International Journal of Management, IT & Engineering
Vol. 11 Issue 01, January 2021
ISSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

FLOOD RISK ASSESSMENT AND MITIGATION STRATEGIES: ENHANCING DISASTER PREPAREDNESS

G.Rahul Indivar, M.Tech
Department of Civil Engineering
NIT, Rourkela, Orissa, India.

ABSTRACT

There are currently a wide range of choices for overseeing floods in the present day. Under various flood management practices, philosophies, and assessment standards, picking the right flood measures is fundamental. Albeit many created countries perceive the worth of risk-based flood management, the characterized return time frame is as yet the acknowledged practice for flood control. Both essential and auxiliary information were gathered for the examination. 120 homes in flood-inclined towns gave the information that were assembled. The previous was utilized to look at the connection between flood risk and weighty precipitation all through a scope of time spans, including yearly, month to month, day to day, and hourly periods. The last option was utilized to distinguish the unmistakable parts that add to the examination region's flood risks. Then, the sub-watershed's flood helplessness was positioned by direct and shape morphometric qualities, with higher straight boundary values and lower shape boundary values showing a higher risk of flooding. Sub-watersheds 6 and not set in stone to be the most flood risk inclined watersheds, requiring quick scene based preservation mediations, in light of the prioritization of sub-watersheds' weakness to flood risk utilizing morphometric examination. Hence, fitting areas and durable water-saving framework are tracked down all through the watersheds.

Keywords:Flood risk assessment, mitigation strategies, disaster preparedness, flood management, flood prevention, flood control*

1. INTRODUCTION

Floods are one of the natural catastrophes that can cause the most death and destruction, and they present a serious risk to people's lives, as well as to the environment and infrastructure all over the world. It is necessary to priorities flood risk assessment and mitigation techniques due to the growing frequency and severity of floods, which is being exacerbated by climate change, urbanization, and deforestation. In order to lessen the effect that flooding has on

International Journal of Management, IT & Engineering
Vol. 11 Issue 01, January 2021
ISSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

society as a whole, governments, communities, and organisations have made it a top priority to improve their disaster preparedness. This makes it necessary to use a holistic approach that incorporates research, technology, public policy, and the participation of the community in order to gain an understanding of the dangers associated with flooding and to devise effective measures for their mitigation and response. This article examines the crucial importance of flood risk assessment and mitigation measures, focusing on how these efforts can strengthen disaster preparedness and build communities that are more resilient and adaptable. This context is important for understanding the context of this work. We are going to delve into the fundamental ideas, methods, and best practises that are the foundation of effective flood risk management. We are going to place a strong emphasis on the relevance of proactive planning and collaborative efforts to reduce susceptibility and protect lives and property. We hope that by conducting this investigation, we may bring attention to the necessity of managing flood risk in a comprehensive manner and bring attention to the need for a concerted effort to construct a safer and more flood-resistant future.

1.1.Flood Management Practices

At this point in time, the process of developing and putting into action flood management measures that are centered on risk assessment is just getting started. This method involves a dynamic process, and as a result, the methodologies, tactics, and principles are evolving on a worldwide scale, albeit at varied paces. However, this does not change the fact that the method involves a dynamic process. One component of flood risk assessment that is worth mentioning is the variety of criteria and obligations that are linked with stormwater mapping. These guidelines and responsibilities typically vary considerably from one location to the next. This variation in approach to the formulation of flood management strategies can be linked to local variables, one-of-a-kind issues, and the expertise that is available locally. As a consequence of this, the process data and planning methodologies that are utilised for flood risk assessment may differ from one site to another, reflecting the particular difficulties and context of each area. As a result of these regional inequalities, flood maps that incorporate different aspects and variables have been established in various countries. This highlights the necessity for a flexible and adaptive approach to flood control that can fit the distinctive conditions that are present in various places

1.2 .Measures, Approaches, and Practices

Choosing appropriate and effective methods, such as structural and non-structural indirect measures and direct measures (flood abatement, control, and alleviation), is the most important step in managing floods. Conventionally, recovery measures, flood alleviation, flood control, and flood relief are the categories into which flood management actions fall. These endeavours encompass both structural and non-structural methodologies, or aid in mitigating the activities inside floodplains. Even flood management strategies and tactics are impacted by the risk-based evaluation.

