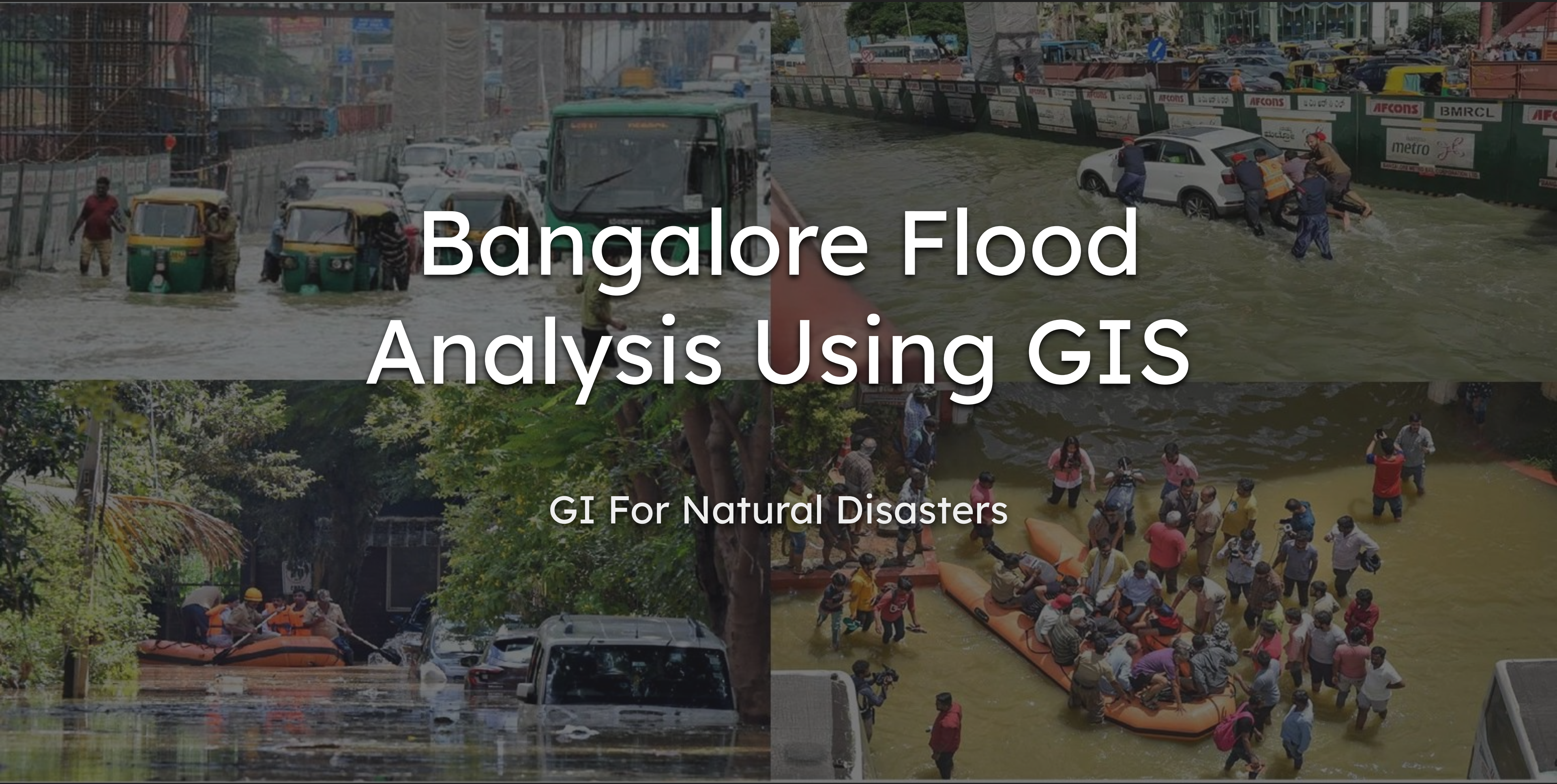
Bangalore Flood Analysis Using GIS

GI For Natural Disasters



Introduction

Frequent flooding (since 2000, even during normal rainfall) in Bangalore is a consequence of the increase in impervious area with the high-density urban development in the catchment and loss of wetlands and vegetation.

