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A Geospatial Study of Urban Floods in Hyderabad City

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Abstract: ***India is one of the world's regions that is most vulnerable to natural disasters, which results in yearly in Hyderabad also losses of property, infrastructure, and human lives. Monitoring and evaluating the floods and other disasters can be done from a unique vantage point by using air and space-based observations of the globe. Geospatial technology has significantly enhanced flood research, particularly in the first three phases of floods. Specifically, there are three phases: a) preparation for floods; b) monitoring for floods; and c) recovery from floods (damage assessment and mitigation phase). Agriculture, socioeconomic, communication, population, and infrastructure data are all included in the GIS data set that was developed during the preparation phase. In the event of a serious flood crisis in Hyderabad, this can be utilised in conjunction with the flooding data to adopt an evacuation strategy, rehabilitation planning, and damage assessment.***

Keywords: Floods, Remote sensing, GIS, Hydrologic-Hydraulic modeling, flood risk map

1. Introduction

Over the last few years, India has seen an increase in the number of urban flood disasters, with major cities across the country being particularly hard hit. Among these, in 2002 and 2003Delhi, Mumbai in 2005 and Chennai in 2004, Surat in 2006, in 2008Jamshedpur and Kolkata 2007 and Guwahati in 2009 and Delhi& were well-known Delhi in 2010. Delhi and Guwahati were the most visited cities in India in 2010. The most recent disasters were in Mumbai in 2017, Kerala in 2019, Karnataka in 2019, and Hyderabad in 2020. In the year 2021, West Bengal will be the most populous state in the country.

The National Disaster Management Authority of India is part of the Indian government (NDMA) Not only are coastal floods essential and significant, but floods in the decan plateau region, particularly those related with urban floods, have also occurred. The systems of weather that will bring of rain a lot, storm also surges can be destructive to towns of coastal and villages, dams that release water too quickly or fail to discharge water at all can be disastrous, and the urban heat effect island has led to a rainfall increase in areas urban. The monsoon season when we receive the majority of our rain, which is a defining feature of India. However, there are other systems of weather that will of rain bring a lot.

The Problem is Assumed to be Assumed

As one of the contributions to this research, an attempt will be made to evaluate the usefulness of spatial methods, remote sensing, and GIS for spatial growth recognition and management of spatial and temporal variability, we'll assess Hyderabad's urban growth over the previous 30 years using images from remote sensing, in order to identify the region of invulnerable surfaces and analyse urban expansion patterns, classified images were used. Employing spatial phenomena to be able to quantify urban attributes such as impervious area, Bheem Bahadur Dhant, (2007).The data on urban floods was gathered using remote sensing and GIS techniques. In order to establish a link between urban growth and some of the elements that generate it, such as population, population density, and built-up density, the spatial and temporal variation of urban growth is investigated, the study then attempted the future to forecast development of city using scenarios of two types, the first, if the current pattern continues into the second future and, environmental if an scenario protection is implemented for city because it has been harmed by a lack of environmental sustainability planning.

2. Review of Literature

Urban flooding, which can result in minor to catastrophic mishaps, is the frequent and deadly disaster natural on the planet, Ramlal and Baban, (2008), Heavy rainfall, inherent challenges in urban systems of drainage and surfaces impermeable that in reduced result infiltration water and runoff quick all contribute to the destructive nature of urban floods. Climate change and broad urban growth are predicted to worsen the problem of urban flooding.

“Shape-based line networks that are asymmetric, irregular, or have a vector component Even though this data can be examined using GIS, Things to consider in the UK include minor mishaps like basement flooding and major calamities like a city being submerged for days. Three factors that are crucial for managing urban floods are technical, economic, legal, and social, but they cannot be modelled using GIS” Bansal, S. K, (1992). While GIS can help with flood modelling and prevention, it can only help to inform and implement decisions made and implemented by a country's political and social processes.

Objective

1) To study the impact flooding of urban in city of Hyderabad
2) To suggest preventive measure for urban flooding and map the hazard prone area through geospatial techniques in the study area.
3) To analyze the role of Govt. agencies in providing relief measure in Flood affected Areas.

