

Global Flooding Issues, 2024: A Review

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ABSTRACT

Flooding is a natural disaster, which occurs when normally dry land become submerged due to excess water from heavy rainfall, river overflow, storm surges, or rapid snowmelt. This may take place for socio-economic and flooding events catastrophic affect by natural environment. Based on the above approaches, in the present investigation mainly focus on global flooding issues during 2024 occurred due to the environmental changes. The South East Asian nations like, India, Pakistan, Bangladesh and China are notable monsoon flooding occurred in current year. In India, Kerala, Andhra Pradesh, Telangana, North Indian states including parts of Assam experienced severe flooding due to the annual monsoon rains led to swollen rivers such as the Ganges and Brahmaputra, causing widespread flooding, particularly in low-lying regions. Pakistan provinces like Sindh and Punjab faced widespread flooding as heavy rains and river overflow submerged communities. China experienced widespread flooding due to unusually heavy monsoon rains. Regions such as Hunan, Guangxi, and Guangdong saw river overflow including the Yangtze and Pearl. Whereas, monsoon floods affected approximately 4 million people in Bangladesh, causing significant damage to homes and crops. Many European countries always affected by flood, the Russia and Kazakhstan which is collapse a dam and several river system near Orsk before entering in Caspian sea. Germany affected by flood during June, causing sudden rising of flood water in the Danubar-river around 6.86 meters. European parliamentary election 2024 which was significantly disturbed by flooding occasion in province of Styria. In Nigeria, significant flooding along with the Benue and Niger river due to above-average rainfall. Current issues of flooding events occurred in across the globe have been widespread and intense, affecting millions of people, destroying infrastructure, devastating for crop-producing regions, significant economic losses and exacerbating humanitarian crises.

Keywords: Environment, Flooding, Global, Monsoon, Rainfall and Submergence

I. Introduction

"Right to Food for a Better Life and a Better Future: Leave No One Behind" is the theme for World Flood Disaster (WFD), 2024 reported by the News Agency of Nigeria (NAN). Flooding is a natural disaster, which occurs when normally dry land become submerged due to excess water, typically from heavy rainfall, river overflow, storm surges or rapid snowmelt. This phenomenon can lead to severe impacts on human populations, ecosystems and infrastructure. Floods types including groundwater flooding, urban flooding, river flooding and coastal flooding, it was also known as flash flooding. There is intentional flooding of land that would otherwise remain dry. This may take place for agricultural, military, or river-management purposes. When rain fall occur, water was stored by ponds or soil, grass and other vegetation and also evaporation take place and the remaining water moves across the land as surface runoff. In the increase of heavy rainfall severe flooding occurs due to interaction between rainfall and flooding are complex phenomena. There are several factors are involved include changes in rain and snowmelt, but also soil moisture. Climate change leaves soils drier in some areas, so they may absorb rainfall more quickly. This leads to less flooding. Dry soils can also become harder. In this case, heavy rainfall runs off into rivers and lakes. This increases risks of flooding. Extreme flood events often result from coincidence such as unusually intense, warm rainfall causes tiny impoundments like beaver dams to be released, heavy snow load to melt, and floating ice to impede channels. Socio-economic and natural environmental damages due to frequent flooding result in disaster.

Impact of flooding

- 1. Agriculture:** Flooding can destroy crops, erode fertile soil, and disrupt rural economies. For instance, recent flooding in parts of Europe and South Asia has caused significant agricultural losses, affecting food security and rural livelihoods.
- 2. Infrastructure and Economy:** Floods can damage infrastructure like roads, bridges, and buildings. For example, Australia experienced severe infrastructure impacts from floods in 2024, resulting in high insurance costs and disrupted transportation.
- 3. Environment:** While floods can replenish soil nutrients and restore natural water tables, they may also spread pollutants and damage ecosystems. In river deltas, for instance, floods are beneficial, but in urban areas, they often lead to contamination and loss of habitat.
- 4. Public Health:** Standing water after floods can lead to outbreaks of waterborne diseases like cholera and malaria, especially in areas with limited access to clean water and healthcare services.

