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Review on Pre-Flood Management Practices in Western Maharashtra Region

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ABSTRACT: This paper describes the flood prone Pre-flood management areas of India along with the flood prevention and management techniques in western Maharashtra region. In this paper researcher focus on to study Rainfall Variability in Kolhapur, Satara and Sangli District and to study and analyze of pre- flood management at western Maharashtra region (Kolhapur, Satara and Sangli). Analyze Flood Management Measures Practiced in India and to Study and analyze detection methods are used for remote sensing the disasters. To Study and analyze Geographical information system (GIS) provides spatial data management and analysis to study flood management. Historically floods are known to cause damage to property and life leaving a long term traumatic impact on those who get affected by them. The intensity and magnitude of floods is supposed to be increasing world over in the recent decades because of climate change and global warming phenomenon. The Western Ghats are globally important, not only being rich in biodiversity, but primarily because of the role, they play in influencing climatic regime and annual precipitation in Indian subcontinent. The climate change has caused uncertainty and wide fluctuations in precipitation pattern from extreme droughts to heavy rains and periodic cloud bursts. Thus, floods, which were locally almost unknown, are becoming a potential disaster in the earlier relatively safe and climatically stable areas such as Western Ghats. Kolhapur district being largely i.e. over 65- 70% of the total area, being situated in the Western Ghats region, receives high annual rainfall in its western hilly part. It was therefore felt necessary to study the region for vulnerability and risk analysis of annual floods in Kolhapur district to know their main causes and their consequences. Therefore, this paper deals with the relevant topics such as rainfall variability in Kolhapur district, correlation and multiple regression analysis of rainfalls and water levels in flood prone Panchganga basin. It also includes readings on drinking water quality from Panchganga river basin, during pre and post flood period and people's perception on the issue through social Impact assessment (SIA) studies.

KEYWORDS: Floods, GIS, RS, HEC-RAS, River, CWC (central water commission), FMS (flood management system), Indian Meteorological Department (IMD).

I. INTRODUCTION

1.1 Introduction

Flooding occur along the major rivers and small streams, in coastal areas as well as along the margins of some lakes in the World. A total of 3.50 per cent area of the world is affected by floods, while it is inhabited by 16.50 per cent population. River Ganga, Brahmaputra, Damodar, Mahanadi, Godavari, Krishna, Narmada, and Tapi are some of the flood prone rivers of the World located in India. Drought is another disaster due to effect of scarcity of rainfall which directly effect on agriculture sector. In scientific language, drought is an abnormal state of season spread over a part of land, where there might be absence of rain in spite of its probability. To study the natural disaster like flood in India, there is need of study the historical perceptiveness at national level. With the help of past experience future planning becomes very perfect. In this chapter researcher has studied the causes and effects of both flood and drought natural hazard in study region considering historical perceptiveness.

In India, there are number of floods occurrence due to physical and climatic setup. Floods have been recurrent phenomenon in India and over 40 million hectares of land is prone to floods. Bangladesh is highest flooded nation in the World and after Bangladesh; India is placed on second rank in flood disaster. Flood in India is very old phenomena from very long period. Every year in India minimum one or two state face flood condition. Recently, unabated population and high rate of development activities forced on the occupation of flood plains and making the society highly vulnerable for flood losses (Sharma, 2005). In India, floods affect each and every year on agricultural losses, economical and human life losses. India is so vast and physically diverse that it has experienced more floods



than any other parts of the world (Thakur, 2003). Flood prone area in India is distributed unevenly. Middle and lower Gangetic plains in Uttar Pradesh, Bihar, West Bengal, Brahmaputra plains in Assam, Mahanadi delta, Godavari, Krishna and Kaveri etc. are the most common flood prone areas of India. Maharashtra is one of the states of India, where floods frequently occur. Due to the physiographic and climatic condition Maharashtra shows controversy in the respect of floods and droughts. At the same time flood and drought condition is prevailed in same region. After 1960, there are more than 40 floods are occurred in Maharashtra state. Remarkable floods have been observed in the basins of Godavari, Tapi and Krishna.

