

SPASIO-TEMPORAL URBAN HEAT ISLAND (UHI) DI KABUPATEN BEKASI MENGGUNAKAN CITRA LANDSAT 8 DAN GOOGLE EARTH ENGINE TAHUN 2014 – 2024

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INTISARI

Fenomena *Urban Heat Island* (UHI) menjadi perhatian global akibat urbanisasi yang pesat, termasuk di Kabupaten Bekasi, yang mengalami pertumbuhan penduduk dan ekspansi kawasan industri secara signifikan meningkatkan suhu permukaan (*Land Surface Temperature/LST*), memperparah UHI, yang berdampak pada kesehatan dan lingkungan. Penelitian ini memetakan distribusi spasial dan temporal UHI di Kabupaten Bekasi pada periode 2014, 2019, dan 2024 menggunakan citra *Landsat 8* dan *Google Earth Engine* (GEE), serta mengidentifikasi hubungan korelasi antara LST dengan indeks tutupan lahan (NDVI, NDBI, MNDWI) untuk mendukung pengelolaan lingkungan berkelanjutan.

Landsat 8 OLI/TIRS diolah untuk LST dari *Band 10* dan indeks tutupan lahan (NDVI, NDBI, MNDWI) menggunakan band multispektral, yang diolah melalui platform *Google Earth Engine* analisis multitemporal (2014, 2019, 2024). Distribusi UHI diidentifikasi dengan metode *Hot Spot Analysis (Getis Ord Gi*)* pada perangkat lunak *ArcGIS Pro*, sedangkan hubungan antara LST dan indeks tutupan lahan dianalisis menggunakan uji korelasi *Pearson*. Validasi LST dilakukan melalui pengukuran lapangan pada Mei 2025 di tutupan lahan. Visualisasi interaktif disajikan melalui aplikasi *Earth Engine Apps* BKS-HEAT untuk mempermudah analisis spasial.

Hasil penelitian menunjukkan bahwa luas *hotspot* UHI signifikan meningkat dari 179,79 km² (13,96%) pada 2014 menjadi 205,86 km² (15,98%) pada 2024, terutama di wilayah industri seperti Tambun Selatan dan Cikarang Barat, sementara *coldspot* menurun dari 132,99 km² (10,32%) menjadi 134,24 km² (10,42%), mencerminkan konversi lahan hijau ke lahan terbangun. Intensitas UHI bervariasi, dengan nilai 5,41°C (2014), 4,07°C (2019), dan 5,87°C (2024), sejalan dengan ekspansi urbanisasi. Korelasi *Pearson* menunjukkan hubungan negatif sedang antara NDVI dan LST ($r = -0,56$), positif kuat antara NDBI dan LST ($r = 0,75$), serta negatif sangat kuat antara MNDWI dan LST ($r = -0,86$), menegaskan peran vegetasi dan badan air sebagai faktor pendingin, sementara lahan terbangun memperparah UHI. Validasi LST menghasilkan MAE 5,41°C dan korelasi *Pearson* $r = 0,59$, menunjukkan akurasi yang cukup untuk analisis regional. Aplikasi BKS-HEAT mendukung visualisasi untuk perencanaan tata ruang.

Kata Kunci: *Urban Heat Island, Landsat 8, GEE, LST, Getis Ord Gi*

**SPASIO – TEMPORAL URBAN HEAT ISLAND (UHI) IN BEKASI REGENCY
USING LANDSAT 8 IMAGERY AND GOOGLE EARTH ENGINE FROM
2014 TO 2024**

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ABSTRACT

The phenomenon of Urban Heat Island (UHI) has gained global attention due to rapid urbanization, including in Bekasi Regency, where population growth and industrial area expansion have significantly increased land surface temperature (LST), exacerbating UHI and impacting both health and the environment. This study aims to map the spatial and temporal distribution of UHI in Bekasi Regency for the years 2014, 2019, and 2024 using Landsat 8 imagery and Google Earth Engine (GEE), as well as to analyze the correlation between LST and land cover indices (NDVI, NDBI, MNDWI) to support sustainable environmental management.

Landsat 8 OLI/TIRS data was processed to extract LST from Band 10 and land cover indices (NDVI, NDBI, MNDWI) from multispectral bands using Google Earth Engine for multitemporal analysis (2014, 2019, 2024). UHI distribution was identified through Hot Spot Analysis (Getis-Ord G_i^) using ArcGIS Pro, and Pearson correlation was used to assess the relationships between LST and land cover indices. LST validation was conducted through field measurements in May 2025 across various land cover types. An interactive visualization was developed using the Earth Engine Apps platform (BKS-HEAT) to facilitate spatial analysis.*

The results indicate that the area of UHI hotspots significantly increased from 179.79 km² (13.96%) in 2014 to 205.86 km² (15.98%) in 2024, particularly in industrial zones such as South Tambun and West Cikarang, while coldspots slightly decreased from 132.99 km² (10.32%) to 134.24 km² (10.42%), reflecting the conversion of green areas to built-up land. UHI intensity varied, with values of 5.41°C (2014), 4.07°C (2019), and 5.87°C (2024), consistent with urban expansion. Pearson correlation results show a moderate negative correlation between NDVI and LST ($r = -0.56$), a strong positive correlation between NDBI and LST ($r = 0.75$), and a very strong negative correlation between MNDWI and LST ($r = -0.86$), emphasizing the cooling effect of vegetation and water bodies and the warming impact of built-up areas. LST validation yielded a Mean Absolute Error (MAE) of 5.41°C and a Pearson correlation of $r = 0.59$, indicating sufficient accuracy for regional-scale analysis. The BKS-HEAT app effectively supports visualization for spatial planning.

Keywords: Urban Heat Island, Landsat 8, GEE, LST, Getis-Ord G_i^*