The Great Flood and its Aftermath in Kashmir Valley: Impact, Consequences and Vulnerability Assessment

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Abstract

Floods have serious implications on land and people. They disrupt the ecological balance, hamper the economic development, affect the social fabric of the society, create chaos and uneasiness, damage the infrastructure, put constraints on the movement of people, create displacements of millions of people and lead to political disturbance at places. In 2014, Kashmir Valley witnessed the worst flood in the last 100 years. The impact of the flood is still felt in the Kashmir Valley, which has changed the perception of the people of the valley regarding floods. The flood had enormous impact of environment, economy, society, political set up and all the aspects of life. The present study analyses the impact of the 2014 flood in Kashmir Valley and its aftermath. It analyses the physical and social vulnerability of different districts regarding floods and analyses the variability of the impact. The study is based on primary as well as secondary sources of data, and the data was analysed by statistical techniques like Z-score and Composite Z-score and also remote sensing techniques and GIS.

Key words: flood, impact, economy, vulnerability, poverty

Introduction

Disasters like floods create havoc in the societies and inundate places which degrade the environment and have a profound impact on the economy. The decadal period from 2010-2019 marked the costliest in the modern record for global natural disasters on a nominal and inflation-adjusted basis. Total direct economic damage and losses tallied USD2.98 trillion. This was USD1.1 trillion higher than the previous decade (2000 2009); USD1.8 trillion. Asia-Pacific (APAC) accounted for USD1.3 trillion – or 44 percent of the decadal total as catastrophic earthquake, tsunami, inland flood, and tropical cyclone events were recorded (Aon**,** 2020). Most of the people affected by disasters (2000-2019) – over 90% - were

affected by climate-related events including extreme weather like floods. 25 million people are displaced every year by climate and weather (United Nations Office for Disaster Risk Reduction, 2020). South Asia is heavily at risk. A rise of more than 2°C will increase coastal flooding in Bangladesh, with the attendant risk that salt water will infiltrate drinking water. Mumbai, Kolkata, Karachi, Chittagong, Colombo, and other coastal cities will be endangered (Chengappa, 2007). The scale, intensity and magnitude of disasters is expected to be unprecedented (Challinor, Slingo, Turner and Wheeler, 2006). More frequent droughts will affect water availability and crop yields; higher temperatures will bring more heat waves; and warmer oceans will produce more intensive storms (Oxfam International, 2008). The effects of floods on developing nations can be summarized according to three categories. First, the consequences for human health include death, physical injury, disease transmission, malnutrition, shock, degeneration of morale and loss of motivation. Secondly, the consequences for agriculture include loss of crops, food stocks, seeds, stored products and agricultural wages, damage to farmed land, death or dispersion of livestock and rising commodity prices. Thirdly, the impact on settlement and the economy comprises damage to housing, buildings and infrastructure, loss of household effects, deprecation of property, reduced output, loss of business income and rising prices. Though these are also the consequences of floods in industrialized nations, in the Third World lack of resources creates some distinctive and particularly serious outcomes (Alexander, 1993).

The Kashmir Valley is one of the most flood hazard-prone Himalayan region (Meraj et al. 2013). From the literature review, it is observed that the valley witnessed significant flooding during 879 AD, 1841, 1893, 1903, 1929, 1948, 1950, 1957, 1959, 1992, 1996, 2002, 2006, 2010 and 2014 (Bhatt et al., 2017). Historical records testify the occurrence of sixty-four flood events from the early seventh century to 1950 CE. (Ballesteros-Cánovas et.al, 2020). Due to its geographic, climatic and geological setup, the Kashmir Valley is vulnerable to all types of the hazards (Meraj et al. 2015; Romshoo et al. 2012; Ray et al. 2009). The historical records reveal that the Kashmir Himalayan region has suffered heavy causalities and loss of property due to the recurrent floods, earthquakes, avalanches and other hydro-meteorological disasters (Lawrence 1895; Mulvey et al. 2008; Kumar et al. 2006; Mohammed et al. 2015).

The 2014 flood in Jammu and Kashmir gravely hampered the societal set up, created panic among people, affected the economy, degraded the environment and ecological balance, led to water pollution and soil erosion and affected the overall socio-economic

development. Jammu and Kashmir, being a political hotbed in South Asia and one of the most politically volatile regions of the world, witnessed heavy and continuous rain from 3rd September to 7th September 2014 during last stage of South-West monsoon which resulted into unprecedented widespread flooding and landslides across the region. It was the worst flood in over 100 years in the Kashmir Valley which can be termed as 'The Great Flood' due to its enormous impact on environment, economy and society as it created political rupture and changed the perception of the people of Kashmir regarding floods.

In September 2014, the north-west of India and northeast Pakistan experienced incessant rains, which were particularly intense in the mountain region of Jammu and Kashmir. Massive floods and debris flows caused catastrophic damage in populated areas located along the main watercourses (Kumar and Acharya, 2016). The situation was especially dramatic in the Kashmir valley, where the Jhelum River flooded most of the inhabited land and crop fields, covering a surface of almost 853 km^2 (Romshoo et al., 2018). The 2014 flood was more devastating as compared to other floods in recent times because the government was not ready for such a devastation (Malik and Hashmi, 2020).

The present study attempts to analyse the socio-economic impact of The Great Flood of 2014 in Kashmir Valley. It analyses the differences in the amount of damage across the different districts and whether the impact depended on the type of houses and their vulnerability. The study also evaluates the social vulnerability in different districts regarding the 2014 flood in Kashmir Valley.

Study Area: The present study deals with the flooding in Kashmir Valley, which lies in the North-western Himalayas (Fig. 1). The Kashmir Valley is surrounded by the Pir Panjal range to the south and southwest, by Kashmir Himalaya to the north and by the Greater Himalayan range in north and northeast. It has an area of about 15,220km^2. The Kashmir Valley forms a part of Jhelum Basin, and has a fairly well-established drainage system, headed by the Jhelum River (Bhatt et al., 2017). The valley is filled with 1299.972 metres thick Plio-Pleistocene fluvio-glacio-lacustrine sediments which are generally known as the 'Karewas' (Kotlia 1985; Dar et al. 2013). The Kashmir valley is affected by the southwest monsoon and extratropical disturbances (Das et al., 2002). On the basis of temperature and precipitation, the Kashmir valley experiences four seasons; winter (Dec–Feb), spring (Mar–May), summer (Jun–Aug) and autumn (Sep–Nov) (Bagnolus and Meher-Homji, 1959). Geologically, the Kashmir valley hosts two geological formations, the Panjal Volcanic Complex and Triassic limestones overlying Archean sediments. The rise of the Pir Panjal Range impounded the primeval

drainage resulting in the formation of a huge lake inundating most of the plains of the Kashmir valley (Rashid et al., 2015; Rather et al., 2016).