1.2 Floods in Upper Krishna Basin

In the upper Krishna basin western tahsils are known as flood prone tahsils. Overall study region 13 tahsils out of 29 tahsils are flood affected and out of these tahsils some tahsils are affected by Krishna, Koyana, Warana and Panchganga River. As per record 16.05 per cent of the population lives in flood prone areas with the major rivers Koyana, Krishna, Venna etc. in which flood comes at least once in a year during the monsoon. Table no. 4.1 shows the flooded rivers and its impact on village-wise population of upper Krishna basin. The river Krishna Koyana, Warana and Panchganga affected in study region, the statistical data shows that in 2005, more than 23.89 lakh populations of 228 villages become a victim. In the same year Sangli district shows that Krishna and Warana played major role in flood period. The water volume of these rivers is increased as compare to water volume of Satara district. Therefore, 81 villages and their population were mostly affected and Satara district it was found that 1.19 lakh population of 16 villages and 131 villages (15.55 lakh population) of Kolhapur district came under the influence of flood water.

Flood Affected Villages Along Krishna & It's Tributaries

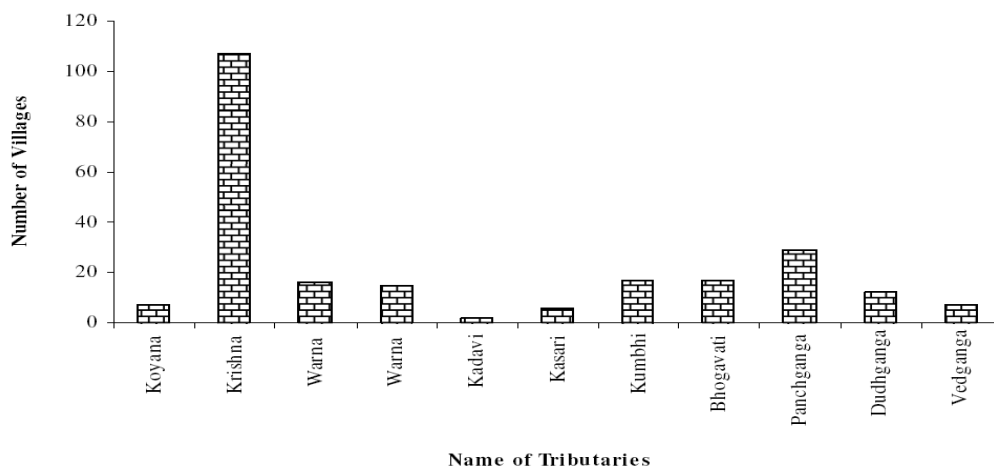


Fig 1.1 Name of Tributaries

Table 1.1: Flood Affected Villages in Upper Krishna Basin (2019)

Name of the River	District	No. of Villages	Affected Population
Koyana	Satara	07	14262
Krishna	Satara	09	103665
Krishna	Sangli	66	698728
Krishna	Kolhapur	25	150243
Warana	Kolhapur	16	97637
Warana	Sangli	15	72840
Kadavi	Kolhapur	02	6888
Kasari	Kolhapur	06	6504
Kumbhi	Kolhapur	17	24232
Bhogavati	Kolhapur	17	50453
Panchganga	Kolhapur	29	1073638
Dudhganga	Kolhapur	12	52496
Vedganga	Kolhapur	07	21125
Total		228	2388711

Release of excess water from the dams in the major rivers, heavy rainfall and the villages lying in or close the river course are the causes of flooding particularly in the Patan, Satara, and Karad tahsils. The Koyanagar dam on the Koyana river has contributed to reducing the vulnerability of many villages in Karad tahsil to flooding. In Kolhapur district there is a large number of river along villages (188) which are prone to floods. High floods generally occur due to heavy rainfall in catchment area of major dams and release of excess water. Past records show that comparatively high floods occurred in 1989 and 1994.

1.3 Causes of Floods in Upper Krishna Basin

Climatic condition of study region is monsoonal type. Though, more than 90 per cent rainfall received from south-west monsoon period (June to September) and other eight months are maximally dry. The flood disaster is a common phenomenon in rainy season due to the natural and manmade causes, which are responsible for flood condition. In upper Krishna basin, the major causes of floods are given below:

i) Morphology of Upstream Catchment Area

Configuration of upstream catchment area is complex in respect of topographical variance in terms of height and form of channels. Large catchment area of upper Krishna basin collects water. Vast area extended from Khambhatkighat (Satara district) in north to Chandgad (Kolhapur district) in south and west from Sahyadri range to east Yerla and Agrni basin. The large area of basin collects water from different channels at different rates. When any area of vast basin gets heavy rainfall it results in flood situation.

