Far Western Review
A Multidisciplinary, Peer Reviewed Journal
ISSN: 3021-9019
Published by Far Western University
Mahendranagar, Nepal

Impact of Mahakali River Flood on Residential Areas in Bheemdatt Municipality, Nepal

Ramesh Prasad Joshi
Assistant Professor
Far Western University, Mahendranagar, Kanchanpur, Nepal
Email: rameshjoshi309@yahoo.com

Abstract

Floods are devastating natural disasters that can be caused by prolonged rainfall, cloudbursts, the combined effects of snowmelt and rainfall, glacial lake outbursts, and dam failures from landslides. The impacts of floods include loss of life and livestock, as well as extensive damage to agriculture and houses. This study aims to assess the physical impact of Mahakali River flooding on residential areas in Bheemdatt Municipality. A descriptive research design was used, with data collected from 210 students, seven school headmasters/principals, and 42 school teachers using structured questionnaires.Seven schools in flood-prone areas of Bheemdatt Municipality were selected for the study. Inundation maps were prepared by using the 1D HEC-RAS model, and data analysis was performed using simple statistical tools and ArcGIS. The study found that flooding from the Mahakali River significantly impacted residential areas, particularly those located near the river. Respondents reported severe crop damage, with many villages experiencing infrastructure damage, loss of livestock, and displacement of residents. The flooding has created both short-term and long-term challenges, including forced migration in vulnerable areas.Based on the findings; it is recommended that the Government of Nepal take immediate action to mitigate flood risks. Specific measures should include conducting flood risk assessments for flood-prone wards, implementing flood defenses, increasing public awareness, and providing emergency preparedness training for residents in high-risk areas. These actions are essential to reduce flood impacts and enhance community resilience in Bheemdatt Municipality.

Keywords: Flood, disaster, vulnerability, Bheemdatt Municipality, Mahakali river

Introduction

Flooding, which occurs when a body of water overflows onto land, remains one of the most prevalent and destructive natural disasters, often resulting in widespread property loss, fatalities, and severe financial strain (UNISDR, 2012; Knock & Kolivras, 2007). Over the past four decades, global flood damages have amounted to approximately 1 trillion U.S. dollars (UNDRR, 2020). In Nepal, the 2017 floods led to a reduction in agricultural workers' cash wages by 9–10%, in addition to causing the loss of livelihoods and economic disruptions due to infrastructure damage and restricted access to workplaces (Kamble et al., 2024; Owuor & Mwiturubani, 2021). A significant flood event in 2013 in Bheemdatt Municipality underscored the region's vulnerability to such disasters, with widespread physical damage, economic losses, and social disruptions (Subedi et al., 2021). Globally, the frequency and intensity of natural disasters, including floods, are on the rise, posing a growing threat to human lives (Stanley & William, 2000). As climate change intensifies, the occurrence of catastrophic flood events has risen significantly (Dilley et al., 2005; MostofiZades et al., 2020), with floods representing 44% of all disaster events between 2000 and 2019 and affecting over 1.6 billion people worldwide (UNDRR & CRED, 2020).

Nepal is particularly vulnerable to flooding, with historical events dating back to 1785 and continuing through the 21st century (Shrestha et al., 2020). Significant floods, such as the 1871 event, caused extensive damage in both Nepal and India's Tarai region, and the 1926 flood destroyed large proportions of harvested and field crops in both countries (Adhikari, 2013). According to the Nepal Disaster Report (2019), floods and heavy rainfall resulted in 213 fatalities between 2017 and 2018, with economic losses exceeding 11 million U.S. dollars annually (MoHA, 2019). The monsoon season in Nepal exacerbates the devastation caused by flooding, resulting in loss of life, widespread property damage, displacement, and disruption to socioeconomic functions (Shrestha et al., 2020; Chidi et al., 2022). For instance, the 2023 Kagbeni flood caused an estimated USD 7.4 million in damages, destroying houses, bridges, and livestock (Fort et al., 2024). The 2008 Koshi flood resulted in the loss of 250 lives, displaced 3 million people from their houses, destroyed over 300,000 houses, and caused significant damage to at least 340,000 hectares of cropland (Rajeev, 2020). Flood inundation affects agricultural land by damaging crops, causing soil erosion, and depleting nutrients, all of which reduce productivity. It also disrupts planting and harvesting timelines, threatening food security and the livelihoods of farmer (Kim et al., 2022). Flooding decreases property values as the inundation area expands (Saptutyningsih, 2024)

Floods in Nepal's Tarai region, particularly during the rainy season, continue to pose significant challenges, devastating livelihoods in low-lying areas, displacing populations, and contributing to the growing issue of environmental refugees (Maharjan & Dan-

