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Climate Change, Climatic Hazards and National Security of Nepal

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Abstract

This article examines the impact of climate change on the national security of Nepal by studying secondary data from the Ministry of Home Affairs. The data covers the last five years and focuses on five climate hazards: flood, landslide, windstorm, forest fire, and avalanches. Through an analysis of the human and economic costs and the frequency of occurrence, the study identifies windstorms as an emerging threat to national security. The research highlights that climatic hazards are affecting Nepal's security, and the study particularly investigates their impacts in the past year. The human and economic costs caused by these climatic hazards were assessed based on factors such as: deaths, injuries, missing persons, affected families, destroyed houses, displaced sheds, and estimated monetary losses. The study indicates a fluctuation in the frequency and impacts of some climatic hazards due to climate change, with 2076 BS being the most destructive year. Traditional threats such as floods and landslides persist, while windstorms are increasingly becoming stronger. Additionally, the incidents of forest fires have risen in the last two years. Among the five hazards, avalanches seem to be the least destructive in terms of human and economic costs. The findings underscore the importance of addressing climate change to safeguard Nepal's national security.

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Introduction

Climate change has been one of the major issues of contemporary world. Nepal is affected by climate change with shifted of species' ranges to higher altitudes, melting of the glaciers and increment in the frequency of precipitation and other issues. Experts have estimated that by 2030. As a result of climate change the number of people affected by river flooding can be increased by double (IDMC & NRC, 2023).

Climate change is defined as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC, 1992).

Different factors are considered responsible for climate change. Hotter temperature, more severe storms , increased drought, a warming, rising ocean, losses of species, not enough food, more health risks and poverty and displacement are some of the effects of climate change (United Nations).

Climate hazards are major phenomenon of climate change. Climate hazard is understood as the climate-related physical events or trends or physical impacts that may cause loss of life, injury or health impacts as well as damage and loss of property, infrastructure, livelihoods, service, provision, ecosystems and environmental resources. These include: warming, precipitation, floods, drought, heat waves, fires, sea level, storms, changes in natural land cover, and ocean chemistry (Bhatti et al., 2023). Due to the climate change climate hazards are affecting human and their livelihoods. In New York City there is increment in destruction of lives and economy by climate hazards caused by climate change (Depietri & McPhearson, 2018). According to a study Nepal is also facing multiple climatic hazards due to the climate change. These climate hazards are directly affecting the human lives in Nepal. One of the examples is disaster displacement. During 2012-2021 the number of displaced people in Nepal was 3.4 million. In 2022 alone displacement of new 32000 people took place due to the disaster in Nepal. Climate change and low level of human development has increased the risk of disaster displacement in Nepal (Cazabat, 2022).

With the expansion of the scope of national security climate change has been associated with national security. Traditionally national security was understood as protection of state from external threats. It was more state centric and external threat focused. But after the cold war, the concept of national security has been sifted to people centric and focused on internal threats. It stresses more on people's security through human development that is through the food, employment and environmental security (Waisová, 2003). The overarching matrices of security are fast changing in present world. Human security advocates that non-traditional security parameters actually determine the state of human and then national security (Lama, 2018).

Climate change is considered as threat to the nation from state as well as human threat prospective. From state security prospective it involves to manage climate-related threats to safeguard their sovereignty, military strength, and power in the international

system and from human security prospective it includes a variety of concerns ranging from the economy, the environment, the community, to health, the body and personal safety (Arnall, 2023).

Nepal is a mountainous country in South Asia. Due to its topography it is vulnerable to natural hazards. About 83 percent of its land is mountainous and hilly and remaining 17 percent of the land is plain. Disaster triggered extreme climate events like flood, landslide, avalanche have been increased by climate change in Nepal. That is threatening the human life and livelihood (Dhungana et al., 2013).

In Nepal, Climate change has been felt other areas i.e. temperature rise, precipitation, floods etc. From 1971 to 2005 average temperature of Nepal had increased by 0.05˚C/ year. Similarly the precipitation is increasing annually by 13 mm. The flood days in certain rivers of Nepal have increased. Similarly, the heavy rainfall events are increased during monsoon (Devkota, 2014).

The rising temperature has resulted the melting of glaciers and increment of the frequency of precipitation with heavy floods. It is projected that in 21st century the natural hazards like drought, heat wave, river flooding, and glacial lake outburst flooding will intensify the human life risk in Nepal (WB & ADB, 2021) . That means national security will be threatened via human security.

The Himalaya mountain located on the northern part of Nepal is directly associated with the livelihood of the people of this region. In one hand it works as the water tower of this region which provides continuous water to the major rivers of this region, and in another hand it assists for rain fall during monsoon season. Monsoon is the agricultural season of South and South-East Asia. Nepal has about two third of the Himalaya range which is also affected by climate change. While addressing the United Nations Framework Convention on Climate Change (UNFCCC) held in Poland in December 2018, Nepal's then president had informed that Himalayan glaciers are melting; snow-capped mountains are becoming dark and dull which is causing the high possibility of glacial lake outbursts and it has adverse effect in river- basin system of Nepal (Bhattarai & Karki, 2020).The effects of climate change in Himalayan region is so strong that Mount Everest's glaciers have lost 2000 years of ice in just 30 years. Due to the variable of weather this year 17 deaths occurred in Mount Everest (Petersen, 2023).