ii) Deforestation

Forest in general increases rainfall and evaporation while it absorbs moisture and lessens runoff (Naik, 2007). In upper catchment area of Krishna basin the forest cover has been decreasing at Mahabaleshwar, Jaoli, Patan, Shirala, Shahuwadi, Bavda, Radhanagari, Bhudargad, Ajra and Chandgad tahsils. Large scale deforestation is effected by man for various purposes, decreases infiltration capacity of the cut over land and consequently increases surface runoff which helps tremendously in increasing the magnitude of flood (Singh 2003). According to table 4.2 and statistical data field observations of region area under forest are declining day by day.

The forest cover growth shows negative trend in study region and it levels in Sangli district (-11.56 %) which is highest in upper Krishna basin followed by Satara district which is - 08.63 per cent and in Kolhapur district has - 08.50 per cent. The upper Krishna basin it is 14.95 per cent forest land in 1981 and in 2001 it has 13.71 per cent which reflects forest land decreased by -08.29 per cent. (fig. 4.2) The negative growth is major cause for increase of runoff and soil erosion in the catchment of Krishna and its tributaries. Soil erosion increased siltation in river beds as well as water reservoirs Dhom, Kanher, Koyana, Chandoli, Laxmi (Radhanagari), Jangamhatti, and Patgaon.

Siltation also affected on river depth due to such happen over topping of riverbanks by enormous volume of water and consequent inundation and submerged the adjacent area.

iii) Heavy Rainfall in Upstream Catchment Area

Continuous heavy rainfall for long period is the root cause of river floods of study region. Immense volume of water through high intensity rainfall is the prerequisite condition for river floods. Heavy rainfall in upper catchment area is concerned with sudden increase in the water volume of downstream. Occasional heavy rainfall resulting from strong rainstorms can cause severe floods. Because of the fact that the rivers maintain very low flow and low discharge of water during most part of the year and hence sudden torrential rainfall causes sudden increase in the volume of water which cannot be disposed off by the rivers immediately and thus the river banks are over topped by the swelling water and instantaneous floods are caused (Singh, 2011). In 2005 and 2006 year, months of July and August recorded heavy rainfall in study region which become the root cause of floods.

iv) Over Irrigation and Ground Water level

Ground water level is very much significant in the flood causes because ground water level affects on the percolation rate of surface water. In heavy rainfall period, ground water level is increased and then extra water is not absorbed by the soil. It affects on the increase in the runoff which generates flash floods. The ground water table near the river side tahsils Karad, Walwa, Miraj, Kagal, Karveer, Shirol and Hatkanangale is high due to irrigation so, it increases the total runoff.



v) Construction of Bridges on Rivers and Kolhapur Type Weirs

There is large number of constructed bridges across the rivers and their streams and Kolhapur type weirs on various rivers and its streams in upper Krishna basin. KT weirs are constructed on the river Krishna, Warna, Panchaganga for the purpose of water storage to irrigation. The KT weirs assist to deposition of sand and silt in the river basin of river Krishna (Khemlapur, 2006).

