A REVIEW OF THE FLOOD DISASTER IN WESTERN MAHARASHTRA

Sub theme: **Goal 13 - Climate Action**

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Abstract

Every year in the Krishna-Panchganga River Basin, there have been significant floods in months of July and August causing extensive harm to human lives, property and the environment. Flood disasters are the result of natural events but due to human interference, there is an increase in their frequency and severity. Flood disaster management has evolved over time from conventional methods to integrated systems that make use of many technologies. Climate change and socio-economic growth have led to an increase in the frequency and severity of floods. Flood control is widely acknowledged as an effective means of reducing the negative effects and recent research has aimed to develop a sustainable approach to flood management. Along with reviewing the definition of flood risk, risk analysis techniques, flood resilience, flood management and flood risk management, we also provide a thorough introduction of the field of flood research. The best course of action for future flood management initiatives is to incorporate the idea of resilience into the risk management framework. As a result, employing the theories of risk, resilience and sustainability, sensible choices and actions made before, during and after a disaster will successfully minimize the negative effects. This review shows the shift in flood research from traditional flood management which offered strategies for mitigation of flood risk. It offers an adaptation approach, mitigation measures and flood resilience management which offered a more sustainable and resilient plan for dealing with flood disasters. Flood layers, evaluation of river basin and land coverage analysis using the AHP Method, GIS techniques were factors taken into account for the assessment of the flood risk analysis. This paper provides

knowledge on flood disaster awareness, mitigation and adaption techniques and readiness and management. The goal of the current study the effects of floods in western Maharashtra, along with their causes and remedies.

Keywords

Flood; Disaster; Flood Management; Causes, Impact; Risk; Western Maharashtra; Disaster prone areas

1. Introduction

India is one of the world's most disaster-prone nations because of its diverse range of natural characteristics, which include mountains, rivers, oceans, and valleys. Now a days in the world the most destructive and frequent natural disaster is flooding. In the last few decades, the Western Maharashtra had some of the most destructive and frequent flood disasters in history. Flooding is currently the most devastating and common natural disaster in the globe. The watershed in the Indian state of Maharashtra has had some of the most catastrophic and frequent flood disasters in recorded history throughout the past few decades. Those who live near the River Basins should relocate to a safer region during floods. Floods are detrimental to society because they destroy infrastructure, agriculture, and property. Farmers in the River basin can reduce their losses of many kinds as a result of flood disasters. Floods harm society by causing property damage, agricultural losses, and facilities. (Prashant N. Pusdekar, 2023)

Large portions of western and central India have been inundated by floods brought on by excessive monsoon rains in recent years; the states of Andhra Pradesh, Gujarat, Maharashtra, Chhatisgarh, and Orissa have been the most severely affected. The western region of Maharashtra's districts of Sangali, Kolhapur, Satara, Pune, and Nashik have been severely impacted by flooding as a result of the monsoon's excessive rainfall. In order to compare the severity of floods that have happened in consecutive years to this day, the current study focuses on the badly impacted in Western Maharashtra region and surrounding districts. Within this framework, the current research endeavours to evaluate the impact of flooding on farmland, residential properties, personal belongings, people, transit, and essential utilities such as phone, cell phone, and power supply. (K.C. Ramotra, 2012)

Considering the importance and severity of flood damage, one of the most important tasks that needs to be completed in order to assess and implement flood risk management measures is mapping floodplains. From a geo-informatics standpoint we can collect data for analysis using GIS software. To identify floodplains, GIS tools like ArcGIS, HEC-HMS, HEC-RAS, and others are employed. A novice user may find it challenging to select one floodplain mapping strategy for his particular assignment due to the abundance of available approaches. (Karthik Nagarajan, 2022)

A number of major floods have occurred in Western Maharashtra in recent decades, particularly in the districts of Kolhapur, Sangli, and Satara. There were significant floods in 2005, 2006, 2009, 2011, and August 2019, with one particularly bad incident. These occurrences have interrupted livelihoods, severely damaged property, and damaged infrastructure. The area had yet another catastrophic flood in 2021, which affected 13 districts in western Maharashtra and claimed over 251 lives. (Tiware V.S., 2022)

Karnataka's Almatti Dam, which is situated on the Krishna River, is important to the area's hydrology. The dam's water management procedures have raised concerns since it was built downstream of Maharashtra. According to studies, the Hippargi Barrage and the Almatti Dam's operation may have enhanced floods in the districts of Kolhapur and Sangli in Maharashtra. Flood severity is significantly influenced by the reservoirs' capacity and how they are managed during periods of high precipitation. The Maharashtra government has responded to these worries by enlisting the National Institute of Hydrology (NIH) in Roorkee to carry out an extensive investigation into how the backwaters of the Almatti Dam affect floods in the state. The purpose of this study is to offer scientific understanding of how the dam affects flood dynamics in western Maharashtra. (Suraj K. Patil, 2021)