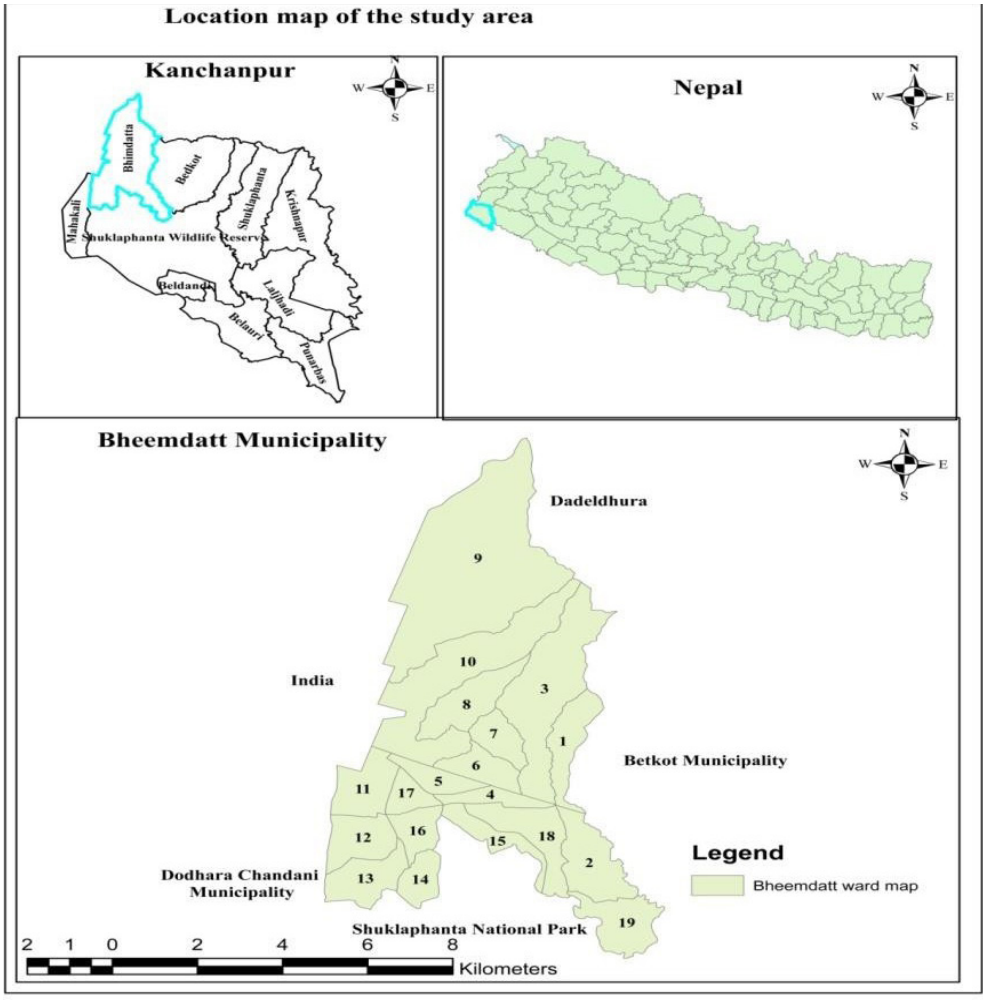
gol, 2024; Dhungana et al., 2016). The 1993, 2008, 2013, 2014, 2021, and 2024 floods in Nepal have resulted in substantial loss of life, property, and developmental setbacks (MOHA & DPNet-Nepal, 2015). The risk of flooding in urban areas is rising because of increased urbanization (Dangol & Carrasco, 2019)In Bheemdatt Municipality, the Mahakali River has caused extensive damage to residential areas (Kunwar, 2014), with its discharge increasing from 544,000 cusecs in 2013 to 547,224 cusecs in 2021 (Joshi, 2024). There has been limited research on the impact of the Mahakali River flood in Bheemdatt Municipality. This study aims to assess the physical impacts of flooding from the Mahakali River on the residential areas of Bheemdatt Municipality.

Study Area

Bheemdatt Municipality, established in 1977 and originally named Mahendranagar, is one of the oldest municipalities in Kanchanpur District. It spans from the Tarai region to the Chure hills. Geographically, it is situated between 28°52' to 29°08' north latitude and 80°06' to 80°15' east longitude. The municipality covers an area of 196.5 square kilometers and is divided into 19 wards. Bheemdatt Municipality is bordered by Betkot Municipality to the east, the Uttarakhand state of India to the west, Parshuram Municipality of Dadeldhura District to the north, and DodharaChandani Municipality to the south. The municipal headquarters, Mahendranagar, also serves as the headquarters of Kanchanpur District. According to the 2021 census report, Bheemdatt Municipality has a population of 122,320, with 47.6% male and 52.4% female (CBS, 2021).