No. of 'KT' Weirs in Flood Prone Tahsils

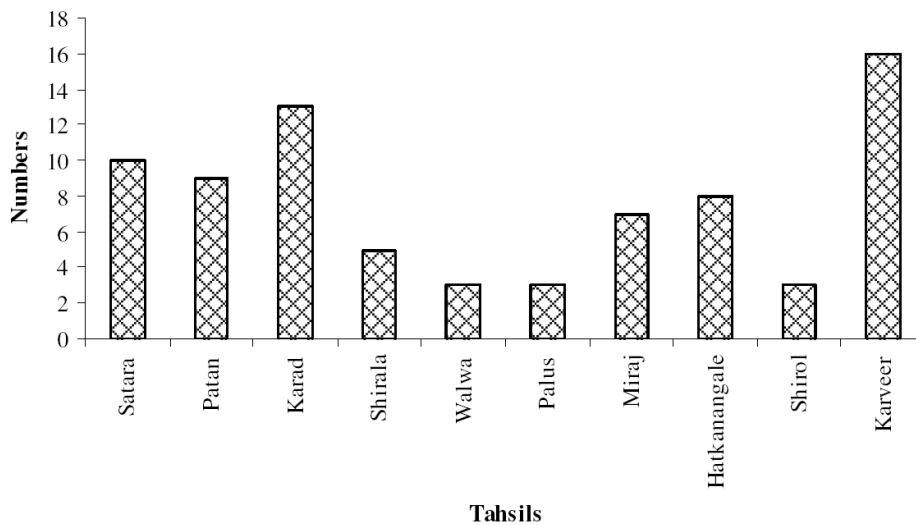


Fig. 1.2 Construction of Bridges on Rivers and Kolhapur Type Weirs

vi) Anthropogenic Encroachment Under Flood Zone

Three districts are included in upper Krishna basin flood region. The study region has urban centers namely Karad, Satara, Wai, Sangli-Miraj, Shirol and Kolhapur. All these centers are located on the bank of rivers. These centers are growing day by day and there is very less space left for their extension. To overcome on this situation, construction within flood lines and filling up of the drainages are the most important man made cause. The man made causes may be immediate or long term (Singh, 2008). So, the people constructed their houses in the flood line and they destroyed the natural drainages. The central flood observation committee noted that flood of Sangli district occurrence because of destroying natural drainages for construction and agricultural land extension (Chandra, 2007). By the observation of researcher at Karnal road near Sangli, the construction of row houses, bungalows and city pride theater and big bazaar building are constructed in natural drainage as well as rural people have constructed houses below the flood lines along the river banks for the agricultural practices of Krishna, Warna and Panchganga.

vii) Meandering Course of Rivers

Highly sinuous meandering courses of the rivers obstruct the normal discharge of water and thus the velocity is reduced which delays the passage of water resulting into stagnation of water. Consequently, the meandering valleys are immediately overflow and meander belts and loops are flooded (Singh, 2011). Rivers like Krishna, Warana, Panchganga, Dudhganga and Vedganga enter in plain region. These rivers form many meanders in their course. The meanders of Krishna are sharp at Shirgaon, Shirate, Retre Harnaksh, Banewadi, Bhilawadi and Haripur. Warana river formed meander near Kokrud, Punvat, Sagaon, Kale, Devarde, Tandulwadi, Shigaon and Samdoli.

viii) Retardation of Flow Due to Back Water Effects

Retardation of flow due to back water effects is also one of the important causes of flood disaster (Patil, 2009). Such prerequisite happens in the study region at various places e.g. near Bramnal where Yerala meets to Krishna and also similar condition is observed at the confluence of Warana and Krishna river near Haripur. Nrusinghwadi is the one location in study region where retardation of flow due to back water affects. In this process major river velocity and volume are high due to that water of tributaries push back. The flood intensity is frequently occurred in the upper

Krishna basin particularly in Palustahsil and Mirajtahsil of Sangli district and Shirol, Hatkanangale tahsil of Kolhapur district.

ix) Backwater Effect of Alamatti Dam

Karnataka state government has constructed Alamatti dam on the river Krishna for irrigation purpose. Alamatti dam is one of the major causes behind flood situation in Sangli district. Because the back water of Alamatti dam controls the volume of Krishna flow (Daily Sakal, 2007). Hon. R.R. Patil expressed their view about Alamatti dam that water level of Alamatti dam is more than 509 meters and back push of water comes up to Sangli.

x) Excessive Water Discharge from Upstream Dams

There are numbers of upstream dams in the catchment area of upper Krishna basin. The upstream dams are namely Dhom, Kanher, Urmodi, Tarli, Koyana, Warana, Radhanagari and Kallamwadi are major water storage projects. These projects had excessive discharge due to heavy rainfall period. In July 27th, 2005 discharge from Koyana dam is highest recorded and it is more than 100000 cusecs.

xi) Land use Pattern in the Study Region

Western part of the study region is highly irrigated. So, the farmers destroy the natural vegetation for the intensive agricultural. Satara, Karad, Walwa, Miraj, Palus, Shirol, Karveer and Kagaltahsil forest area is decreasing day by day to increase the net sown irrigated area. So in absence of forest cover, soil erosion rate is highest and it helps to increase runoff. Soil erosion effects on the siltation in the river bed and water level is increasing in rainy season.

1.4 Effects of Floods in Upper Krishna Basin

Flooding is the most common environment hazard; due to the wide spread geographical distribution of river valleys and coastal areas and attraction of human settlements to these areas (Kewalramani, 2006). Almost all the river valleys are subjected to varying degrees of flood incidents, either creating minor damages or devastating havoc at times.

