

Analyzing The Cooling Effect of Forest and Its Relation to Spatial Configuration and Vegetation Quality on Improving Thermal Comfort in Built-up Area of East Kalimantan, Indonesia

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Ibu Kota Negara Nusantara (IKN) is the prospective capital of Indonesia in East Kalimantan that is envisioned to be able to regulate its own microclimate under 28°C through urban forests and greenspaces by the concept of forest city. In order to achieve this vision, the cooling effect of forest in IKN area must be understood correctly. The aim of this study was to analyze the cooling effect of forest in IKN's buffer zone—East Kalimantan, and its relation to spatial configuration and vegetation quality using correlation analyses. The cooling effect was analyzed by comparing each land cover's cooling intensity over built-up area based on Land Surface Temperature (LST) derived from MODIS-TERRA through 2014-2018 and 2019-2022. The spatial configuration and vegetation quality were calculated using landscape metrics (Size, NDVI, and PLAND) using the standard and moving-window in a 750x750 m spatial scale. The result suggested that natural forest has a cooling effect indicated by a strong cooling intensity up to 2.91°C in 2014-2018 and 2.19°C in 2019-2022. Moreover, the result also found that other land covers which were peat/mangrove forest and water bodies have a similar cooling effect as natural forest and thus can be a good combination to help regulate the city's microclimate. The cooling effect of forest was not strongly correlated to the size of its forest, indicating a stronger influence from vegetation's quality and coverage. Specifically, the cooling effect of forests is suggested to be stronger by improving the quality of forest's vegetation to the state of healthy natural forest indicated by strong correlation to NDVI and increasing the proportion of forest cover by at least 30% indicated by strong correlation to PLAND. The results provides several insights to plan the forest city's building strategy on improving thermal comfort by regulating microclimate in IKN.

Keywords: thermal comfort, cooling effect, forest, built-up, UHI