

# Study of urban land built-up in the region of Hyderabad

**Aim:** Study of the amount land with built-up i.e. concrete structures and roads using Built-up insides.

## Methodology:

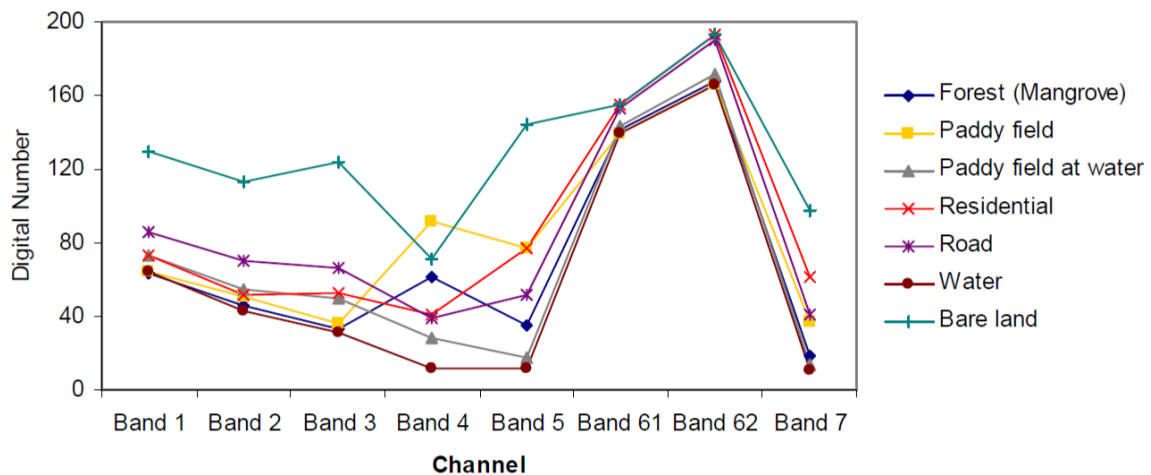
By identifying the unique spectral characteristics different objects can be identified. This can be done using Normalized Difference indices which have the form

$$\text{Normalized Index} = \frac{A - B}{A + B}$$

A and B are the values of pixels at different bands.

The index can take the values from -1 to 1. The value of the index will be high for an object which has more reflectance in A and less reflectance in B. So by finding the index value of each pixel an object can be identified.