Due to both recent and upcoming socioeconomic and climatic changes, the potential damage from river and coastal floods is significantly increasing. In actuality, it is anticipated that climate change would make natural dangers more frequent and severe. Growth in the economy will expose more people to the assets and people concentrated in cities, which are frequently located in risky areas. As a result, as exposure, hazard, and vulnerability all rise at the same time, risk will also rise. Ecosystems, economies, and communities will all suffer as a result. Consequently, it is evident that in order to prevent a rise in loss, policymakers and local stakeholders need to emphasize risk-reduction strategies more.

There isn't really a consensus on what constitutes "mitigation," despite the fact that it is becoming more and more important to comprehend how to create effective disaster mitigation options and actions. The US Federal Emergency Management Agency (FEMA) defines mitigation as "a sustained action taken to reduce or eliminate the long-term risk to people and property from natural hazards and their effects" in its study on the "Cost and Benefits of Natural Hazard Mitigation" (1997). This highlights the distinctions between mitigation and other important disaster management practises, like short-term recovery, reaction, and preparation.

Putting money and lives at risk into mitigation efforts can save both. Cost benefit analysis (CBA), a well-established economic tool for identifying and comparing all costs spent and benefits accruing from mitigation actions, is typically the foundation of an economic assessment of disaster risk reduction [19, 20, 21]. The use of CBA occurs in four stages: (1) project definition; (2) resource allocation; (3) project impacts identification; and (4) potential benefit assessment. The main indicator of effectiveness and economic acceptability of mitigation is cost-benefit ratios (CBRs). It makes sense to invest in flood risk mitigation if the advantages outweigh the disadvantages. Which mitigation strategies improve community resilience and whether they are cost-effective are still unknowns, though. This research aims to determine which mitigation measures are effective in reducing or preventing the impact

International Journal of Management, IT & Engineering
Vol. 11 Issue 01, January 2021
ISSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

and loss from flood disasters; evaluate current approaches to economic efficiency assessment in natural hazard risk management; categories several current studies on mitigation actions based on strategies adopted; and analyse the involvement of individuals and local stakeholders in the mitigation process. Implementing structural (such as reservoirs, dams, dikes, and levees) and non-structural (such as land use policy, early warning, property level flood risk mitigation measures, financial incentives, and risk transfer) flood alleviation schemes is a common feature of most local, regional, and national flood risk management plans. Individual homes are now more involved in controlling the risk of flooding as a result.

Individual property safeguards and private mitigation strategies lessen the risk of resident assets in flood-prone locations. Households may be encouraged to implement mitigation measures by the absence of physical protections, residual risk, negative mitigation CBR, bottom-up initiatives, and financial incentives. But the two most important factors to take into account are people's perceptions of danger and their level of hazard awareness. These affect how people react to the risk of flooding—whether they ignore it, cope with it, or adapt. Risk perception has a key role in inciting behavioural adjustments that boost community resilience. Household decisions to take private action to mitigate flooding can increase the efficacy of public policies that have been put in place.

2. LITERATURE REVIEW

McDougall (2017) reviewed flood in the center rural areas of Brisbane City, Queensland, Australia, to test various spatial logical devices. These included line measurements, quadrat analysis, computerized height demonstrating and metropolitan morphological portrayal with 3D analysis, nearness analysis, fluffy rationale, line measurements, gather occasions analysis, and spatial autocorrelation procedures with worldwide and nearby Moran's I, reverse distance weight technique, and hot s Utilizing topological bunch analysis, a two-aspect self-coordinating brain organization (SONN) of 100 neurons and 200 preparation ages was prepared to address the adequacy of demonstrating factors issue. By consolidating the demonstrative factors with weighted overlay and altered fluffy gamma overlay systems using the Bayesian joint restrictive likelihood loads, the fittingness of flood risk displaying was additionally tended to. To defeat the disadvantages of logical (master judgment) and standardizing (equivalent loads) methods, variable loads were applied. The flood risk and environment variation limit files of the exploration region were resolved utilizing a geographic information system (GIS) and the important conditions, and guides addressing these records were created.