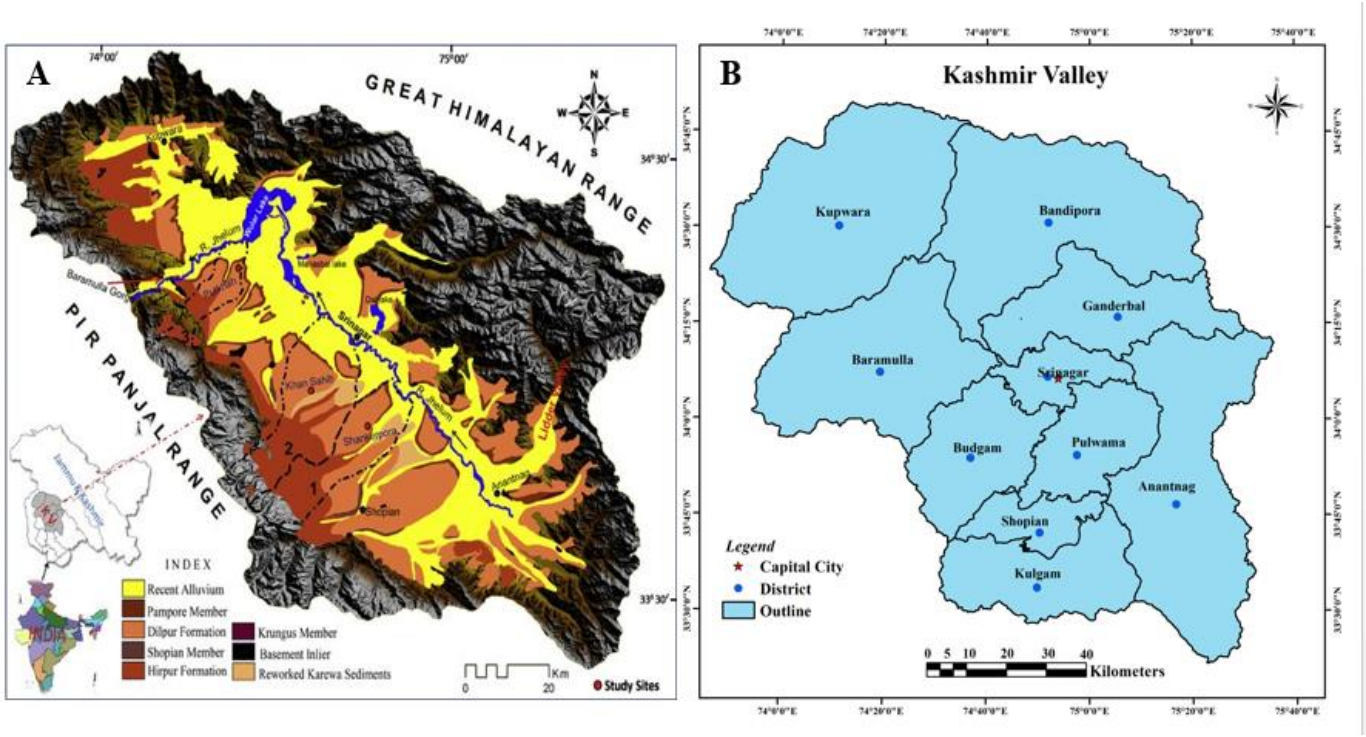


Fig. 1: (A) Geological Map of Kashmir Valley; Source: Dar et al. 2014

(B) Geographical Map of Kashmir Valley (Study Area).

Materials and Methods:

The present study is based on primary as well as secondary sources of data. The primary data was collected through questionnaires, focused group discussions (FCD), interviews of experts in the field of flood management in Kashmir and interviews of people involved in rescue and relief operations. The expert opinions of several experts was recorded, which helped in the analysis of the impact. The secondary data was collected from Indian Meteorological Department (IMD), Flood Control and Irrigation (FCI) Department of Government of Jammu and Kashmir, various reports and articles. Z-score and Composite Z-score statistical techniques were used for the tabulation and analysis of the data regarding damage experienced by different districts. Arc GIS and Erdas Image were used to process the data and map making.

Results and Discussion

Projected rapid land-use changes, when coupled with climate change, could potentially lead to increased flood risks with deleterious impact on infrastructure (Ewen and Parkin 1996, Poelmans et al. 2011, Shafiq et al. 2019, Ganaie et al. 2020, Jamal and Ahmad 2020). The

concept of vulnerability has been an increasing concern within the literature that seeks to explore the social impacts of flooding (Tapsell et al. 2002, Fielding and Burningham 2005). Within this literature, vulnerability is often considered to be linked to particular demographic and socio-economic factors such as age, ethnicity, income, pre-existing poor health and family structure (Thrush et al. 2005, Walker et al. 2006). Flooding in J&K and Pakistan became the costliest weather event of 2014 (2014 Annual Global climate and catastrophe report, 2015). The 2014 flood in Kashmir caused great damage to agriculture, trade, infrastructure, tourism and handloom industries. According to the Govt. of Jammu and Kashmir, the state suffered a loss of Rs. 1.0 trillion due to September 2014 floods (Yaseen, 2014). Over one million people were displaced from their homes and over a 3,000 villages were inundated incurring economic loss of US$ 6,560 million (Carpenter et.al, 2020). According to EM-DAT, the International Disaster Database, this is the most expensive natural disaster in India's history, surpassing the $11.6 billion price tag (2014 dollars) of the July 1993 monsoon floods." The Kashmir valley represents a paradigmatic case in terms of water governance because watershed management is constrained by the Indus Water Treaty (IWT), signed in 1960 between India and Pakistan. The IWT states that the management of the Jhelum River belongs to Pakistan, even in the case of its tributaries within Indian territory. Although the IWT was a success in terms of solving legal issues related to water sharing between two countries, this special status also renders flood risk management highly challenging. Indeed, the implementation of structural measures (such as flood storage structures) requires the approval of both countries (IWT, 1960). The situation in the region may be aggravated in the near future given that climate change may result in increased precipitation through changes in monsoon activity (Gosain et al., 2006; Attri and Tyagi, 2010) and/or the advection of moisture from the Arabian Sea (Murakami et al., 2017).