**Spectral characteristics of different objects (bands of Landsat)**



To identify the built-up the form of Normalized Difference Built-up Index is

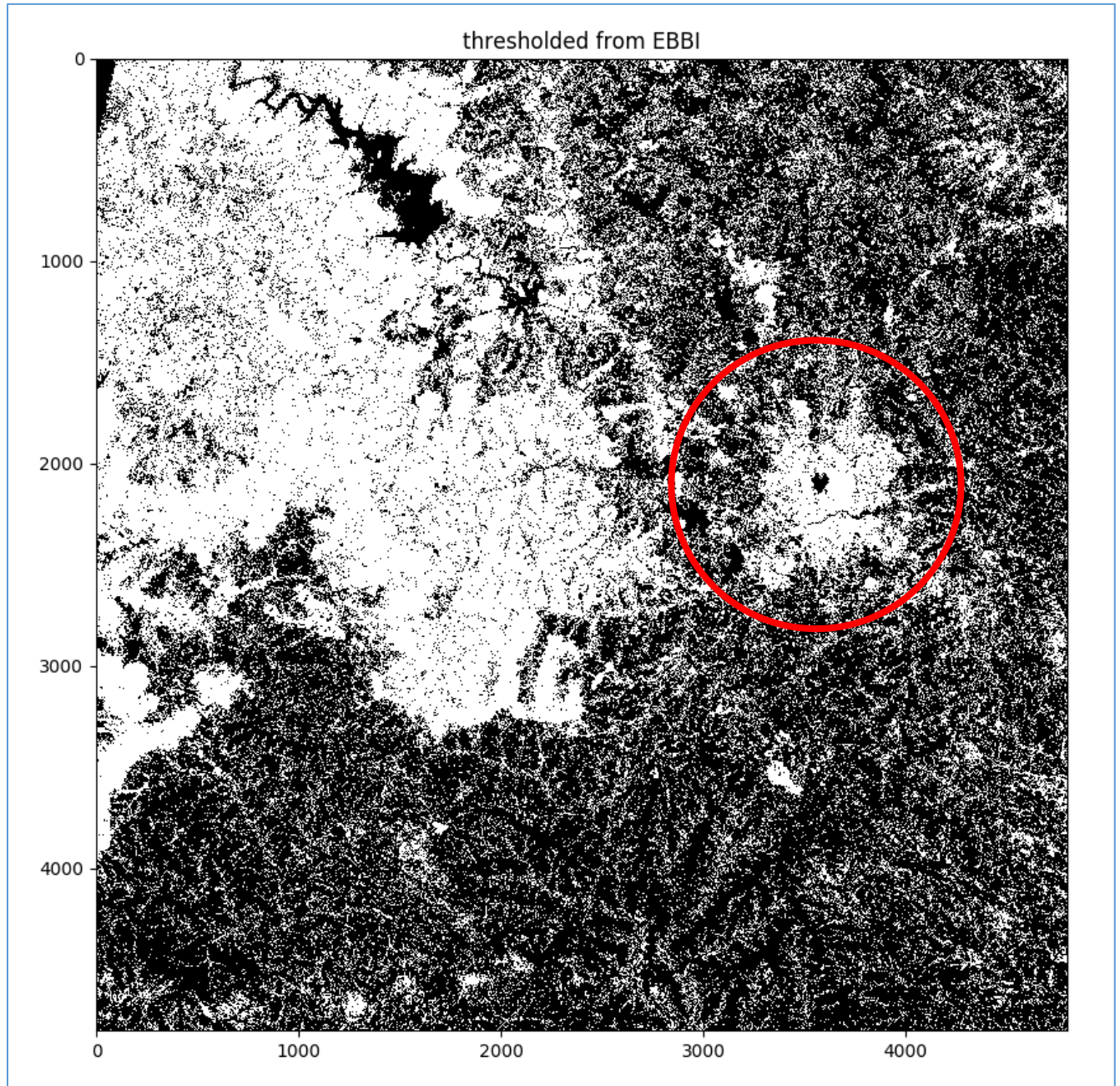
$$NDBI = \frac{SWIR - NIR}{SWIR + NIR}$$

A modified form of NDBI is Enhanced Bareness and Built-up Index which has higher contrast.

$$EBBI = \frac{SWIR - NIR}{10\sqrt{(SWIR + TIR)}}$$

### Findings:

Landsat 5 TM images are used for this study and the EBBI is calculated. A threshold value is given to EBBI such that whichever pixel satisfies the condition of having EBBI between 0.1 to 0.35 is classified as Built-up area. EBBI with value more than 0.35 is classified as bare soil. A python code is written to execute the above method.