Local communities and activists have also called for the publication of studies looking at the Almatti Dam's backwater impacts, particularly in light of plans to raise its height, which might make floods in Maharashtra's upstream districts worse. Flooding in western Maharashtra is largely caused by natural reasons like excessive rainfall, but the management of downstream facilities like the Almatti Dam has a major influence on the frequency and intensity of floods. (Sandip B. Mangalekara, 2019)

2. Study Area:

Western Maharashtra region consists of Western Ghats area distinguished by hills and valleys physiographically includes mainly Sangli, Satara, Kolhapur districts. District's geographical terrain is separated into three primary regions: the Eastern, Central and Southern ranges.

3. Problem Identification:

In the Western Maharashtra, districts like Sangli, Satara, Kolhapur are located next to the Panchganga River, in the Krishna River basin experienced flooding in August 2005, August 2019, August 2021, and August 2024 due to heavy rains. The areas nearer to the Panchganga River basin directly gets affected resulting flood because of Radhanagari dam and Krishna river water backwater. It affects the people shelter, vegetation, transportation, basic services like electricity, telecommunication, irrigation, real estate, land use etc. Consequently, Western Maharashtra is selected as the study region for the disaster management strategy due to its frequent flooding, which should help the area to reduce the danger creating a flood risk disaster.

4. Literature Review and Methodology:

4.1. Literature Review:

1. Prashant N. Pusdekar and Sanjay V. Dudul, 2023 published paper on Assessment Flood Susceptibility Accuracy Assessment of Panchganga River Basin (PRB), Kolhapur, Maharashtra (India) using Frequency Ratio and Weight of Evidence Model**.** According to the literature, flow velocity is increased by changes in the pattern of land use and cover that result in an increased impervious surface.

2. K.C. Ramotra, Prashant T. Patil, 2012 presented a paper on Impact of Flood on Prayag Chikhali Village of Karveer Tehsil in Maharashtra (India): A Comparative Analysis (2005-2006). The Researcher focuses on, approximately 80% of people affected by disasters worldwide are victims of natural disasters, which include floods, droughts, cyclones, earthquakes, and other man-made events like riots, conflicts, refugee situations, fire epidemics, industrial accidents, and environmental fallout.
3. Iliasse Khaddor and Mohammed Achab, 2021 publishes a paper on The The Impact of the Construction of a Dam on Flood Management. Researcher highlights on, Heavy storm events are known to cause violent and brutal floods in hilly urban areas, which can be quite devastating. Both a national and regional response is necessary to this kind of flooding. He conclude that urban management however, an evaluation and measurement of the impact of flooding on hydraulic structures, such as dams, are necessary.
4. Karthik Nagarajan and Raju Narwade, 2022 presented a paper on Review Paper for floodplain mapping with applications of HEC-HMS, HEC-RAS and ArcGIS softwares - A Remote Sensing and GIS Approach. According to the literature, Natural calamities have afflicted India for a very long time. In recent years, flooding has increased in frequency. People's lives and property both have been severely damaged by these floods. Researchers have been studying floodplain mapping for a long time. When doing research on the topic for the first time, a user might not know which method to utilize or how to apply it.
5. Suraj K. Patil, 2021 publishes a paper on Water Resources Development and Causes of Flood Blossoming in Upper Krishna River Basin. The researcher's main emphasis is, In South India's Krishna basin, agricultural and water development projects have resulted in an increasing excessive collection of water resources. Due to excessive collection of nearly all surface water resources are used for human consumption; rising groundwater abstraction disrupts the surface water balance by reducing base flows; and the discharge to the ocean keeps declining.
6. Mr. Harshavardhan U Kamble, 2020 presented a paper on Socio-Economic and Environmental Impacts on agricultural related activities of Flood Disaster in and around Panchganga river basin. The Researcher highlights, Since last two decades, the Panchganga river basin has undoubtedly been impacted by and made more extreme by natural disasters. Because of human interference in the ecosystem, issues like pollution are getting worse. This is due to global warming and climate change is a direct result.
7. Nale, Gaurav Pakhale and Jyoti, 2023 publishes a paper on Progression of flood risk assessment in India at a decadal scale: a critical review. The Researcher focuses on, In some places of India, floods are a perennial occurrence, making them a frequent natural event. Flood risks characterize the associated flood risk when weighed against exposure restrictions and vulnerability. Flood risk is evaluated using a number of criteria. It is crucial to realize that flood risk management used to be primarily concerned with post-event damage control.
8. Bansode, Swati Parmeshwar, 2014 presented a paper on Pre-Flood Management Practices in Western Maharashtra Region. The researcher highlights on, It is possible to use satellite images with higher resolutions. Employing RS and GIS methods will facilitate improved map update. The ground water table rises during periods of intense rainfall, which prevents the soil from absorbing more water. It has an impact on the rise in runoff that causes flash floods.

