



# Root Causes And Remedial Measures Of Floods In Krishna River Basin- An Empirical Study

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## ABSTRACT:

The immediate cause for the latest floods was a lower pressure built up over the Bay of Bengal, besides a land-based cyclone, which drew moisture from both Arabian Sea and Bay of Bengal: IMD. The devastating floods in Krishna and Godavari River basins that wreaked havoc in several parts of Andhra Pradesh and Telangana in the past week, leading to death of 75 people and displacement of more than 59,000 people in both the states, is unusual in the terms of short spurt of extreme rainfall. The immediate cause for the latest floods, according to the Indian Meteorological Department, was a lower pressure built up over the Bay of Bengal, besides a land-based cyclone, which drew moisture from both the Arabian Sea and Bay of Bengal. The combination of these factors led to very heavy rains in both the Telugu states, starting from the night of August 30 and continuing till September 3.

“Over 27 per cent of the state’s annual rainfall occurred in just 48 hours, causing severe flooding in many areas and Vijayawada, particularly, bore the brunt of the deluge with 290 mm of rainfall in a single day on the night of August 31 and September 1, which was the highest rainfall in the last 30 years,” said Andhra Pradesh Disaster Management Authority managing director Ronanki Kurmanath. During this period, several parts of Telangana received the highest rainfall ranging from 438 mm in Mahabubabad to 435 mm in Warangal, 425 mm in Suryapet and 422 mm in Khammam.

Experts attributed the flooding in several parts of the state to extreme rainfall but held massive construction on the river flood plains in both Krishna and Godavari basins as a contributing factor. The two flood plains fall receive 84% of rainfall during monsoon, starting from June to September, thereby increasing probability of floods during the rainy season. Compared to Godavari, which witnesses floods almost every year, Krishna river is less prone to floods. According to the official data, the Krishna river, the second largest eastward draining interstate river basin, witnessed as many as 17 floods in the last 100 years.

## KEY WORDS:

FLOODS, REMEDIAL MEASURES, RIVER BASIN, CATCHMENT AREA, BUND RESTORATION, DISPLACEMENT, INFRASTRUCTURE, POST-DISASTER RECONSTRUCTION, SOCIO-ECONOMIC STATUS, PSYCHOLOGICAL VULNERABILITY.

## INTRODUCTION:

According to Veeramalla Prakash, chairman of Indian Peninsular River Basin Council (IPRBC), the major cause of floods to the Krishna river are torrential rains in the upper catchment area in Maharashtra and Karnataka, although cyclone and deep depression-induced rains have been one of the major common causes of floods. “One of the main reasons for floods in Krishna river is lack of proper river management by the riparian states. Maharashtra and Karnataka impound Krishna water in their dams to the brim before releasing to the downstream. This is causing floods in their respective states due to backwaters of these dams. For example, Sangli city and its surroundings suffer from floods whenever water is impounded in Almatti dam by Karnataka,” Prakash said.

However, the flooding has aggravated in recent decades due to climate change induced extreme rainfall in upstream of the river, forcing the two states to open the gates of the dams and release water to the downstream, resulting in floods in Andhra Pradesh. The worst flood the state had witnessed in Krishna river before 2024 was in the first week of October 2009. Due to heavy rainfall in Karnataka, the gates of Almatti and Narayanpur dams on Krishna river and Tungabhadra dam on Tungabhadra river were lifted affecting many districts along the river course. Kurnool town was submerged in the backwaters of the Srisailem dam due to unprecedented inflows then. The Srisailem dam, which was designed to withstand a maximum flood flow of 19 lakh cusecs, received 25.4 lakh cusecs of water for eight hours on October 2, 2009. At the Nagarjunasagar dam, too, more than 11 lakh cusecs of waters and by the time the flood reached Prakasam barrage, it was around 10.94 lakh cusecs. “Had the water been released by Karnataka periodically to the downstream, there would not have been such a huge flood to the river and destruction in Andhra Pradesh,” Prakash said. Like 2009, the latest flood in Krishna river that ravaged Vijayawada and its surroundings was also because of impounding of water in the dams upstream. “All the dams in Maharashtra and Karnataka were filled to the brim in July itself. So, was the case with Srisailem and Nagarjunasagar,” said Prakash. The damage to one of the gates of Tungabhadra dam added to the misery, as more water to the extent of 32 tmc (thousand million cubic feet) joined the Krishna river in Andhra Pradesh. So, when there were heavy rains upstream in the last week of August, the already swelling Krishna river received more inflows and the irrigation authorities had to open all the gates of major dams, leading to flooding, official said.