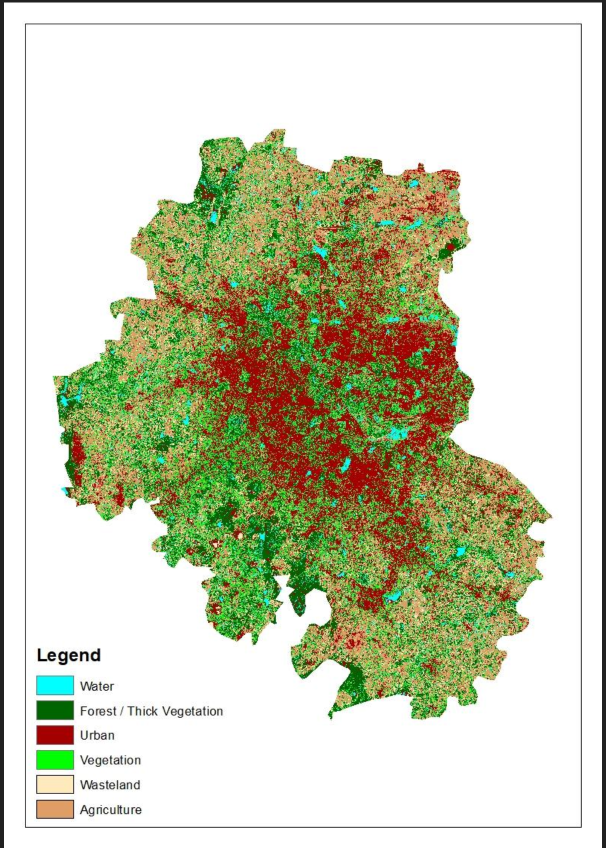
Only a few millimetres separated Bengaluru's August 2022 rainfall total (370 mm) from the all-time high of 387.1 mm set in August 1998.

The Outer Ring Road (ORR), which connects the city to its tech parks, frequently floods as a result of a lack of infrastructure.

The area's infrastructure cannot support the rate of development. The stormwater drains are overworked as a result of the combination of precipitation and sewage.

There is no proper planning to use lakes to buffer extra water.

Drainage map of Bangalore (🔗)



LULC Map of Bangalore Urban District

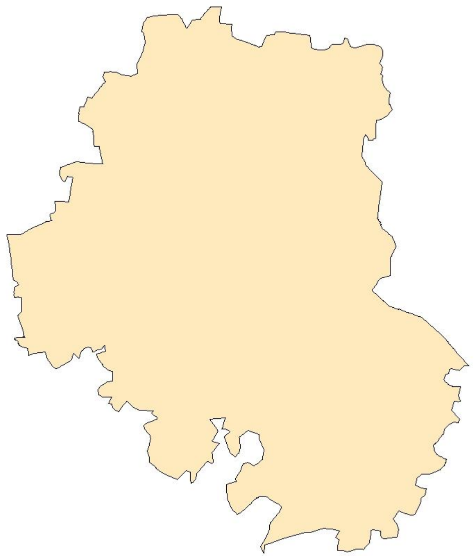
Study Area

Our GIS analysis would be focused on the Bangalore Urban District.

(12.970214°N, 77.56029°E)

It is the most densely populated district in Karnataka.

Population Density = 4400 per km^2 (2011 census)



Bangalore Urban Shapefile

Causes Of Frequent Flooding

Loss of interconnectivity among lakes due to encroachment of drains or dumping of solid wastes.

Encroachment of floodplains and wetlands (construction in valley zones, flood plains).

Narrowing and concretising storm water drains impairing hydrological functions of the natural drains.

Loss of pervious areas - reduction of open spaces, wetlands and vegetation cover.

Increased paved surfaces in the city due to unplanned irresponsible urbanisation.

Rapid increase in deforestation in catchment.

Bellandur Lake 2002

Bellandur Lake 2022

Encroachment of Bellandur lake bed and surrounding areas.