Figure 1

The study area map



Research Methodology

A descriptive research design was employed for this study. Field data were collected from respondents through a structured questionnaire and field observations. All respondents were well informed about the research topic and the use of collected information. Seven schools were purposively selected based on their location within flood-prone areas of Bheemdatt Municipality. These schools were chosen because they are directly affected by flooding, either in terms of infrastructure damage, student displacement, or other socio-economic impacts. A total of 210 students, seven headmasters/principals,

and 42 teachers were specifically selected from the sampled schools. In this study, basic statistical methods were used to analyze the data, such as descriptive statistics (like frequencies and percentages) to show the effects of floods in Bheemdatt Municipality. These methods were chosen because the data mainly consists of categorical responses about flood impacts. The results were presented and explained using text, tables, maps, and figures. Geographical data was analyzed with ArcGIS software, and MS Excel was used for editing and analyzing the data.For preparing the inundation map of Bheemdatt Municipality, the HEC-RAS 1D model was developed. Digital Elevation Model (DEM) data of the study area, downloaded from the USGS website, were used to generate the terrain in RAS Mapper. River centerlines, bank lines, flow paths, and cross-sections were delineated on the terrain. Manning's roughness coefficient values for the channel and floodplain were assigned, and a 1D steady flow analysis was performed for the Probable Maximum Flood (PMF) using the developed geometry data in HEC-RAS. The inundation area resulting from the PMF simulation was then exported to ArcGIS. Finally, the inundation area for each ward of Bheemdatt Municipality was calculatedbby using ArcGIS.

Results

Effects of Flood in the Residential Area

Out of the total 210 respondents, 30 respondents (14.3%) reported damage to their houses, indicating a notable impact on residential structures, while the majority (85.7%) reported no such damage. A smaller portion, 5 respondents (2.4%), reported complete destruction of their houses. There were no reported deaths; however, 20 individuals (9.5%) sustained injuries, and 3 individuals (1.4%) were reported as missing. Additionally, 130 respondents (61.9%) indicated that their families were affected by the flood, resulting in their relocation to flood victim camps at local government schools. Furthermore, 180 respondents (85.71%) reported crop damage, which is a critical issue for the local economy.

Table1

Effects of flood in residential area of Bheemdatt municipality

S.N.	Effects of flood	Yes	No	Don't know
1	House Damage	30(14.3%)	180(85.7%)	0
2	Houses Destroyed	5(2.4%)	202(96.2%)	3(1.4%)
3	Death	0	200(95.2%)	10(4.8%)
4	Missing	3(1.4%)	207(98.6%)	0
5	Injured	20(9.5%)	185(88.1%)	5(2.4%)
6	Affected	130(61.9)	80 (38.1%)	0
7	Crop damaged	180(85.71)	30(14.29)	0

Source: Field survey 2021

Figure 2

Flood Hazard Photographs in Bheemdatt Municipality

Rescue Team

Household surrounded by flood

Flood rescue team

Rescue the baby

Mahakali River Sidecutting

Woman collect paddy

Flood victim people

Flood victim people staying at school

The photographs from Bheemdatt Municipality show the serious effects of flooding on the community, with damage to houses and property. They capture rescue teams helping people, like saving a baby from flood waters. Some pictures show flooded houses

and the eroding banks of the Mahakali River. There's also an image of a woman trying to collect paddy after the flood. Many people are shown taking shelter in schools, which have been turned into temporary houses. These photos highlight the struggles people face and the efforts to help them recover.

Ward Wise Inundation in Bheemdatt Municipality

Floods have severely impacted Ward Nos. 9, 10, 11, 12, and 13 of Bheemdatt Municipality, which are located along the Mahakali River. A total of 3.39 square kilometers of Bheemdatt Municipality was affected by flooding from the Mahakali River, with Ward No. 11 experiencing the highest level of inundation (3.86 square kilometers, accounting for 28.83% of the total affected area). In contrast, Ward No. 9 had the lowest flood impact, with an inundated area of 1.9 square kilometers, or 7.69% of the total in 2021.

Table2

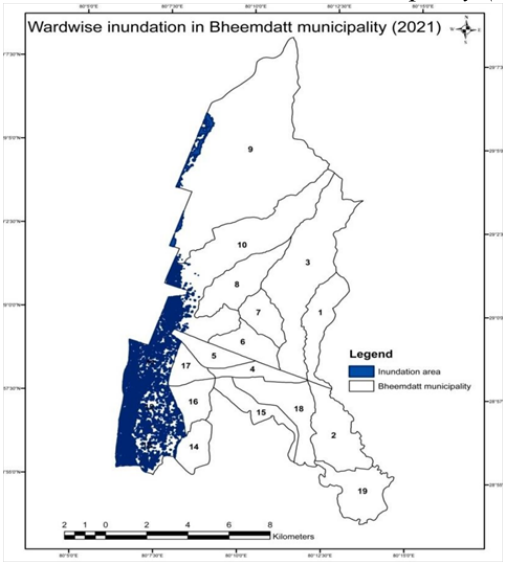
Ward wise inundation area of Bheemdatt Municipality

WardNo	Inundationarea(SquareKm)	%
9	1.03	7.69
10	1.99	14.86
11	3.86	28.83
12	3.50	26.14
13	3.01	22.48
Total	13.39	100.0

Source: USGS, 2021

Figure 3

Wardwise inundation Area in Bheemdatt municipality (2021)

