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ASSESSMENT OF FLOOD AND FLOOD HAZARD ZONE USING GEOSPATIAL INFORMATION TECHNOLOGY

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ABSTRACT: The most common sudden geohazards are the Floods. The geo-spatial technique gives information about historical events and their characteristics from various map records. For flood studies using geospatial technology, the two major factors are flood magnitude and flood frequency. The present work isin light to achieve the objective to simplify the challenge that is faced towards assessing the flood hazard of December 10,2015 flood event in the Cuddalore district,Tamilnadu and preparation of flood inundation map to analyse the hazards of the flood zone for various rainfall.Based on analysed data obtained from the satellite images of Sentinel-1, related to 24th November 2015that were taken out of European Agency for Space in which “the dark areas in black” refer tothe standingwater determine the severity of the flood in the affected districtsof Tamil Nadu. To map the flooded areas, suggest the alternative for marshallland area. In total about an estimate of 360 sq.km were flooded which includes Cuddalore among the highly affected districts.

KEYWORDS: Map preparation, Flood map, Geo Spatial Technology, Remote sensing.

I. INTRODUCTION

Floods are created because of heavy rainfall and the most common natural disasters. As an outcome of the rigid regulations of developing countries, significant floods can occur and even unforeseen eruptions cause high levels of deterioration. The context of deforestation was altered due to the loss of natural flooding and the introduction of wetlands, floodplain and water bodies [1]. Floods are often described as overflow drainage. The term may also be related to the flow of a wave depending on the flowing water.In the direction of Hydrology, floods are an important area of study relating to agriculture, the river of public health and civil engineering. Overcrowding where water escapes its normal boundaries and exceeds breakage levels or excessive rainfall overflow causes flooding. Based on geographical characteristics and literature review, approximately 13 flood risk factors were selected to obtain a flood risk map, including height, feature, edge, slope, SPI index, seismic index (STI) and lithology, earth consumption, average vegetation index (NDVI), soil, distance to rivers and rainfall [2].This study focused on flood and flood hazard zone mapping of Cuddalore district by using geospatial information technology. This study aims to (a) study the Chennai floods of 2015 and (b) simulate the frequency of such similar event occurred in future, considering both urban sprawl and increased patterns ofprecipitationas a result of effects from the change in the climate[3].Using the freely available hydrologic (HEC-HMS)-hydraulic (HEC-RAS) models the baseline scenario is generated and the results are validated with the observed data of flood-mark. Historical use of the land and the maps of land cover for the study area are used to train an Artificial Neutral Network model for constructing spatially varying scenarios of urban sprawl.Bourne, have usedhydro-geomorphological approach for mapping the flood hazards of the river plains of Boumerzoug and Rhumelin the urban area of Constantine that is based on the analysis and interpretation from the geomorphology of the flood plain[4]. In this study using the RADARSAT, SAR time series and images in the detection of floodwater, the analysis and description regarding the monitoring of spatial extent and propagation of flood inundation were done. The study of Dash, Pratik Punia, Milap (2019) [5]., involved the evaluation of the environmental aspects of these existing policies related to the regulation of land use changes and also the developmental activities considered concerningthe flooding. The article by Shazade Jameson*, Isa Baud(2015), deals on the investigation on how a vast varieties of knowledge about the flooding contribute towards a more effective way of flood management (FM) governance configuration in Chennai, India. Using the configurations and drawing on the assemblage perspectivefor socio-spatial analyses of the city, we trace into the knowledge of construction processes revolving around two networked FM infrastructures, drawing out various discourses, actor coalitions and process of practices[6].

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II. Study Area

The Cuddalore district revenue area lies along the stretch of the eastern coastal area of India. On the boundaries of the Northern side lies the Villupuram district, on the southern side the Nagapattinam district, on the western side Villupuram and Perambalur districts and the eastern side lies on the Bay of Bengal. Cuddalore city is the headquarters and its southern boundary is followed along the length of the Coloroon and Vellar rivers.The district includes a total area of around 3,677.5 Sq.km. It contains 7 revenue taluks,3 revenue divisions and 896 villages[8].