Adverse Effects of Floods

Flood effects in upper Krishna basin are in both negative and positive ways. There are awful effects of floods more than beneficial effects. The flood area and flood duration in 2005 and 2006 are highest. So, the negative impacts are on very large scale.

i) Impact of Flood on Agriculture

The agriculture land at flood prone area of upper Krishna basin is low lying area. The flood prone agriculture area in Sangli and Kolhapur district is submerged more than 10 to 15 days under flood water. Flood prone region cultivates Sugarcane, Rice, Turmeric, Soybean, Groundnut, Chilli and rapeseed. Over the entire study region flood prone 13 tahsils, their villages and thousands of farmers were affected by the flood. Agriculture losses are calculated more than 50 per cent losses. The agricultural losses reveal from table 4.6, the tahsil Patan has recorded nearly 40496.12 ha land was damaged which cost was Rs. 4802.80 in 2005.

ii) Physiographical Changes

At the time of flood, volume of water is increased. This flood water is a cause of the physical changes on river side area. Floods have not only a temporal effect on the material loss but usher in some changes of the physical environment and drainage arteries. Physical changes usher in the bank side erosion, breach of levees, sometimes shifting of the river courses, causing removal of vegetation and subsequent impacts on the soil and vegetation of the area (Sen, 1985). In the study region in 2005, 2006 and 2011 after flood situation researcher observed physical changes in study region.

iii) Impact on Livestock

Flood impact is seen not only on man but also on animal lives in upper Krishna basin flood prone area. When flood water level suddenly increased; meanwhile farmers are unable to shift their animals at safety place. The cow pens (farm houses) as well as houses were surrounded by the water, numbers of animals were dip downed and some were float down with water. In Karad, Hatkanangale and Shirol tahsils were recorded for maximum animal loss.

iv) Loss of Houses

Loss of houses in the flood period of 2005 is more than 2006. In these years flood remained more than 10 to 15 days due to this condition houses were in water so, the walls as well as luxurious goods and house furniture was damaged by



the flood water. Losses of houses are maximum in Palus, Karad, Shirol and Hatkanangale. In Shiralatahsil maximum houses are built in clay and stone or brick.

v) Loss of Human Lives

The intensity of flood is recognizing on the basis of loss of human lives. Before the flood of 2005 and 2006 the human lives loss is insignificant. But in 2005 and 2006 flood took more than 30 human lives. The loss of human lives is highest in Shirol tahsil, due to accident of boat at Rajapur 09 peoples sunk in the boat accident. Another cause of human lives loss is drain into flood water at the time of crossing the flood channel to reach safety place. Some peoples were dead due to frightening and heart attack.

vi) Outbreak of Diseases

At the time of flood and after flood period, it generates many problems in different ways. Flood is cumulative hazard which brings many other hazards with it (Samant, 2006). In the study region at the time of flood condition, the power supply is disconnected and the unavailability of power supply affects the supply of drinking water. Therefore people use untreated water. In the flood affected villages sanitation system becomes very poor, time being no. of ponds have been formed.

vii) Impact on Basic Needs and Facilities

Basic facilities are important for better human life. These basic facilities are food, clothing, shelter besides that electricity, transportation and communication etc. In 2005 and 2006 years flood water level increased beyond imagination. So, when people left their houses they did not take precaution to store food grains at safe place. When they came back after releasing flood situation, all food grains were in unusable condition. Drainage lines are totally blocked in urban and rural area siltation was fully deposited in drainage. Drinking water facility, filtration system, and electricity and fuel shortage these problems occur in number of rural and urban areas.

1.5 Positive Impacts

Flood is a natural disaster, and due to flood maximum adverse effects are seen on the human life. Each incidence has merits and demerits, in above discussion researcher has elaborated demerits of floods but floods are having some merits, which supports for the human development.

1.6 Problem Statement

In existing scenarios the heavy floods can be so disastrous that the infrastructure is washed away, the people and the animals drown, and the people can be stranded for long periods, the society and the economy of the country will suffer in many ways after the flood. The loss of lives, vegetation, and infrastructure means there will be fewer people on the labor force, less agriculture available for the locals and the exportation, and fewer businesses to contribute to the economy of the country.