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Hypothesis

1) The present flood affected areas are once upon either lakes or tanks, which over a time of period have been encroached.
2) Huge Population growth of the study area is playing a vital role in Urban Flooding.
3) The flood affected areas do not have proper watershed of opportunities/ Provision.

In the Deccan Plateau, City of Hyderabad is located at 78° 15' E and 17° 15' N approximately. The terrain of peninsular India is characterized with massive boulders called as rock formations. The scenery in the Deccan Plateau is just about magnificent. Hyderabad is divided into two areas by the river Musi.

3. Study Area

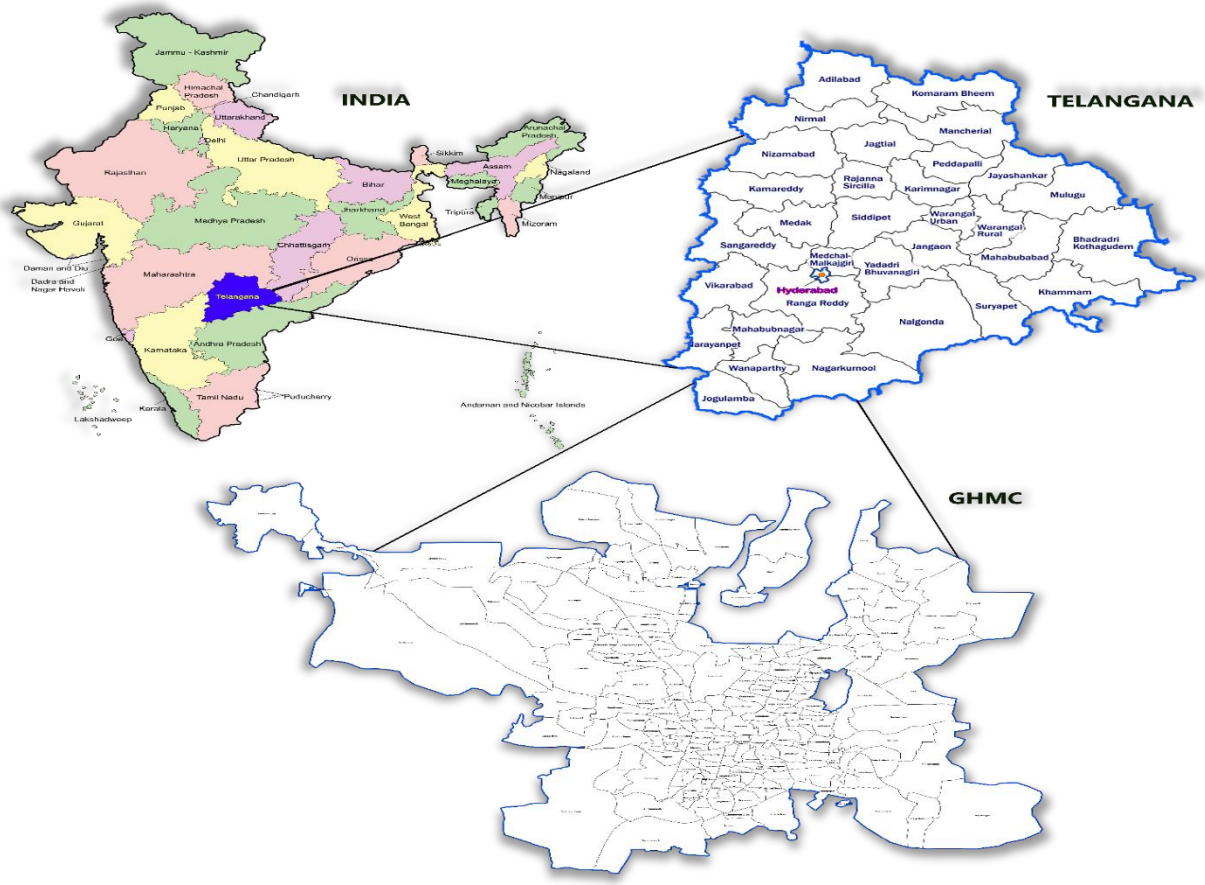

Figure 2.1: GHMC Hyderabad Map of the Study area

The city's water and drainage pipes were laid plain on this, which has an1,600 to 1,650 feet of elevation a uniform with slope northerly, and is delimited in the south-west, south, and east Koh-i-tur & by Mir Alam tank, Sarurnagar and tank of 6,3 and 4 miles at distances, from Charminar respectively.