According to state irrigation minister Nimmala Ramanaidu, the discharge at Prakasam barrage on Krishna river at Vijayawada reached up to 11.43 cusecs on September 1, which was the highest since the barrage was built in 1852-56. “This resulted in submergence of colonies along the river course in Vijayawada and the villages in Krishna district downstream,” Ramanaidu said. But more than Krishna river, it was the unprecedented floods to its tributary Munneru, which ravaged Telangana’s Khammam town, and Budameru, an independent river, passing through northern side of Vijayawada that caused extensive damage to the lives and properties in several colonies. The Munneru river, typically a dry tributary, swelled unexpectedly, causing a flash flood in just one hour between 10 am and 11 am on September 1. With no prior warning or announcement from the authorities, the flood devastated Khammam, for the first time in the last 70 years, disaster management officials said.

“The flash floods to Munneru was because of a sudden surge in the Akeru forest stream upstream about four kilometres away. It came like a Tsunami to the people of Khammam, who built their colonies along the river course,” said R Satyanarayana, a resident of Khammam. Similar was the case with Budameru river, which created havoc in the colonies of Vijayawada, that are submerged even after a week. Originating from the hills of Mylavaram, Budameru traverses 176 kilometres before it empties into the Kolleru Lake. Several streams join it on the way. At Velagaleru near Vijayawada, a barrage with 11 locks impounds water if the flow is sluggish. The last time Budameru received floods was in 2005, when it received an inflow of more than 75,000 cusecs which submerged many areas in

Vijayawada. Following a hue and cry, the then government constructed the Budameru diversion channel (BDC) in 2006-07, which meant for diverting the Budameru flood into the 37,500-cusec-capacity Polavaram Right Canal which finally empties into the Krishna.

In the last 17 years, there has not been much flood in Budameru river. During this period, Vijayawada expanded rapidly and several new colonies like New Rajarajeswaripet, Nandamuri Nagar, Nunna, Payakapuram, Singh Nagar, Devi Nagar and others came up, making the Budameru shrink into a narrow drain. Even the bunds along the river were destroyed and encroached upon by the greedy realtors. “The river no more exists and its flood plains have been taken over by all types of construction. The canal was primarily built to divert river water to Polavaram canal after 2005 floods and 11 gates were built on the river to prevent it from entering the city. This created a false hope,” said independent weather man, Pradeep John.

This hope dashed on September 1, when heavy rainfall in the upper catchment of Budameru resulted in an inflow of 50,000 cusecs of water into the river. The water could not be diverted from Budameru into Krishna river through a diversion channel as the Krishna river was already in spate with 11 lakh cusecs. Hence, the massive flooding. So, it created a rebound effect as 50,000 cusecs of water flowed back into Budameru with tremendous speed. The authorities were forced to open 11 locks at Velagaleru to let the water into the river. Had it not been done, water would have submerged Narla Tata Rao Thermal Power Station. So, it entered Vijayawada city and flooded the colonies which came up on the flood plains of Budameru. Even after a week, the colonies are still in water. As mentioned above, compared to Krishna basin, Godavari basin is more prone to floods, because it flows through huge forest areas which has several tributaries like Manjira, Pranahita, Sabari, Indravati and Kinnerasani, which get huge floods during the rainy season, which join the Godavari river at different locations. “Most of these tributaries pass through the forest area and flow at a faster pace, causing flash floods to the Godavari river. Added to this, they bring a lot of silt along with them, because of which there will be a heavy submergence of areas in the flood plains of the river. Even moderate rainfall in the upstream of the river leads to massive floods,” said Prof D Narasimha Reddy, independent climate expert and former visiting faculty of University of Hyderabad.