The devastating impact of the flood is most conspicuously visible in the economic dent born the valley. According to Associated Chambers of Commerce and Industry of India (ASSOCHAM), "there was an initial immediate loss of around 5,700 crores INR or $92 million. These were only the initial figures and did not take into account the loss of financial wealth through lack of productivity, loss of livelihood and devastation of much of the private property. As days passed with unrelenting waters refusing to recede, the magnitude of the damage seemed to be under-reported or at least under - estimated. As it became clear that the valley would take years and even decades to come to terms with the devastation caused by the marauding waters, economists started, for the first time, to realize

the magnitude of the economic dent that had been left in place post the flood event. Former president of Federation of Chamber of Commerce, Kashmir, estimated an economic loss greater than 15 billion dollars, which is greater than the respective GDPs of almost 80 countries around the globe." The impact, consequences and aftermath scenario of The Great Flood in Kashmir Valley can be understood by the following points;

1. **Effect on Agriculture and Allied activities:**

The 2014 flood in South Asia was one of the greatest floods in the modern history of South Asia. The situation was especially dramatic in the Kashmir valley, where the Jhelum River flooded most of the inhabited land and crop fields, covering a surface of almost 853 km2 (Romshoo et al., 2018). The havoc wreaked by the floods and resultant landslides directly affected about half a million people. The regional economy relies on agriculture and tourism, which were both severely impacted. The main economic activity in area affected is agriculture because of the availability of fertile soil deposited by the rivers and water for irrigation (Carpenter et.al, 2020). Agriculture suffered a great loss by 2014 floods in J&K which caused damage to 3, 00,000 hectares of crops which accounts for Rs.3,674 crore loss. The floods caused a loss of Rs 1,000 crore to the apple crop in Kashmir, threatening a collapse of the horticulture industry in the state (The Associated Chambers of Commerce & Industry of India, ASSOCHAM, 2014). In Srinagar, about 34.10 km² of agricultural land was inundated by floods. The September floods have caused an immediate loss of Rs 5400–5700 crores to the state's economy. The initial estimated loss to hotels, trade, agriculture-horticulture, roads and bridges in the Jammu and Kashmir regions is Rs 2,630 crores. Besides it, high-cost infrastructure like railways, power and communication in the hilly terrains suffered a loss of Rs 2700-3000 crores (ASSOCHAM India, 2014).

The growth in Agriculture sector (Agriculture & Livestock only) has decelerated by -16.23% in the year 2014-15 as compared to 6.25% in the year 2013-14 while as the Agriculture & the allied sectors which include Agriculture & Livestock, Fisheries, and Forestry & Logging sectors, has decelerated by -14.9% as compared to positive growth of 5.14% in the year 2013-14. At constant (2004-05) prices, Forestry & Logging sector has decelerated by -8.00% as compared to -0.15% during 2013-14 while as Fishing has decelerated at -9.96% as compared to 0.15% during 2013-14 (Economic Survey 2014-15, Government of Jammu & Kashmir). The loss in all these sectors is attributed to the 2014 flood in Kashmir. Crop loss was reported in 6.52 lakh hectares (16, 11,127 acres) of land, besides huge losses to the public and private infrastructure, including roads, bridges, schools

and hospitals (DEERS, 2014). Romshoo et. al (2018) opine, “In the Bandipora district, Sonawari and recently created Sumbul tehsil, known as 'the rice bowl of Kashmir' suffered the worst damage, with orchards and paddy crop worth crores of rupees destroyed Out of the 1760 sq. km. of floodplains, 912 sq.km were flooded in the Jhelum basin during the 2014 flooding. The inundation levels recorded in the flood plains were the highest in the archived hydrological history of Kashmir.”

Table 1: Composite Z-Score of the Impact of The Great Flood of 2014 in the Kashmir Valley

District	Z-Score Values							Composite Z-Score
	Total Houses Damaged	Cowsheds Damaged	Huts Damaged	Crop Area Affected	Cattle Lost	People Dead	People Affected	
Srinagar	2.90	0.44	0.24	-0.75	-0.38	2.94	2.08	**1.07**
Budgam	0.01	0.32	0.34	0.68	0.27	-0.39	0.17	**0.20**
Anantnag	0.12	0.42	-0.35	1.68	2.78	0.19	0.84	**0.81**
Baramulla	-0.31	-0.42	-0.24	1.26	-0.33	-0.56	0.84	**0.03**
Kulgam	-0.50	-0.19	-0.33	-0.29	-0.31	-0.31	-0.61	**-0.36**
Shopian	-0.58	-0.94	-0.59	-1.05	-0.15	-0.48	-1.18	**-0.71**
Pulwama	-0.06	2.20	-0.53	0.89	0.19	-0.31	-0.23	**0.31**
Bandipora	-0.34	0.68	2.82	-0.88	-0.93	-0.31	-1.08	**0.00**
Ganderbal	-0.62	-1.25	-0.68	-0.22	-0.96	-0.48	-0.82	**-0.72**
Kupwara	-0.63	-1.26	-0.70	-1.33	-0.18	-0.31	0.82	**-0.51**

Z score and Composite Z score values have been derived by the following methods.