A. Esmaiel. (2022) to expand the flexibility of urban communities, especially those in Egypt, better reconciliation between flood risk management and spatial arranging processes is expected because of the rising flood risk welcomed on by fast urbanization and environmental change. Notwithstanding a lot of exploration on the impacts of floods in Egypt, there hasn't been a lot of conversation in scholastic circles on the need to coordinate flood risk assessment with spatial arranging procedures. In Egypt, the act of not needing flood risk assessment for neighborhood level spatial arranging drives has prompted an expansion in flood risk. This paper takes a gander at the explanations for this dissimilarity and recommends a few potential fixes that could further develop flood strength. In light of a poll review with nearby partners in the scholar and expert classifications, a blended strategy approach was utilized. The discoveries show the reasons for the difference, which incorporate issues with understanding how spatial arranging decreases flood risk, an absence of coordination between the organizations responsible for making flood danger maps and the spatial arranging authority, the openness and accessibility of the vital information, and the subjectivity of the flood investigations that are completed. The improvement of a functional system for integrating flood risk assessment into spatial preparation, upgrading partner participation and mindfulness, reinforcing risk correspondence, and improving information quality and openness are the four fundamental suggestions. By making these strides, they will effectively build their flood versatility by helping with conquering the recognized difficulties and working on the cooperation between flood risk assessment and spatial plan.

Waghwala(2019) led a review exploration region is investigated utilizing geographical guides from 1968 and a satellite picture of Assets 1 from 2006. The analysis shows that the essential component adding to the expansion in flood risk in the review region is the shift from a low to a high urbanization design. This shows that deficient management of flood water in metropolitan regions has brought about an expansion in flood misfortunes in the endless suburbia. The Geographic Information System (GIS's) spatial scientific abilities were utilized to make the flood management maps, which will assist with moving and decrease flood risk. It will make the flood-inclined region stronger to flooding.

Albano, R. (2017) review the risk lattice's presentation is commonly not all around confirmed, and that implies it has restrictions. These incorporate abstract rating understanding that isn't all around made sense of and lacking goal (brought about by range pressure), which can prompt mistakes in the general positioning of risk locales. In such manner, the Flood Risk approach is invested in this effort determined to upgrade the flood risk guide's viability and conquering the deficiencies of the EDQ strategy by giving an information establishment that empowers the cost-benefit analysis of different mitigation strategies. To raise public mindfulness, the proposed technique can likewise include the general population in the flood management strategy. A use of the Flood Risk technique is exhibited on a pilot case in the "Serio" Valley, North Italy. Its benefits and detriments, concerning the additional work expected to apply it in contrast with the EDQ strategy, have been inspected, with an accentuation on the viability of the outcomes presented for the satisfaction of FRMPs. On account of the utilization of resource worth and profundity harm bends, the outcomes have demonstrated the way that Flood Risk can effectively recognize various degrees of weakness of openness components when contrasted with the EDQ approach. This considers a fitting assessment of the viability of risk mitigation strategies. In such manner, the recommended concentrate on case effectively represents the utilization of a cost-benefit analysis of the Flood Risk procedure on an arrangement of various mitigation endeavors (i.e., primary and non-underlying estimations). Flood Risk, nonetheless, needs further information, for example, the assessment of water profundities and resource values, as well as a thorough analysis and exposure of the vulnerability in its discoveries. However there are still issues that keep the Flood Risk application from working appropriately without a careful understanding and basic analysis of the review region's peril, openness, and weakness qualities, ideas are given to how to capitalize on this approach's utilization considering the impending modification of the flood risk maps, which is expected by December 2019.

