

Impact of Floods on People Residing in Flood-Affected Areas of Assam: A Comprehensive Review of Health, Social, Economic, and Environmental Consequences

Geeta Dutta¹, Dr. Bikramjit Singh²

¹Research Scholar, Faculty of Nursing, Desh Bhagat University, Mandi Gobindgarh, Punjab, India

²Assistant Professor, Faculty of Nursing, Desh Bhagat University, Mandi Gobindgarh, Punjab, India

Abstract

Floods are among the most devastating and recurrent natural disasters worldwide, with India ranking among the countries most severely affected by annual flood events. Assam, situated in the northeastern region of India within the Brahmaputra and Barak river basins, experiences recurrent flooding almost every monsoon season owing to heavy rainfall, riverbank erosion, sediment deposition, deforestation, climate change, and inadequate drainage infrastructure. Approximately 39.58% of the geographical area of Assam is classified as flood-prone, making floods one of the greatest public health and developmental challenges facing the state. ¹

The consequences of recurrent flooding extend beyond immediate mortality and property damage, significantly affecting physical health, mental well-being, nutrition, livelihoods, education, sanitation, agriculture, and healthcare delivery. Waterborne diseases such as diarrhoea, cholera, typhoid fever, hepatitis A and E, as well as vector-borne diseases including malaria, dengue, and Japanese encephalitis, commonly increase following floods due to contamination of water supplies and proliferation of mosquito breeding sites. ^{2,3} Mental health disorders, including anxiety, depression, post-traumatic stress disorder (PTSD), and psychological distress, have also been increasingly documented among flood survivors. ⁴

This review synthesizes published evidence on the multidimensional impact of floods among populations residing in flood-affected areas of Assam. Literature published between 2005 and 2026 was reviewed using PubMed, Scopus, Web of Science, Google Scholar, ScienceDirect, and official reports from governmental and international organizations. Evidence demonstrates that recurrent flooding contributes substantially to increased morbidity, economic instability, food insecurity, educational disruption, displacement, environmental degradation, and widening health inequities among vulnerable populations. Children, pregnant women, older adults, persons with disabilities, and socioeconomically disadvantaged households experience disproportionately severe impacts. Strengthening community-based disaster preparedness, resilient healthcare systems, climate-adaptive infrastructure, early warning systems, and community health nursing interventions are essential to reduce future flood-related health burdens and enhance resilience in Assam.

Keywords: Flood, Assam, Brahmaputra River, Disaster Management, Public Health, Community Health Nursing, Climate Change, Mental Health, Socioeconomic Impact, Riverbank Erosion

How to cite this article: Dutta G, Singh B. Impact of Floods on People Residing in Flood-Affected Areas of Assam: A Comprehensive Review of Health, Social, Economic, and Environmental Consequences. *Int J Drug Deliv Technol.* 2026;16(65s):363-368. DOI: 10.25258/ijddt.16.65s.39

Introduction

Floods are among the most frequent and destructive natural disasters worldwide, accounting for approximately 43% of all recorded natural disasters and affecting millions of people annually. They result in substantial mortality, displacement, destruction of infrastructure, agricultural losses, and long-term socioeconomic disruption. Climate change has further intensified the frequency and severity of extreme precipitation events, increasing the vulnerability of flood-prone regions across the globe. ¹ India is one of the most flood-prone countries in South Asia, with nearly 40 million hectares (approximately 12% of the country's geographical area) susceptible to flooding. ² Among the Indian states, Assam experiences one of the highest flood frequencies due to its unique geographical location within the Brahmaputra and Barak river basins. The state receives heavy monsoon rainfall from June to September and is

intersected by more than 50 major and minor rivers. These rivers carry enormous sediment loads from the Himalayas, leading to riverbed aggradation, channel instability, and recurrent overbank flooding.