$$z = \frac{data\ point - mean}{standard\ deviation}$$

i.e,

$$z = \frac{x - \mu}{\sigma}$$

where x = raw score

μ = mean

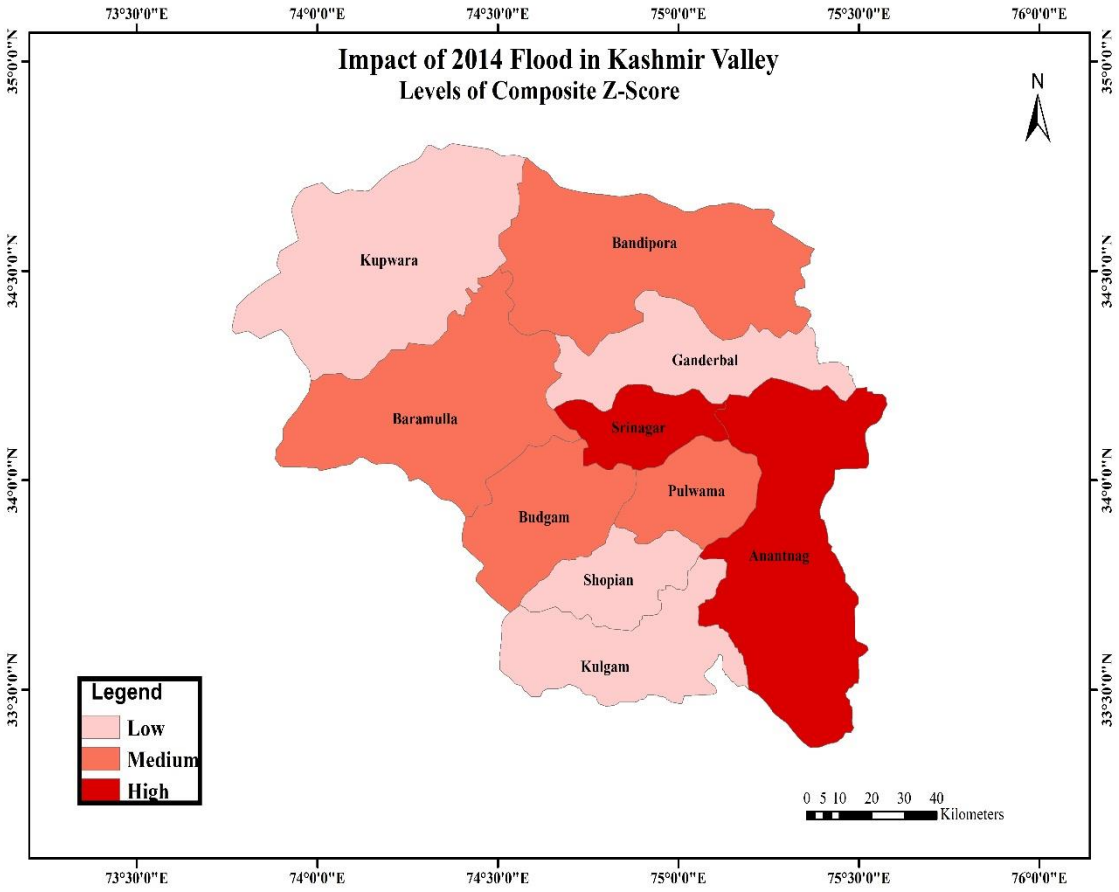
σ = standard deviation.

Averaging is the most commonly used approach for creating a composite variable. In this approach, the composite variable (symbolized as C) is created by summing z scores of the original variables. Thus,

$$C = \frac{z1 + z2 + \ldots zp}{n}$$

Where n is the number of items

Fig. 2: Composite Z-Score Map of the Impact of The Great Flood in Kashmir Valley



Srinagar was the most affected district in the Kashmir Valley due to The Great Flood of 2014 in terms of loss of lives and property and a considerable area was inundated (Table 1 and Figure 2). The area inundated in Srinagar city was 100 km^2, which accounts for 18% of the total area inundated in Kashmir. 998 mohallas and colonies were inundated in 59 wards of Srinagar. The Composite Z-Score values of ten districts of Kashmir Valley are: Srinagar: 1.07; Budgam: 0.20; Anantnag: 0.81; Baramulla: 0.03; Kulgam; -0.36; Shopian: -0.71; Pulwama: 0.31, Bandipora: 0.00, Ganderbal; -0.72 and Kupwara: -0.51. Srinagar has the highest score while Budgam has the lowest score in terms of houses damaged. Figure 2

shows the impact of 2014 flood in Kashmir Valley, which depicts that Srinagar and Anantnag fall in the high impact zone, Bandipora, Baramulla, Budgam and Pulwama fall in the medium impact zone while as Kulgam, Shopian, Ganderbal and Kupwara fall in the low impact zone. The analysis suggests that under the same natural conditions, people living in more urbanized districts like Srinagar and Anantnag suffer with more flood risks and inundation from floodwater than those that live in less urbanized districts like Kupwara and Shopian while as people in lower urbanized districts are more vulnerable because they have a low capacity to cope with floods due to poverty, flood-prone living conditions and lack of awareness on the changing variability. Socio-economic conditions and vulnerability of people to flood resulted into huge impact in some districts while as low physical vulnerability in the districts of north Kashmir resulted into low impact.

Table 2: Total Cropped Area Affected by 2014 Flood in Kashmir Valley

District	Total cropped area affected (acres)	No. of people affected
Anantnag	153140	159507
Bandipora	25791	44562
Baramulla	132052	159200
Budgam	103215	119009
Ganderbal	58499	59946
Kulgam	55089	72193
Kupwara	3218	158111
Pulwama	113947	95200
Shopian	17359	38363
Srinagar	32074	NA
Total	**694389**	**906091**

Source: Divisional Commissioner's Office, Srinagar

From Table 2, it can be seen that Anantnag district was the most affected by the flood in terms of cropped area as well as people affected. In Anantnag district, 153140 acres of land and 159507 people got affected by the flood. It was followed by Baramulla in which 132052 acres of land and 159200 people got affected by the flood. The least affected district in terms of cropped area was Kupwara in which 3218 acres of land was affected. The total cropped area affected in Kashmir Valley by the 2014 flood was 694389 acres while as the total of 906091 people were affected excluding the district Srinagar. According to Jammu

Kashmir Coalition of Civil Society (JKCCS, 2015), "Crops to the tune of Rs 3,674 crores, were damaged according to a survey carried out by Jammu and Kashmir Agriculture department. Pulwama district suffered the maximum damage in terms of damage to agricultural produce, with losses estimated to be Rs 1104 crores. The amount includes Rs 778 crores losses to Saffron crop as flood-water inundated Pampore town of Pulwama. The Horculture Sector, consisting of vegetable and orchard crops incurred an estimated loss of Rs 1565 crores." Years of research on flood hazard and risk mapping has indicated that the maximum water level, flood water velocity, and flood duration in a given area are essential components to evaluate the possible damage or flood risk (Todini 1999; Dutta et al. 2003; Merz et al. 2007).

2. Damage of Houses and Infrastructure:

About 2,600 villages were flooded and 300 villages were submerged due to 2014 Floods in J&K. Half of the Srinagar was inundated by more than 6 metres of water. It is estimated that 15% of houses as per the 2011 Census were damaged. About 2, 34,516 structures were damaged, and 20,000 were fully destroyed. The destruction of houses was most visible in Srinagar city as the water inundated the first floors of most of the houses. The estimated loss of hotels,other buildings, roads and bridges is Rs.2,630 crore (ASSOCHAM, 2014).