4. Remote Sensing and GIS Analysis of Study Area

4.1 Urban Flooding in Hyderabad

The Hyderabad floods of 2020 were a string of flash floods brought on by Deep Depression BOB 02 (Bay of Bengal 02), which destroyed Hyderabad, India, and claimed many lives. BOB 02, the tropical fourth storm and deep third of the 2020 depression Ocean North Indian season cyclone, over developed the Bay of Bengal west-central on October 11, 2020. It then steadily drifted eastward over the three following days.

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Table 1: Indian remote sensing satellites (IRS) in support of flood and disaster management

Satellite	Sensor	Spatial Resolution (Meters)	Revisit time (days)	Service period
Bhaskara½	Television Camera	1000		June1979-1980 November1981-1983
IRS1A/1B	(LISS-I & LISS-II)	36.5and72.5	22	March1988-1992 August1991-1990
IRS1C/D	PAN,LISS3, WIFS,	5.80, 23.5, 188.	22 22 5	December1995-2001 September1997-2005
IRSP3	WiFS	188	5	March1996- 2002
IRSP4	OCM	360	2	May1999-operating
IRS -P6 (Resourcesat-1)	LISS4, LISS 3,AWIFS.	5.8, 23.5, 56.0.	22 22 5	October2003-operating
IRS– P5 (Cartosat–1)	Stereopan	2.5	5	June2019-operating
(Cartosat–2)	Pan	1	5	Jan2020-operating

Source: ISRO

Rainwater seeps into the ground, then flows into the atmosphere as surface runoff and evapotranspiration. Infiltration is eliminated, evapotranspiration is reduced, and surface runoff is dramatically increased in urban areas with impermeable surfaces like as roads and buildings. Buildings and roads are created on open spaces as a result of the urbanisation process, which results in the rise of cities and the development of infrastructure. As a result, rainwater-absorbing areas are replaced with hard, impermeable surfaces, increasing runoff volume and speed.

Building in the path of floods

During rainstorms, low-lying areas (floodplains, lake beds) face heightened flood danger, which includes public infrastructure (bus depots, roadways, metro rail, airports, and so on).The growing need for residential, commercial, and business zones has resulted in a lot of construction around lakes, streams, and wetlands. The natural flood buffer provided by these sites has been eliminated, and buildings in these locations now suffer a significant danger of flooding.

5. GIS and Flooding

5.1 Satellite Imagery

One of the most powerful and crucial techniques utilized by meteorologists, they're the sky's eyes, in a sense, is satellite photography. But they provide a clear, simple, and accurate explanation of how events occur, these visualizations reassure forecasters about the behavior of the atmosphere, weather forecasting and research would be impossible without satellites, data collected at locations around the country has limited representations of atmospheric motion. Although useful information Given the distance between the stations (hundreds of miles), important nuances could be missed while collecting knowledge from big data. The visualization of things that cannot be seen or measured is aided by satellite photos. Furthermore, satellite pictures are accepted as fact. There is no margin for error. Satellite images provide data that may be analyzed in real time.

5.2 DEM (Digital Elevation Model)

Digital models elevation (DEMs) the most are basis popular for produced digitally maps relief is widely and in geographic used systems information. DEMs a three-dimensional are representation computer graphic of data elevation may be that to simulate used on a planet terrain, or asteroid moon. A digital model is terrain needed for planetary research, land-use studies, geological applications, modeling of flood or drainage, and other uses.