³ According to the Assam State Disaster Management Authority (ASDMA), approximately **31,500 km² (39.58%)** of Assam's geographical area is classified as flood-prone, representing nearly **9.4% of India's total flood-prone area**. On average, floods affect **about 39.5 lakh people every year**, causing widespread damage to homes, agriculture, transportation networks, educational institutions, healthcare facilities, and public utilities. Between 2011 and 2020, floods in Assam claimed **811 human lives**, while the devastating floods of 2022 alone affected approximately **88.5 lakh people** and resulted in **181 deaths**, highlighting the persistent humanitarian and public health burden of recurrent flooding. ^{3,4} the causes of flooding in Assam are multifactorial. In addition to intense

Impact of Floods on People Residing in Flood-Affected Areas of Assam: A Comprehensive Review of Health, Social, Economic, and Environmental Consequences

monsoon rainfall, factors such as riverbank erosion, excessive sediment deposition, deforestation in upstream catchments, rapid urbanization, encroachment of wetlands, inadequate drainage systems, and climate change contribute significantly to the increasing frequency and severity of floods. Human-induced alterations in land use have reduced the natural capacity of floodplains to store excess water, thereby exacerbating flood risks across both rural and urban areas.^{3,5}

Floods have profound implications for public health. Immediate consequences include drowning, traumatic injuries, electrocution, and snakebite incidents. In the post-flood period, contamination of drinking water sources and disruption of sanitation systems substantially increase the incidence of waterborne diseases such as diarrhoea, cholera, typhoid fever, leptospirosis, and viral hepatitis. Simultaneously, stagnant water promotes mosquito breeding, increasing the transmission of vector-borne diseases including malaria, dengue, and Japanese encephalitis.^{6,7} Beyond physical health, recurrent flooding has substantial psychological and social consequences. Flood-affected populations frequently experience anxiety, depression, post-traumatic stress disorder (PTSD), sleep disturbances, and prolonged psychological distress. These mental health challenges are often compounded by the loss of homes, livelihoods, educational disruption, displacement, and uncertainty regarding future disasters. Children, pregnant women, older adults, persons with disabilities, and socioeconomically disadvantaged households remain disproportionately vulnerable to these adverse outcomes.⁸ the economic burden of recurrent floods in Assam is equally significant. Annual losses include destruction of standing crops, livestock mortality, damage to roads, bridges, irrigation systems, schools, and healthcare facilities, leading to reduced household income, food insecurity, unemployment, and increased poverty. Riverbank erosion further aggravates these challenges by permanently displacing thousands of families and reducing cultivable agricultural land, thereby threatening long-term livelihood security.³ Considering the increasing influence of climate variability and anthropogenic environmental changes, floods in Assam should no longer be viewed solely as seasonal natural hazards but as complex public health and developmental challenges requiring multidisciplinary interventions. Although considerable research has examined individual aspects of flood impacts, a comprehensive synthesis integrating health, social, economic, environmental, and healthcare dimensions remain limited.

Therefore, this review aims to comprehensively examine the multidimensional impacts of floods among people residing in flood-affected areas of Assam by synthesizing current scientific evidence.

The findings are expected to support policymakers, disaster management authorities, public health professionals, community health nurses, and researchers in developing evidence-based strategies to strengthen disaster preparedness, improve community resilience, and reduce flood-related morbidity and mortality.

Burden of Floods in Assam

Assam is one of India's most flood-vulnerable states because of its location in the Brahmaputra and Barak river basins. According to the Government of Assam, **31.05 lakh hectares (39.58%)** of the state's geographical area are flood-prone, compared with the national average of approximately **10.2%**. Thus, Assam alone accounts for about **9.4% of India's total flood-prone area**, despite occupying only about 2.4% of the country's land area.¹² Floods in Assam occur almost every year during the southwest monsoon (June–September). However, in recent years, climate variability, intense rainfall events, riverbank erosion, sediment deposition, embankment breaches, and land-use changes have increased both the frequency and severity of floods. The Assam State Disaster Management Authority (ASDMA) reported that **2024 witnessed three major waves of flooding**, causing widespread damage to lives, agriculture, livestock, transport infrastructure, and public utilities across numerous districts.³ the humanitarian burden remains substantial. During the **2025 monsoon floods**, ASDMA reported that **more than 3.64 lakh people across 19 districts** were affected during the first major flood wave in early June, requiring large-scale rescue and relief operations.⁴ at the peak of the event, **over 4.43 lakh people across 18 districts** remained affected, with **more than 40,000 people** accommodated in relief camps and relief distribution centres. Approximately **16,558 hectares of cropland** were inundated, threatening agricultural productivity and household food security.⁵