Table 3: Total Number of Houses Damaged in Kashmir Valley due to The Great Flood of 2014

	Total number of houses damaged								
District	**Fully damaged**		**Severely damaged**		**Partially damaged**		**Total**	**No. of cowsheds damaged**	**No. of huts damaged**
	Pucca	**Kacha**	**Pucca**	**Kacha**	**Pucca**	**Kacha**			
Srinagar	6048	113	25426	78	61798	73	**93536**	2397	421
Budgam	875	26	3538	3	12485	36	**16963**	2223	466
Anantnag	1542	272	3923	232	13482	534	**19985**	2371	156
Baramulla	190	149	1288	146	5969	888	**8630**	1193	203
Kulgam	231	108	639	76	2111	200	**3365**	1517	165
Shopian	203	11	181	5	911	25	**1336**	468	48
Pulwama	1957	58	1926	16	11203	40	**15200**	4857	74
Bandipora	544	243	1488	71	5039	318	**7703**	2737	1580
Ganderbal	2	1	1	4	328	93	**429**	34	9
Kupwara	1	1	0	0	87	0	**89**	22	0
Total	**11593**	**982**	**38410**	**631**	**113413**	**2207**	**167236**	**17819**	**3122**

Source: Divisional Commissioner's Office, Srinagar

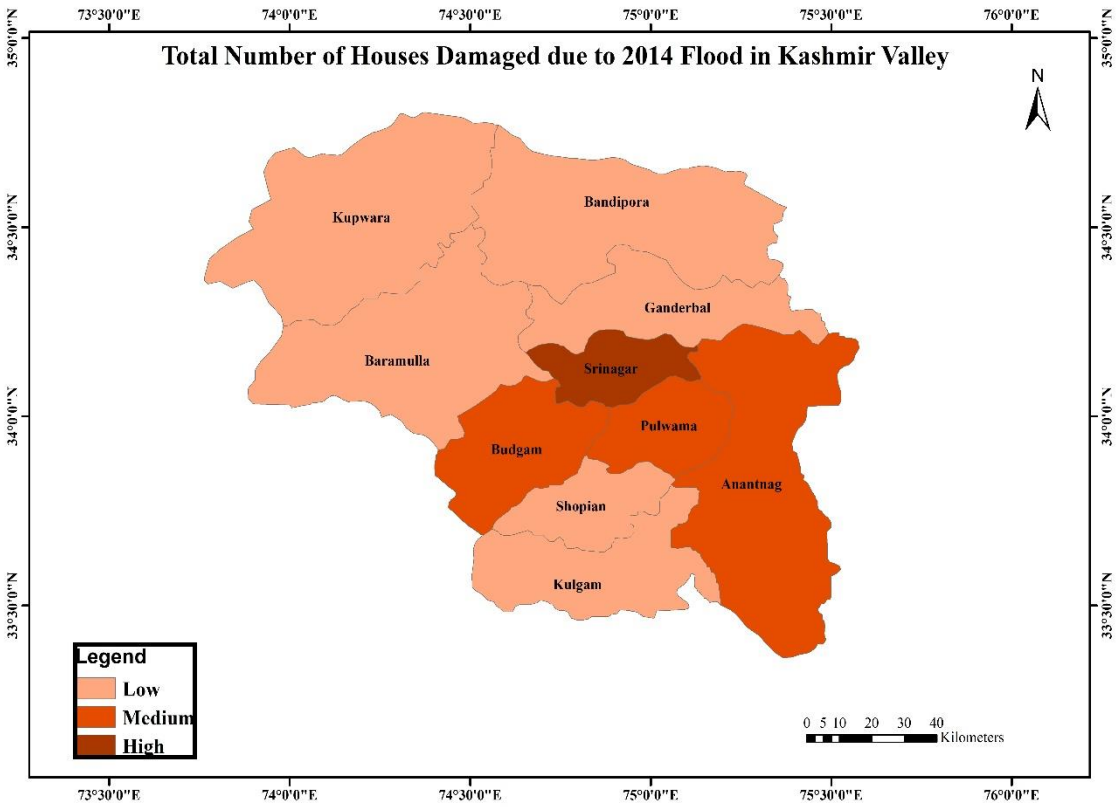
The total number of houses damaged by the 2014 flood in Kashmir Valley were 167236 (Table 3). Srinagar district suffered the greatest loss in terms of houses damaged followed by Anantnag, Budgam, Pulwama, Baramulla, Bandipora, Kulgam**,** Shopian, Ganderbal and Kupwara. The highly urbanised districts were affected more as compared to less urbanised districts because urbanisation can make the flood situation worse. Unplanned urbanisation is one of the main reasons for flood in Srinagar. (Malik and Hashmi, 2020). Urbanisation can potentially magnify flooding intensity by ten-fold (Hollis, 1975).

Table 4: Total Number of Houses Damaged in Kashmir Valley due to The Great Flood of 2014 (Using Z-Score)

District	Total no. of houses damaged	Z score
Srinagar	93536	**2.75**
Budgam	16963	**0.01**
Anantnag	19985	**0.12**
Baramulla	8630	**-0.29**
Kulgam	3365	**-0.48**
Shopian	1336	**-0.55**
Pulwama	15200	**-0.05**
Bandipora	7703	**-0.32**
Ganderbal	429	**-0.58**
Kupwara	89	**-0.60**

The number of houses damaged in each district varies due to the location, extent of inundation and water level. In the districts of south and central Kashmir, the damage is relatively higher as compared to the districts of north Kashmir due to location and speed of water as these factors are crucial for inundation during floods. During 2014 flood in Kashmir, the combination of physical and social factors contributed to uneven impact on different districts and different sections of the population.

Fig. 3: Total Houses Damaged in Kashmir Valley due to 2014 Flood



By applying Z-score, Table 4 was formulated which helped in the formation of Figure 3, which shows the houses damaged in the districts of Kashmir. From the figure, it can be seen that the district of Srinagar falls into the high category in terms of damage while as the districts of Anantnag, Pulwama and Budgam fall into the medium category and the districts of Shopian, Kulgam, Baramulla, Bandipora, Ganderbal and Kupwara fall into the low category in terms of houses damaged. Several houses were fully damaged particularly in the districts of Srinagar, Anantnag and Baramulla. Severely damaged houses are mostly found in the districts of Srinagar, Kulgam, Shopian, Budgam and Pulwama while as partially damaged houses are mostly found in the districts of Kupwara, Ganderbal and Bandipora. Pucca houses were mostly damaged in the districts of Srinagar, Anantnag, Kulgam, Shopian and Pulwama while as most of the kacha houses were damaged in the districts of Baramulla, Bandipora, Kupwara, Budgam and Ganderbal.