Forest fire in another affected areas from climate change. Human activities and other factors are responsible for the forest fire but scientists have observed the changes in "fire weather" i.e. when the chances of fire is high (Doer et al., 2022). Nepal is also affected by the forest fire. Despite its low industrial carbon emission Nepal's forest fire is remarkably contributing in it (Khadka, 2021). This is causing the environment pollution which is accelerating the climate change with the result of climatic hazards. In this way climatic vicious cycle is developing.

Another effect of climate change is the strong storms. There had been long debate about the effects of climate change on strong storms. In 2018 a study from NASA concluded that there is relation between extreme storms and temperature rise. According to that

study, temperature rise has increased the occurrence of strong storms in certain part of the earth (Buis, 2020). Nepal is also the victim of wind storm. Every year Nepal faces large number of wind storm in different parts of the country. In addition to that the effect of climate change can be felt in dieses also. Malaria and dengue have moved to the higher altitudes of Nepal (Karki et al., 2009) that is directly affecting the wellbeing of people in Nepal; that is how it is related with the human security prospective as well.

The constitution of Nepal has included the attainment of all round human security, social good-will, tolerance and cohesion and reduction of risks of natural disaster as the directive principles and policies of the state (Law commission, 2015). National Security Policy of Nepal has also identified the climate change and natural disaster as threat for ecological equilibrium. It has mentioned protection of environment and climate as the matter of paramount national interest. In addition to that, it has recognized climate change and environment loss as national security threat and challenge to national security (MoD, 2016).

This article has the two objectives. The first objective is to identify the trend of five climate hazards i.e. flood, landslide, windstorm, forest fire and avalanche in Nepal covering the period of 2075 BS to 2079 BS. Second objective of this article is to have comparative study of the human and economic costs of those climate hazards from 2075 BS to 2079 BS.

Review of the Literature

Malla (2023) explained climate change as the national security issue and it has to be addressed accordingly but Nepal has failed to do so. To justify his opinion, the author has listed the wide spread effects of climate change in Nepal. He has covered the areas of national defense, economy, development, environment, sociocultural aspects, politics and diplomatic and foreign relations. Unlike other Nepali writers, he has related climate change and national security with the security of infrastructures of Nepali army and interference in military tactics and technology. He has explained about the cross border spillover of disasters caused by climate change and that can threaten the national security of Nepal i.e. glacier lake outburst in Tibet and construction of flood protection structure by India in Indo-Nepal border. Though he has covered wider areas affected by climate change but his work is mainly focused on effects flood. He has briefly covered about the trend of forest fire but it seems that other major climate hazards of Nepal like windstorm, avalanche, and landslide are overlooked (Malla, 2023).

US department of Defense (2021) states in its report that climate hazard threaten national security both directly and indirectly. According to the report climate hazard can cause the scarcity of resources, which may result instability in local and regional level. That threatens the US national security. Another potential threat to national security is identified as disaster migration which invites competition for the resources resulting conflict. As US is the global power such developments threaten its national interests. Though this report does not specify about a particular climate hazard but it talks about strategic implications of climate hazards in national security (Department of Defense, 2021).

Ministry of Forests and Environment (2021) in its report mentioned that effects of climate change have been increased in Nepal through the climate hazards and destruction done by them. This report has analyzed the data from 1971 to 2019. This report covered different 14 climate hazards and their economic and human cost. According to this report, some of the districts in terai region are vulnerable from flood and forest fire. Some of the districts from both terai and hilly regions are vulnerable to wind storm and though the incidents of avalances are increasing but they are not significant. In this report, hazard-wise comparison of deaths affected population and economic losses among the five hazards of (flood, fire, landslide, windstorm and avalanches) revealed that landslides and floods are the top most. Fire causes the most economic losses (56.6 percent) followed by floods (31 percent) and landslides (3.7 percent). This report has studied the 49 yeas data which provides best opportunity to study the trends of the climate hazards. Similarly, study of 14 different climate hazards of all the districts of Nepal has make it easy to have a comparative study of different districts of Nepal (MoFE, 2021).

Ministry of Home Affairs (2022) informs, from 2015 to 2021 there were 22,250 incidents of different climate hazards. In this period these hazards took 12,315 lives, injured, 32,464 people affected 84,483 families and had the estimated economic loss of NRs 163,409,909. This data does not provide separately the frequency of incident, economic and human cost of individual climate hazard. This makes difficult to compare among these climate hazards (Ministry of Home Affairs, 2022).

International Federation of Red Cross and Red Crescent Societies (2021) in its report state that there has been climatic variation as a result of climate change in Nepal. According to the report there is fluctuation of rain fall timing of rain fall in different parts of Nepal. In addition to that the report informs that due to the heavy rain, the chances of landslides have increased in Nepal. This report is focused on rainfall, landslide and their relation. According to this report, due to the climate change some parts of Nepal are facing drought and temperature rise. This is directly affecting the health of the local population. Though this report is limited within four clime hazards it has analyzed the relation between climate change and public health. Public health is directly related with the human security of the nation which is ultimately the national security issue (IFRC, 2021).

Among the reviewed literatures first two have clearly accepted climate change as the national security threat. They have mentioned about the climate hazards which can threaten the national security. Rest of the literatures have described about different climate hazard and their trend in different time frame in Nepal. These literatures lack the comparative study of major climate hazards of Nepal within the time frame of last five years. This time frame is significant because new government within the framework of new constitution of Nepal that advocated the betterment of people, this timeframe is significant.