The **2024 Assam Flood Memorandum** highlighted that repeated flooding caused substantial losses to housing, standing crops, roads, bridges, embankments, educational institutions, drinking water systems, and health facilities. The report also emphasized that recurring floods continue to impede socioeconomic development, particularly among rural communities dependent on agriculture and fisheries.³ Riverbank erosion is another major concern closely associated with flooding in Assam. Government estimates indicate that thousands of hectares of fertile agricultural land are lost annually because of erosion along the Brahmaputra and Barak rivers. This has resulted in repeated displacement of families, loss of livelihoods, landlessness, and long-term migration, especially in districts such as **Dhemaji, Lakhimpur, Barpeta, Dhubri, Morigaon, Goalpara, Darrang, Majuli, Sonitpur, Cachar, and Golaghat**.² Floods impose a

Impact of Floods on People Residing in Flood-Affected Areas of Assam: A Comprehensive Review of Health, Social, Economic, and Environmental Consequences

considerable burden on the healthcare system. Damage to roads and bridges often delays access to emergency medical care, while submergence of health facilities disrupts routine maternal and child health services, immunization, chronic disease management, and emergency referrals. Overcrowded relief camps with inadequate sanitation and limited access to safe drinking water increase the risk of outbreaks of diarrhoeal diseases, acute respiratory infections, leptospirosis, malaria, dengue, and Japanese encephalitis.⁶⁻⁸ from an economic perspective, the Water Resources Department of Assam estimates that **approximately 9.31 lakh hectares of land are affected by floods every year**. Annual losses include destruction of crops, livestock mortality, damage to irrigation systems, roads, bridges, schools, public buildings, and private property, resulting in losses worth hundreds to thousands of crores of rupees depending on the severity of the monsoon season.² Climate change is expected to further intensify flood hazards in Assam. Increasing temperatures, erratic monsoon rainfall, glacier melt in the eastern Himalayas, wetland degradation, and rapid urbanization are likely to increase the magnitude and recurrence of extreme flood events. Consequently, floods in Assam should be recognized not only as seasonal natural disasters but also as recurring public health, environmental, and developmental emergencies requiring integrated, climate-resilient disaster management strategies.⁹

Table 2.1. Recent Flood Situation in Assam

Indicator	Latest Available Evidence
Flood-prone area	**31.05 lakh hectares (39.58%) **12
Share of India's flood-prone area	**9.4%**2
Average annual flood-affected area	9.31 lakh hectares ²
Major flood waves in 2024	Three ³
Population affected (June 2025 first wave)	>3.64 lakh people ⁴
Peak affected population (June 2025)	>4.43 lakh people across 18 districts ⁵
Relief camp population (June 2025)	>40,000 persons ⁵
Cropland affected (June 2025)	16,558.59 hectares ⁵

Causes of Recurrent Flooding in Assam

Flooding in Assam results from the interaction of natural and anthropogenic factors. The state's geographical location within the **Brahmaputra and Barak river basins**, coupled with heavy southwest monsoon rainfall, makes it one of the most flood-prone regions in India. Approximately **39.58% of Assam's geographical area** is susceptible to