3. RESEARCH METHODOLOGY

The study area in India is located in the state of Maharashtra, specifically within the district of Pune. This region falls within the geographical coordinates of 18°30'N to 18°50'N latitude and 73°45'E to 74°10'E longitude. Pune District is bordered by various neighboring districts, including Satara to the south, Ahmednagar to the north, Raigad to the west, and Solapur to the east. The city of Pune, the district's administrative and cultural center, is situated within this study area.

Pune District is known for its diverse landscape, including hilly terrain and a rich network of rivers, with the Mutha and Mula rivers being prominent water bodies in the region. The district spans a wide range of elevations, from the Deccan Plateau to the Western Ghats, which results in varying climatic and topographical conditions.

Table 1: Summary of flood induced risks in Maharashtrawatershed since 2018

Village / City	Human Loss	Livestock Loss	Property Loss
Pune City	12	Not stated	Not stated
Mumbai	8	18	15 ha crops
Pimpri-Chinchwad	22	Not stated	50 houses, roads, and bridges
Kalyani Nagar	6	30	75 ha crops and 32 Houses
Sinhagad	16	38	40 ha crops and 20 Houses
Lavasa	7	45	Not stated
Satara	Not stated	25	3 houses
Total	71	156	180 ha crops, 52 houses

The Pune District Organisation Committee gets support from both rural and urban areas. The total land area of Pune District is 1288 square kilometres, including both urban and rural areas. Satara lies to the south, Ahmednagar to the north, Raigad to the west, and Solapur to the east are some of the neighboring districts. Pune City, the administrative and cultural hub of the district, can be found within this scope of investigation.

The climate and topography of the Pune District varies greatly from the lower-lying Deccan Plateau to the higher-lying Western Ghats. The district's varied topography includes hilly terrain and a dense network of waterways, with the Mutha and Mula rivers serving as particularly significant examples.

According to India's predicted statistical report for 2023, Pune City is expected to have a population of around 466,000, growing at an annual rate of 2.7%. Due to its location near a number of mountains and its drainage by a number of significant streams, the city has historically been subject to occasional flooding. Flash floods have occurred in the city from 2016 to 2023, according to polls of city residents over the age of 60 and reports from the city government.

Since 2016, the table below has provided a concise assessment of the losses and hazards associated with flooding in different communities across the Pune District in Maharashtra, India. Notably, Pune City witnessed 12 human casualties and the relocation of 6200 residents, while figures on livestock and property losses are lacking. Meanwhile, eight people were killed, eighteen animals were lost, and fifteen acres of crops were ruined in Mumbai. There were 22 deaths and damage to 50 buildings, roads, and bridges in Pimpri-Chinchwad. Six people were killed, thirty animals were lost, and seventy-five acres of crops and thirty-two homes were destroyed or severely damaged at Kalyani Nagar. Sixteen people were killed, 38 animals were killed, and 40 acres of crops and 20 homes were destroyed at Sinhagad. Seven people were killed and 45 animals were lost, although Lavasa did not report any damage to buildings. While the number of people killed in Satara is unknown, 25 animals and 3 buildings were destroyed. A total of 71 life, 156 cattle, 180 acres of crops, and 52 homes were lost as a result of the flooding in the region. A thorough flood mitigation and disaster management strategy is needed in Pune District, as shown by the table below.

3.1.Methods

To achieve the review's objectives, essential and auxiliary information were thought about. An organized poll was made and dispersed using a purposeful and systematic irregular example strategy in the picked towns to accumulate the essential information. The settlements that were picked were explicitly decided to address the individuals who were at risk of flooding. In like manner, five towns were explicitly assigned as flood-weak zones in light of reports of flood-inclined networks in Pune city. From that point forward, example homes were picked indiscriminately from every villa utilizing a purposeful technique. Thusly, 15% of the 1273 houses situated in towns at risk of flooding were chosen for a family overview examining. Arbitrary examining was utilized to choose test families eventually for every one of the four towns.