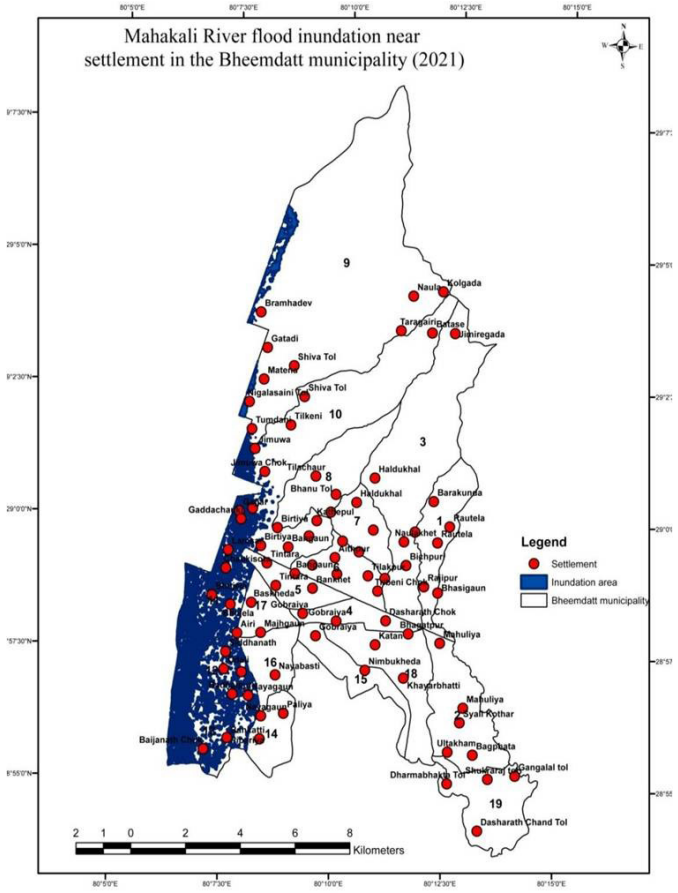


Inundation and settlement of Bheemdatt Municipality

The settlements along the Mahakali River in the Bheemdatt Municipality of Kanchanpur district are at risk of flooding. People living near the bank of the Mahakali River are always to stay on high alert for flooding.WardNo.9, 10, 11, 12 and13 were inundated due to the Mahakali River flood.

Figure 4

Impact of the 2021 Mahakali River Flood on Settlements in Bheemdatt Municipality



Flood risk wards of Bheemdatt Municipality

Flooding is the primary disaster impacting the municipality. Rivers transport sediment from the Chure, Mahabharat, and Himalayan regions of Sudurpaschim Province, depositing it in the lowland Terai of Bheemdatt Municipality. The accumulation of sand on agricultural land has reduced agricultural productivity. Each year, floods erode riverbank wards of the municipality, submerging nearby settlements. Based on flood event occurrences and inundation maps, Bheemdatt Municipality has been divided into four

flood risk zones.

Table 3 categorizes flood risk into four groups: very high, high, moderate, and low-risk wards. Among the 19 wards, wards 11, 12, and 13 are classified as very high risk. Out of the total wards 9, 10, and 18 fall into the high-risk category. The moderate-risk category includes wards 1, 4, 6, 14, and 19. The largest group, with 8 wards (2, 3, 5, 7, 8, 15, 16, and 17), is classified as low risk.

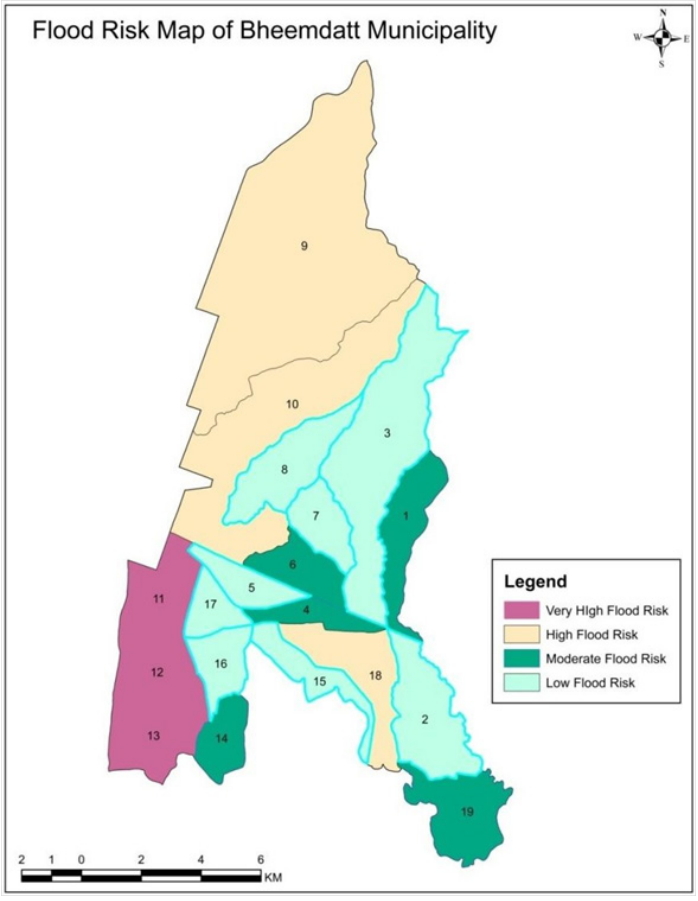
Table3

Flood riskwards of Bheemdatt municipality

S.N.	Types offloodrisk	Ward No	Total No.of wards
1	Veryhighrisk	11,12,13	3
2	Highrisk	9,10,18	3
3	Moderaterisk	1,4,6,14,19	5
4	Lowrisk	2,3,5,7,8,15,16,17	8