According to Veeramalla Prakash, the floods to Godavari river in Telangana and Andhra Pradesh begin only after Kaleshwaram. “The Maharashtra government constructed a series of dams and barrages, and a number of small lift irrigation schemes on the river course. That led to the disturbance in the natural river course, depriving the water to downstream projects in Telangana like Kadem project, Sri Ram Sagar Project (SRSP) and Sripada Yellampalli project,” Prakash said. In order to meet the irrigation requirements of Telangana, the previous BRS government took up the construction of lift irrigation project of Kaleshwaram at the confluence of Pranahita with Godavari river, which has three barrages, which would be filled up by lifting water from the river and from there to different parts of northern Telangana. “What is causing floods to the river leading to submergence of human habitations and agriculture fields is the greed to impound more water to the brim. When there are heavy rains on the upstream, the irrigation authorities are forced to lift the gates of these barrages to release water to the downstream, resulting in heavy floods,” Prof Narasimha Reddy said.

Historically, the highest flood level recorded in Godavari at Bhadrachalam was 75.60 feet in 1986, with a discharge of 27 lakh cusecs. In 2022, the flood level reached 71.30 feet, with a discharge of 21.78 cusecs. The heavy flows in Godavari river at Telangana’s Bhadrachalam reach Polavaram dam, which is still under construction in West Godavari and from there to Dowleswaram barrage near Rajahmundry. In 2022, more than 23 lakh cusecs of water was released from this barrage, inundating several island villages in Konaseema region enroute to Bay of Bengal. “Submergence of thousands of acres of crops, destruction of houses and evacuation of lakhs of people to the relief camps has been a regular phenomenon in this region every year,” Reddy said. Water conservationists like Bhiksham Gujja have expressed apprehensions that once the Polavaram dam is completed, its backwaters might submerge many

parts of Bhadrachalam, which is already getting flooded whenever the water level increases in the Godavari river.

Another prominent water expert and former professor of IIT Bombay B V Subba Rao, who was also a former member of Lakes, Reservoirs and Water Domain of Bureau of Indian Standards said the main reason for frequent floods to might rivers like Godavari and Krishna, besides their tributaries and other rivulets was the disturbances in the river courses, affecting their natural flow. "If expanding agriculture in the flood plains of rivers is the reason for floods in the rural areas, fast growing urbanisation leading to encroachments is the reason for flooding in urban areas," he said. Rao said the river flood pattern has been undergoing drastic changes in the last 20 years and the river basins have experienced unscientific and unsustainable land use. "However, no scientific studies have been conducted in this direction," he said.

### Budameru overflowing near Ayodhya Nagar

In early September 2024, Vijayawada, a city in Andhra Pradesh, India, experienced severe flooding triggered by exceptionally heavy rainfall that began on August 31, 2024. The floods resulted in at least 35 deaths in NTR district and significantly impacted approximately 270,000 people in Vijayawada alone.[1] The disaster was characterized by over 29 cm of rainfall in a single day, which overwhelmed the Krishna River and Budameru Rivulet. The flooding caused extensive damage to infrastructure, homes, and agricultural land.[2] The extreme rainfall caused catastrophic flooding, severely damaging infrastructure, homes, and agricultural land. The flooding exposed critical issues with the city's flood management infrastructure and urban planning, highlighting the urgent need for improved measures to handle such extreme weather events.

