Mapping Build-Up Area Density Using Normalized Difference Built-Up Index (NDBI) and Urban Index (UI) Wetland In The City Banjarmasin

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Introduction

- Increase in population and all their activities cause the need for land to increase. The increasing demand for land encourages the development of facilities and infrastructure including housing, roads, bridges, markets, agriculture, and irrigation. As a result, empty land or vegetation turns into a land [1]–[3].

- Rapid changes in building density make it impossible to use field surveys to monitor changes. The utilization of information from remote sensing is a solution for monitoring building density because it can be done quickly, multi-temporal, and covers a large area [5], [6]. The remote sensing method has advantages over mapping with field surveys, because satellite image data shows the condition of the earth's surface without visiting the entire location, thereby accelerating the monitoring of land change or mapping of an area [7].

- Digital remote sensing image processing for built area density studies requires a special transformation to be able to identify the appearance of objects in urban or urban areas. The image transformation models that most effectively distinguish building materials from natural materials usually utilize the near-infrared, middle infrared, and far-infrared channels because they are sensitive to differences in building materials and natural materials such as water, vegetation, and exposed land [8].
Method

- Research conducted in Banjarmasin City, South Kalimantan Province with an area of 98.46 km². The data used for the research are field data, secondary data in the form of Landsat 8 Oli Tirs imagery recorded on August 14, 2019, and the RBI Map of Banjarmasin City in 2004. Data processing in this research is experimental by building and developing spectral transformations. The spectral transformations used are NDBI and UI.

- \[ \text{NDBI} = \frac{\text{SWIR}_1 - \text{NIR}}{\text{SWIR}_1 + \text{NIR}} \]

- \[ \text{UI} = \frac{\text{SWIR}_2 - \text{NIR}}{\text{SWIR}_2 + \text{NIR}} + 1 \]
Results and Discussion
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- The built-up area density is low covering 1048 ha, medium built area density is 2386 ha, and high built area density is 31 ha. The density of built area in Banjarmasin City based on UI resulted in 3 classifications of built area density. The built-up area density is low of 2419 ha, the density of the constructed area is 64 ha, and the density of the built-up area is 5 ha.

- Accuracy results between the NDBI classification transformation and UI compared to visual interpretation map data with class objects of each non-built and built area shows an NDBI accuracy of 91.4505% and a UI accuracy of 92.5359%, there is a difference of 1.0854% greater UI accuracy.
## Results and Discussion

<table>
<thead>
<tr>
<th>No.</th>
<th>Built-up Land Density Class</th>
<th>Spectral Transformation Image NDBI</th>
<th>Google Earth</th>
<th>Area (Hectares)</th>
<th>Coordinate X</th>
<th>Coordinate Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low Density Built Land</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td>6.1198</td>
<td>114.6155</td>
<td>3.3063</td>
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<tr>
<td>2</td>
<td>Medium Density Built Land</td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
<td>4.9037</td>
<td>114.5853</td>
<td>3.3168</td>
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<td>3</td>
<td>High Density Built Land</td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td>1.8104</td>
<td>114.5901</td>
<td>3.3141</td>
</tr>
<tr>
<td>4</td>
<td>Vegetation</td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td>11.8157</td>
<td>114.6082</td>
<td>3.3125</td>
</tr>
</tbody>
</table>
Conclusion

- Area density built-in Banjarmasin City in 2019 based on NDBI transformation. It is shown that the resulting value ranges from -0.760237 (low built-up area density) to 0.42407 (high built-up area density), while the UI spectral transformation ranges from -0.56051 (low built-up area density) to 0.388064 (high built-up area density). Area density built-in Banjarmasin City in 2019 is centered in the central area of Central Banjarmasin District.

- The area density built-in Banjarmasin City based on NDBI resulted in 3 classifications of built area density. The built-up area density is low covering 1048 ha, medium built area density is 2386 ha, and high built area density is 31 ha.

- The density of built area in Banjarmasin City based on UI resulted in 3 classifications of built area density. The built-up area density is low of 2419 ha, the density of the constructed area is 64 ha, and the density of the built-up area is 5 ha.

- The accuracy between the NDBI and UI classification transformations compared to visual interpretation map data with class objects of each non-built and built area shows an NDBI accuracy of 91.4505% and a UI accuracy of 92.5359%, there is a difference of 1.0854% greater UI accuracy. Overall accuracy exceeding 80% indicates very high accuracy.
References