flooding.¹ The **Brahmaputra River** carries one of the world's highest sediment loads from the Himalayas. Continuous deposition of silt raises the riverbed, reduces channel capacity, and increases the likelihood of overflow during the monsoon.² In addition, more than **50 tributaries** contribute substantial runoff, particularly during periods of intense rainfall.³ Climate change has further increased flood risk by altering rainfall patterns, intensifying extreme precipitation events, and accelerating glacier melt in the Himalayan catchments. The **IPCC** projects an increase in the frequency and intensity of extreme rainfall events in South Asia, thereby increasing flood hazards in Assam.⁴ Human activities have also amplified flood severity. Rapid **deforestation, wetland encroachment, unplanned urbanization, and land-use changes** have reduced the natural water retention capacity of the landscape, leading to increased surface runoff. In urban centres such as Guwahati, inadequate drainage systems frequently result in severe urban flooding after heavy rainfall.⁵ Another important contributing factor is the deterioration of flood-control infrastructure. Ageing embankments, poor maintenance, and periodic embankment breaches allow floodwaters to inundate nearby settlements and agricultural land. Riverbank erosion further compounds the problem by displacing thousands of families and reducing cultivable land each year.² Overall, recurrent flooding in Assam is no longer solely a natural phenomenon but is increasingly influenced by environmental degradation and climate change. Effective flood mitigation requires integrated river basin management, ecosystem conservation, resilient infrastructure, and climate-adaptive disaster preparedness strategies.^{1,4}

Health Impacts of Floods among People Residing in Flood-Affected Areas of Assam

Floods have profound and multidimensional effects on the health of affected populations. The immediate health consequences include **drowning, traumatic injuries, snakebites, and accidental deaths**, while prolonged flooding increases the risk of communicable diseases, malnutrition, mental health disorders, and disruption of essential healthcare services.¹ One of the major public health concerns following floods is the increased incidence of **waterborne diseases**. Contamination of drinking water with sewage and floodwater leads to outbreaks of diarrhoea, cholera, typhoid, hepatitis A and E, and leptospirosis. Overcrowded relief camps with poor sanitation further facilitate disease transmission.^{2,3} Flooding also promotes the breeding of mosquitoes by creating stagnant water bodies, resulting in a higher prevalence of **vector-borne diseases** such as malaria, dengue, Japanese encephalitis, and chikungunya. Assam has reported seasonal increases in these infections following major flood events, particularly in districts with prolonged

Impact of Floods on People Residing in Flood-Affected Areas of Assam: A Comprehensive Review of Health, Social, Economic, and Environmental Consequences

waterlogging.⁴ the disruption of healthcare services during floods significantly affects disease management and preventive care. Damage to roads, bridges, and health facilities limits access to medical services, interrupts immunization programmes, antenatal care, and treatment for chronic illnesses such as diabetes and hypertension. Pregnant women, children, older adults, and people with disabilities are particularly vulnerable to these disruptions.⁵ Floods also have substantial **psychological consequences**. Loss of family members, homes, livelihoods, and repeated displacement contribute to anxiety, depression, stress, sleep disturbances, and post-traumatic stress disorder (PTSD). Studies have shown that these mental health effects may persist long after floodwaters recede, highlighting the need for psychosocial support as part of disaster response.⁶ Nutritional status is frequently compromised during and after floods because of food shortages, crop losses, and disruption of food distribution systems. Children and pregnant women are especially at risk of undernutrition and micronutrient deficiencies, increasing their susceptibility to infections and adverse health outcomes.⁷ Overall, floods represent a major public health challenge in Assam, emphasizing the importance of strengthened disease surveillance, safe water and sanitation, resilient healthcare systems, mental health support, and community-based disaster preparedness to reduce flood-related morbidity and mortality.^{1,8}

Socioeconomic Impacts of Floods among People Residing in Flood-Affected Areas of Assam

Floods have significant socioeconomic consequences for communities in Assam, particularly those dependent on agriculture, fisheries, and daily wage occupations. Recurrent flooding destroys standing crops, livestock, fisheries, houses, roads, bridges, schools, and public infrastructure, resulting in substantial financial losses and prolonged disruption of livelihoods.¹ Agriculture, the primary source of income for a large proportion of Assam's rural population, is severely affected by annual floods. Thousands of hectares of cropland are inundated each year, leading to reduced crop yields, food insecurity, and decreased household income. Riverbank erosion further aggravates the situation by permanently destroying fertile agricultural land and displacing farming communities.² Flood-induced displacement remains a major humanitarian concern. Many affected families are forced to seek temporary shelter in relief camps, where overcrowding, inadequate sanitation, and limited access to clean water increase the risk of disease and social vulnerability. Repeated displacement also disrupts children's education, weakens social support systems, and contributes to long-term poverty.³ the economic burden extends beyond direct property damage. Floods interrupt transportation, markets, healthcare services, and