1.7 Scope of the projects

The scope of this project is only upper Krishna basin western tahsils (Kolhapur, Satara and Sangli) are known as flood prone tahsils. Overall study region 13 tahsils out of 29 tahsils are flood affected and out of these tahsils some tahsils are affected by Krishna, Koyana, Warana and Panchganga River. As per record 16.05 per cent of the population lives in flood prone areas with the major rivers Koyna, Krishna, Venna etc. in which flood comes at least once in a year during the monsoon.

II. REVIEW OF LITERATURE

Historically floods are known to cause damage to property and life leaving a long term traumatic impact on those who get affected by them. The intensity and magnitude of floods is supposed to be increasing world over in the recent decades because of climate change and global warming phenomenon. The Western Ghats are globally important, not only being rich in biodiversity, but primarily because of the role, they play in influencing climatic regime and annual precipitation in Indian subcontinent. The climate change has caused uncertainty and wide fluctuations in precipitation pattern from extreme droughts to heavy rains and periodic cloud bursts.



2.1 Research Gap

2.1.1 Flood Preparedness Planning

Flood preparedness planning is about putting in place a set of appropriate arrangements in advance for an effective response to floods. Some of the commonly identified flood preparedness activities are; Public awareness raising on flood preparedness, response and mitigation measures; Stockpiling of emergency relief materials i.e., food, fodder for livestock, emergency medicines, materials for temporary shelter etc

2.1.2 Flood Preparedness Plan

A flood preparedness plan (FPP) which is an integral component of the multi-hazard disaster management plan, is an action oriented document detailing specific actions to be undertaken prior to floods, which set the ground for effective execution of emergency response and recovery activities during and after floods. Assessment of probable needs: Based on historical data from previous flood disasters, officials at the State and district levels compile a list of likely needs and available resources. Gaps between needs and resources are identified in advance and also ways to mobilize them.

2.1.3 Flood Management

Though it is not possible to completely avoid the flood disasters, but the sufferings can be minimized by creating proper awareness of the likely floods and its impact by developing a suitable warning system, flood preparedness and management of flood disasters through application of information technology tools. The changing trends have opened up a large number of scientific and technological resources and skills to reduce disaster risk. Providing absolute protection to all flood prone areas for all magnitude of floods of different probabilities of occurrence is neither practically possible nor economically viable.

2.1.4 Flood Simulation

Simulation is nothing but a simple mathematical description of the response of a system to a series of events during a selected time period. The basic steps involved in the simulation process are (i) identification of the system; (ii) conceptualization of the system; and (iii) implementation of the model. More complex conceptual models with greater reliability and accuracy have been developed with the widespread use of large, fast electronic computers.

2.1.5 Policies on Flood Management

After the unprecedented floods of 1954, the Govt. of India took several initiatives and constituted a number of committees to study the problems of floods in the country. The important steps are (i) Policy statement 1954 (ii) High level committee on floods – 1957 (iii) Policy statement of 1958, Ministerial committee on flood control 1964 (iv) Ministers committee on floods and flood relief — 1972 (v) Working group on flood control for Five Year Plans, Rashtriya Barh Ayog (RBA) — 1980 (vi) National Water Policy (1987)

2.2 Literature Survey

Kabir Uddin et.al, in their research article, analyzed Sindh province Pakistan. The study area is the South Eastern province of Pakistan. In their framework of investigations, they used moderate resolution imaging spectrometer (MODIS) imagery to generate flood inundation maps. A topographic map and Shuttle Radar Topographic Mission (SRTM) Digital Elevation Model (DEM) data from different sources were used to analyze flood hazard area and flood shelter areas. For image analysis E-cognition software was used to perform Object Based Image Analysis (OBIA). The objective to go for OBIA analysis, over pixel based analysis was to get accurate and better classification. The outcomes of their work were flood hazard maps, delineating Sindh Province in district level and to identify the potential area of shelter zone locations. The results revealed that OBIA techniques and GIS systems allow different rules for different classes that can be analyzed for further flood mapping.

Gomaa M Dawood et.al, in their research article, investigated spatial mapping techniques for Makah City Saudi Arabia. In first stage of the work, Flood estimating was done, DEM was generated and soil, Land Cover, geological maps were overlaid. With these initial parameters, morphometric parameters were calculated using GIS Software. Then Curve Number (CN) was generated. Using these set of procedures, computations were done using the depth of precipitation for 200 mm for a return period of 50 years. Log Pearson III statistical analysis was used with all available datasets. The research findings showed that, Makah city flash floods are due to following factors Basin stream length Peak discharge. Also, it is observed that higher CN values indicate higher runoff and flood hazards.

