Flood prediction & disaster risk analysis using Geographical Information System (GIS) of Panchganga River in Kolhapur District

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Abstract -Flood is defined as the overflow of areas that are normally submerged with water or a stream that has broken its normal confines or has accumulated due to lack of drainage. Floods are among the most common and destructive natural hazards causing extensive damage to infrastructure, public and private services, the Environment, the economy and devastation to human settlements. The flood creates a significant impact on life & livelihoods due to its destructive effects. The human beings living in this area cannot accurately predict the extreme event of flood risk. Normal floods are expected and generally welcomed in many parts of the world as they provide rich soil, water and a means of transport, but flooding at an unexpected scale (damaging flood) and with excessive frequency causes damage to life, livelihoods and the environment. Over the past decades, the pattern of floods across all continents has been changing, becoming more frequent, intense and unpredictable for local people.

***Key Words*:**Flood, damage, satellite images, GIS, Hydraulic model.

1. INTRODUCTION

Accurate and current floodplain maps can be the most valuable tools for avoiding severe social and economic losses from floods. Accurately updated floodplain maps also improve public safety. Early identification of flood-prone properties during emergencies allows public safety organizations to establish warning and evacuation priorities. Armed with definitive information, government agencies can initiate corrective and remedial efforts before disaster strikes (Chapman and Canaan, 2001). Sam U. Shamsi(2002) in the report „GIS Applications in Floodplain Management" has conveyed that GIS is ideally suited for various floodplain management activities such as, base mapping, topographic mapping, and post-disaster verification of mapped floodplain extents and depths. For example, GIS was used to develop a River Management Plan for the Santa Clara River in Southern California. A GIS overlay process was used to further plan efforts and identify conflicting uses along the river and areas for enhancing stakeholder objectives. A 1 inch = 400 ft. (1 cm = 122 m) scale base map was created to show topography, plan metric features, and parcels. Attribute data were entered into a separate database and later linked to the appropriate map location. Six layers were created for flood protection related work: 100-year floodplain, 100-year flood way, 25-year interim line, existing facilities, proposed facilities, and flood deposition. The lessons learned from this mapping project indicate that GIS is useful in capturing and communicating a vast amount of information about the study area and the river. While the use of GIS and the process to gather and record data were not without problems, the overall value of GIS was found to overweigh those challenges.

2. LITERATURE REVIEW

Mr. Satish S, et al, (Nov 2012) - In this paper Author studied that the flood occurred in the year 2008 in Krishna & Tungabhadra river valley in Karnataka. This study was done with the help of satellite images available for one in 50 year flood event occurred in June 2008. Then that was compared with the flood extent derived from the flood extent obtained for the 50 year rainfall using relevant models based on the flood extent & to develop , demonstrate & validate on information system for flood forecasting , planning & management using remote sensing data with the help of flood hazard maps for different return periods(10,20,40,50,&,100 years) Assess the population vulnerability and physical vulnerability of the lowest administrative division subjected to floods, and using above results conduct a flood risk analysis of the study area. A comprehensive prediction model will mitigate the risk to a greater extent. Availability of technologies such as Remote Sensing and GIS (Geographic Information Systems) gives more reliable scenario to analyze and find solutions in policy framework. Post flood information system is often random and patchy in its quality of data. Much of the physical observations and extent of flood levels can be accurately modeled for effective analysis. Both the aspect of flood risk and post flood evaluation has been studies in Krishna river valley topography plays a major role in spreading the level of water which affects normal life.

Matthew BiniyamKursah, (May 2013) - In this paper the author says that this study used to GIS identify flood risk areas on the proposed Wapuli and Kpalba roads to help policy makers take a firm decision on which road to link Yendi, Saboba, Chereponi and Gushiegu districts in Northern Ghana. The aim was to identify and measure floodable areas on the proposed roads. Factors influencing flooding in thearea are identified and reclassified to flood risk values based on their suitability to retain waters, and then combined using weighted overlay tool in Arc Map to generate flood prone areas. The results showed that Wapuli road has lesser passage through flood risk areas. The study, thus, reveals how road planners can identify flood risk areas to aid in designing mitigations. The study concludes that flood risk areas should not be the sole factor in road planning, but rather multi-factors, including cost of construction, access to people and economic activities and the ability to ease trade.