Figure 5

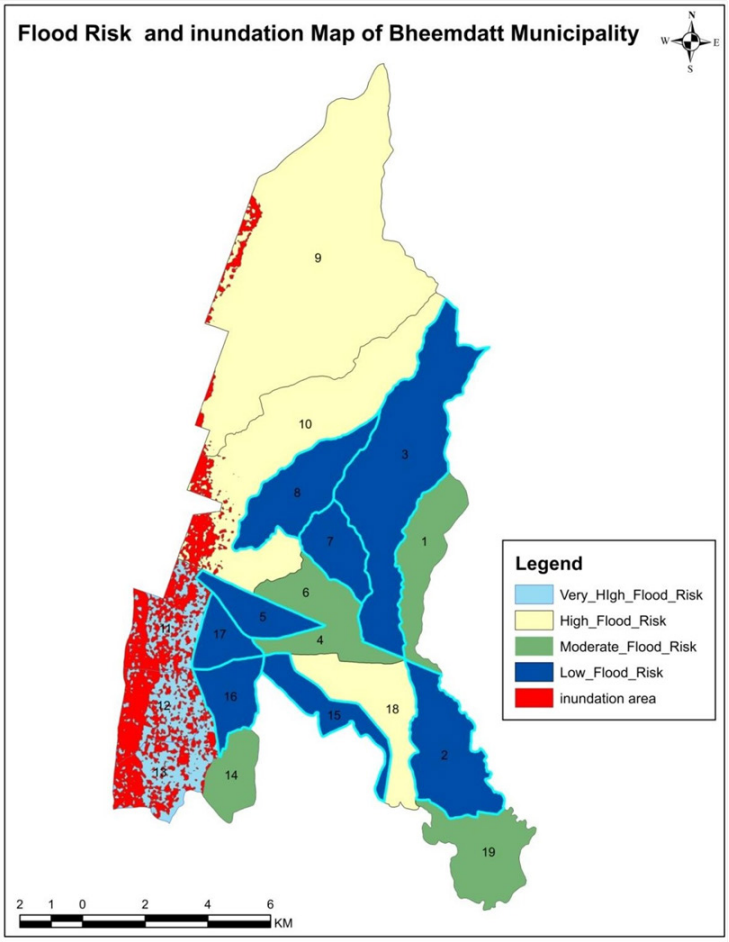
Floodrisk map of Bheemdatt municipality



Relationship between inundation area and flood risk area of Bheemdatt municipality

Figure 6

Flood risk and inundation map of Bheemdatt municipality



The very high-risk wards (11, 12, and 13) have significant inundation areas, with Ward 11 experiencing the largest at 3.86 square km (28.83% of the total inundation). This finding demonstrates a clear correlation between higher flood risk and greater inundation areas. The high-risk wards (9, 10, and 18) also experience inundation, though to a lesser extent than the very high-risk wards.

In contrast, the moderate and low-risk wards (1, 4, 6, 14, 19, and 2, 3, 5, 7, 8, 15, 16, 17) have zero reported inundation areas, indicating no recorded flood events in these wards.

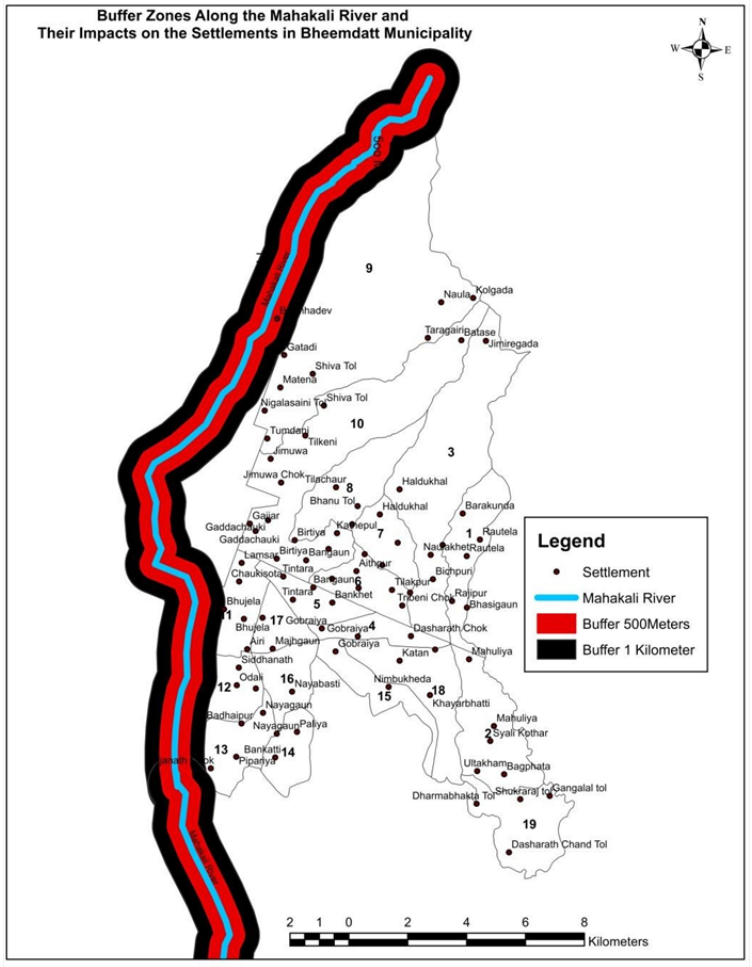
Vulnerability of flood in the Bheemdatt municipality