Methodology

This study adopted descriptive quantitative approach. Five years secondary data from

the public domain was analyzed from 2075 BS to 2079 BS about the five climatic hazards (i.e. flood, landslide, forest fire, wind storm and avalanche). The data were collected from Disaster Risk Reduction online Portal of Ministry of Home Affairs, Government of Nepal. This is the only source of data for this study. Five years longitudinal data were analyzed to study the relation between the independent variables i.e. climatic hazards and dependent variables i.e. human and economic costs. Higher in number of dead, injured, missing and affected family is considered the higher the human cost. In the same way higher the higher the number of destroyed houses, displaced sheds and estimated costs in terms of NRS is considered the higher economic cost. Higher the human or economic or both cost higher the negative effect in human security.

Discussion

Distribution of Climatic Hazard Incidents

Among different types of climatic hazards, this article has studied five major climatic hazards. They are flood, wind storm, forest fire, landslide and avalanche. From 2075 to 2079 BS, among these five climatic hazards landslide had taken place 1929 times which is the highest one respectively followed by wind storm 621 times, flood 597 times, forest fire 284 times and avalanche 13 times. In 2077 BS landslide had highest record of 489 times and the lowest 328 times in 2079 BS. Similarly, avalanche had the highest record of 4 times in 2075 BS and 2078 BS. In 2077 BS there was not any record of avalanche. The highest number of floods was recorded 204 in 2076 BS and the lowest number was in 2079 which was 59. 2075 BS witnessed the highest numbers of wind storm i.e. 226 and lowest number was recorded 59 in 2078 BS. There were not any incidents of forest fire in 2075 BS and 2077 BS. But 2079 BS witnessed the highest number of forest fire i.e. 190. Table 1 shows detail description of the climatic hazards in last five years.

Table 1

Five Years Distribution of Climatic Hazard Incidents

Year	Flood	Wind Storm	Forest Fire	Landslide	Avalanche
2075	82	226	0	334	4
2076	204	149	2	434	2
2077	97	80	0	489	0
2078	155	59	92	344	4
2079	59	107	190	328	3
Total	**597**	**621**	**284**	**1929**	**13**

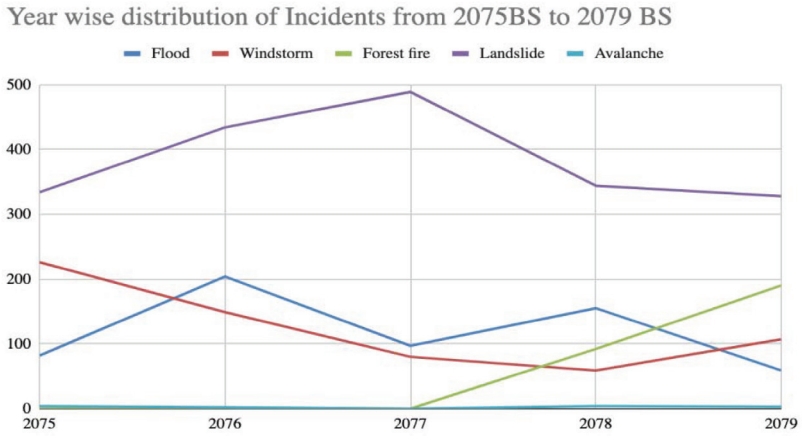
Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Figure 1 shows the trend of the climatic hazards. The figure shows that forest fire has ascending trend whereas avalanche has linear trend. Rest of the others has fluctuation in their trend. Windstorm has fluctuation in its trend but according to last two years, the incidents of windstorm in increasing where as in the same period the incidents of

landslide are decreasing.

Figure 1

Distribution of Incidents



Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Human and Economic Cost by Flood

In last five years total 214 people were dead by flood. Among them the largest number i.e. 73 were dead in 2076 BS and the lowest i.e. 17 people were dead in 2075 BS. In the same period 88 people were injured by the flood. In 2075 the highest number people i.e. 27 injured by the flood and the lowest number of injured was 11 in 2077 BS. Total 116 people were missed by flood in last five years. In 2077 BS 37 people were missed which was the highest number and the lowest number of missing people was 3 in 2075 BS. The flood had affected 5100 families in last five years. In 2076 BS the highest number of family were affected by flood which was 3073 and lowest number of affected family was 155 in 2079 BS.

From economic prospective total 3860 houses were destroyed by the flood in last five years. In 2076 the highest number of houses was destroyed by the flood which was 2359. The lowest number of houses was destroyed by the flood was 71 in 2079 BS. In the same period total 160 sheds were displaced by the flood. Among them the largest number was 76 in 2076 BS and the lowest number was 6 in 2075 BS. Below Table 2 shows the human and economic losses caused by flood in last five years in detail.

Table 2

Five Year Distribution of Incidents by Floods

Year	Dead	Injured	Missing	Affected Family	Houses Destroyed	Displaced Shed
2075	17	27	3	1080	560	6
2076	73	19	27	3073	2359	76
2077	42	11	37	512	214	25