International Journal of Management, IT & Engineering
Vol. 11 Issue 01, January 2021
ISSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

4. DATA ANALYSIS

Table 2: Causes of the perceived flood danger in Pune city

Flood causing factors	Agree	Disagree	No response
Intense rainfall	109	0	9
Flood zone occupation	69	13	35
Land use change	84	24	8
Topography	85	16	15
Damping of solid waste in river channel	54	55	7
Aggravating factors	79	24	12
Institutional problem	16	72	27

Table 2 shows the apparent flood-causing causes that were assembled from the study in Critical Pune city.

Precipitation is the single most important predictor of flood risk in Pune City, including the Hadapsar, Market Yard, and Sinhagad Road neighborhoods. The likelihood of flooding events in these areas is very sensitive to the duration, size, and intensity of precipitation. In Pune City, areas including Hadapsar, Market Yard, and Sinhagad Road flooded due to heavy rains, the study found. This was the agreement of 93.7% of the participants. The Pune City Meteorological Station, in addition to another urban station and a high-altitude station, all serve the areas immediately surrounding Pune City. The meteorological research undertaken in this study highlights that precipitation is the major component directly associated to flood risk in Pune City, comprising places like Hadapsar, Market Yard, and Sinhagad Road.

International Journal of Management, IT & Engineering
Vol. 11 Issue 01, January 2021
ISSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

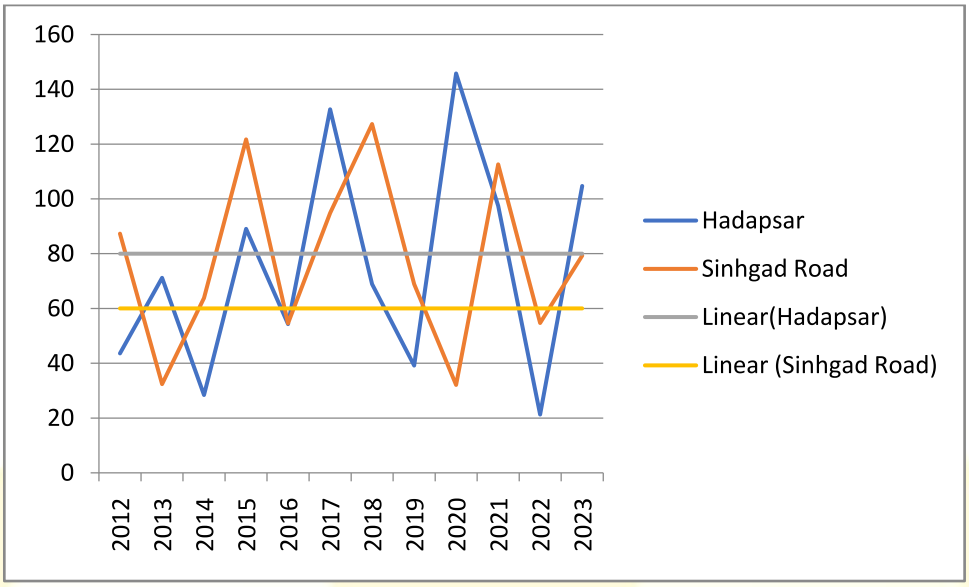

Fig 1: Distribution of daily rainfall at the stations

Figure 1 exhibits that (I) the precipitation causing flooding is beginning from the mountains encompassing Hadapsar region. The precipitation design at the Hadapsar has plainly declined, as indicated by its information. The precipitation diagram for the Hadapsar shows a negative station that is arranged in the higher catchments, as per the slant of precipitation pattern analysis (Figs. 1). This shows that there is minimal possibility flooding at Critical Hadapsar region because of precipitation. Hence, the upper catchments of the SinhagadRoad , which are beyond Pune city political limits, are the wellspring of the precipitation that causes flooding.