9. Sandip B. Mangalekara, 2019 publish a paper on Correlation of Rainfalls and Water Levels in Panchganga Basin and Almatti Dam During Monsoon of Year 2010, and Multiple Regression Analysis of Rainfall and Water Level at Rajaram Bandhara on Panchganga River for Prediction of Flood of Prediction. According to the literature, The discharge of water from nearby dams, including the Koyna and Warna, caused significant flooding in the Kolhapur regions. Flood floods in Karnataka's Kolhapur district were unable to recede due to the backwater impact of the Almatti dam.

10. Tiware V.S., 2022 presented a paper on Identification of flood control measures for Kolhapur city. The Researcher highlights on, Climate change is reportedly one of the causes of natural disasters. By ensuring full storage by the conclusion of the monsoon season, the reservoir operation schedules are created. The inflow of floods cannot be controlled manually in spillways without gates or in dams with completely automated gates.

4.2. Methodology:

A. Rainfall amount

The flood-affected areas of Satara, Sangli, and Kolhapur experienced excessively high levels of rainfall on a constant basis from July to August. Large quantities of rain fell in Satara, Sangli and Kolhapur during the first week of August. These amounts differed from their long-term averages by +569.3%, +347.2%, and +344%, respectively. These districts continued to receive extra rainfall, with +89% of normal over +152% over Kolhapur, +89% over Satara, and +59% over Sangli districts, even though the intensity of the rainfall dropped in the second week.

B. Analysis of Land Cover

The Land Cover research indicates that the agricultural area is 383 square miles, while the town occupies 84.95 square kilometers.

5. Results and Discussion:

In summary, the flood assessment highlights the causes and impacts in Western Maharashtra. After analyzing the available recent data and facts it gives:

1. Frequency And Severity: Flooding occurrences are common and severe in Western Maharashtra particularly during the rainy seasons. A combination of excessive rainfall and a lack of infrastructure to control the overflowing water frequently causes these flood hazards.
2. Flood Prone Areas: Certain areas in Western Maharashtra have been identified by the flood assessment as being particularly susceptible to flooding which includes locations close to river basins, urban areas with inadequate drainage infrastructure.
3. Inadequate Infrastructure: The evaluation draws attention to how inadequate the current infrastructure is for preventing and controlling of floods. The effects of floods are made it worse by inadequate drainage systems, flood control techniques and encroachment on natural rivers.

4. Impact on Environment And Bio-Diversity: Western Maharashtra flooding has a negative impact on the environment and bio-diversity. It causes harm to agriculture, contaminates water supplies, destroys natural habitats and erosion soil. It shows the long-term effects on the environment and bio-diversity.
5. Social and Economic Effects: Local communities are upended by flooding, which results in property and infrastructure damage, job loss, and displacement. Damage to industry, infrastructure, and agriculture has a major negative impact on the economy and sets back the development of the area.
6. Need For Preventative Action: Urgent need for preventive steps to lessen the effect of floods in Western Maharashtra is highlighted by the flood assessment. It should include actions like Better infrastructure design, the development of efficient drainage systems, the implementation of early warning systems, and sustainable land management techniques.
7. To Develop Preparedness Plan: A strategy combining governmental organizations, local groups and professionals is essential to control flood hazards. Improving preparedness by community awareness initiatives, capacity building and the execution of efficient disaster management plans.
8. Change in Climate: Future flooding events are expected to occur more frequently and with greater intensity due to climatic changes. Consequently, the flood assessment emphasizes how crucial it is to incorporate methods for adapting to climate change into flood management plans. These strategies should include infrastructure and nature-based solutions.

6. Conclusions:

The Western region of Maharashtra has experienced enormous flooding in 2005, 2006, 2019, and 2021, which had an impact on the several areas such as social, economic and environment. Numerous human and animal casualties occurred, along with property destruction and the forced relocation of thousands of people from their home areas. More than 1000 crore rupees have been reimbursed by the state government for the flood resilience. Before, the area under investigation had not see this kind of severe flooding. As a result, several specialists from various fields have investigated the likely reasons behind this circumstance. Thus, the main responsible factors in terms of geography and science are listed as above for current flood disaster in Western Maharashtra.

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