Bashir Ahmad et.al, in their study for Nullah Lai Basin, Rawalpindi Pakistan, used hydrological modeling using HEC-RAS and HEC-GeoRAS. Their objectives were to carry out river flood modeling within GIS environment to assess flood water depth and vulnerable mapping. Also, they focused on risk assessment and hazard mapping for different scenarios. 19 flood events occurred between 1944 to 2002 were analyzed, with extreme flood events in the year 1981, 1988, 1997 and 2001. Year 2001 experienced highest floods. In their methodology, DEM was prepared from elevation data and was modified using interpolation techniques. For flood modeling peak discharge of 100 year return period was considered. They concluded that the integrated modeling approach used in the study, works well in order to locate the area vulnerable to flood with a good estimation of inundation depths at a specific discharge value.

Adel Omran et al in their research article used GIS techniques to produce a potential flood hazard map based on geomorphic parameter. In their study area Wadi Dahab Egypt, they used DEM for the morphometric analysis. Then delineation of basin boundaries by identifying the ridge lines (water divide) between sub basins. Snap pour point tool was used to ensure that selection of the points of high accumulated flow during delineation drainage basins using watershed tool.

Michalis Diakakis investigated a method for flood hazard mapping based on basin morphometry. A good quality DEM was developed, from it flow direction, flow accumulation, were used in Arc Hydro Model. Results were produced in form of maps categorizing the catchments in five classes according to their peak flows. The method proposed uses of simple morphometric variables like catchment area, basin slope, and point elevation that can be deduced from the topographic maps.

Ahmed M, et al, studied the utilization of remote sensing data such as Landsat Thematic Mapper (ETM) plus, Shuttle radar Topography Mission (SRTM), coupled with geological, Geomorphological, and field data in the GIS environment for the estimation of the flash floods risk along the Katherine Road Southern Sinai Egypt. In this study, different types of data like ETM and SRTM was used to identify the outline surface features of the study area. Arc Hydro tool of Arc GIS 9.2 was used for better understanding of the drainage and watershed system. Morphometric analysis was done in each sub watershed to analyze the potential degree of risk. Risk analysis was done and results computed were used to assist flood mitigation and land use planning.

Eric Forkuo, in his research article tried to address the need of efficient and cost effective methodology to prepare the floods maps. A composite flood hazard index map was developed incorporating variables near to the river flow. The level-1B of ASTER (Advanced Spaceborne Thermal Emission and Reflectance Radiometer) image data was used to produce a high-resolution land use map for the study area. This data is geometrically and radiometrically calibrated. Classification of remotely sensed data is used to assign corresponding levels with respect to groups with homogeneous characteristics, with the aim of discriminating multiple objects from each other within the image. The study has described the integration of GIS and ASTER imagery in combination of DEMs in delineating flood hazard extent of each revenue district of the study area. An additive model was utilized to create a composite flood hazard index based on administrative units.

Fowze JSM et al, in their research article worked on the flood hazard mapping for Lower reach of Kelani River, Sri Lanka. The one dimensional steady flow component of HEC-RAS Software was utilized for the study. The requisite geo-spatial modeling of the flood plain was carried out by implementing HECGeoRAS utility in ArcView environment and using a TIN model. The land-use map of the study area was updated using the data remotely sensed by ALOS for attributing the study area with necessary hydraulic parameters. Peak flows associated with considerable return periods were obtained from a frequency analysis and the calibration run was executed simulating the 50 year return period flood event. Model results and field records corresponding to the above event of 1989 was compared and it was found that results are very satisfactory. Accordingly, the first ever set of flood hazard maps associated with 10 year, 20 year, and 50 year return period events to be adopted by the government of Sri Lanka were prepared successfully.

III. CONCLUSION

From the consideration of all the above points we conclude that this paper describes the flood prone Pre-flood management areas of India along with the flood prevention and management techniques in western Maharashtra region. In this paper researcher focus on to study Rainfall Variability in Kolhapur, Satara and Sangli District and to study and analyze of pre- flood management at western Maharashtra region (Kolhapur, Satara and Sangli). Analyze Flood Management Measures Practiced in India and to Study and analyze detection methods are used for remote sensing the

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