The detailed analysis of Gull (2014) reveals, “around 300 villages were submerged and around 10,000 families rendered homeless in the South Kashmir districts of Kulgam, Pulwama and Anantnag by flash floods and inundation according to official figures. The worst affected district was Kulgam, where more than 121 villages were affected by floods,

rendering around 3000 homeless. Four villages in Kulgam district, namely Aarigatnoo, Chamgund, Kelam Gund and Zanglipora were completely damaged by flash floods in the Vaishav, which also altered its course. 52 villages were officially designated as 'worst affected', with substanal damage to homes, livestock and lives, including Mirhama, Achthal, Chehlan, Aadipora, Arigutnoo, Chamgund, Kaimoh, Khudwani, Rehpora, Redwani, Ghat, Havoora, Mishpora, Wanpora, Vadipora, Shamsipora, Sealipora, Kujur, Brazloo Jageer, Dumbdaloo, Tengan, Rampora, Nawbal, Gandbal and Nowpora. Pulwama district also faced severe losses with 77 villages submerged and damage to nearly 2000 houses. The most affected villages were Gulzarpora and Beighpora in Litter area of the district, where around 200 and 92 houses respecvely, were completely damaged by the floods. Kakpora and Pampore areas of the district were also highly affected, especially the villages of Kandizaal, Chursu, Lelhar, Marwal, and Khadermoh. Mudslides and flash floods were recorded in Akharwana, Batpora, Shaltaekna, Pusul and Jangalnarda, as the Rambiara and Romshu nallahs became torrential. Shopian district remained less affected and only some villages around Rambiara Nallah were affected by flash floods." As per JKCCS (2015), "137 villages in Srinagar district limits were affected by the flooding, with 105 villages facing submergence. The total number of families affected due to the submergence of villages was 2, 17,700, of which 34,397 were affected by flash-floods, flooding and landslides. The total number of deaths reported was 46, while figures for injuries were unavailable. 95,394 houses were reported as damaged, of which 33,374 houses were classified as 'pacca house damaged fully', 42,721 were classified as 'pacca houses damaged severely', 18,964 as 'pacca houses damaged partially', 295 as 'kaccha houses damaged fully' and 40 as 'kaccha houses damaged partially'. 58,540 other non-residential structures were reported as damaged, including 4597 cowsheds, and 49,216 shops and other establishments. 9,625.86 acres of paddy crop was damaged, and 3100.85 acres of vegetable and horticultural crops, including orchards. 586 cows, 115 bulls, 53 calves, 30 horses and 3495 sheep were reported as having perished. In terms of public and civilian infrastructure the flood affected about 1700 villages in Kashmir division, with heavy damage to the basic infrastructure of the state." A media report described 390 villages as fully submerged and 1,225 houses as partially submerged. 'The worst hit is the housing sector which has witnessed damage to 15 percent infrastructure,' said the industrialist Shakeel Qalander, member of Kashmir Centre for Social and Development Studies (KCSDS). The Society, which is an amalgam of experts from fields like economy, academics and business, said of 20, 50,000 houses in Jammu and Kashmir as per 2011

census, at least 3, 00,000 houses have got either fully or partially damaged. “On an average we have calculated that every affected house has suffered a damage of Rs 10 lakh including the household items,” said another member of the formation (Ali, 2014).

According to historical accounts, the size of Wular lake reached its maximum extension during the 18th and 19th centuries (up to ~200 km^2). By contrast, the minimum extension of the lake occurred during the 6–7th centuries, 16–17th centuries, and nowadays during the late 20th century (lake extension between 55 and 90 km^2). Thus, the freshwater surface of Wular lake has been reduced significantly over the last century due to siltation processes, from 89 km^2 in 1911 to 9.5 km2 nowadays (Romshoo et al., 2018). The siltation process has contributed to reduce the capacity of the lake to laminate flood discharge and increase the effect of backwater effects during extreme events (Romshoo et al., 2018), thus causing heavy damage to the houses in different districts of the Kashmir.

3. Damage of Infrastructure (Railways, Bridges, Electricity and Communication):

Landslides, triggered by heavy rainfall, damaged roads, destroyed dozens of bridges and washed away flood defences. National Highways, for example the Jammu-Srinagar Road, were cleared and repaired within a fortnight. Many parts of Srinagar were flooded and vital roads were submerged. Communication broke down and power supply was disrupted. Many families lived on boats for days till the water receded (Shankar, 2017). As a result of the 2014 flood, thousands of structures – mostly residential houses – in the main cities of the Kashmir valley were damaged (Farooq, 2014). Key infrastructures such as hospitals, water and energy supply systems, communication lines, government establishments and cultural heritage sites were seriously affected. The situation resulted in an emergency with more than one hundred fatalities and thousands of families affected, as well as huge economic losses (Venugopal and Yasir, 2015). According to Lawford et.al (2013), “Costs associated with flooding fall into three general categories, viz., the pre flood cost of building flood control infrastructure; the losses associated with direct damages resulting from a flood; and post-flood costs associated with restoration and clean up. Flood prevention is big business. Large dams, often partially justified by their ability to mitigate flood losses, individually cost hundreds of millions of dollars to construct. In addition, spillways to pass floods safely around these dams cost tens of millions of dollars each. Recently, damages by floods and their associated clean-up costs have led to a growing recognition that floods are a very significant natural hazard” for Kashmir Valley and that a higher priority should be given to understanding their causes and

effects. The 2014 flood in Kashmir Valley caused great damage to railways, bridges, electricity and communication. The damage was greater in the hilly and mountainous areas.

According to ASSOCHAM (2014), an apex trade association, "the September floods have caused an immediate loss of Rs 5400–5700 crores to the state's economy. The initial estimated loss to hotels, trade, agriculture-horticulture, roads and bridges in the Jammu and Kashmir regions is Rs 2,630 crores. Besides, high-cost infrastructure like railways, power and communication in the hilly terrains suffered a loss of Rs 2700-3000 crores" and according to Roads & Buildings Department (R&B) Govt. of J&K, "the floods have damaged 1700 Kms of road network and 271 bridges in Kashmir division." JKCCS (2015), while analysing the loss, says "an estimated Rs 200 crore loss to automobiles and car showrooms, with more than 15,000 vehicles hit by the floods. The telecommunication sector was one of the worst affected sectors during the floods, with losses running into crores of rupees. The state owned BSNL telephone exchange in Srinagar was submerged, as well as mobile towers, transmitters and other equipment belonging to almost every service provider. Cell phone signals could only be received in selected highland areas of the city. The Indian army donated a limited number of cell phones, and wireless sets to the state administration. An ISRO (Indian Space Research Organisation) team sent to the valley set up Disaster management modules after about a week, with satellite connectivity through four V-sats, allowed state officials, functioning out of temporary offices set up at the Military airport at Srinagar, at the Governor's Residence at Raj Bhavan, Hari Niwas on Gupkar Road, and the Civil Secretariat, and limited landline connectivity. Aircel was the only service provider which was able to provide some connectivity to its customers through the floods, under its newly introduced 3G internet scheme."