Figure 7 shows that settlements along the Mahakali River in Bheemdatt Munici-

pality are vulnerable to flooding. There is a strong correlation between settlement proximity and flood risk. The villages of Brahmdev, Bhujela, Badaipur, and Pipariya are situated very close to the Mahakali River, within a distance of 500 meters to 1 kilometer from its banks.

Figure 7

Buffer Zone Map: 500-Meter and 1-Kilometer Areas along the Mahakali River



Discussion

The Tarai region of Nepal experiences annual flooding events (Dhakal, 2013). In Nepal, floods have severe impacts, resulting in loss of life, destruction of cultivated fields, and damage to irrigation systems crucial for agriculture, as well as to bridges and other infrastructure in rural areas. These disruptions significantly affect the livelihoods of local communities (Dixit, 2003). Bheemdatt Municipality, located in Nepal's southwestern Tarai region, is particularly vulnerable to flood risks posed by the Mahakali

River. The river has been found to pose a serious flood risk to the residential areas of Bheemdatt, impacting both inhabitants and infrastructure. Flooding from the Mahakali River has damaged and destroyed houses along its banks within Bheemdatt Municipality. Many residents have reported reduced income due to crop destruction, which has led to food shortages in specific wards of the municipality. This finding aligns with observations by Pariyar (2019).

Floods have extensive impacts on human life, property, and health. They result in loss of life, property damage, health risks due to water contamination, crop destruction, loss of livestock, displacement from houses, and major economic burdens. Flood leads to high mortality rates, injuries, outbreaks of diseases, mental health issues, malnutrition, infrastructure damage, and the creation of environmental refugees, with particularly severe consequences for vulnerable populations (Iqbal, 2022). Among South Asian countries, Nepal has the highest average annual number of people exposed to floods, primarily driven by monsoon storms originating in the Bay of Bengal that move across central India and reach northern Pakistan (Sayed & González, 2014).

According to the Ministry of House Affairs (MoHA, 2009), disasters claimed 21,246 lives in Nepal from 1983 to 2003, with 32% of these fatalities resulting from floods and landslides (MOHA &DPNet, 2009). In recent years, floods have continued to cause widespread damage in Nepal, affecting 418 communities and 16,196 families in 2017 and 2018 alone (MoHA, 2019). In 2017, floods impacted 35 districts, damaging over 190,000 houses and leaving 10,000 people houseless (Khanal, 2020).

In Nigeria, the effects of flooding are similarly severe. Flooding causes substantial damage to houses and infrastructure, leading to costly repairs and depreciation in property values. The findings from Bheemdatt Municipality align with those of Badamosi et al. (2023) regarding the widespread impacts of flooding on property and infrastructure. The patterns observed in Nepal's flood-prone areas also resemble those in Pakistan's Punjab region, where heavy rainfall between July and September is the main driver of riverine floods (Gronewold, 2010). Both countries share similar monsoon-driven seasonal flood characteristics due to comparable geographic features.

Farmers are significantly impacted by flooding, experiencing effects such as reduced crop yields, extensive crop damage, and psychological stress. The agricultural sector's vulnerability to flooding poses a global threat to food security (Muhammad et al., 2018). In the study area, flooding led to the destruction and damage of agricultural products, resulting in a food supply shortage. This shortage, in turn, reduced the availability of certain food items, causing price increases and making these items more expensive for consumers.

Inundation, defined as the overflow of water onto normally dry land due to flood events, is crucial for evaluating flood risk and impacts (Peter, 2022). The study high-

lighted that inadequate drainage systems can lead to localized flooding during periods of intense rainfall. Findings indicate that floods have direct effects on infrastructure and property, especially in populated areas within a 2 km radius of the Mahakali River.

Comfort et al. (2024) utilized field surveys and GIS to develop a flood risk map of Kafanchan, identifying areas of high, moderate, and low vulnerability based on factors such as rainfall, drainage, and slope. Similarly, in the Kayadhu River Basin in Maharashtra, areas were categorized into high, moderate, and low-risk zones through morphousetric analysis and GIS, which supported effective flood management and forecasting (Tamanna, 2023).