Supreme Court expressed concern about such encroachments in 2011, and ordered state governments to start evictions.

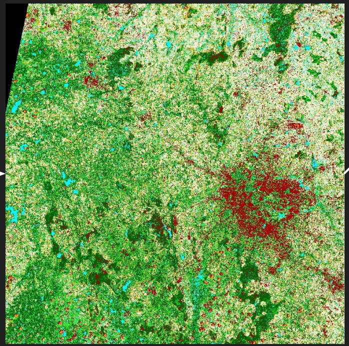
Dataset Used

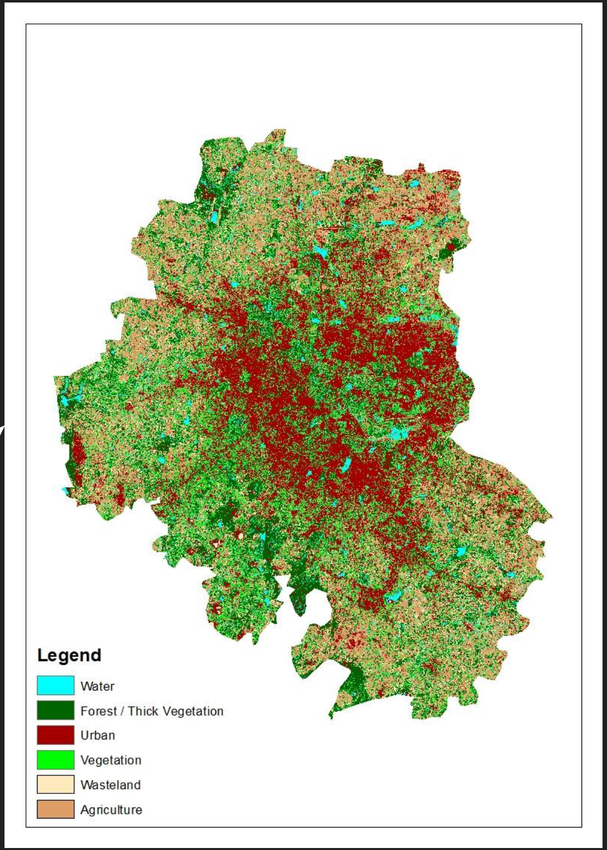
Data	**Source**	**Info**
Satellite Imagery	Sentinel 2, USGS Earth Explorer (🔗)	10m, 20m, 60m WGS84
Karnataka Shapefile	MapCruzin (🔗)	-
Global Soil Map	FAO Soils Portal (🔗)	1:5000000 Scale
Daily Gridded Rainfall Data	IMD Pune (🔗)	0.25° x 0.25°
SWAT Soil Database For SNum to Texture	Google Drive (🔗)	-

Methodology

Preparing LULC map for Bangalore Urban

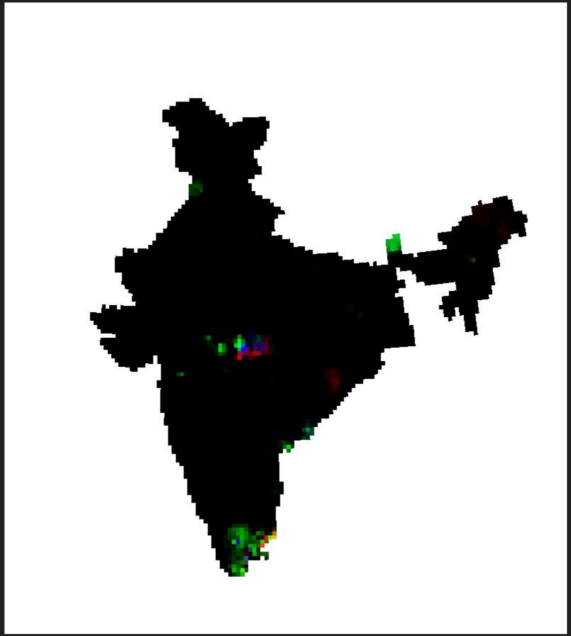
a. Layer stack 1 to 8 bands of Sentinel 2 image
b. Unsupervised classification with 50 classes
c. Recode
d. Import to ArcGIS, extract by mask using bangalore urban shapefile



