NATIONAL CONSORTIUM FOR REMOTE SENSING EDUCATION, RESEARCH, AND APPLICATIONS

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PROJECT FACT SHEET

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Sky View Factor Measurements in Support of Local Climate Zone Classification

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Introduction: Increasing urbanization coupled with threats from global climate change are driving research innovations that seek to inform sustainability of urban socio-ecological systems. The Local Climate Zone (LCZ) classification system developed by Stewart and Oke (2012) provides a framework for examining relationships between urban morphology and temperature, as well as a standardized approach to facilitate data integration from around the globe. In addition to urban heat island studies, parameters used to define LCZs are increasingly applied in related fields, such as modeling fine-scale variations in urban air quality (Badach et al., 2020).

Objectives: As part of broader initiative to develop a LCZ map of Indianapolis, this research compares multiple methods and data sources for calculating sky view factor (SVF) measures in multiple LCZ types using three different 3D building datasets (Microsoft, OpenStreetMap, and a detailed local model). Results will be compared to SVF from field-based hemispherical photos and Land Surface Temperature (LST) estimates derived from day and nighttime Landsat 8 imagery. A second objective is to develop an understanding of error propagation using these different approaches when SVF values are summarized with kernel-based methods.

Preliminary Results: Nighttime Landsat 8 image data were tasked over central Indiana in 2019 & 2020 through the USGS resulting in at least three cloud-free images over Indianapolis, an area characterized by diverse urban morphology common to many cities. A poster summarizing the project was presented at the 2020 Conference of the West Lakes Division of the American Association of Geographers (Fig. 1). The poster was awarded 3rd place in the graduate student poster competition. A process for developing SVF estimates at sampling locations that correspond to Landsat 8 image pixels has been adapted from Park et al. (2017) (Fig. 2).

Future Work: Ongoing work focuses on evaluating integration of tree inventory & canopy cover data to model vegetation effects on SVF, examining how LST varies with SVF, and planning a field campaign for hemispherical photo acquisition in 2021. The overall goal is to contribute to development of a high-quality LCZ map for Indiana's capitol city.

References:

Stewart, I. D., & Oke, T. R. (2012). Local climate zones for urban temperature studies. *Bulletin of the American Meteorological Society*, 93(12), 1879-1900.

Badach, J/, et al. (2020). A framework for Air Quality Management Zones-useful GIS-based tool for urban planning: Case studies in Antwerp and Gdańsk. *Building and Environment*, 106743.

Park, C., Ha, J., & Lee, S. (2017). Association between three-dimensional built environment and urban air temperature: Seasonal and temporal differences. *Sustainability*, 9(8), 1338.

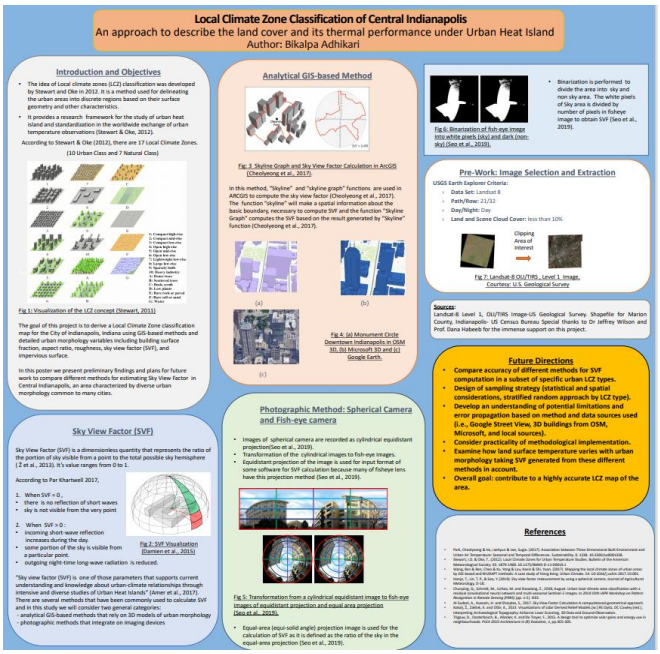
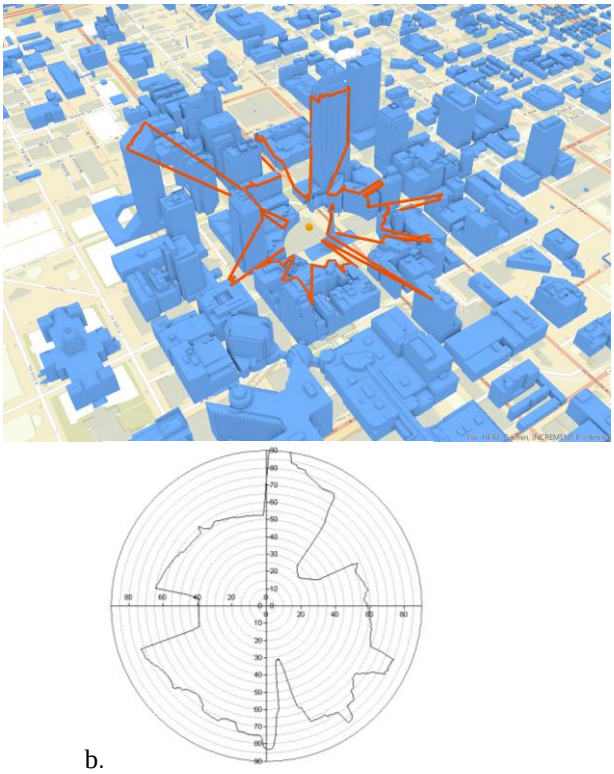


Figure 1. Poster presented at West Lakes Division of the American Association of Geographers (WLDAAG) Conference, November 13, 2020.



a.

b.

Figure 2. (a) 3D polyline representing the border separating sky and urban features surrounding an observer point in Monument Circle; (b) polar graph of sky visibility.