Table 2: Foreign remote sensing satellites in support of flood and disaster management

System	Status	Capabilities
AQUA/TERRA (MODIS)	Existing	Optical 36 bands in VIS, IRS WIR, TIR
DMSP	Existing	Optical, IR
ENVISAT	Existing	Radar, optical, IR
ERS 1&2	Existing	Radar, 5-500kmswath, 25m resolution
IKONOS1-2	Existing	Optical 1 and 4m resolution
KVR-1000	Existing	Optical 150kmswath, 2m
EO-1ALI,Hyperion	Existing	Optical, VIS, IR, SWIR, TIR10m to 30m Multispectral (ALI) to hyperspectral (Hyperion)
LANDSAT7	Existing	Optical, IR185kms wath, 30m, 80m
NOAA-GOES	Existing	Optical, AVHRR
NOAA-POES	Existing	In-situ visible and IR observation
OrbView	Existing	Optical1, 2 and 4m
QuickBird	Existing	Optical 1m resolution
RADARSAT1	Existing	C-band Radar (SAR) 45-510km, 9-63m
TERRASAR-X	Existing	X-band Radar (SAR) 10-510km, 1-50m
ALOS(PALSAR)	Existing	L-band Radar (SAR) 40-350km, 7-100m
TRMM	Existing	Microwave radiometer, Rain radar, Thermal MI

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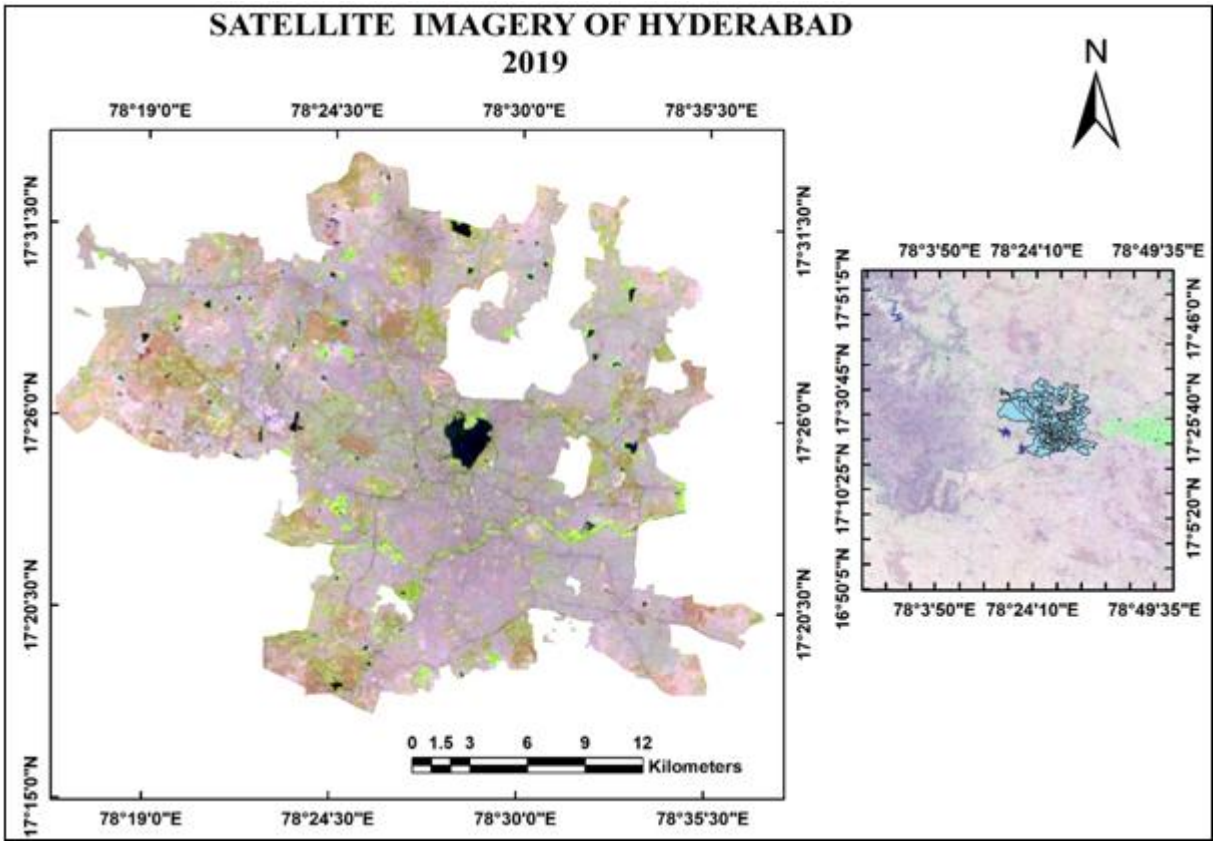
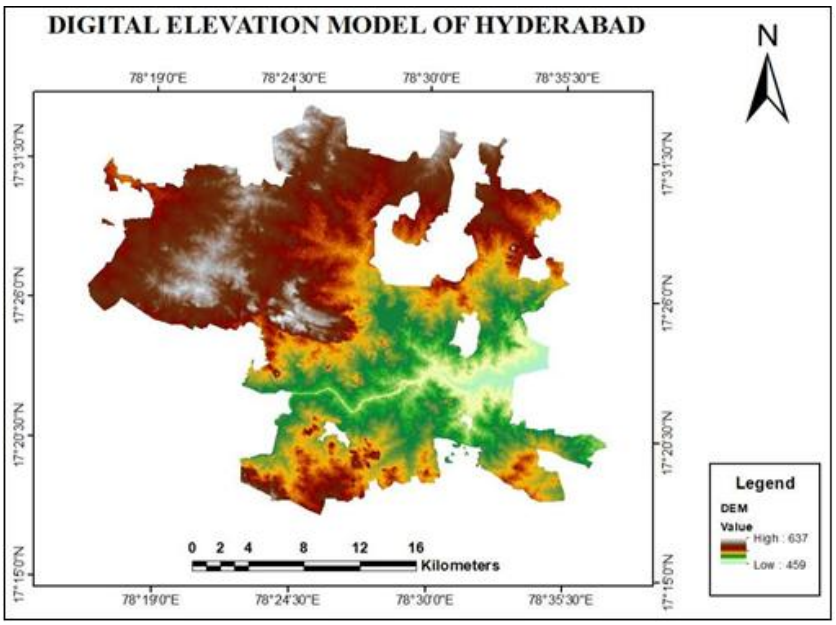
Resurs-03	Existing	Optical 34-600m
SeaWiFS	Existing	Optical, IR1-4msea observations
SPOT1-5	Existing	Optical 60 kms wath, 10m, 30m
ENVISAT	Existing	Radar, optical, IR
ERS 1&2	Existing	Radar, 5-500kms wath, 25m resolution