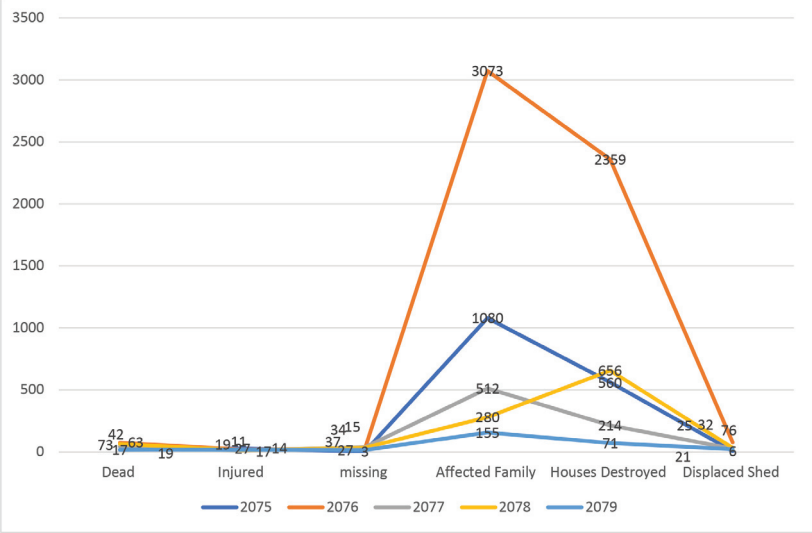
2078	63	14	34	280	656	32
2079	19	17	15	155	71	21
Total	**214**	**88**	**116**	**5100**	**3860**	**160**

Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Figure 2 describes the general trend of human and economic loss caused by the flood in last five years. It shows that the number of dead caused by flood is in fluctuation. So it does not have any specific trend. But comparatively the numbers of injured and missing seem linear and more stable. The number of affected family by flood is decreasing every year. The number of houses destroyed by flood is fluctuated. And number of displaced shed seems comparatively stable but increase from 2076 BS.

Figure 2

Incidents Caused by flood in last five years



Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Human and Economic Cost by Wind Storm

In last five years total 75 people were dead by wind storm. Among them the largest number i.e. 45 were dead in 2075 BS and the lowest i.e. 3 people were dead in 2078 BS. In the same period 1411 people were injured by the wind storm. In 2075 the highest number people i.e. 1199 injured by the wind storm and the lowest number of injured was 10 in 2078 BS. During last five years only one person was missed by wind storm in 2078 BS. The wind storm had affected 15815 families in last five years. In 2076 BS 10723 families were affected by the wind storm which was the highest in the last five years and lowest number of affected family was 271 in 2079 BS.

From economic prospective total 6048 houses were destroyed by the wind storm in last five years in Nepal. In 2076 the highest number of houses was destroyed by the wind

storm which was 4167. The lowest number of houses was destroyed by the wind storm was 233 in 2079 BS. In the same period total 194 sheds were displaced by the wind storm. Among them the largest number was 110 in 2076 BS and the lowest number was 12 in 2077 BS. Below Table 3 shows the human and economic losses caused by wind storm in last five years in detail.

Table 3

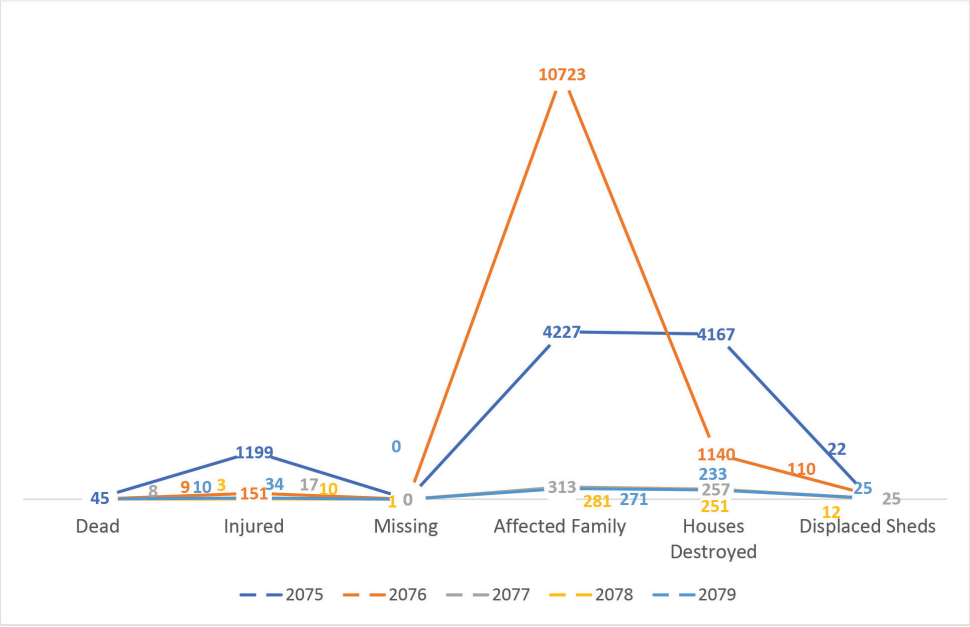
Five Year Distribution of Incidents Wind Storm

Year	Dead	Injured	Missing	Affected Family	Houses Destroyed	Displaced Shed
2075	45	1199	0	4227	4167	22
2076	9	151	0	10723	1140	110
2077	8	17	0	313	257	25
2078	3	10	1	281	251	12
2079	10	34	0	271	233	25
Total	**75**	**1411**	**1**	**15815**	**6048**	**194**

Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Figure 3 describes the general trend of human and economic loss caused by the wind storm in last five years. It shows that the number of dead caused by wind storm had decreased after 2075 BS but it is linear. The number of injured people by wind storm is fluctuated. There is only one case of missing by wind storm in last five years. Number of affected family, houses destroyed and displaces sheds is fluctuated.

Figure 3



Incidents Caused by Wind Storms in Last five years

Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Human and Economic Cost by Forest Fire

In last five years total 4 people were dead by forest fire. Among them the largest number i.e. 3 were dead in 2078 BS and there were no deaths from forest fire in 2075, 2076 and 2077 BS. In the same period 5 people were injured by forest fire. The highest number person injured by forest fire was 3 in 2079 BS. There were not any injury cases caused by forest fire in 2075, 2076 and 2077 BS. During last five years there were not any cases of missing caused by forest fire. The forest fire had affected 78 families in last five years. In both 2078 and 2079 BS the highest 38 families were affected by forest fire and no families were affected by forest fire in 2075 and 2077 BS.