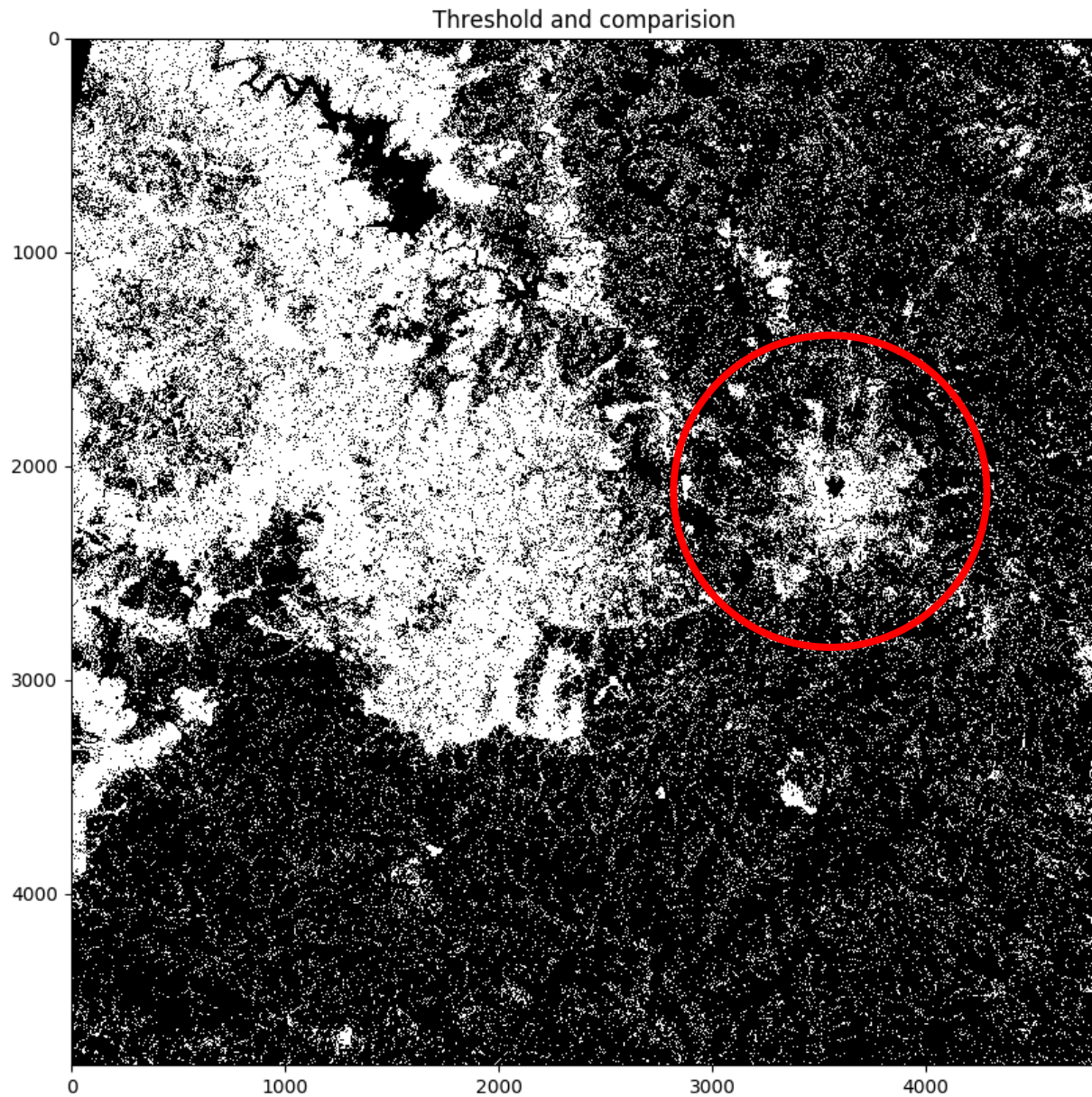


*Image from 1999 covering Hyderabad and neighboring areas*

One more method is also implemented which involves EBBI and mean value of band 4 and band 6. Assumption is made that the difference of mean value of band 4 and band 6, and band 5 will be positive for bare soil. So the pixels with following condition are classified as built-up.

$$\text{Built up Flag} = (\text{EBBI} > 0.1) \text{ and } \left( \left( \frac{\text{band4} + \text{band6}}{2} \right) < \text{band5} \right)$$