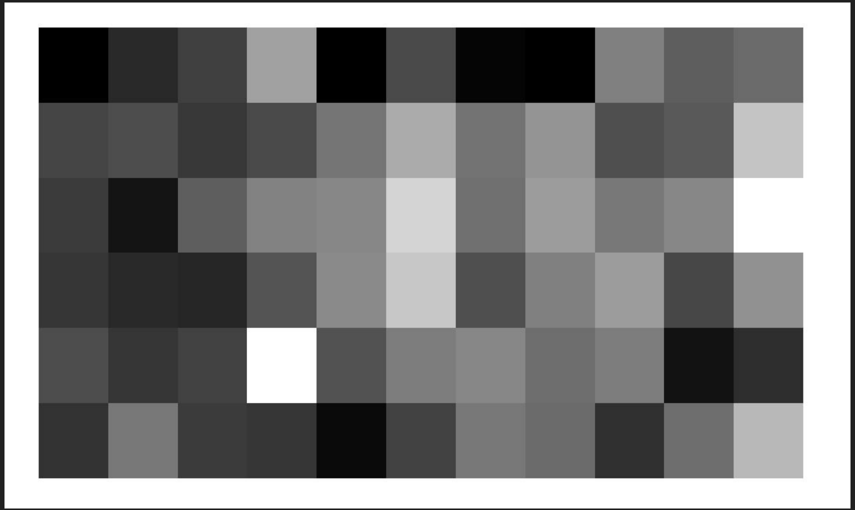


Preparing Annual Rainfall Maps

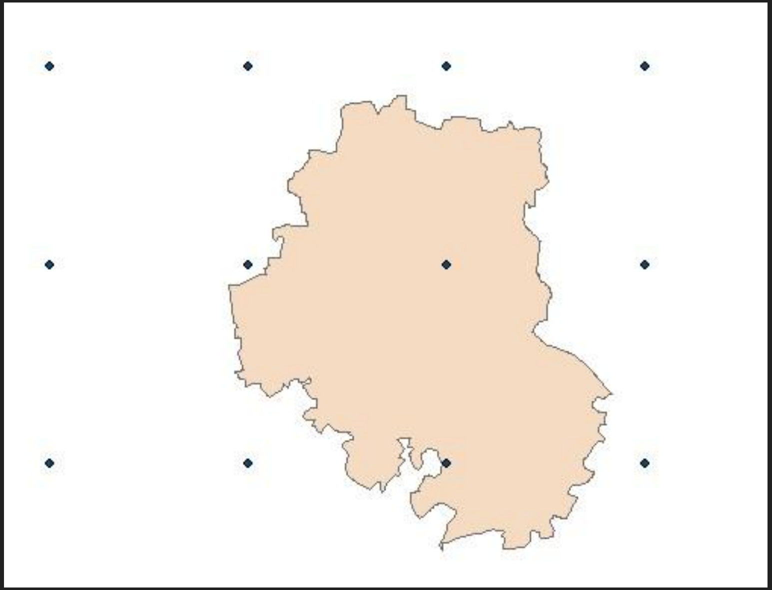
a. Too many steps to write here



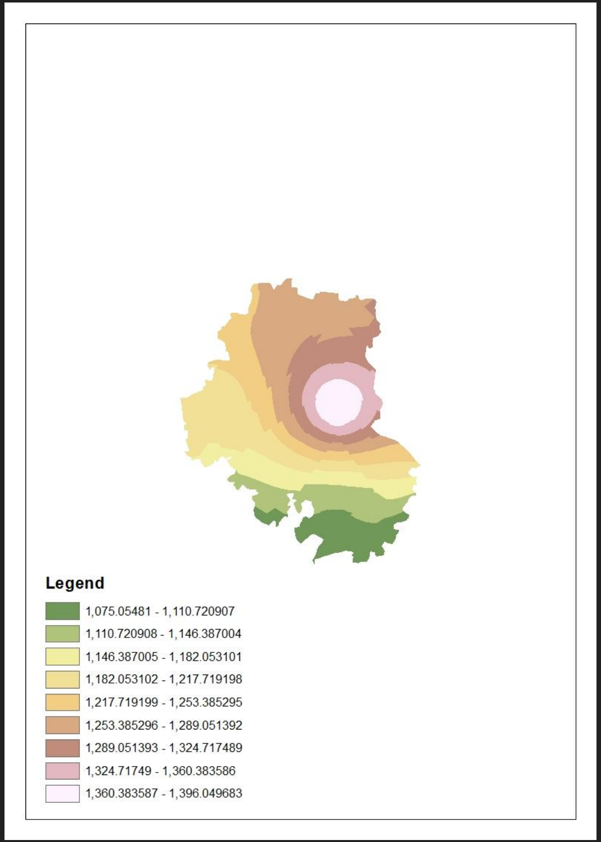
Daily Rainfall data after using "Create NetCDF Raster Layer" tool



Annual Rainfall data after applying "SUM" in "Cell Statistics" Tool



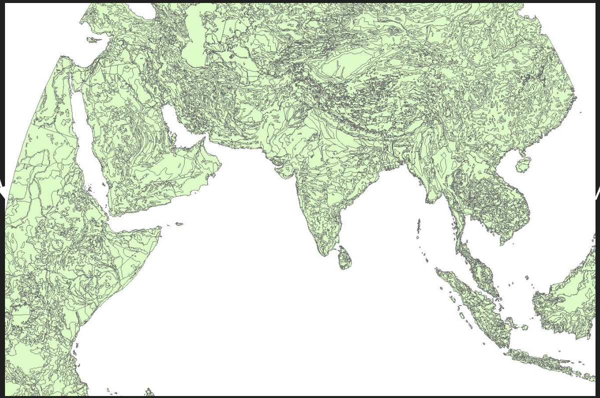
Annual Rainfall Point data

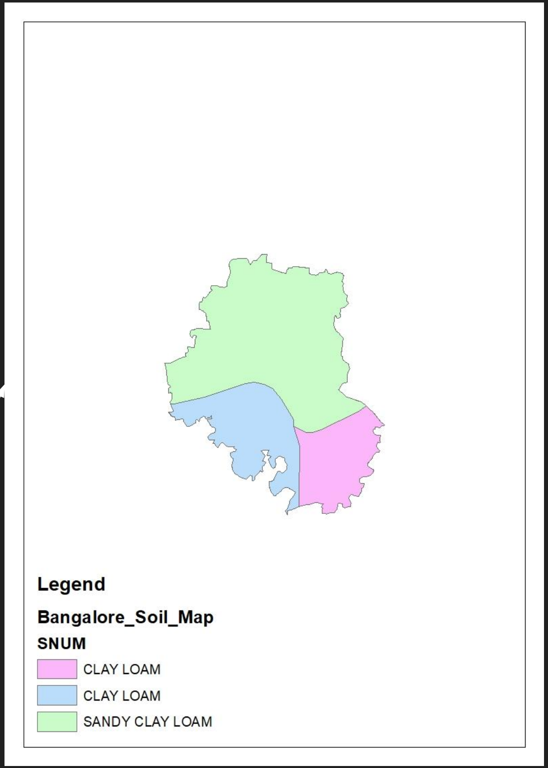


2021 Annual Rainfall Data after IDW interpolation

Preparing Soil Map

a. Projected FAO Global Soil Map to WGS84
b. Clipped Bangalore urban data using it's shapefile





Significance

Annual flooding is considered normal is many parts of India even though the cause is primarily man-made.

Unplanned rapid urbanization leads to weak drainage systems and excessive increase in surface runoff.

Our study would help identify the regions that are most prone to floods in Bangalore. The data could be used for eviction of encroached floodplains and lake beds.

Solutions

Reduction of encroached wetlands and replacing concrete with green spaces.

Regain interconnectivity of lakes.

More sewage treatment plants as only 60% of them are operational.

Adopting thirsty concrete and increasing the drainage capacity.

Stop narrowing and concretising natural drains.

Stop further industrialization and commercial establishments in bangalore.