From economic prospective total 53 houses were destroyed by the wind storm in last five years in Nepal. The forest fire did not cause destruction to any houses in 2075, 2076 and 2077 BS. In 2078 forest fire had destroyed 29 houses which was the highest number in last five years. In the same period total 13 sheds were displaced by the forest fire. Among them the largest number was 11 in 2079 BS. There were not any cases of displacement of sheds caused by forest fire in 2075, 2076 and 2077 BS. Below Table 4 shows the human and economic losses caused by wind storm in last five years in detail.

Table 4

Five Year Distribution of Incidents Forest Fire

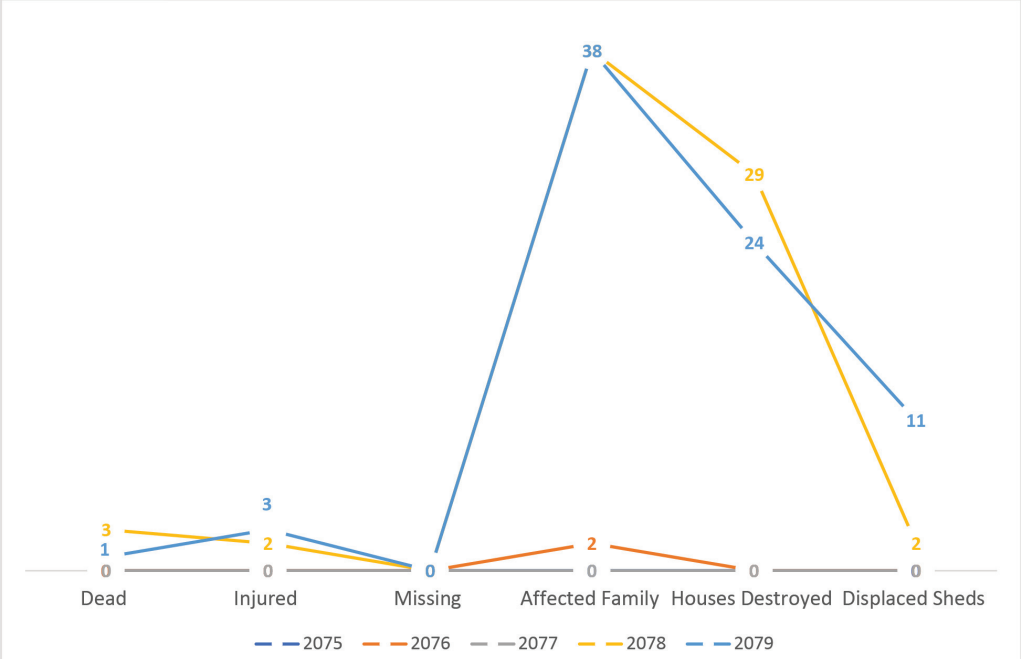
Year	Dead	Injured	Missing	Affected Family	Houses Destroyed	Displaced Shed
2075	0	0	0	0	0	0
2076	0	0	0	2	0	0
2077	0	0	0	0	0	0
2078	3	2	0	38	29	2
2079	1	3	0	38	24	11
Total	**4**	**5**	**0**	**78**	**53**	**13**

Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Figure 4 describes the general trend of human and economic loss caused by forest fire in last five years. It shows that the number of dead caused by forest fire has decreased and in linear pattern. Though the number of injured caused by forest fire in increased but it is also in linear pattern. There are not any cases of missing by forest fire in last five years. The number of affected family seems fluctuation in its pattern but has increased in last two years in linear pattern. Similarly, the number of houses destroyed by forest fire is decreasing but in linear pattern. The number of displaced sheds seems increasing.

Figure 4

Incidents Caused by Forest Fire in Last five years



Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Human and Economic Cost by Landslide

In last five years total 750 people were dead by Landslide. Among them 301 were dead in 2077 BS which was the largest number of dead caused by landslide in last five years. In the same period the lowest number of dead by landslide was 83 people in 2076 BS. Total 671 people were injured by landslide in last five years. The highest number of injured people was 226 in 2077 and the lowest number of injured people by landslide was 81 in 2076 BS. In last five years there 127 people got missed by landslide in Nepal. Only 2 people got missing in 2075 which was the lowest number and 64 people got missed in 2077 which was the largest number of people to get missing by landslide in last five years. The landslide had affected 7166 families in last five years. The largest numbers of families' i.e 1987 were affected by landslide in 2079 BS and the smallest number of affected family was 615 in 2078 BS.

From economic prospective total 5737 houses were destroyed by landslide in last five years in Nepal. In 2076 BS, 2717 i.e. houses the largest numbers of houses were destroyed by landslide whereas the previous year the smallest number of houses i.e. 302 houses were destroyed by landslide in 2075 BS. During this period total 933 sheds were displaced by landslides. The largest numbers of sheds i.e. 659 were displaced by landslide in 2076 BS and the lowest number of displaced shed was 48 in 2075 BS. Table 5 shows the human and economic losses caused by wind storm in last five years in detail.