II. Global flooding issues during 2024

1. South Asia: Monsoon Flooding (India, Bangladesh, Pakistan)

India: In 2024, northern India and parts of Assam experienced severe flooding due to the annual monsoon rains. Intense rainfall led to swollen rivers such as the Ganges and Brahmaputra, causing widespread flooding, particularly in

low-lying regions. Bihar, Uttar Pradesh, and West Bengal were the worst-hit states, with millions displaced and over 200 deaths reported. Flash floods were a common issue, exacerbated by rapid urbanization, deforestation, and inadequate flood control infrastructure.

Pakistan: Provinces like Sindh and Punjab faced widespread flooding as heavy rains and river overflow submerged communities. In addition to monsoon rains, flash floods due to mountain runoff led to at least 100 fatalities and the displacement of thousands. Pakistan continues to face significant challenges in flood management, particularly in rural areas that lack sufficient infrastructure (United Nations Office for Disaster Risk Reduction (UNDRR), BBC News).

Bangladesh: In Indian rivers such as, Padma and Jamuna caused overflow for inundating heavy rainfall and upstream flooding. In 2024, monsoon floods affected approximately 4 million people in Bangladesh, causing significant damage to homes and crops. The government has been focusing on emergency relief efforts, while longer-term climate adaptation strategies remain a priority.

China

In 2024, China experienced widespread flooding due to unusually heavy monsoon rains. Regions such as Hunan, Guangxi, and Guangdong saw rivers including the Yangtze and Pearl overflow. The Hunan province faced flash floods that led to over 100 deaths and widespread property damage. Several provinces were also affected by landslides triggered by heavy rainfall. The Chinese government activated emergency measures and carried out large-scale evacuations. However, the flooding led to significant damage to agriculture and infrastructure, particularly in southern China (China Daily & Reuters, 2024).

2. Afghanistan–Pakistan floods

The unseasonal rainfall occurred during the month of March, 2024 in Afghanistan and Pakistan extensively affected both infrastructure and agriculture. This flash flooding due to heavy rain resulted by killing more than 1000 people in this countries (Afghanistan–Pakistan floods, 2024). There are 9,271 hectares (22,910 acres) of agricultural land was affected by and most of the casualties are reported. The extreme rainfall which was in starked contrast in the unusual dry winter, dry soil struggled to absorb the rain water which leading to flash flooding. The Pakistan Meteorological Department also predicted more intermittent rain in all four provinces in Balochistan and Khyber Pakhtunkhwa region.

3. Central Asian floods

The Kazakhstan's country, Ministry of Emergency Situations has announced the evacuation of approximately 96,472 residents, including 31,640 children, due to severe flooding across parts of the western and northern regions. Key affected areas include the cities of Aktobe and Petropavlovsk, along with the parts of Atyrau, Akmol, Kostanay, East Kazakhstan, North Kazakhstan and Pavlodar. The flooding crisis escalated following the collapse an Orsk dam, significantly impacting river systems of by Russia and Kazakhstan before draining water into the Caspian Sea. The failure of the Orsk dam, along with others, was triggered by intense rainfall and a sharp increase in water discharge, particularly in areas such as Novotroitsk, Orenburg

Oblast and Tomsk, where the Tom River experienced rising levels that further strained dam infrastructures.

4. Europe floods

During early autumn of 2024, several parts of Europe were impacted by destructive floods, with countries such as Spain, Austria, the Czech Republic, Croatia, Germany, Hungary, Italy, Poland, Romania, and Slovakia reporting unadorned damage. This disaster was triggered by Storm Boris, which delivered an extraordinary volume of rainfall equivalent to an entire month's precipitation in just 24 hours, beginning on September 13 and persisting for several days. The storm left a trail of destruction, demolishing residential buildings, schools, and essential infrastructure. Over 1,000 individuals had to be evacuated, at least 26 lives were lost, and thousands were forced to flee their homes. Among the most severely affected were Ukrainian refugees in Poland, especially in the town of Łądek Zdrój, where floodwaters damaged three shelter facilities, leaving around 90 mothers and their children loose the houses.