The Budameru Rivulet, which flows through Vijayawada, plays a crucial role in draining the basin between the Godavari and Krishna Rivers into Kolleru Lake.[3] Historically, this rivulet has been prone to overflowing, leading to the construction of a diversion canal designed to redirect its flow into the Krishna River from Velagaleru village, situated 15 km from the city. However, during the severe rainfall event in late August 2024, the rivulet was overwhelmed like never before. Torrential rains in the NTR district and neighboring Khammam district caused a significant increase in runoff, which dramatically surged the flow into Budameru. The Krishna River, already swollen from preceding rains, was unable to accommodate the additional inflows from Budameru, which reached an unprecedented 35,000 cusecs, far surpassing the Budameru diversion canal's capacity of 7,000 cusecs. This immense volume of water led to extensive flooding in Vijayawada, exacerbated by breaches in the Budameru Rivulet. The floodwaters breached several manmade barriers and inundated areas that had previously been safeguarded by the diversion canal. The canal, which had been designed to manage high flows, proved inadequate for handling the extreme conditions of this event.[4] The flooding not only highlighted the limitations of existing flood control measures but also underscored the impact of urban encroachments on traditional floodplains, contributing to the widespread damage and displacement in the city.[5]

The recent floods in Vijayawada have exposed severe vulnerabilities related to encroachment on natural water bodies and inadequate flood management infrastructure. The deluge, which began on August 31, significantly impacted more than half of Vijayawada, causing widespread disruption. The Budameru Rivulet, which normally glides through the city, overflowed violently due to extreme rainfall, exacerbated by the already swollen Krishna River. The river's inability to manage the additional inflows from Budameru.[6] The floodwaters inundated residential areas, particularly affecting those built on the Budameru Rivulet's floodplains. Encroachment along the rivulet and its floodplains has obstructed natural water flow and flood management, worsening the impact of the floods. Key factors contributing to the disaster include the heavy

rainfall, which exceeded expected levels, and climate change, which has led to increasingly severe weather events. Encroachments and poor urban planning have also played critical roles, blocking natural water pathways and aggravating the flooding.[7]

The Krishna River also experienced unprecedented flooding, impacting Vijayawada and surrounding regions. Due to continuous heavy rainfall, the river saw record inflows, with the Prakasam Barrage discharging a staggering 1.18 million cusecs of water, the highest in its 70-year history. This massive release was necessary as the barrage reached its capacity, and all 70 gates were opened to manage the excess water. The inflows were intensified by torrential rains in the upstream regions, including the Pulichintala and Nagarjuna Sagar projects. The barrage's total capacity of 11.9 lakh cusecs was overwhelmed, leading to the temporary suspension of vehicle and pedestrian movement across the structure for safety reasons. The floods inundated low-lying residential areas in Vijayawada and several villages downstream, causing significant damage to infrastructure, homes and agricultural land.[8] Historical data indicates that this flood event surpassed previous records, with only the 2009 and 1998 floods coming close in terms of discharge levels. The state government and irrigation officials took swift action to fortify vulnerable areas with sandbags and other materials to mitigate further damage. Despite these efforts, the floods led to widespread disruptions, including the cancellation of trains and the evacuation of thousands of residents. Relief operations were mobilized with the help of national agencies to address the emergency and assist affected communities.

On September 1, 2024, five boats drifted from upstream and collided with Gate No. 69 of the Prakasam Barrage, causing significant damage to its counterweight.[10] The impact led to the counterweight breaking into two pieces, raising concerns about the barrage's safety. The boats, which were not claimed by any known parties, were found to be inadequately anchored, with some tied together with iron chains and others using weak ropes. This has led to suspicions of possible sabotage.[11] Following the incident, the One Town police registered a case and arrested two individuals, Vakkalagadda Ushadri and Komati Ram Mohan, for their suspected involvement. Three special teams have been formed to investigate and identify the boat owners.[12] Repair work on the damaged counterweight began immediately, with a metal box fixed as a temporary measure. Full repairs are expected to take an additional two to three days. Meanwhile, some gates were closed to remove additional boats that were obstructing floodwater flow. The investigation continues to determine the cause of the crash and ensure the barrage's safety.[13]