Source: NRSC



4.3 DSM (Digital Surface Model)

In a nutshell, a digital surface model (DSM) is a depiction of the world's surface that contains all of its objects. It represents the MSL heights of the surfaces reflecting, buildings of trees, other and elevated structures the bare above dirt. In other words, DSMs show the Earth's surface and all of its features. Computer surface models (DSMs) are scanned copies of surfaces that include both natural and man-made elements, such as plants and buildings. They also demonstrate any features that are raised above the bare soil and have reflecting surfaces.



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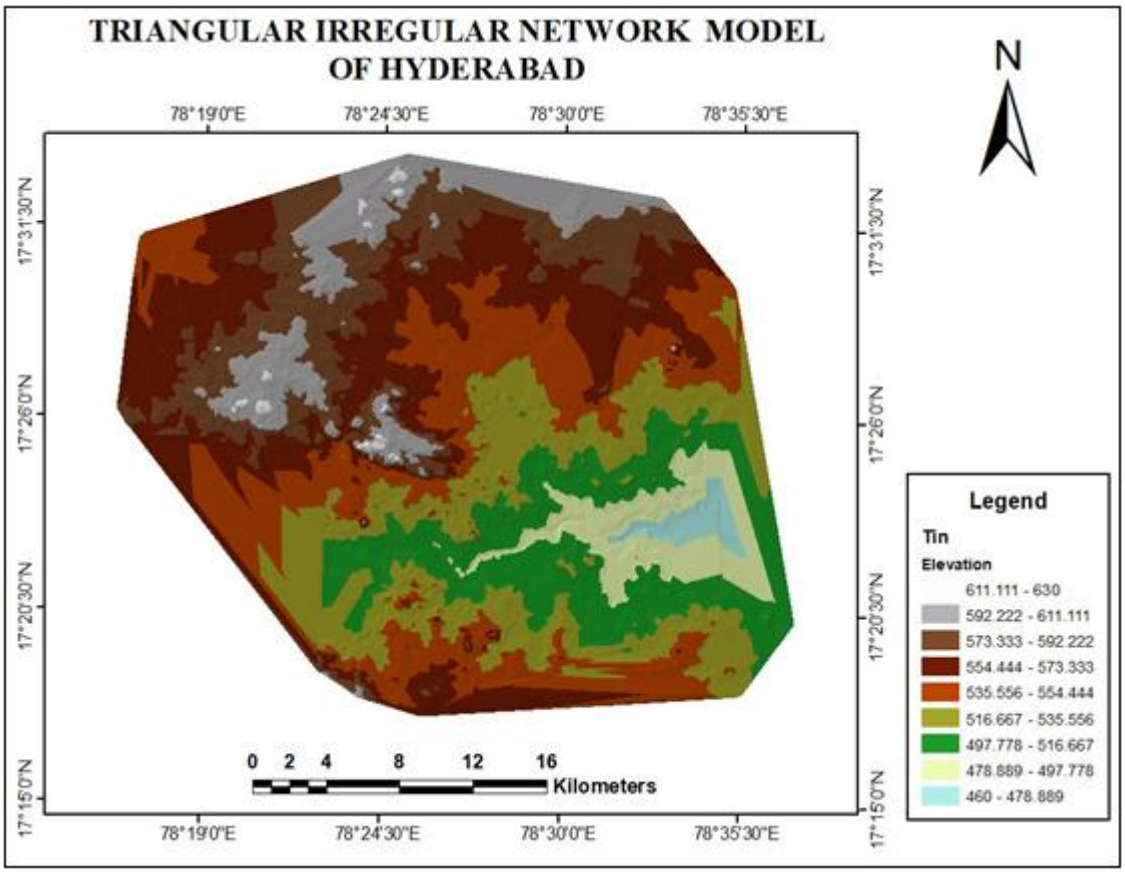
4.5 TIN (Triangular Irregular Network Model)

Networks of Triangular irregular (TINs), type of digital vector-based data geographic by triangulating created of vertices a set, have been used for a long time by the GIS community to depict surface morphology. ArcGIS supports the Delaunay triangulation technique. Mumbai Marooned. IN structure is a topological data model based on vectors that is used to represent terrain data. The terrain surface is represented by TIN as a series of interconnected triangular faces. The TIN structure - Digital Elevation Model - is a vector, based alternative to the classic raster representation of terrain surface (DEM).



5. Findings in Research

Study area experienced the greatest increase in this class from 2019 to 2020, with a decadal gain of 104.57 percent. The main reasons for the rise in area under this class are the rehabilitation of scrub lands by plantation and proper management of these lands by the forest department, particularly along the national highway and road sides in the research region. The research area was also subjected to an urban sprawl analysis, which revealed that the city saw significant growth from 2019 to 2020, with an overall increase of 86.98 km2 accounting for a 505.11% rise in area from 17.22 km2 in 2019 to 104.20 km2 in 2020.The study area experienced the greatest increase in this class from 2019 to 2020, with a decadal gain of 104.57 percent.

6. Conclusion

Natural laws anticipate a state of equilibrium regardless of the manner of growth, but it is clear that all laws collapse in the face of exponential population rise and subsequent urban expansion. Urban agglomeration is an unavoidable fact, and the current task is to comprehend the relationships between population and use land patterns, as well as to make good to manage the urban environment optimally and sustainably. It is clear from the study, which assessed the land use, land cover dynamics, Hyderabad expansion and metropolis GIS techniques and using remote sensing, that the city has been growing at a faster rate, particularly since the mass migration of people to Hyderabad in 1989 and thereafter due to ongoing militancy and political disturbances. Over time, the city's land use has shifted from primarily agricultural to primarily urban. Increased competition for land has resulted from an in the number increase of individuals moving to area the study.

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