The Andorra due to strong circulation of winds(Kirk's Circulation- 126km/hr) and heavy rainfall (34mm) in Port d'Envalira. Germany was affected by flood during early June , causing suddern raing of flood water around 6.86 meter in the Danubar river. European parliament election, 2024 which was significantly disrupted by flooding occasion in province of Styria. In the Belgium country being hitten rainfall and falling of trees due to heavy wing during January and June month flooding. Whereas, overflow of rain water in the river Eau Rouge near the Franch border. Southern Bosnia and Herzegovina on first week of October was unnatural flooding due to lashing rain with naccessible roads and bridges of villages and railways also blocked due to flooding along with landslides. Flashflood warnings were issued and rainfall received around 249 and 192 mm (9.8 and 7.6 in) during October in Gračac and Krk. March 2024, heavy rainfall lead to severe flooding at Montmorillon in France. Floods in Central France affected the departments of Yonne and Saône-et-Loire in April, 2024. In June 2024, heavy rains caused flooding in Eauze, Montréal, and Fourcès in Gers. The remnants of Hurricane Leslie led to widespread flooding in parts of Europe, particularly impacting several regions with exceptionally heavy rainfall. In many communes, precipitation totals surpassed 300 mm, with Mayres reporting an extreme 689 mm (27.1 inches) of rain. In May 2024, intense downpours hit Saarland in Germany, where more than 100 liters of rain per square meter fell in less than a day. This situation worsened in June 2024 as southern regions of Germany, especially Baden-Württemberg and Bavaria had experienced severe flooding. Continuous heavy rain caused multiple dams and dykes to either fail or exceed capacity, forcing the evacuation of numerous villages across both states. Several rivers swelled beyond safe levels, including the Danube, Isar, Zusam, Weilach, Ilm, Paar, Schmitter, Roth, and Leibi, contributing to the extensive flooding across the region.

5. Australia: Queensland and New South Wales Flooding

Queensland and New South Wales in Australia have faced ongoing flood risks in 2024, with heavy rainfall and intense storms causing rivers such as the Brisbane River and Hunter River to overflow. Brisbane, Townsville, and Sydney were particularly affected, with flash floods overwhelming drainage systems and causing widespread property damage. Floodwater rescues were conducted throughout the region, and the Australian Bureau of Meteorology issued continuous flood alerts.

The flooding has also caused significant disruptions to transportation and agriculture in Queensland's farming regions (ABC News, Australia & The Guardian, 2024).

6. Africa: Flooding in Nigeria and Uganda

In Nigeria, 2024 saw significant flooding along the Benue River and Niger River due to above-average rainfall. Lagos and Benue state were particularly affected, with tens of thousands of people displaced by rising waters. The floods caused major damage to homes, infrastructure, and farmlands. Additionally, urban areas with inadequate drainage systems faced severe flash floods. Uganda also faced severe flooding in 2024, with the Nile River and its tributaries experiencing unusually high water levels, leading to widespread flooding in Kampala and surrounding areas. The government and NGOs were involved in evacuation and relief efforts (UNDRR & BBC News, 2024). In September 2024, catastrophic floods struck Libya, particularly in the northeastern city of Derna. These floods were triggered by the collapse of two dams after heavy rainfall from Storm Daniel. The flooding caused widespread devastation, leading to thousands of casualties. Reports indicated that over 10,000 people were killed, and tens of thousands were displaced.

6. Pacific Islands: Coastal Flooding

Pacific island nations such as Kiribati, Fiji, and the Marshall Islands continue to face recurring flooding due to rising sea levels, exacerbated by tropical storms and storm surges. Fiji and Vanuatu experienced flooding in 2024, with coastal areas inundated during high tide, destroying homes, infrastructure, and crops. Rising seas and stronger storms pose existential threats to many of these island nations, contributing to increased displacement (UN Climate Change & The Guardian, 2024).