Table 5: Damaged Locations by the 2014 Flood in Kashmir Valley and their Restoration

S.No	Name of Division	No. of locations damaged	No. of locations restored	No. of locations under restoration
	District Anantnag			
1	I.D. Anantnag	347	160	90
2	F.C.D. Anantnag	690	34	343

3	MID Anantnag	16	14	2
	Sub Total	**1053**	**208**	**435**
	District Kulgam			
1	I.D. Kulgam	508	90	130
2	FCD Anantnag	665	5	225
3	MID Anantnag	7	6	1
	Sub Total	**1180**	**101**	**356**
	District Pulwama			
1	I.D. Pulwama	134	51	17
2	I.D. Tral	100	45	25
3	I.C.D. Pampore	49	0	49
4	I.D. Shopian	5	2	0
5	F.C.D. Kakapora	263	0	92
6	MID Anantnag	48	29	19
7	MID Srinagar	1	0	1
8	MICD Srinagar	7	0	7
	Sub Total	**607**	**127**	**210**
	District Shopian			
1	I.D. Shopian	88	54	9
2	FCD Kakapora	57	0	2
3	MID Anantnag	13	10	3
	Sub Total	**158**	**64**	**14**
	District Srinagar			
1	I&FC Division Srinagar	100	0	79
2	MID Srinagar	22	3	19
3	MICD Srinagar	2	0	2
	Sub Total	**124**	**3**	**100**
	District Ganderbal			

1	I&FC Ganderbal	129	40	89
2	MID Srinagar	7	0	7
	Sub Total	**136**	**40**	**96**
	District Budgam			
1	I.D. Budgam	339	116	26
2	F.S.C.D. Narbal	114	15	67
3	MID Srinagar	4	2	2
	Sub Total	**457**	**133**	**95**
	District Baramulla			
1	I&FCD Baramulla	259	20	46
2	I&FCD Sopore	128	34	12
3	F.B.I.D. Tangmarg	140	24	52
4	HYD. Division Uri	82	9	63
5	MID Baramulla	42	30	12
6	MICD Srinagar	1	1	0
	Sub Total	**652**	**118**	**185**
	District Bandipora			
1	Hyd. Division Bandipora	58	4	17
2	I&FCD Sumbal	210	65	137
3	SSD Gurez	58	0	15
4	MID Shadipora	68	45	23
	Sub Total	**394**	**114**	**192**
	District Kupwara			
1	I&FCD Kupwara	88	28	35
2	I&FCD Handwara	53	35	18
3	SSD Tangdar	42	11	31
4	MID Baramulla	8	4	4

	Sub Total	**191**	**78**	**88**
	Grand Total	**4952**	**986**	**1771**

Source: Irrigation and Flood Control Department, Govt. of Jammu and Kashmir (2014).

Table 5 shows the damaged locations by the 2014 flood in Kashmir Valley and their restoration. The number of locations damaged by 2014 Kashmir flood in Anantnag were 1053, in which 208 locations have been restored and 435 locations are under restoration. The number of locations damaged in Kulgam were 1180, in which 101 locations have been restored and 356 locations are under restoration. The number of locations damaged in Pulwama were 607, in which 127 locations have been restored and 210 spots are under restoration. The number of locations damaged in Shopian were 158, in which 64 locations have been restored and 14 locations are under restoration. The number of locations damaged in Srinagar were 124, in which 3 locations have been restored and 100 locations are under restoration. The number of locations damaged in Ganderbal were 136, in which 40 locations have been restored and 96 locations are under restoration. The number of locations damaged in Budgam were 457, in which 133 locations have been restored and 95 locations are under restoration. The number of locations damaged in Baramulla were 652, in which 118 locations have been restored and 185 locations are under restoration. The number of locations damaged in Bandipora were 394, in which 114 locations have been restored and 192 locations are under restoration. The number of locations damaged in Kupwara were 191, in which 78 locations have been restored and 88 locations are under restoration. Thus, the total number of locations damaged in the Kashmir Valley by 2014 flood were 4952, in which 986 locations have been restored and 1771 are under restoration.

4. Loss of Tourism Industry and Handicraft Industry:

Tourism plays a significant role in revenue generation of Kashmir (Malik, 2015). Kashmir is an area of outstanding beauty with fertile, green, mountainous valleys, crystalline blue lakes and high snow covered peaks of the Himalaya. International tourism to Jammu and Kashmir contributed 10% of the gross GDP and 30% of services exports. The effect of the floods on tourist numbers was, therefore, of great concern (Carpenter et.al, 2020). Both tourism and handicraft industries suffered significant loss because of 2014 flood in Kashmir valley due to complete stoppage of tourists for about two months, which created psychological distress among the population of Kashmir as research indicates that natural disasters may produce long-term psychological and somatic damage on affected populations (Abrahams, Price,

Whitlock, & Williams, 1976; Ben-Ezra, 2004). The cancellations for airlines and hotels was 100 percent up to 15th October. Due to less influx of tourists in J&K in 2014, handicraft industry suffered a great loss because it gets lot of income from tourists. Tourism infrastructure and government residential colonies have suffered losses to the tune of 5,000 crore INR (Vithalani and Bansal, 2017). Mohammad Yusuf Chapri, President of the Houseboat Owner's Association told JKCCS that 15 houseboats were completely destroyed by the floods, while serious damages were caused to the other houseboats on the Dal Lake (JKCCS, 2015).

5. Effect on State GDP:

According to the official figures of Jammu and Kashmir government, the SGDP of Jammu & Kashmir suffered a loss of about 15 percent. This is because the floods caused heavy damage to crops, horticulture, infrastructure, handicraft, trade, electricity, railways, communication and tourism.

The floods were described as not just a 'national' but an 'international' disaster by J&K Chief Secretary, Iqbal Khandey, on 29 September, 2014 at the first official press conference held by the state administration, almost three weeks after the flooding. He said that it was a classic case of flooding of urban areas and would be studied worldwide. Kashmir was hit by one of the worst floods in a century in which thousands were rendered homeless. Kashmir had suffered losses in excess of 1 trillion (100,000 crore INR). Across the State, 125000 families have been affected due to floods. According to a rough estimate, the housing sector in Kashmir has suffered losses over 30,000 crore INR while the business sector had suffered losses worth more than 70,000 crore INR (Vithalani and Bansal, 2017). According to Economic Survey 2014-15, Government of Jammu & Kashmir, "The State economy registered growth of 0.40% during 2014-15 as compared to 13.85% in 2013-14 and 12.81% in 2012-13. Growth in GSDP of J&K State registered a negative growth of -1.57% during the year 2014-15 as compared to 5.63% during 2013-14. The lesser growth rate during 2014-15 is mainly attributed to floods of September, 2014, which has shattered the economy of the state affecting particularly Kashmir valley."