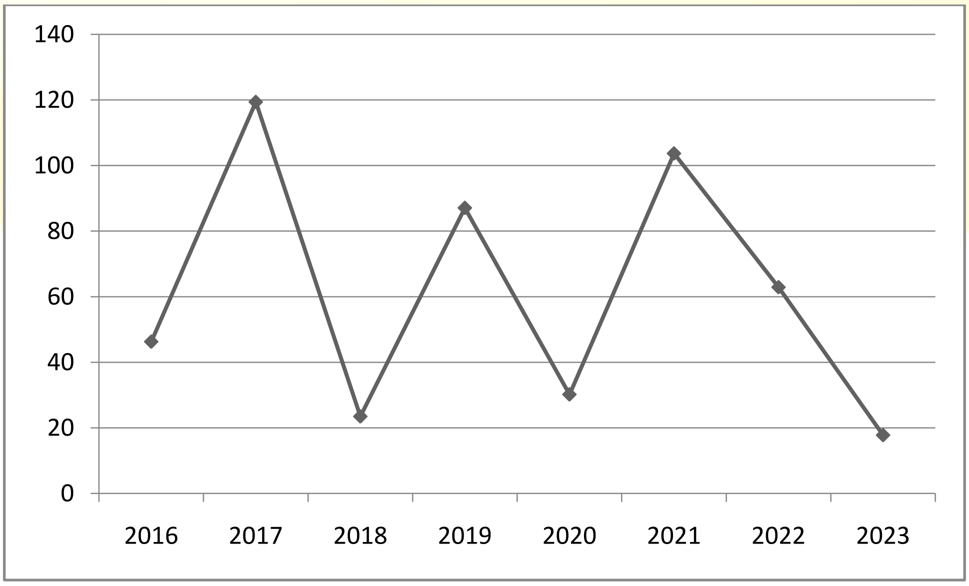

Fig 2: Distribution of daily rainfall at Sinhagad Road(2016-2021)

The hourly precipitation change is the reason for the review region's flooding. The day to day

International Journal of Management, IT & Engineering
Vol. 11 Issue 01, January 2021
ISSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

change in precipitation isn't critical over the read up periods for any region, as per the pattern analysis of the dissemination of everyday precipitation. All the more altogether, vacillations coming about because of the hourly circulation of precipitation hold significant significance. In the jungles, rainstorms are normally extremely, major areas of strength for focused, brief — they typically most recent an hour or less and cover under 20 km Fig. 2 shows the hourly circulation variety and its ramifications.

As per the normalized everyday precipitation irregularity, years with the most noteworthy hourly precipitation can at times have a declining day to day precipitation design that is lower than the mean hourly precipitation records. This exhibits that the hourly difference in precipitation dissemination, which decides the probability of flooding, works freely of the hourly, month to month, and yearly dispersion of precipitation. As per an exhaustive month to month precipitation examination, the Desperate Pune region kept extreme and weighty precipitation in 2016 to 2023. At the point when these more precipitation years are contrasted with past flood occasion years, it becomes obvious that the greater part of these events are not causally related. The outcome is high for the times assigned as flood occasion years, as indicated by the hourly conveyance of weighty precipitation. This exhibits that glimmer floods in and close to city limits are brought about by the hourly vacillation in the precipitation circulation of the Critical Pune station.