Davies, 2024(a) reported the city of Florida receiving 120 mm of rain fall March 2024. Significant rainfall totals were recorded 154.0mm in Río Branco of Cerro Largo, 154.0 mm, 140.0mm in José P. Varela of Lavalleja, 138.0mm in Nueva Helvecia of Colonia, 135.0mm in Ecilda Paullier of San José and 134.0mm in Reboledo of Florida: 134.0 mm from 20th & 31st March, 2024 within 24-hour period. According to Servicio Meteorológico Nacional (SMN), Argentina's meteorological organization, the Buenos Aires suburb of Morón had 130 mm of rain in a 24-hour period ending at 9:00 on 12th March, 2024. Total rainfall more than 125mm received including the region of Parque Roca, Barracas, Mataderos, Villa Soldati and Parque Avellaneda (Davies, 2024b). The World Meteorological Organization (WMO) data states that Buenos Aires received an average of 140.1 mm of rain in March 2024.

III. Global flooding issues in agricultural and allied sectors

Flood devastation in Sherpur, Mymensingh and Netrokona district during October 2024, excessive rainfall triggered significant flooding in the low-lying border regions located near Meghalaya in India. The floodwaters caused widespread agricultural damage, with more than 92,000 hectares of farmland either completely destroyed or partially affected. The estimated economic loss has been valued at around 1,144 crore in Taka, Bangladesh (Ibrahim, 2024). According to data from the India Meteorological Department (IMD), the heaviest rainfall recorded within a 24-hour period was 120 mm in Cachar and 80 mm in Tinsukia, while the regional average stood at 21.1 mm. The Central Water Commission (CWC) bulletin indicates that the Brahmaputra and two other rivers are flowing above the danger level.

A total of 823 villages were affected by flood and 16,673.86 hectares of cropped area have been damaged across the state. In Uttar Pradesh, a total of 13 districts and 413 villages were impacted by flooding during July 2024, affecting approximately 324,528 hectares of agricultural land (Fig. 1). Meanwhile, the Kerala state, receiving continuous heavy rainfall severely disrupted daily life, particularly in the hilly regions of the northern districts. It was highlighted localized flooding, uprooted trees and minor landslides (Fig. 2). The districts of Wayanad and Ernakulam witnessed particularly intense rainfall accompanied by strong winds, leading to widespread disruptions. In addition, the water levels of multiple rivers traversing these regions rose sharply, increasing the risk of further flooding and erosion (Sphere India, 2024).



Fig.1. Flood affected areas of Uttar Pradesh



Fig.2. Flood affected areas of Kerala

The floods have affected more than 1.3 million farmers and damaged crops worth CHF 240 million (USD 282 million) reported by the Bangladesh Agriculture Ministry. This is particularly harmful because over 42% of Bangladesh's workforce is employed in the agriculture sector. Additionally, cattle and fisheries have suffered losses of CHF 132 million (USD 156 million) as a result of the floods (IFRC, 24 Nov 2024).

Between the period of 7th - 13th March, 2024, heavy rainfall on Sumatra Island, Indonesia, triggered flash floods and landslides, leading to widespread disruption and damage. The flooding submerged approximately 113 hectares (279 acres) of rice fields, while around 300 square meters (3,230 square feet) of plantations and home gardens were also impacted (Retrieved, 2024).

The Kenya Red Cross reports that floods have devastated nearly 40,000 acres (16,800 hectares) of crops, raising worries about Kenya Seed Company's agricultural output, which has lost roughly 2,000 acres of seed (The Star, 2024).

Around 354,000 hectares of agricultural land across the region West and Central Africa were impacted by flood during the August 2024 (Fig.3). The affected total area rendering 3,80,000 hectares of land unfit for livestock and agricultural production (OCHA, 2024).

According to the report received from Food and Agricultural Organization (FAO), Nigeria, estimated loss of 855,629 metric tonnes of food supplement's through floods during the rainy season of 2024 (Olatunji and Falaju, 2024).