G. Thilagavathi, et al, (2013) - In this paper the author say Flood is an inevitable natural phenomenon occurring from time to time in all rivers and natural drainage systems, which not only damages the lives, natural resources and environment, but also causes the loss of economy and health. The impact of floods has been increased due to a number of factors, with rising sea levels and increased development on flood plain. Recurring flood losses have handicapped the economic development of both developed and developing countries. Heavy rainfall due to the cyclone name of NISHA has thrown normal life out of gear with many low-lying areas flooded in Cuddalore, Thiruvarur, Chithambaram, Karur and neighboring areas. Cyclones are among the most awesome events that nature can produce. They pose a major threat to lives and property in many parts of the world. Every year these sudden, unpredictable, violent storms bring widespread devastation to coastlines and islands lying in their erratic paths. A windstorm's destructive work is done by the high wind, flood-producing rains and associated storm surges. An attempt has been made in this research paper to demarcate the flood hazard prone areas in the PapanasamTaluka using Geographic Information System. The main problems encountered in Papanasamtaluka with respect to floods are inundation, drainage congestion due to urbanization and bank erosion. The problems depend on the river system, topography of the place and flow phenomenon. Finally the Papanasam have been broadly divided into five zones of flooding, viz. (a) Very low, (b) Low, (c) Moderate, (d) High (e) Very high.

Naveed Ahmad, et al, (2013) - This paper presents a comprehensive study of the flood analysis and prediction using Geographical Information system (GIS). Different scientists and researchers from all over the world had performed detailed analysis of flood risk assessment specifically for human population and to take precautionary measurements before or after the critical condition of disaster occurs using Remote sensing and satellite images. In this research study, we had performed detailed analysis of Flood Prediction techniques based on GIS using Ad hoc wireless Sensor Network Architecture. We had also proposed a Model for Flood Risk Analysis and prediction, which would be very helpful for us in calculating the impact of Flood damage in disaster hit regions. The GIS domain proves to be very helpful for us in geographical survey and to identify the tsunamis causing vast potential and economical damage. In this research study, we had also used Arc GIS simulation tool to identify pre and post disaster flood risk analysis. Our Research study focuses on various geographical information Systems specifically designed for Flood Disaster management and to analyze necessary input parameters including soil moisture, air pressure, direction of wind, humidity and rain fall. These parameters would be very helpful for us in modeling real life scenarios specifically in case of flood disasters. Our proposed model is also very helpful for us in predicting the upcoming disasters and to take necessary actions by emergency and rescue authorities to save the life of thousands of people before this critical condition occurs.

Mr. Y. Wan,et al, (2014) - In recent years, an important development in flood management has been the focal shift from flood protection towards flood risk management. This change greatly promoted the progress of flood control research in a multidisciplinary way. Moreover, given the growing complexity and uncertainty in many decision situations of flood risk management, traditional methods, e.g., tight-coupling integration of one or more quantitative models, are not enough to provide decision support for managers. Within this context, this paper presents a beneficial methodological framework to enhance the effectiveness of decision support systems, through the dynamic adaptation of support regarding the needs of the decision-maker. In addition, we illustrate a loose-

coupling technical prototype for integrating heterogeneous elements, such as multi-source data, multidisciplinary models, GIS tools and existing systems. The main innovation is the application of model-driven concepts, which put the system in a state of continuous iterative optimization. We define the new system as a model-driven decision support system (MDSS).Two characteristics that differentiate the MDSS are as follows: (1) it is made accessible to non-technical specialists; and (2) it has a higher level of adaptability and compatibility. Furthermore, the MDSS was employed to manage the flood risk in the Jingjiang flood diversion area, located in central China near the Yangtze River.

3. CONCLUSIONS

From the above review I have concluded that lot of research have carried on the flood prediction and disaster risk analysis using GIS software of various regions. So I have chosen the Region of PanchgagnaRiver in Kolhapur District. On this region there is no enough work on flood prediction. So I will work on this Panchganga River and to prepare flood zonation map, Flood forecasting chart, hydraulic model of Panchgagna River, Environment aspect in study area and study of present flood status and suggest precautionary measures.

4. METHODOLOGY

I) Collection and study of related literature

II) To carry out land survey in the region of PanchgangaRiver basin using GIS software with the following steps.

i. Flood related data collection.
ii. To carry out survey in the study area using GIS & classification of images.
iii. To prepare toposheet of convenient scale with geo reference.
iv. To prepare physical terrain map of study area.
v. To prepare slope map of the study area.
vi. To prepare flood affected agriculture land map of the study area.
vii. To prepare drainage layout of study area.
viii. To prepare flood zonation map of study area.

5. REFERENCES

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