS Excel.
8. Weights are assigned to all the categories within indicators affecting socio-economic vulnerability using Delphi method. Socio-economic vulnerability assessment for entire Nainital Township and wards is carried out for all the identified indicators.
9. On the basis of these weights, socio-economic vulnerability index is developed which gives a comparative analytical picture of socio-economic vulnerability of 13 wards of Nainital.
10. Policy recommendations are suggested to reduce the socio-economic vulnerability of Nainital Township on the basis of the studies conducted.

Indicators for Socio-Economic Vulnerability for Nainital Township:

Extensive literature survey is conducted to identify the indicators of socio-economic vulnerability as discussed in previous section. The socio-economic vulnerability of Nainital is assessed through 21 indicators found relevant to the township, falling into four categories which are given in Table 1. Questionnaire for collecting information about all the indicators were developed and data collected.

Table 1:- Socio-economic vulnerability indicators for Nainital Township.

Community	Demography
Religion	Gender
Caste	Age
	Health
	Disability
Social	Economic
Education	Occupation
Awareness for Disasters	Per capita Income
Access to local leadership	Income Dependency on Tourism
Local Connections	Diverse Income Sources
Access to Social Infrastructure	Number of Dependents
Linkage with NGOs, CBOs and Informal Groups	Access to Physical Infrastructure
	Insurance
	Debt

Housing

Socio-Economic Vulnerability Index and Categories:

Mustafa et. al. (2008) states that formulation of indexes is generally prone to problems like generalization and individualistic perceptions for importance of variables. However, in spite of these shortcomings indexes prove to be immensely useful because they translate the complex set of parameters into easy to comprehend quantitative matrix. An indicator-based approach to vulnerability assessment enables a complex and intangible reality to be captured in a single measurement.

A socio-economic vulnerability index is developed by assigning weights to the identified indicators. Delphi technique is used for finalizing the weights for the parameters to minimize the error obtained because of individualistic perceptions for importance of variables. Positive weight values are assigned to indicators which are increasing vulnerability of the person and negative values are assigned to indicators which are reducing the vulnerability i.e. increasing the resilience to disasters. The maximum vulnerability weight for any category of indicator is 5 which is allotted to children below 4 years of age and to disabled persons because of their high level of dependency. The factors which do not make the individual vulnerable have been allotted a '0' weight. In some cases negative scores are allotted, which indicates the disaster resilience of individual belonging to that group. The overall socio-economic vulnerability score an individual can attain a maximum value of 60 points. The overall score of '0' point depicts 'no vulnerability and no resilience'. In many cases individuals were seen to attain an overall negative score which indicates the resilience of the individual to disasters. The maximum negative score (resilience) of an individual can reach upto '-25' which depicts very high socioeconomic resilience.

The vulnerability values are determined at three levels viz. for individuals, for wards and for Nainital Township. The index is indicative in nature, for being concerned with persistent conditions that drive socio-economic vulnerability of Nainital Township. The individuals are categorized according to their socio-economic vulnerability into 8 distinct categories ranging from 'very high vulnerability' to 'high resilience' as shown in Table 2. The average socio-economic index value for wards suggests the cumulative socio-economic vulnerability and average socio-economic index value of Nainital Township represents the socio-economic vulnerability of the township.

Results:-

The socio-economic index values calculated for all surveyed individuals were seen varying from -16 to 30. The average socio-economic vulnerability index value for Nainital Township is found to be 12.21, the Township as a whole falls into 'Moderate Vulnerability' category as per the index. It was found that 14.79 % population of Nainital has high vulnerability for their socio-economical condition, 18.1% population is moderately vulnerable while 50.85% population displays low socio-economic vulnerability. 2.06 % population is neither vulnerable nor resilient, whereas the rest 14.2 % was found to be socio-economically resilient to disasters. Table 2 shows the number of vulnerable / resilient persons in Nainital. Fig 8 and Fig 9 show distribution of vulnerable / resilient population groups in wards of Nainital based on survey groups.

Table 2:- Socio-economic Vulnerability of Nainital.

Index Value Range	Vulnerability/Resilience Description	Surveyed Population		Vulnerable/Resilient Population	
		No.	%		
				Number	%
Above 24	Very High Vulnerability	17	1.25	201	14.79
15 to 24	High Vulnerability	184	13.53		
10 to 15	Moderate Vulnerability	246	18.1	246	18.10155
5 to 10	Low Vulnerability	320	23.54	691	50.85
0 to 5	Very Low Vulnerability	371	27.29		
0	Not Vulnerable Not resilient	28	2.06	28	2.060338
0 to -8	Resilient	182	13.39	193	14.2
Less than -8	Highly Resilient	11	0.8		
Total		1359	100	1359	100

The average socio-economic vulnerability value found in 13 wards is shown in Fig 8 and Fig 9. It can be seen that the average socio-economic vulnerability of ward no. 2 (Narayan Nagar) is the highest, followed by ward no. 5 (Raj

Bhawan) and ward no. 11 (Mallital). The wards with lowest socio-economic vulnerability are discovered to be ward nos 6 (Awagarh), 7 (Sher kaDanda) and 8 (Upper Mall). From Fig 9 it is evident that the areas on the eastern side of Naini lake are socio-economically less vulnerable, while those on the western side are more vulnerable.