A flood risk map of Bheemdatt Municipality was prepared using ArcGIS, based on the field observation and past flood data from the Department of Hydrology and Meteorology (DHM), Nepal. The map divides the municipality into five risk zones: very high, high, moderate, and low. The map shows that three wards are in the very high-risk zone, three in the high-risk zone, five in the moderate-risk zone, and eight in the low-risk zone.

The buffer tool is valuable in assessing the vulnerability of nearby communities to flooding, helping to better understand their potential exposure to flood risks (Chang et al., 2022). In Bheemdatt Municipality, the villages of Bhujela, Airy Odali, Badaipur, and Pipariya were found to be the most affected by floods. People shared that flooding has caused injuries and even missing persons due to floods from the Mahakali River.

Wards 11, 12, and 13 of Bheemdatt Municipality are highly vulnerable to flooding due to factors such as proximity to the Mahakali River, low elevation, and flat topography. These features contribute to poor drainage, water stagnation, and prolonged inundation. Urbanization, land-use changes, and inadequate drainage further exacerbate flooding by blocking natural drainage routes and increasing runoff. Loss of vegetation and soil erosion also reduce the land's ability to absorb rainfall, heightening flood risk. These factors lead to significant agricultural losses, threatening food security and livelihoods, while economic stability is compromised due to disrupted markets and reduced income for farming households.

Conclusion and Recommendations

The findings of this study reveal the significant impact of floods on both the residents and infrastructure of Bheemdatt Municipality. The Mahakali River, which runs through the region, poses a considerable flood risk, particularly in wards located along its banks. A considerable proportion of the population has faced property damage, displacement, and injury, with the agricultural sector also suffering from crop destruction, which has strained the local economy. The study identified areas with very high, high, moderate, and low flood risks, with Ward Nos. 11, 12, and 13 being the most vulnerable. The vul-

nerability of settlements, especially those within 500 meters to 1 kilometer of the river, is high, emphasizing the need for targeted flood risk management and mitigation strategies.

The municipality of Bheemdatt should focus on strengthening flood protection infrastructure, especially in high-risk areas along the Mahakali River, through the construction of embankments and reinforced riverbanks. Improving flood forecasting and early warning systems is also critical to allow residents time to prepare and evacuate, minimizing injury and displacement. Public education on flood preparedness and risk reduction is essential, along with supporting agricultural recovery through insurance schemes or subsidies for affected farmers. Additionally, disaster management should be enhanced by strengthening local governance and improving flood victim camp infrastructure. Finally, adopting integrated land-use planning that considers flood risk zones and regularly updating flood risk maps can help reduce future flood impacts.

Acknowledgement

I would like to express my sincere gratitude to the University Grants Commission (UGC) Nepal for their generous financial support, which made this research possible. I am also deeply appreciative of all the respondents who participated in this study, as their insights and cooperation were invaluable to the completion of this research.

References

Adhikari, B. (2013). Flooding and inundation in Nepal Terai: Issues and concerns. *Hydro Nepal, Journal of water energy and environment*, *12*, 59-65.

Central Bureau of Statistics (2021). *National population and housing census, 2021*. Central Bureau of Statistics, Kathmandu, Nepal.

Chang, A., Seikh, A. A., Noralfishah, S. A., Umber, N. A., & Kamran, A. (2022). A systematic review of flood vulnerability using geographic information systems. *Heliyon, 8*(3).

Chidi, C. L., Shrestha, B., & Sapkota, L. (2022). Flood risk mapping and analysis: A case study of Andheri Khola catchment, Sindhuli district, Nepal. *Geographical Journal of Nepal*, 103–118. https://doi.org/10.3126/gjn.v15i01.42889

Comfort, G. A., Saliu, I. A., & Jamila, U. (2024). Mapping of flood risk zones in Kafanchan town, Jema'alocal government area, Kaduna State, Nigeria. *Fudma Journal of Science, 8*(3), 14.

Dangol, N., & Carrasco, S. (2019). Residents' self-initiatives for flood adaptation in informal riverbank settlements of Kathmandu. *International Journal of Disaster Risk Reduction, 40*, 101156. https://doi.org/10.1016/J.IJDRR.2019.101156

Dhungana, H., Pain, A., & Dhungana, S. P. (2016). *Disaster risk management and meso-level institution in Nepal: A case study in Tinau River in Western Tarai*, Southasia Institute of Advanced Studies (SIAS), Kathmandu, Nepal.

Dilley, M., Chen, R. S., Deichmann, U., Lerner-Lam, A., Agwe, J., Buys, P., (2005). Natural disaster hotspots: A global risk analysis. *World Bank Disaster Risk Management Series, 1*.

Dixit, A. (2003). Floods and vulnerability: Need to rethink flood management. *Natural Hazards, 28*, 155-179.