6. Loss of livestock:

The September, 2014 flood in Kashmir Valley resulted into death of more than five thousand cattle. The dead cattle were seen floating on the muddy flooded water in every district of Kashmir. The dead cattle from South Kashmir were transported all the way to Srinagar and the districts of North Kashmir by the flood. According to the Divisional Commissioner's

Office, Srinagar, "the total of 52136 cattle died due to the flood. Over 10,000 milk animals and 33,000 sheep and goats perished in the floods."

Table 6: Loss of livestock by 2014 flood in Kashmir valley

District	No. Of cattle lost
Anantnag	5797
Bandipora	11773
Baramulla	34702
Budgam	6265
Ganderbal	6433
Kulgam	7866
Kupwara	10990
Pulwama	725
Shopian	471
Srinagar	7613
Total	**52136**

Source: Divisional Commissioner's Office, Srinagar.

Table 6 reveals that 52136 cattle perished in the flood waters during 2014 flood in Kashmir Valley, in which district Baramulla recorded the highest deaths with 34702 cattle loss followed by district Bandipora with 11773 and Kupwara district with loss of 10990 cattle loss, thus signifying great cattle loss.

Reasons for different degree of damage in different districts and Vulnerability assessment:

Vulnerability assessment at varied spatial scales is a key component to address the disaster risk. Vulnerability has emerged as a central concept for understanding what it is about the condition of people that enables a hazard to become a disaster, however, almost every aspect of vulnerability conceptualisation and measurement is the subject of intense debate. Various definitions of vulnerability have been provided in the context of natural hazards and climate change (Varnes, 1984; Blaikie et al., 1994; Twigg, 1998). From these definitions, vulnerability can be viewed from the perspective of the physical, spatial or locational, and socioeconomic characteristics of a region. Vulnerability to flood hazards is likely to increase unless effective flood mitigation and management activities are implemented. An important prerequisite for developing management strategies for the mitigation of extreme flood events is to identify areas of potentially high risk to such events, thus accurate information on the

extent of floods is essential for flood monitoring, and relief (Smith, 1997). Over the last decades, the Kashmir valley has suffered intense forest degradation and has lost ~0.45% of its forest cover every year between 1930 and 2013 (Wani et al., 2016; Rather et al., 2016; Reddy et al., 2016). Most of the forest degradation has taken place in the Pir Panjal mountain range lying towards the W-E flank of the Kashmir valley. During the same period, settlements increased by ~400%, not only contributing towards further forest degradation but also encroaching upon wetland areas within the floodplain of the Jhelum River (Ballesteros-Cánovas et.al, 2020). Commentators and reports on the Kashmir floods, have overwhelmingly attributed the devastating nature of the flooding to the degradation of Kashmir's ecology, including the effects of trans Himalayan climate change, and the fragmentation and destruction of wetlands, depletion of forest cover, soil erosion, urbanization of flood plains, and encroachments on water bodies and river embankments (Chauhan et al., 2014) The specific catchment characteristics of the Jhelum River – in particular the bowl-shaped topography of the valley – and land degradation over the last decades played an important role in the evolution of the flood event (Meraj et al., 2015). The magnitude of the flood was considered unprecedented, because it represented the largest discharge contained in systematic records (Farooq, 2014). Understanding the occurrence of such extreme floods is crucial when it comes to the implementation of Disaster Risk Reduction (DRR) strategies, as they can contribute to better preparedness and coping capacities, and as they can increase resilience of inhabitants against future flood disaster. The design and implementation of DRR activities seem highly relevant in Kashmir due to the extremely high vulnerability of the ever growing population on the floodplains (population increase: 26% between 2001 and 2011 (Census of India, 2011), and multiplied by 10 since late 19th century (Digby, 1890). This strong demographic increase has also resulted in increased exposure of infrastructures on the floodplains (Malik and Bhat, 2014).

The damage due to 2014 flood was not uniform in all the districts of the Kashmir Valley. Different districts experienced different intensity and extent of damage due to physical and social vulnerability. Srinagar and Anantnag districts suffered the greatest loss among all the districts because these two districts lie in the high vulnerability zones of the Jhelum floodplain. These two districts constitute large percentage of population that resides along the banks of the Jhelum River, and the flooding of the Jhelum River was one of the main factors of inundation in the Kashmir Valley. However, in remaining districts, the percentage of damaged kacha houses is greater than Srinagar and Anantnag districts while as

in the districts of Srinagar and Anantnag, the percentage of damaged kacha houses is greater than other districts, thus implying that the economic condition of the districts of Srinagar and Anantnag is relatively better than other districts of the Kashmir Valley. Social and physical vulnerability played an important role in the extent of damage in different districts as these factors are key determinants of the impact of any disaster. The physical factors like slope and high speed of water in upper reaches of district Anantnag and other south Kashmir areas, as South Kashmir lies at higher altitude than North Kashmir, led to higher damage in the district while as in low lying districts of north Kashmir like Baramulla and Budgam, the slope and water speed was relatively low, which resulted into lesser damage. Thus, location, physical and social vulnerability, socio-economic conditions of people, slope and speed of water were the main factors for varying impact of flood on different districts during 2014 flood in Kashmir Valley.

Conclusion: The impact of 2014 flood in Kashmir valley was massive. It disrupted the normal functioning of the society, degraded the environment, damaged thousands of houses in every district, hampered the economy seriously, created panic among people, shattered the lives, led to poverty, imposed many diseases on people and had overall grave socio-economic implications. The people suffered badly due to the deluge and the flood had a long time impact on environment, economy and the lives of people. The flood did not only result in destroyed infrastructure and damaged property, but also had an adverse social impact on citizens affected by the disaster. The long term effects of flooding on psychological health may perhaps be even more important than illness or injury. The impact of 2014 flood Kashmir flood on physical and mental health was extensive. It resulted into the loss of lives, emotional consequences, stress, panic and anxiety. The stress of dealing with a traumatic event can exacerbate pre-existing health conditions and lead to a variety of illnesses that continue to impact lives long after flood waters have receded. Making repairs, cleaning up, and dealing with insurance claims can be stressful. If there is a lack of support during the recovery process, stress levels may increase further. Being evacuated from home and losing personal possessions undermine people's sense of place as well as their sense of attachment and self-identity. Flood victims frequently reported feeling isolated and depressed, which created social tension and psychological distress among the population of Kashmir. The political stability of Kashmir Valley is key for the proper management of resources and framing of disaster management policies so that the impact of floods could be reduced and millions of lives could be saved.

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