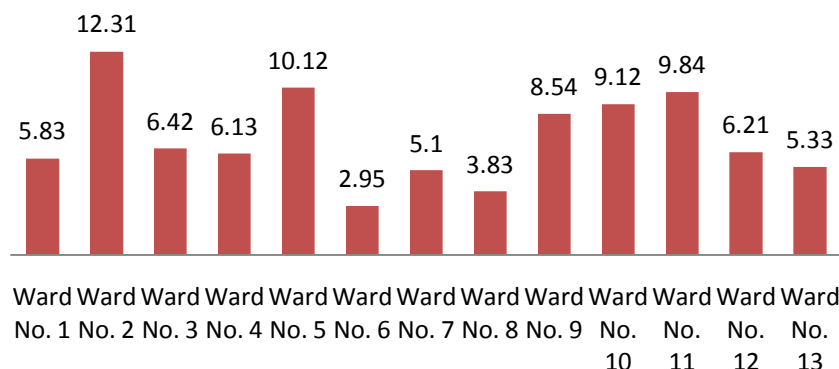


Fig 8:- Ward wise average socio-economic vulnerability index value of Nainital population.

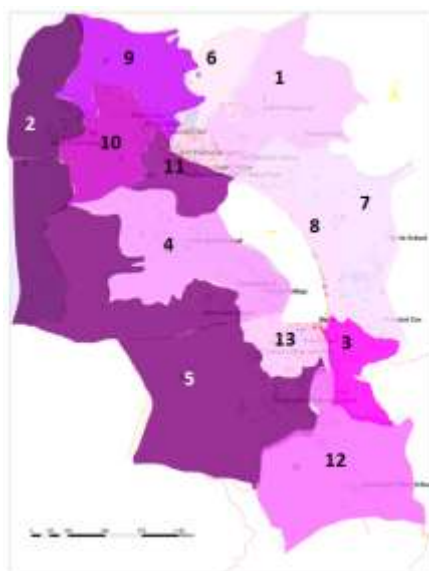


Fig 9:- Average Socio-economic Vulnerability Index value calculated for sample population in wards of Nainital.

Recommendations:-

This socioeconomic vulnerability assessment presented in this paper can guide formulation of practical strategies for vulnerability reduction for Nainital. Some of the policy recommendations which could be developed and formalised further are:

Awareness about disaster vulnerability and preparedness measures is most important for increasing disaster resilience of the population. Almost half the surveyed population displayed low awareness for disasters. This emphasizes a need to undertake an awareness campaign for the residents of Nainital. The awareness campaign can include TV and radio broadcasts, social media campaigns, organizing special talks and lectures in schools, colleges, offices etc.

In disaster prone areas like Nainital Township, insurance schemes need to be complemented by other low cost risk sharing mechanisms in poorer communities such as microfinance to increase coping capacities. Additional tools and financial incentives are necessary to promote proactive disaster risk reduction investment.

There is a need for initiatives for women empowerment in Nainital as they generally exhibit higher vulnerability on account of low awareness, low education and low participation in economic activities. Many working women were

found to be engaged in candle making workshops and have gained expertise in the art of candle making over years. Government should formalize and facilitate such initiatives as there exists a huge demand for candles.

Senior citizens above 60 years of age are considered to be more vulnerable because of their declining health conditions. During the survey it was observed that there are many senior citizens retired from defence forces. Such citizens possess special skills, knowledge and free time. Such senior citizens should also be encouraged to participate in the initiatives taken by government or voluntary organizations for disaster management. Specialized training programmes for disaster awareness and preparedness measures need to be organized for all senior citizens. This would reduce their and their family's vulnerability.

Disabled persons and their care givers of the township should be provided specialized training for actions to be taken in case of any disaster.

Special adult literacy programs and night schools should be conducted in Nainital to increase the literacy level of population.

The high number of unemployed youths of Nainital should be engaged in disaster management efforts in their respective areas. They should be given monetary and other benefits for their assistance.

The poor families living with compromising living standards should be identified. Special programmes for providing assistance to such families for reducing their vulnerability to disasters should be formulated and implemented.

Conclusions:-

The vulnerability of Indian Himalayan region to various disasters is continuously increasing on account of growing human activities related to tourism. The previous sustainable and quiet Himalayan settlements are now bustling with activities which have altered their socio-economic conditions. The socio-economic vulnerability index suggested in this paper can facilitate the communication of socio-economic vulnerability analysis to policy makers and hence facilitate disaster risk reduction. The results show that the overall vulnerability of Nainital Township is moderate, where population located on western side of Naini Lake display high socio-economic vulnerability. The index presented in this paper could be a valuable tool in facilitating the development of a safer environment for population living in disaster prone hilly tourist townships of Indian Himalayan region.

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