Fort, M., Gurung, N., Arnaud-Fassetta, G., & Bell, R. (2024). *Retrospect of the polygenetic Kagbeni flood event ((Agust13,2023) in Mustang, Nepal. Are rapid hydromorphological processes relays and sediment cascades in the catchment well taken into account in the risk equation?* https://doi.org/10.5194/egusphere-egu24-2563

Iqbal, T. (2022). Floods have posed serious health and economic challenges in affected areas of Pakistan. *Pakistan Journal of Physol, 18*(4).

Jaehyung, S., & Dong, S. R. (2024). Estimating flood inundation in urban areas using scenario generation methods and inundation graphs. *Applied Sciences*, *14*(3).

Joshi, R. P. (2024). Mahakali River flood disaster impact on the educational performance of students of Bheemdatt municipality, Nepal. *Journal of Geography and Natural Disasters, 14*(1), 297.

Kamble, V, Paudel, J. & Mishra, A (2024). Environmental shocks and agriculture: implications of floods on labor market outcomes. *Environment and development economics, 29*(6), 479-498.DOI: 10.1017/S1355770X24000196

Khanal, B. N. (2020*). Nepal: A brief country profile on Disaster Risk Reduction and Management*. Ministry of House Affairs, Government of Nepal.

Kim, S.-H., Kim, D.-J., & Yang, S. W. (2022). A Study on the Use of Geospatial Information-Based Simulation for Preemptive Response to Water Disasters in Agricultural Land. *1*(7), 52–60. https://doi.org/10.30693/smj.2022.11.7.52

Knock, E., &Kolivras, K. (2007). Flash flood awareness in the southwest. *Risk Analysis, 27*(1), 155-169.

Kunwar, M. B. (2014). Rationale of Pancheshwar Multipurpose Project for reduction. *Hydro Nepal: Journal of Water, Energy, and Environment.*

Maharjan, K. & Dangol, S. (2024). Climate change and flood vulnerability analysis in the Narayani River of Nepal, *Nepalese journal of geoinformatics*.

MOHA & DPNet-Nepal (2015). *Nepal disaster report 2015*. Ministry of House Affairs and Disaster Preparedness Network-Nepal.

MostofiZades, S., Burn, H. D., & Brien, N. O. (2020). Detection of trend in flood magnitude and frequency in Canada. *Journal of Hydrology: Regional Studies, 28,100673*. DOI:10.1016/j.ejrh.2020.100673

Muhammad, A., Norsida, M., & Farrah, M. M. (2018). *Impacts of natural disasters on farms and farmers in Malaysia*. DOI:10.31433/1605-220X-2018-21-3(1)-132-135

MoHA (2019). *National Diisaster Report*. Ministry of House Affairs.

Owuor, M. O & Mwiturubani, D. A. (2021). Nexus between flooding impacts and coping strategies in Nairobi's settlements. *International journal of disaster risk reduction,64*. DOI: https://doi.org/10.1016/j.ijdrr.2021.102480

Pariyar, R. K. (2019). Community based disaster risk management: A case study of Mahakali River basin, Kanchanpur. *The Geographic Base*, *6*, 77-86.

Pariyar, R. K. (2020). Disaster Vulnerability Assessment in Parshuram. *The Geographic Base*, *7*, 79-90.

Peter, K. (2022). Flood inundation Prediction. *Annual Review of Fluid Mechanics, 54* (1), 287-315.

Rajeev, R. (2020). Impact of floods on the people of kosi region. *Journal of Emerging Technologies and Innovative Research*. https://www.jetir.org/view?paper=JETIR2003162

Saptutyningsih, E. (2024). *Willingness to pay for flood risk mitigation among residents living near river's confluence in Yogakarta, Indonesia*. https://doi.org/10.1088/1755-1315/1314/1/012061

Shrestha, B. R., Rai, R. K., & Marasini, S. (2020). Review of Flood Hazards Studies in Nepal. *The Geographic Base*, *7*, 24-32.

Stanley, p., & William, S. (2000). *After disaster: Responding to the psychological consequences of disasters for children and young people*. New Zealand Council for Educational Research.

Subedi, S., Kafle, G., & Tripathi, S. (2021). Geospatial Assessment of Floods in Western Nepal. *Scientific World Journal*.

Subodh, D. (2013). Flood Hazard in Nepal and New Approach of Risk Reduction. *International Journal of Landslide and Environment*.

Tamanna, J. (2023). A GIS-Based Flood Risk Assessment and Mapping Using Morphousetric Analysis in the Kayandu River Basin, Maharashtra. *Advanced in geography and environment*.

UNDRR& CRED. (2020). The Human Cost of Disasters: *An Overview of the Last 20 Years, 2000-2019*. UNDRR, Geneva, Switzerland.

UNISDR. (2008). *Towards National Resilience. Good Practices of National Platforms for Disaster Risk Reduction*.United Nations Secretariat of the International Strategy for Disaster Reduction. UNISDR.

UNISDR (2012). *Terminology*. United Nations Secretariat of the International Strategy for Disaster Reduction. Geneva, Switzerland.