Fig. 3. Aerial view show houses are submerged under flood water in the Adonkolo district of Lokoja, Central Nigeria



Fig. 4. Floods in Florida Department, Uruguay, March 2024. Photo: SINAE

The Food and Agriculture Organization (FAO) and the United Nations reported that the flood has impacted 1.39 million hectares of crops, making food insecurity in Northeast Nigeria (Fig. 4). An estimated 166,731 metric tons of food were lost as a result of the submersion of flood around 6,570 hectares of irrigated cropland and over 104,000 hectares of rainfed crops in the Yobe, Adamawa and Bomo states of Nigeria. Approximately 3.82 million hectares of land were flooded between 16 to 30th September, 2024, it damaging 1.39 million hectares of crops in Adamawa, according to statement given by Dr. Abdullahi Usman, FAO Field Office Coordinator. Borno and Adamawa states, there are 143,395 hectares of land severely affected by of flood and with 58,088 hectares of impacted farmland. It is predicted that 486,000 tons of maize alone might be lost in production due flood, which would be enough to feed around four million people annually (WFD, 2024).

Table 1. Country wise flood affected area and estimated agricultural/horticultural losses during 2024

S. No.	Country	Flood Event	Reason	Rainfall Received (cm)	Duration of Flooding	Estimated Agricultural Losses (ha)	Estimated Horticultural Losses (ha)	Overall Economic Loss (Rs.)
1	Bangladesh	Eastern Flash Floods	Monsoon rains, river overflow	≥80 cm	August–October	296,852 ha; 1.1 million tons of rice lost	Significant losses in vegetables and fruits	₹3,800 crore
2	China	Anhui Province Floods	Heavy rains, river overflow	Not specified	August	Significant damage to rice fields	Not specified	₹7,500 crore
3	China (Guangdong)	Southern China Floods	Torrential rains and landslides	Up to 36.7 cm	April–June	Significant damage to agricultural lands	Not specified	₹4,300 crore
4	Indonesia (Sumatra)	Flash Floods	Torrential rains and landslides	30 cm in 6 hours	March	113 ha of rice fields submerged	300 sq. meters of plantations affected	₹1,200 crore
5	Philippines	Typhoon-induced Flooding	Typhoon and heavy rains	Not specified	August	Extensive damage to rice and corn fields	Damage to banana and coconut plantations	₹2,500 crore
6	USA (Southeast)	Hurricane Helene	Hurricane-induced flooding	Not specified	September	Widespread crop destruction	Soil contamination affecting crops	₹6,500 crore
7	Canada (British Columbia)	Atmospheric River Floods	Intense rainfall	Not specified	October	Agricultural lands inundated	Infrastructure damage affecting farming	₹900 crore
8	Costa Rica	Hurricane Rafael	Heavy rains and flooding	Not specified	November	₹500 million (~₹6 crore) in agricultural losses	Not specified	₹80 crore
9	Brazil (Rio Grande do Sul)	Severe Flooding	Heavy rains and storms	Up to 80 cm	April–May	3.2 million ha affected; 2.71 million tons of soybeans lost	Damage to rice, corn, and livestock sectors	₹5,000 crore
10	Australia	North Queensland Floods	Cyclone-induced heavy rains	Not specified	February	94% of banana plantations affected	80% of sugarcane fields damaged	₹1,000 crore
11	Spain	Valencia Region Floods	DANA storm, torrential rains	Not specified	October	21,137 ha affected; major citrus losses	Damage to persimmons, grapes, almonds	₹9,500 crore
12	Ghana	Nationwide Floods	Prolonged heavy rains	Not specified	August	1.8 million ha affected	Significant crop failures	₹15,000 crore
13	West & Central Africa	Regional Floods	Unprecedented rainfall	2–6× average levels	Mid-2024	Extensive crop and livestock losses	Not specified	₹12,000 crore
14	Lebanon	Akkar Plain Floods	River overflow, heavy rains	Not specified	November	200 ha of wheat, oats, strawberries lost	200 greenhouses destroyed	Not specified
15	Kenya	Nationwide Floods	Heavy rains, river overflow	Not specified	May	Estimated 42,000 acres of crops destroyed	Significant crop failures	₹1,500 crore
16	Somalia	Gu Season Floods	Seasonal rains, river overflow	Not specified	April–June	5,899 ha of agricultural land inundated	Significant crop failures	Not specified
17	Russia	Nationwide Weather Events	Floods and frost	Not specified	May–June	20–22 million tons of grain lost	Not specified	₹10,000 crore