III. Methodology

In years 2007-2008, the normal rainfall in the North-East monsoon season is 717.5 mm and 372.6 mm in the South-West monsoon season but the actual rainfall that occurred during the North-East monsoon was 1346.1 mm and the South-West monsoon was 340.3 mm. The district gets a rainfall greater than the annual rainfall on an average from august to December months. The maximum and minimum temperatures on an average have been 37°C and 20°C in May and January months [9].. The district soil cover is classified into black, red and ferruginous soils. These soils are further split into clays,sands and loam. Black soils are found in the taluks of Chidambaram and Virudhachalam. Sandy soils are located at the side of coastal line of Cuddalore taluks.Small patches of the alluvial soils were noted in the river course and stream area of the district [10]. It serves for capturing, analyzing, storing, and visualization of data that describe a small part of the geographical surface, including the technical and administrative entities and also the findings of geo Science, of economics and the applications related to the ecological aspects. It is a system of information with a data of observables consisting of spatially distributed activities,events or objects, which can be depicted by surfaces, lines or points. It combines the comprehensive collection of many tools for specialized applications that involve storing, visualization, capturing, transformation and retrieval visualization of spatial data of the real world.

3.1. Remote Sensing

Remote sensing includes the usage of Air jets and satellites to collect information and examined images of Earth's surface. Remotely sensed images are one kind of geographically referenced database that is prepared with GIS. The ancestry of remote sensing is linked with the initiation of taking photograph using balloons in 1858. During World War I, the aeroplane becomes a significant platform and plays a major role in aerial photography and data collection. During mid of the battle, film chemicals are expanded into colour and infrared photography. The concluded edition of this technology is often used in military purposes, evolved with camouflaged features.

1.2. Digitization

Reconstruction of data can be done by using GIS, which converts the data into various formats. For example, GIS software may be used to convert map of satellite images into a vector structure form by the method of generation of lines around all the cells with similar classification, such as inclusion or adjacency for establishing the cell spatial relationships. This is actually a significant improvement and advancement over manual heads-up digitizing concerning the speed of digitizing and accuracy.

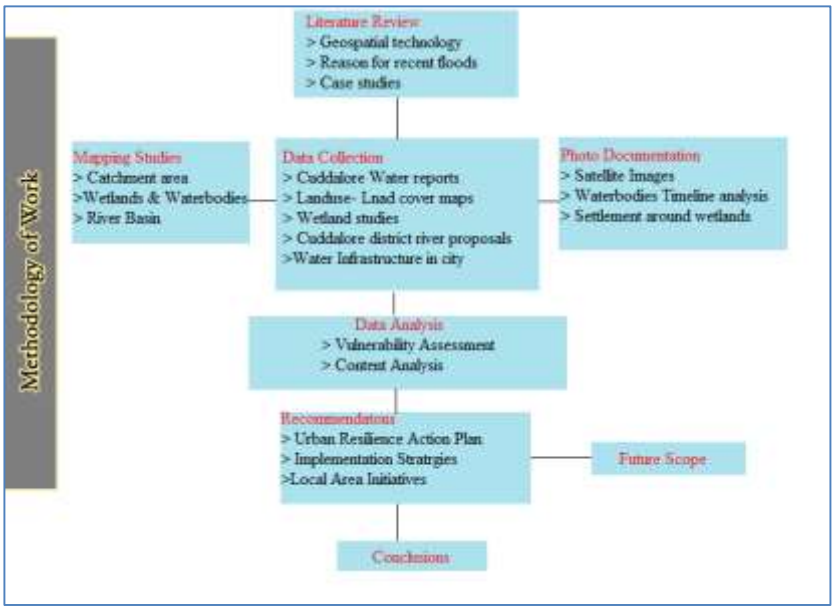

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Figure 1. Methodology flow diagram for flood mapping

The hydrological processes of this model include precipitation, interception and melting, depression storage, groundwater flow, surface runoff, evapotranspiration, percolation and interflow [11]. A modified rational method is used to figure out the surface runoff in each cell, that is controlled by the factors like the intensity of rainfall and moisture content of the soil. From literature, the coefficient for Potential runoff is obtained and a lookup table is set up linking potential runoff coefficient with the various categories of the slope, type of soil, usage of the land, proportions of bare soil present and the impervious areas present in a particular grid cell [12]. With the use of diffusive wave approximation method, the excess rainfall is directed along the paths of the flow. The interflow and the percolation are restrained by certain soil characteristics and are modelled by Kinematic approximation method and Darcy's law.

IV. Results and discussion

The full usage of the remotely sensed data for calculation purposes is performed with GIS tools and a Wet Spa model has arrived, such that it can be used exclusively for predictions of floods in complex terrain by analyzing the topographical effects, type of soil and usage of land or soil cover on the flood zone. Additionally, this model creates an ease to conjoin with the other models like soil erosion and models of quality of water, and also used for replicating spatial hydrological behaviour or characteristics of a river basin.