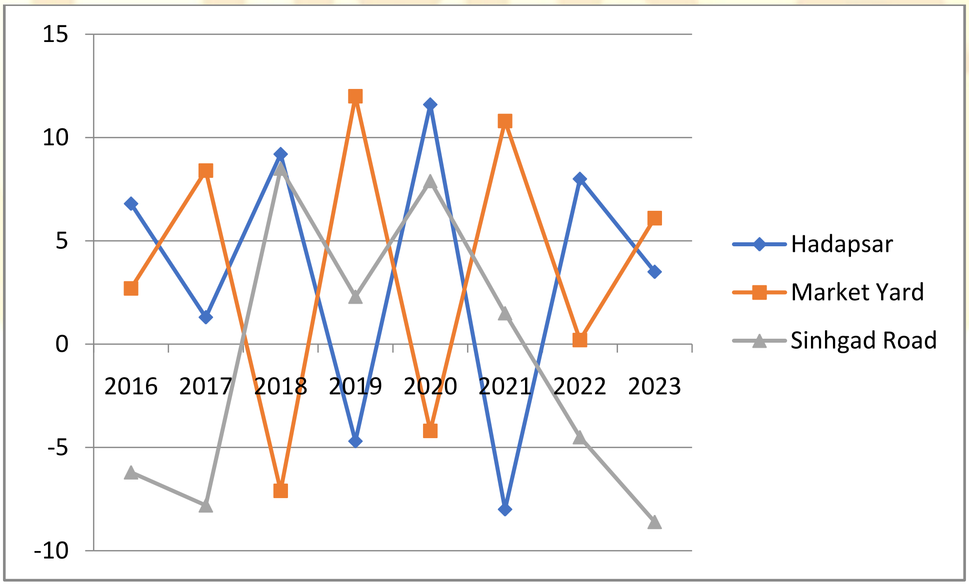

Fig 3: Standardised daily extreme rainfall anomalies at the stations in Hadapsar, Market Yard, Sinhagad road

The discoveries of other stations' hourly precipitation varieties likewise support the

International Journal of Management, IT & Engineering
Vol. 11 Issue 01, January 2021
ISSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

hypothesis set forward by Hadapsar region, which holds that the review region's hourly precipitation varieties are adding to the risk of flooding. High precipitation was seen in 2016 to 2023for the Market Yard and in 2016, 2018, 2021, and 2023 for the Sinhagad road, as per the everyday pattern analysis of precipitation dissemination (Fig. 3). The high day to day precipitation records at either site don't essentially relate with the long stretches of affirmed flood occasions. On the other hand, the greatest hourly precipitation dispersion between the two regions shows a connection between's the hourly dissemination result and the long stretches of perceived flood occasions.

The elements of populace increment and the improvement of foundation are two of the main variables driving metropolitan extension. Thus, the city is constrained to expand its lines toward each path, incorporating districts that are inclined to flooding and mountains. A prompt element adding to the ascent in impermeable surface would be the metropolitan region's extension combined with framework improvement.

5. CONCLUSION

The motivation behind this study was to evaluate the factors that increment the risk of flooding and to suggest scene based flood mitigation techniques. The viewpoints of anthropogenic, institutional, meteorological, and actual elements were utilized to dissect the reasons for floods. The factors of flood risk in the research region were evaluated utilizing GIS-based morphometry analysis, meteorological records, satellite pictures, and data gathered from questionnaires. The study's decisions demonstrate that various factors, including topography, land use and land cover change, institutional issues, strong waste damping in stream channels, intense precipitation at the nearby mountains, and encroachment of settlements onto riverbanks, contribute to the risk of flooding in Desperate Pune city. Aggravating factors like blackouts and shifts in power to these reasons. Most significantly, hourly precipitation variability was viewed as the reason for the flooding in the study region. After a thorough analysis of the factors contributing to flood risk, the vulnerability of sub-watersheds to flooding was inspected. As a result, the watershed was split up into twenty-six more modest watersheds. Morphometric parameters, for example, direct aspects like stream request (Nu), bifurcation ratio (Rb), drainage density (Dd), stream frequency (Fs), texture ratio (T), and shape aspects like structure factor (Rf), circulatory ratio (Rc), elongation ratio (Re), and compactness constant (Cc), were utilized to quantify each sub-watershed. Elevated straight parameter levels and diminished shape parameter values were connected to expanded flood risk. The classification of sub-watersheds into five classes — exceptionally high, extremely high, high, moderate, and low flood sensitive zones — was made conceivable by the results of these criteria. Sub-watersheds were given priority for conservation efforts in view of these classes. The general discoveries of the morphometric analysis demonstrate that addressing the upper catchment's essential drivers of flooding can lessen the amount and intensity of water that causes flooding before it arrives at the city limit. Eventually, classes delivered from morphometric characteristics were joined with overlays of soil, permeability, incline, land use, land cover, and stream requests to pick sites for water conservation. As a result, a few locations for scene based flood mitigation techniques, similar to lake construction, nala bunds, terracing, check dams, percolation tanks and storage tanks, were suggested. It is strongly exhorted that the suggested water conservation structures be incorporated into long haul flood risk management plans for Pune City and the adjacent regions to completely address the flooding issue.