In response to the crisis, extensive relief and rescue operations have been implemented. As of the latest reports, 6,44,536 people have been affected by the floods. To assist those displaced, 190 relief camps have been established, providing shelter for 44,041 individuals. More than 20 drones have been utilized to deliver food and medicines to areas that are inaccessible by traditional means such as boats and helicopters.[14] Rescue efforts have involved significant coordination among various agencies. A total of 26 teams from the National Disaster Response Force (NDRF) and 22 teams from the State Disaster Response Force (SDRF) have been deployed, alongside numerous volunteers and government officials. Five helicopters from the Indian Air Force and Navy have conducted multiple sorties to supply essentials and rescue stranded individuals.[15]

### Budameru Bund Restoration

Budameru Bund restoration was commenced, which had suffered multiple breaches, leading to widespread devastation. The restoration process involved immediate measures to plug the breaches in the Budameru Diversion Channel (BDC), with significant support from local authorities, the Water Resources Department, and the Indian Army. To prevent future incidents, an additional layer of the bund was constructed with a gap of 4 meters, filled with black cotton soil, and reinforced using concrete mettle and geotextile technology.[16] Despite the challenges of heavy seepage

in the repaired areas, the authorities successfully fortified the bund, shifting their focus to expanding Kolleru outlets to ensure the safe drainage of surplus water. The restoration efforts included increasing the height of the Budameru Bund as a precautionary measure.[17]

Despite challenges like heavy seepage in the repaired areas, the authorities successfully fortified the bund and shifted their focus to expanding Kolleru outlets to ensure the effective drainage of surplus water. Restoration efforts also included increasing the height of the Budameru Bund as a precautionary measure. As part of a broader flood management strategy, Operation Budameru was launched to explore alternative solutions for increasing the discharge capacity in the event of flash floods and cloudbursts, as well as to remove encroachments. This initiative also involves enhancing the flood discharge capacity of the diversion channel, constructing a 20 TMC ft reservoir downstream of the Pulichintala project, and conducting a clean-up drive to remove fish tanks and restore the contours of Kolleru.[18] A comprehensive survey was planned to identify and remove encroachments along the river, aiming to mitigate future risks and protect the region from similar disasters.[19]

A retaining wall for the Budameru rivulet was proposed following severe flooding in Vijayawada.[20] The floods, which impacted residential areas including Indira Naik Nagar, New RR Peta, Ajith Singh Nagar, and Payakapuram, highlighted the need for enhanced flood protection measures. The proposed retaining wall aims to prevent future inundation by managing floodwaters more effectively.[21] In addition to the retaining wall, plans include increasing the height of existing bunds along the Budameru rivulet to better contain and redirect floodwaters. Recent efforts have addressed breaches in the Budameru diversion channel, which previously allowed floodwaters to enter the city.[22]

## CONCLUSION

### POST DISASTER RECONSTRUCTION AND THE VULNERABILITY

Flooding is one of the most pervasive natural disasters globally, disproportionately affecting vulnerable communities. In India, the frequency and intensity of floods have risen due to rapid urbanization, climate change, and inadequate infrastructure, particularly in low-income and informal settlements. The urban poor often inhabit areas prone to flooding due to their socioeconomic status, exacerbating their vulnerability to the consequences of such disasters. Among these areas, Singh Nagar in Vijayawada and the Budameru catchment region are particularly susceptible, where recurring floods lead to significant economic, social, and *psychological* hardships for the residents.