Table 2. Country wise flood affected area and estimated agricultural/horticultural losses during 2024

S.No.	Country	Flood Event & Region	Reason	Rainfall Received (cm)	Duration of Flooding	Estimated Agricultural/ Horticultural Losses (ha)	Estimated Agricultural/ Horticultural Losses (Rs.)	Overall Economic Loss (Rs.)
1	India	Nationwide Floods	Extreme weather events	Not specified	Throughout 2024	1.02 million ha affected	Not specified	₹14,771 crore
2	India	Ernakulam District, Kerala	Heavy rains	Not specified	April–May	1,269 ha affected	₹11 crore in damages	₹11 crore
3	India	Karnataka (Coastal & Malnad regions)	Early monsoon, landslides	45% above average	May	Over 3,500 ha affected	Not specified	Not specified
4	India	Nashik Region, Maharashtra	Unseasonal rains and winds	Not specified	May	21,500 ha affected	Significant damage to bananas, onions, mangoes	Not specified
5	Pakistan	Nationwide Monsoon Floods	Monsoon rains	Not specified	August	Extensive crop and livestock losses	Not specified	Not specified
6	Pakistan	Multisectoral Rapid Need Assessment Regions	Monsoon floods	Not specified	August	Destruction of 15,000 households; loss of 2,283 livestock	Severe impact on agricultural communities	Not specified

IV. Conclusion

In 2024, flooding events across the globe have been widespread and intense, affecting millions of people, destroying infrastructure, and exacerbating humanitarian crises. The increasing frequency of extreme weather events such as heavy monsoons, hurricanes, and typhoons, combined with rising sea levels and inadequate flood protection systems, is expected to continue to worsen. Adaptation and mitigation strategies will be critical in addressing these challenges in the coming years. The World Economic Forum (WEF) highlights that global flooding has a significant economic impact, particularly in agriculture, infrastructure, and tourism. In countries where agriculture forms the backbone of the economy, flooding disrupts food production, deepening food insecurity and economic losses. Flooding in 2024 has been particularly devastating for crop-producing regions, such as those in Sub-Saharan Africa and South Asia, leading to significant economic losses and further complicating recovery efforts (WEF Global Risks Report 2024).

V. Feature prospects

International collaboration, sustainable land use and water management, legislative changes, and technology innovation are all necessary to address the global flooding problems. The following feature prospects techniques and solutions offering that can be applied locally, regionally and globally to reduce the effects of flooding: 1. Integrated flood management system: Systematic plan for land use, infrastructure development, agriculture and water resources in organized manner. It may improve community resilience, provide balanced ecological services, and foster coexistence with floods. 2. The Real Time Monitoring and Early Warning System: It may be used for artificial intelligent technology (AI), IoT, satellites and hydrological model for predict and alarming the weather condition in a particular time in a place. Accurate alerts can save lives and assets, enhance disaster preparedness and mobile apps can notify remote farmers directly. Indian Metrological Department (IMD), Flood Monitoring system, NASA WaPOR platform for agricultural water management, FAO. 3. Climate-Resilient Agricultural System: Development of agricultural crop varieties tolerant against the flood, use newly invented and changes the cultivation techniques. To reduce the crop failure and increase the farm income, enhance the food security in flood vulnerable region. 4. The Policy, Governance and International Cooperation: Disaster management structure, flood management programmes, enforcement of building codes, land use laws and combination of national and regional flooding policies are helpful for public.

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