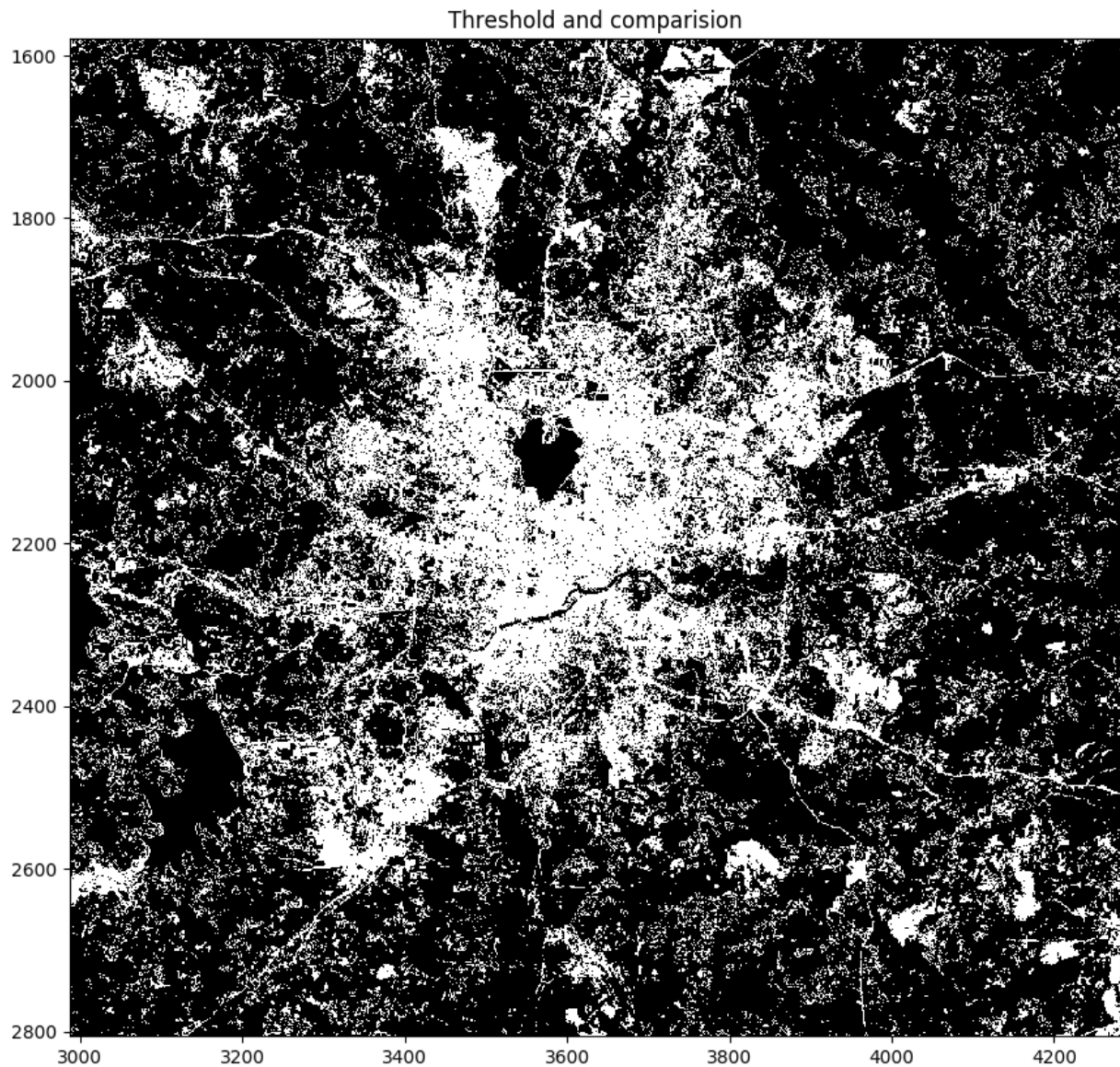
If the above Flag value is true then the pixel is classified as urban. The above method is purely based on observation of spectral characteristics. And the following results are obtained.



*Image from 1999 over Hyderabad and covering neighboring areas*



By the second method comparatively features are more recognizable. The roads are clearly distinguishable.



Zoomed image of Hyderabad

### Limitations:

In both the method there is a patch to the left of the city which is classified as built-up but it is not built-up. Due to this observations in the results the above methods are found to have limitations is differentiating some kinds of bare soil and the built-up. So the results vary with seasons due to different crop covers.

Calculating the extent of urbanization was not possible, since classification was not accurate.

**Inference:**

The spectral characteristics can have variations with different soils. A general characteristic of soil is considered. So better knowledge of the soil present can result in better result.

Spectral characteristics of terrains in our target locations can be identified by taking a mean of the area of land with different features. So the indices can be modified based on target location.

**Data sources:**

<https://glavis.usgs.gov/>

**References :**

<http://www.mdpi.com/2072-4292/4/10/2957/pdf>

<https://landsat.usgs.gov/what-are-best-spectral-bands-use-my-study>