Table 5

Five Year Distribution of Incidents Landslide

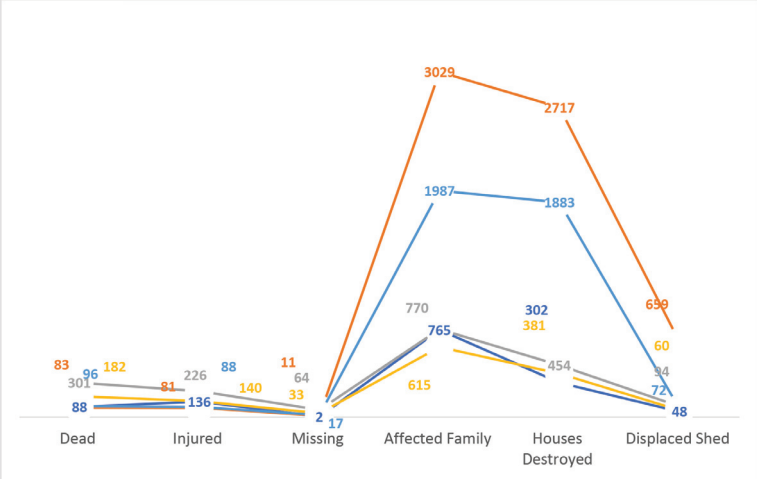
Year	Dead	Injured	Missing	Affected Family	Houses Destroyed	Displaced Shed
2075	88	136	2	765	302	48
2076	83	81	11	3029	2717	659
2077	301	226	64	770	454	94
2078	182	140	33	615	381	60
2079	96	88	17	1987	1883	72
Total	**750**	**671**	**127**	**7166**	**5737**	**933**

Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Figure 5 describes the general trend of human and economic loss caused by landslide in last five years. It shows that the number of dead caused by landslide is fluctuated. But it is decreasing. Situation is same in case of injured missing persons, displaced shed also. The number of affected family and houses destroyed by landslide seems fluctuated.

Figure 5

Incidents Caused by Landslide in Last five years



Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Human and Economic Cost by Avalanche

In last five years total 12 people were dead by avalanche. Among them 8 was the highest number of dead in 2075 BS. There were no deaths caused by avalanche in 2076 and 2077 BS. During same period 23 people were injured by avalanche in Nepal. The highest numbers of people i.e. 11 were injured by avalanche in 2078 and 2079 BS. But there were not any injury caused by avalanche in 2075 and 2077 BS. In last five years 4 people were missed by avalanche in Nepal. Among them 3 were missed in 2079 BS. But there were not any cases of missing by avalanche in 2075, 2077 and 2078 BS. Total

40 families were affected by the avalanche in last five years. Among them the largest number of families i.e. 16 was affected in 2079 BS and no family was affected by avalanche in 2077 BS

From economic prospective in last five year only one house was destroyed and another only shed was displaced by the avalanche in 2078 BS. Table 6 shows the human and economic losses caused by avalanche in last five years in detail.

Table 6

Five Year Distribution of Incidents Avalanche

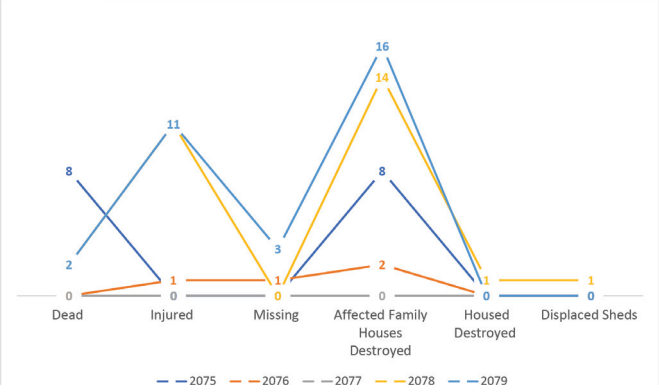
Year	Dead	Injured	Missing	Affected Family	Houses Destroyed	Displaced Shed
2075	8	0	0	8	0	0
2076	0	1	1	2	0	0
2077	0	0	0	0	0	0
2078	2	11	0	14	1	1
2079	2	11	3	16	0	0
Total	**12**	**23**	**4**	**40**	**1**	**1**

Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Figure 6 describes the general trend of human and economic loss caused by avalanche in last five years. It shows that the number of dead caused by landslide is fluctuated but it is in linear pattern. Similarly numbers of injured, number of missing, number of affected family are fluctuated but it is increasing. Numbers of houses destroyed and displaced sheds are fluctuated in last five years.

Figure 6

Incidents Caused by Avalanche in Last Five Years



Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Estimated Monitory Cost by Climatic Hazards

Among the five climatic hazards flood had the highest cost of damage in last five years which is estimated NRs 1,28,62,16,649, it is followed by landslide NRs 70,90,33,600,

Wind Storm NRs 32,69,45,498, Forest Fire NRs 1,78,86,200 avalanche zero. The highest damage caused by flood was in 2076 BS it was NRs 1,06,34,95,249 and the lowest damage was NRs 3, 45, 30,900. Similarly in total damage of NRs 32,69,45,498 caused by wind storm the highest was NRs 16,56,06,800 in 2079 BS and the lowest was NRs 1,35,56,500. The total damage caused by forest fire was NRs 70, 90, 33,600 in last five years. There were not any monitory damage in 2075 and 2077 BS. The highest damage was NRs 1,37,00,000 in 2079. Landslide had the total damage of NRs 70, 90, 33,600 in last five years. The highest damage was NRs 40,14,86,00 in 2076 BS and the lowest damage was NRs 3, 46, 35,000 in 2078 BS. Avalanche did not have any monitory damage in last five years. Table 7 shows the estimated loss in NRs caused by climatic hazards in last five years.