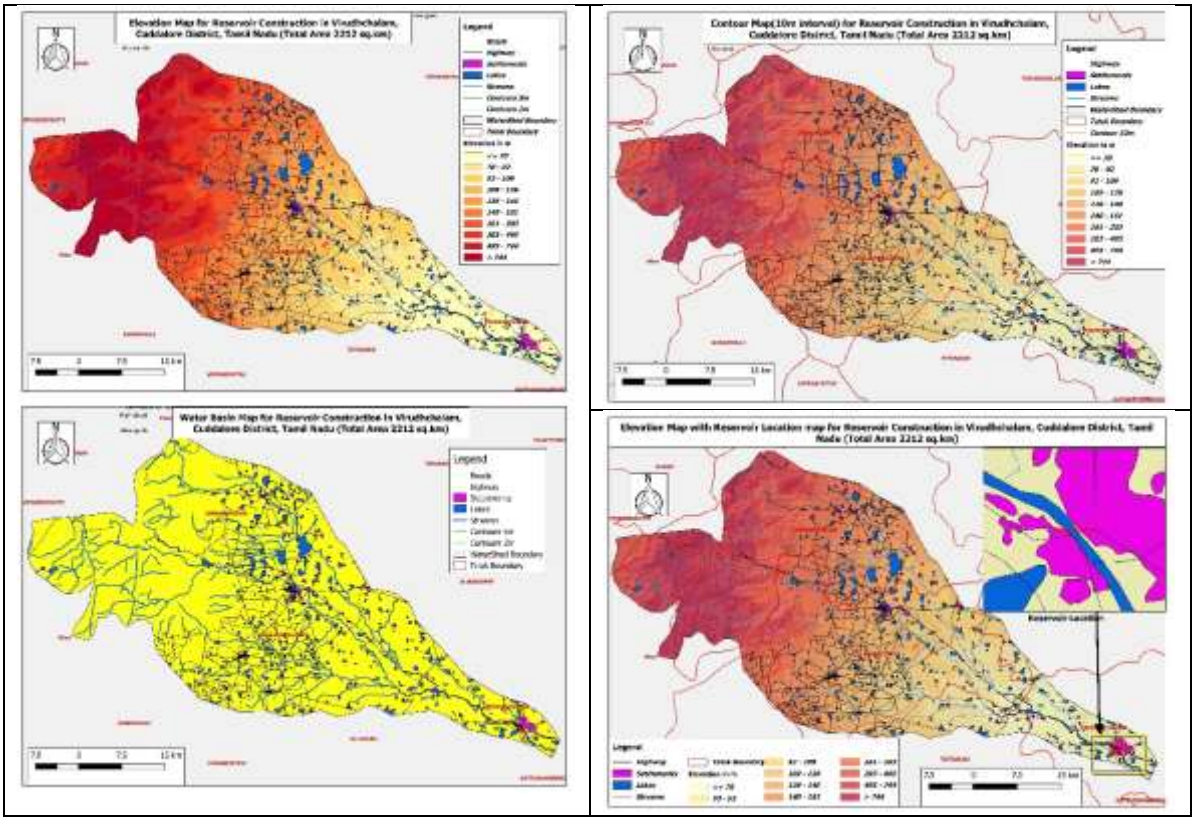

Figure 2. Flood map of Cuddalore district Tamil Nadu

Due to increased demand in the water resources, there is a vast growing requirement to anticipate and foresee the natural processes for conveying many environmental problems today and in the nearest future [13]. A simplified depiction of the natural hydrological system is done with a hydrological model in which representations of physical processes at a vast range of space and time scales are done. This has been in collaboration with an in complexity of the model, lack of relevant observational data to constrain the model states, and an inclining number of output models [14]. The detailed description of the hydrological cycle and energy cycle, in particular, carried by distributed hydrological models and it creates a provision of opportunities to handle with forcing variables that keep fluctuating with space and time. Therefore these models are being tried to be implemented increasingly by the Hydrologists as a means to apprehend the state of intelligence and knowledge on basins of interest, and to provide valuable and treasured information regarding thehydrological state variables and that is potentially important [15].

V. Conclusions

A simple way of soil,land use and elevation data are used for modified WetSpa model, this is utilized to estimate runoff and soil moisture, not beyond the root zone which is on the scale of GIS which derives natural units and allows for the internal drainage structure of WetSpa for tiny subwatershed. The degradation of the catchment is established confer to the model purpose, terrain complications, and the spatial variable distribution interest. In case of fine degradation, channel components are more necessary for controlling the routing of streamflow, has to be resolute perfectly. On the other side, coarse degradation requires the flow routing inside the subwatershed, also accurately forecast away from the flow hydrographs. This model has been tested to the river basin of 360 km^2 in Luxembourg where 4 years of hourly rainfall and streamflow data noticed.

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