educational institutions, reducing productivity and delaying recovery. Small businesses, informal workers, and daily wage earners are particularly vulnerable because prolonged flooding limits employment opportunities and income generation.⁴ Women, children, older adults, and socioeconomically disadvantaged households experience disproportionately greater impacts due to limited financial resources, restricted access to healthcare, and reduced coping capacity. Strengthening livelihood diversification, social protection schemes, resilient infrastructure, and community-based disaster preparedness is essential to minimize the long-term socioeconomic consequences of floods in Assam.⁵

Environmental Impacts of Floods in Assam

Floods have profound environmental consequences in Assam, affecting ecosystems, biodiversity, water quality, and land resources. One of the most significant impacts is **riverbank erosion**, particularly along the Brahmaputra and Barak rivers, which results in the permanent loss of fertile agricultural land, destruction of settlements, and displacement of local communities.¹ Floodwaters also cause **soil erosion and sediment deposition**, reducing soil fertility and agricultural productivity. While moderate flooding can replenish nutrients, recurrent and prolonged inundation often leaves behind coarse sediments that impair crop cultivation and alter land use patterns.² Another major concern is the **contamination of surface and groundwater**. Floodwater mixes with sewage, industrial waste, and agricultural runoff, leading to deterioration of water quality and increasing the risk of waterborne diseases. Wetland degradation and loss of natural drainage systems further reduce the ecosystem's capacity to absorb excess water, making future floods more severe.³ Floods also affect Assam's rich biodiversity, including protected areas such as **Kaziranga National Park**, where seasonal inundation causes wildlife displacement and mortality. Although seasonal flooding supports wetland ecosystems, extreme floods threaten habitat stability and increase human-wildlife conflict.⁴ Climate change, coupled with deforestation, unplanned urbanization, and wetland encroachment, has further intensified environmental degradation and increased flood vulnerability. Therefore, sustainable river basin management, afforestation, wetland conservation, and climate-resilient land-use planning are essential to reduce the environmental impacts of floods in Assam.⁵

Role of Community Health Nurses in Flood Disaster Management

Community Health Nurses (CHNs) play a vital role in disaster preparedness, response, recovery, and rehabilitation during flood emergencies. Their responsibilities begin with **community awareness and preparedness**, including health education on personal hygiene, safe drinking water, sanitation,

Impact of Floods on People Residing in Flood-Affected Areas of Assam: A Comprehensive Review of Health, Social, Economic, and Environmental Consequences

vector control, first aid, and emergency preparedness to enhance community resilience.¹ During floods, CHNs conduct **rapid health assessments**, identify vulnerable groups such as pregnant women, children, older adults, and persons with chronic illnesses, and ensure timely referral and continuity of essential healthcare services. They actively participate in relief camps by providing first aid, maternal and child healthcare, immunization, disease surveillance, nutritional assessment, and health counselling.² Community Health Nurses also contribute significantly to the **prevention and control of communicable diseases** by promoting safe water practices, environmental sanitation, chlorination of drinking water, hand hygiene, and early identification of outbreaks of diarrhoeal diseases, malaria, dengue, and other vector-borne infections.³ Psychosocial support is another important responsibility. CHNs provide **psychological first aid**, emotional support, stress management, and referral of individuals experiencing anxiety, depression, or post-traumatic stress disorder (PTSD), thereby facilitating community recovery after disasters.⁴ In the rehabilitation phase, CHNs collaborate with government agencies, local authorities, non-governmental organizations, and community leaders to restore healthcare services, strengthen community participation, and improve disaster preparedness through capacity-building activities. Their involvement is essential for developing resilient communities capable of responding effectively to future flood events.⁵