Table 7

Estimated Loss by Climatic Hazard Incidents in Five Year (in NRs)

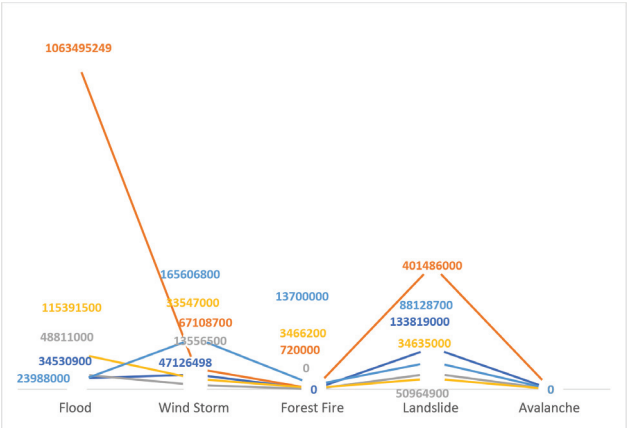
Year	Flood	Wind Storm	Forest Fire	Landslide	Avalanche
2075	3,45,30,900	4,71,26,498	0	13,38,19,000	0
2076	1,06,34,95,249	6,71,08,700	7,20,000	40,14,86,000	0
2077	4,88,11,000	1,35,56,500	0	5,09,64,900	0
2078	11,53,91,500	3,35,47,000	34,66,200	3,46,35,000	0
2079	2,39,88,000	16,56,06,800	1,37,00,000	8,81,28,700	0
Total	**1,28,62,16,649**	**32,69,45,498**	**1,78,86,200**	**70,90,33,600**	**0**

Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Figure 7 shows trend of the monitory loss caused by five climatic hazards in last five years. In this figure we can see except avalanche that the monitory damage caused by climatic hazards is fluctuated.

Figure 7

Monitory Costs Caused by Climatic Hazards in Last Five Years



Note. Adopted from Nepal disaster risk reduction portal of MoHA (2023).

Comparison of Incidents and Losses

In last five years landslide had occurred the highest numbers times in Nepal and avalanche had occurred the lowest numbers of times. Among the 1055 dead landslide had killed the highest number of people i.e. 750 and forest fire had killed 4 people which was the lowest number. Among the 2198 injured wind storm had injured the highest number of people i.e 1411 and forest fire had injured 5 people which was the lowest number of injured. Total 248 people had been missing in this period among them the highest number of missing i.e 127 was caused by landslide and forest fire didn't cause any missing. Among 28,199 affected families the highest number of families i.e. 15815 were affected by wind storm and the lowest 40 families were affected by avalanche. In total 1301 sheds were displaced in this period. Avalanche had displaced only one shed and landslide had displaced 933 sheds as the highest numbers of displaced shed. It is estimated that climatic hazards cost NRs 2,340,081,947 during this period. Among them the avalanche did not have any monitory loss whereas flood had the highest cost of NRs 1,28,62,16,649. Table 8 shows the comparison between incidents and losses.

Table 8

Comparison of Incident and Loss

Climatic Hazards	Incidents							
	Frequency	Dead	Injured	Missing	Affected Family	House Destroyed	Displaced Sheds	Estimated Monitory Cost (In NRs)
Flood	597	214	88	116	5100	3860	160	1,28,62,16,649
Wind Storm	621	75	1411	1	15815	6048	194	32,69,45,498
Forest Fire	284	4	5	0	78	53	13	1,78,86,200
Landslide	1929	750	671	127	7166	5737	933	70,90,33,600
Avalanche	13	12	23	4	40	1	1	0
Total	**3,444**	**1,055**	**2,198**	**248**	**28,199**	**15,699**	**1,301**	**2,340,081,947**

Note. MoHA (http://www.drrportal.gov.np/reports).

From the discussion we have seen that climatic hazards are affecting both human and economic sectors of Nepal every year. In this way they have direct effects in human security of Nepal. It appears that there may not any relation between the number of incidents and intensity of damage caused by it. It seems that it may not have relation between flood and landslides in Nepal. From human and economic point of view 2076 BS had the most destructive year. The major contributors for this destruction were flood, windstorm and landslide.

In terms of dead injury and missing person landslide is the most fatal climatic hazard of Nepal which is respectively followed by windstorm, flood, avalanche and forest fire. If the number of affected family is also included then windstorm is the most fatal climatic hazard followed by landslide, flood forest fire and avalanche. In fact the incidents of windstorm are fluctuated than of flood and landslide. The incidents of 2076 BS brought the windstorm on the top otherwise the in comparatively Landslide and flood are most

occurring as well as most damaging climatic hazards of Nepal.

In case of economic loss without land slide had destroyed the largest number of houses and displaced the sheds which is respectively followed by windstorm, flood, forest fire and avalanche. In case of monitory loss flood cost the highest respectively followed by landslide, windstorm, forest fire and avalanche

From both the human and economic cost the degree of threat is higher from landslide which is respectively followed by windstorm, flood, forest fire and avalanche.

The frequency of landslide seems stable in comparison to other climatic hazards. Other of other climatic hazards is fluctuated. Similarly, the cases of forest fire have increased significantly in last two years. These can be the effects of climate change.

Among the five climatic hazards, comparatively the destruction caused by landslide is stable than the others. There is fluctuation in the level of destruction caused by avalanche and forest fire.

Landslide and flood had been our traditional climatic hazards threatening life and property every year. But wind storm can compete with them. Similarly, considering the last two years data if not addressed in an effective way forest fire can another big challenge in few years.