REFRENCES

1. *Ahmad, S.; Simonovic, S.P. Integration of heuristic knowledge with analytical tools for the selection of flood damage reduction measures. Can. J. Civ. Eng. 2001, 28, 208–221.*
2. *Albano, Raffaele, Leonardo Mancusi, and Andrea Abbate. "Improving flood risk analysis for effectively supporting the implementation of flood risk management plans: The case study of "Serio" Valley." Environmental Science & Policy 75 (2017): 158-172.*
3. *Ciullo, A.; Viglione, A.; Castellarin, A.; Crisci, M.; Di Baldassarre, G. Socio-hydrological modelling of flood-risk dynamics: Comparing the resilience of green and technological systems. Hydrol. Sci. J. 2017, 62, 880–891.*
4. *Dixon, S.J.; Sear, D.A.; Odoni, N.A.; Sykes, T.; Lane, S.N. The effects of river restoration on catchment scale flood risk and flood hydrology. Earth Surf. Process. Landforms 2016, 41, 997–1008.*
5. *Esmaiel, A., Abdrabo, K. I., Saber, M., Sliuzas, R. V., Atun, F., Kantoush, S. A., & Sumi, T. (2022). Integration of flood risk assessment and spatial planning for disaster management in Egypt. Progress in Disaster Science, 15, 100245.*
6. *Espada, R., Apan, A., & McDougall, K. (2017). Vulnerability assessment of urban community and critical infrastructures for integrated flood risk management and climate adaptation strategies. International Journal of Disaster Resilience in the Built Environment, 8(4), 375-411.*

7. *Hooijer, A.; Klijn, F.; Kwadijk, J. (Eds.) Towards Sustainable Flood Risk Management in the Rhine and Meuse River Basins; Main Results IRMA Sponge Res. Proj. NCR-Publication 18-2002; NCR: Delft, The Netherlands, 2002.*
8. *Hudson, P.; Botzen, W.J.W.; Poussin, J.; Aerts, J.C.J.H. Impacts of Flooding and Flood Preparedness on Subjective Well-Being: A Monetisation of the Tangible and Intangible Impacts. J. Happiness Stud. 2017, 20, 665–682.*
9. *Kourgialas, N.N.; Karatzas, G.P.; Nikolaidis, N.P. Development of a thresholds approach for real-time flash flood prediction in complex geomorphological river basins. Hydrol. Process. 2011, 26, 1478–1494.*
10. *Kron, A. Flood damage estimation and flood risk mapping. In Advances in Urban Flood Management; Ashley, R., Garvin, S., Pasche, E., Vassilopoulos, A., Zevenbergen, C., Eds.; Taylor & Francis/Balkema: Leiden, The Netherlands, 2007; pp. 213–235.*
11. *Merz, B.; Kreibich, H.; Schwarze, R.; Thieken, A. Review article "Assessment of economic flood damage". Nat. Hazards Earth Syst. Sci. 2010, 10, 1697–1724*
12. *Messner, F.; Penning-Rowsell, E.; Green, C.; Meyer, V.; Tunstall, S.; van der Veen, A. Evaluating flood damages: Guidance and recommendations on principles and methods. FLOODsite Consort. 2007, 189.*
13. *Pelling, M.; Maskrey, A.; Ruiz, P.; Hall, L. Reducing Disaster Risk: A Challenge for Development. United Nations Development Programme, Bureau for Crisis Prevention and Recovery; John S. Swift Co., Inc.: New York, NY, USA, 2004*
14. *Petrow, T.; Merz, B.; Lindenschmidt, K.-E.; Thieken, A.H. Aspects of seasonality and flood generating circulation patterns in a mountainous catchment in south-eastern Germany. Hydrol. Earth Syst. Sci. 2007, 11, 1455–1468.*
15. *Van Alphen, J.; Lodder, Q. Integrated flood management: Experiences of 13 countries with their implementation and day-to-day management. Irrig. Drain. 2006, 55, S159–S171.*