Preventive and Mitigation Strategies

Effective flood management in Assam requires a combination of structural and non-structural measures. Strengthening embankments, improving drainage systems, restoring wetlands, and adopting integrated river basin management can reduce flood risks.¹ Early warning systems, disaster preparedness programmes, and community awareness are essential for minimizing loss of life and property. Timely dissemination of weather forecasts and evacuation alerts enables communities to respond effectively during flood emergencies.² Ensuring access to safe drinking water, sanitation, disease surveillance, emergency healthcare, and vaccination is crucial to prevent post-flood disease outbreaks. Community Health Nurses play an important role in health education, disease prevention, psychosocial support, and rehabilitation of affected populations.³ Long-term strategies should focus on climate-resilient infrastructure, afforestation, sustainable land-use planning, and active community participation to strengthen resilience against future flood disasters.⁴

Conclusion

Floods remain one of the most significant natural disasters affecting Assam, causing substantial health, social, economic, and environmental

consequences. Recurrent flooding disrupts livelihoods, damages infrastructure, increases the burden of communicable diseases, and adversely affects the mental and physical well-being of affected populations.^{1,2} Climate change, rapid urbanization, riverbank erosion, and environmental degradation have further intensified flood vulnerability across the state.³ A comprehensive approach involving effective disaster preparedness, resilient healthcare systems, early warning mechanisms, sustainable environmental management, and active community participation is essential to reduce flood-related risks. Strengthening the role of Community Health Nurses in health promotion, disease prevention, emergency response, and rehabilitation can significantly improve the resilience of flood-affected communities.^{2,4} Continued investment in climate-adaptive policies and integrated flood management strategies will be crucial for protecting the health and livelihoods of the people of Assam.

References

1. Intergovernmental Panel on Climate Change. Climate Change 2023: Synthesis Report. Geneva: IPCC; 2023.
2. World Health Organization. Flooding and Communicable Diseases: Risk Assessment and Preventive Measures. Geneva: WHO; 2024.
3. World Health Organization. Health Emergency and Disaster Risk Management Framework. Geneva: WHO; 2023.
4. National Disaster Management Authority. National Guidelines on Flood Management. New Delhi: NDMA; 2023.
5. Assam State Disaster Management Authority. Annual Activity Report 2023–24. Guwahati: ASDMA; 2025.
6. Assam State Disaster Management Authority. Assam Flood Memorandum 2024. Guwahati: ASDMA; 2024.
7. Government of Assam. Water Resources Department. Flood and Erosion Problems in Assam. Guwahati: Government of Assam; 2025.
8. Kumar S, Rao AP, Tiwari RR, et al. Role of natural and anthropogenic factors in causing frequent floods in Assam, India: A scoping review. *Int J Environ Health Eng*. 2023; 12:15.
9. Hazarika D, Borgohain Baruah N. Saga of flood management strategies in Assam: A critical evaluation. *GUINEIS Journal*. 2025;11(1):181–193.
10. Alderman K, Turner LR, Tong S. Floods and human health: A systematic review. *Environ Int*. 2012; 47:37–47.
11. Mortality and morbidity risks associated with floods: A systematic review and meta-analysis. *Environ Res*. 2024; 263:120263.

Impact of Floods on People Residing in Flood-Affected Areas of Assam: A Comprehensive Review of Health, Social, Economic, and Environmental Consequences

12. Flood impacts on healthcare facilities and disaster preparedness: A systematic review. *Int J Disaster Risk Reduct.* 2025; 119:105340.
13. Impact of flooding events on waterborne and vector-borne infections: A systematic review. 2025.
14. Human impacts of flood disasters: A global systematic review (1980–2025). 2025.
15. Effect of losses and other secondary stressors on psychological health outcomes following floods in Assam. *J Biosoc Sci.* 2025.
16. India Meteorological Department. Annual Climate Summary of India 2024. New Delhi: IMD; 2025.
17. Central Water Commission. Annual Flood Report 2024. New Delhi: Government of India; 2025.
18. National Centre for Disease Control. Integrated Disease Surveillance Programme Annual Report 2024. New Delhi: NCDC; 2025.
19. Indian Council of Medical Research. Climate Change and Human Health in India. New Delhi: ICMR; 2023.
20. United Nations Office for Disaster Risk Reduction. Sendai Framework for Disaster Risk Reduction 2015–2030. Geneva: UNDRR.