Conclusion

The incidents caused by the climatic hazards have threatened the human security of Nepal that ultimately affects the national security of Nepal. The effects of climate change can be observed in Nepal with the fluctuation and increase in the incidents as well as impacts of climatic hazards. Large numbers of lives and properties and affected by climatic hazards every. Some climatic hazards have been stronger in terms of both frequency and effects. They are posing new threats to human security of Nepal. The linear effect of some of the climatic hazards shows that in these five years sufficient measures are not taken to address these threats. Considering these facts it is suggested that Nepal has to take adequate action to address landslide and flood. Special attention should be given to wind storm. Forest fire has to be addressed on time not to prevent it from becoming a major threat as landslide and flood. Avalanche incidents have to be monitored.

Reference

Arnall, A. (2023). Climate change and security research: Conflict, securitisation and human agency. *PLOS Climate, 2*(3), Article 3. https://centaur.reading.ac.uk/110372/

Bhattarai, K. D., & Karki, S. (2020, January 27). *Nepal gets serious about climate change.* Thediplomat.com. https://thediplomat.com/2020/01/nepal-gets-serious-about-climate-change/

Bhatti, M. T., Anwar, A. A., & Hussain, K. (2023). Characterization and outlook of climatic hazards in an agricultural area of Pakistan. *Scientific Reports, 13*(1), Article 1. https://

doi.org/10.1038/s41598-023-36909-4

Buis, A. (2020, March 10). *How climate change may be impacting storms over earth's tropical oceans.* World Economic Forum. https://climate.nasa.gov/explore/ask-nasa-climate/2956/how-climate-change-may-be-impacting-storms-over-earths-tropical-oceans/

Cazabat, C. (2022). *Disaster displacement Nepal country briefing* (pp. 5–15). Internal Displacement Monitor Center and Asian Development Bank.

Department of Defense. (2021). *Department of defense climate risk analysis.* Office of the Undersecretary for Policy (Strategy, Plans, and Capabilities.

Depietri, Y., & McPhearson, T. (2018). Changing urban risk: 140 years of climatic hazards in New York City. *Climatic Change, 148*(1), 95–108. https://doi.org/10.1007/s10584-018-2194-2

Devkota, R. P. (2014). Climate change: Trends and people's perception in Nepal. *Journal of Environmental Protection, 5*(4), Article 4. https://doi.org/10.4236/jep.2014.54029

Dhungana, H., Pain, A., Khatri, D., Gurung, N., & Ojha, H. (2013). *The Impact of climate change in Nepal* (Climate Change and Rural Institutions in Nepal, pp. 9–18). Danish Institute for International Studies. https://www.jstor.org/stable/resrep15677.6

Doer, S. H., Santin, C., Abatzoglou, J., Jones, M. W., & Canadell, P. (2022, July 7). *Wildfire risk has increased, but we can still influence where and how fires strike.* World Economic Forum. https://www.weforum.org/agenda/2022/07/climate-change-wildfire-risk-has-grown-nearly-everywhere-but-we-can-still-influence-where-and-how-fires-strike/

IDMC & NRC. (2023). *Global report on internal displacement* (pp. 59–71). Internal Displacement Monitor Center and Norwegian Refugee Council.

IFRC. (2021). *Climate Change Impacts on Health and Livelihoods: Nepal Assesmsnt* (pp. 6–10). International Federation of Red Cross and Red Crescent Societies.

Karki, M., Mool, P., & Shrestha, A. (2009). Climate Change and its Increasing Impacts in Nepal. *The Initiation, 3*, 30–37. https://doi.org/10.3126/init.v3i0.2425

Khadka, N. S. (2021, April 11). Why India and Nepal's forest fires are worrying scientists. *BBC News.* https://www.bbc.com/news/world-asia-india-56671148

Lama, M. P. (2018). Human vs. national security. *Global-e, 11*(22). https://globalejournal.org/global-e/april-2018/human-vs-national-security

Law commission. (2015). *Constitution of Nepal.* Law comission, Ministry of Law and Justice, Government of Nepal.

Malla, S. B. (2023, July 30). Climate change: Catalyzing threat to the national security. *New Spotlight Magazine.* Spotlightnepal. https://www.spotlightnepal.com/2023/07/30/climate-change-catalyzing-threat-national-security/

MoHA. (2022). *Risk to Resilience: Disaster Risk Reduction and Management in Nepal.* Ministry of Home Affairs, Government of Nepal.

MoD. (2016). *National security policy 2016* (pp. 16–20). Ministry of Defence, Government of

Nepal.

MoFE. (2021). *Vulnerability and risk assessment and identifying adaptation options: Summary for policy makers* (pp. 23–44). Ministry of Forests and Environment, Government of Nepal.

Petersen, H. E. (2023, May 30). Climate change to blame for up to 17 deaths on Mount Everest, experts say. *The Guardian.* https://www.theguardian.com/world/2023/may/30/climate-change-to-blame-for-up-to-17-deaths-on-mount-everest-experts-say

UNFCCC. (1992). *United nation's framework convention on climate change* (pp. 3–4). United Nations.

United Nations. (n.d.). *Causes and effects of climate change.* United Nations; United Nations. Retrieved July 27, 2023, from https://www.un.org/en/climatechange/science/causes-effects-climate-change

Waisová, Š. (2003). Human security—the contemporary paradigm? *Perspectives, 20*, 58–72.

WB & ADB. (2021). *Climate Risk Country Profile: Nepal* (pp. 1–22). The World Bank Group and the Asian Development Bank.