Vijayawada, a city in Andhra Pradesh, is situated along the Krishna River and is prone to seasonal flooding, particularly during monsoons. The Budameru River, which traverses the area, frequently overflows, leading to inundation in low-lying areas like Singh Nagar. These events cause widespread damage to housing, infrastructure, and livelihoods, particularly affecting marginalized populations living in informal settlements. Additionally, these communities face long-term socioeconomic challenges, such as displacement, loss of employment, food insecurity, and inadequate access to essential services like education and healthcare.

The *psychological* impact of floods is often overlooked, yet it is profound and enduring. Residents of flood-affected communities not only face immediate trauma from the disaster itself but also prolonged stress due to displacement, loss of loved ones, and financial instability.

Mental health issues, including anxiety, depression, and post-traumatic stress disorder (PTSD), are common, yet mental health services in disaster-prone areas remain insufficient.

In this context, social work interventions play a pivotal role in both mitigating the immediate impacts of flooding and supporting long-term recovery. Social workers operate at the intersection of humanitarian relief, psychosocial support, and community rehabilitation, addressing both the socioeconomic and *psychological* vulnerabilities of affected communities. Effective social work intervention in flood-prone regions includes not only disaster relief efforts but also sustained engagement to build resilience, restore livelihoods, and promote *psychological* healing.

This study focuses on understanding the nature and effectiveness of social work interventions aimed at mitigating the socioeconomic and *psychological* vulnerabilities of flood-affected communities in Singh Nagar, Vijayawada, and the Budameru catchment areas. By examining the specific challenges faced by these communities, this research aims to provide insights into the role of social workers in disaster management and contribute to the development of more targeted, holistic interventions.

This Background of the Study introduces the core issues related to socioeconomic and *psychological* vulnerability in flood-affected areas and sets the stage for exploring how social workers contribute to addressing these challenges in the specific context of Singh Nagar and Budameru. This section provides a clear rationale for why this research is necessary and relevant.

The vulnerability of flood-affected communities is a critical issue, particularly in urban areas where the socioeconomic and *psychological* impacts of flooding are compounded by rapid urbanization, poverty, and inadequate infrastructure. In Vijayawada, specifically the Singh Nagar neighborhood and the Budameru catchment areas, recurring floods have devastated local communities, creating severe disruptions to livelihoods, housing, and access to essential services. These floods disproportionately affect marginalized populations who often reside in low-lying, flood-prone zones due to economic constraints, making them more susceptible to both immediate and long-term consequences of disaster events.

While short-term relief efforts in the aftermath of floods—such as the provision of food, shelter, and medical care—are critical, they do not address the ongoing socioeconomic and *psychological* challenges that arise in the recovery period. The lack of sustainable interventions leaves these communities trapped in cycles of vulnerability, where repeated exposure to floods erodes their resilience, worsens poverty, and heightens *psychological* distress. Furthermore, *psychological* impacts, such as trauma, anxiety, and post-traumatic stress disorder (PTSD), are often under-addressed, leaving affected individuals without adequate mental health support during and after disaster events.

In this context, the role of social workers becomes central. Social workers are uniquely positioned to deliver comprehensive interventions that address both the

socioeconomic and *psychological* dimensions of vulnerability in flood-affected communities. However, there is a significant gap in the literature regarding the specific nature and effectiveness of social work interventions in addressing the holistic needs of such communities. There is limited empirical research that focuses on how social work practices are being applied in disaster-prone regions like Singh Nagar and Budameru, and whether these interventions are successfully mitigating the long-term vulnerabilities these communities face.

This study seeks to fill this gap by critically examining the socioeconomic and *psychological* vulnerabilities of flood-affected communities in Singh Nagar, Vijayawada, and the Budameru catchment areas, and evaluating the role of social workers in mitigating these vulnerabilities. Through a descriptive case study approach, the research will explore the effectiveness of social worker interventions in building community resilience, supporting livelihood recovery, and promoting *psychological* healing. In doing so, this research aims to contribute to a more nuanced understanding of disaster social work in urban, flood-prone contexts and offer practical insights for strengthening interventions to better serve vulnerable populations.

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