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Studying the Effect of Urban Green Spaces Location on Urban Heat Island in Cities Using Remote Sensing Techniques, 6th October City as a Case Study

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Abstract:

The term urban heat island refers to the urban area being warmer than the surrounding non-urban temperature. Urban heat island is a common manifestation of urbanization, as the increase in the area of concrete and asphalt surfaces and the decrease in green area leads to an increase in the surface temperature of the earth (Yin et al., 2019). Several strategies have been proposed to mitigate excess heat, including the use of urban green spaces as a nature-based solution (Wu et al., 2021). Urban green spaces are those open public or private green spaces in urban areas that are mainly covered by vegetation, whether used for recreational or other purposes (Haq, 2011). It is the most widely applied mitigation measure that can achieve significant energy savings (Memon et al., 2008). It has been proven that it forms cool islands, significantly reduces surface temperature and improves thermal comfort, which has a role in reducing environmental stress from urban heat islands (Yang et al., 2017). Several studies over the past few years have focused on understanding the effects of urban green space on the urban heat island (Yang et al., 2017). The integration of remote sensing and geographic information systems helped provide data on surface temperatures, and the possibility of studying and analyzing the relationship between them and urban green spaces with high accuracy on large urban areas. The land cover classification of satellite images was determined using the maximum likelihood method, which is one of the most important and widely used observational classification methods in land cover mapping (Sheriza Mohd Razali, 2012). Although increasing urban green space is an important strategy for mitigating urban heat island effects, urban areas usually lack sufficient public space to create all the urban green spaces they need (Yang et al., 2017).
Objectives: The research aims to analyze the impact of urban green spaces on the urban heat island as a common strategy for thermal mitigation, by studying the relationship between land surface temperatures for urban areas and distance from urban green spaces. To accomplish this goal, the Sixth of October City will be studied as a case study using remote sensing and geographic information systems. **Methodology :** This study employed an inductive strategy to collect data on the city, obtain essential maps and coordinates, and select the proper satellite to capture the study's most recent visual images. Thus, the applied strategy depended on remote sensing techniques, geographic information systems, and the application of equations to determine the land surface temperature, which is primarily responsible for the urban heat island effect. Additionally, geographic information systems were used to classify the city's land cover and to determine the temperatures associated with each class of land cover. Additionally, to determining summertime urban temperatures and distances to urban green places. Finally, the analytical approach was employed to investigate and conclude on the influence of urban green space proximity on the urban heat island. **Results:** According to the study's findings, there is a direct relationship between urban heat island and distance from urban green spaces, and thus the temperature decreases as the urban area approaches urban green spaces and increases as the distance increases, as 46 percent of the city's urbanization is within a distance of no more than 100 m from urban green spaces and their average temperatures. 36 The temperature gradually increased till it reached 40.6 at a distance of 1200 meters from the green areas. While the vegetative index and urban heat island have an inverse connection, the higher the vegetative index, the lower the temperature. Therefore, the study recommended increasing urban green spaces within cities and interspersing them within urban areas intensively to reduce the effects of urban heat islands and improve thermal comfort.

Keywords:

Urban Heat Island, Remote Sensing, Urban Green Spaces, Sixth of October City.

References:

1- Abdel Fattah El Sayed Abdel Fattah. (2017). Evaluation of satellite visualization classification methods to study urban change in Buhaira Governorate.

2- Bahi, H., Mastouri, H., & Radoine, H. (2020). Review of methods for retrieving urban heat islands. Materials Today: Proceedings, 27, 3004–3009. https://doi.org/10.1016/j.matpr.2020.03.272
3- Haq, S. M. A. (2011). Urban Green Spaces and an Integrative Approach to Sustainable Environment. Journal of Environmental Protection, 02(05), 601–608. https://doi.org/10.4236/jep.2011.25069
4- Kalkhan, M. A., Reich, R. M., & Czaplewski, R. L. (1997). Variance Estimates and Confidence Intervals for the Kappa Measure of Classification Accuracy. Canadian Journal of Remote Sensing, 23(3), 210–216. https://doi.org/10.1080/07038992.1997.10855203
5- Li, Z.-L., Tang, B.-H., Wu, H., Ren, H., Yan, G., Wan, Z., Trigo, I. F., & Sobrino, J. A. (2013). Satellite-derived land surface temperature: Current status and perspectives. Remote Sensing of Environment, 131, 14–37. https://doi.org/10.1016/j.rse.2012.12.008
6- Mansour, K. F. G. (2016). Studying the relationship between urban changes and the emergence of heat islands in the city of Tanta using remote sensing and geographic information systems. Journal of Scientific Research in Arts, 3(4), 1–18. https://doi.org/10.21608/jssa.2016.11381
7- Memon, R. A., Leung, D. Y. C., & Chunho, L. I. U. (2008). Review of Generation, Determination, Mitigation UHI. Journal of Environmental Sciences, 20, 120–128.
8- Mohamed Mahmoud Abdullah Youssef. (2013). Optimal use of land and sustainable development by applying to the Sixth of October City in Egypt. Organization of Islamic Capitals and Cities.
9- Mushore, T. D., Odindi, J., Dube, T., & Mutanga, O. (2017). Understanding the relationship between urban outdoor temperatures and indoor air-conditioning energy demand in Zimbabwe. Sustainable Cities and Society, 34(April), 97–108. https://doi.org/10.1016/j.scs.2017.06.007
10- Nkomeje, F. (2015). Comparative Performance of Multi-Source Reference Data to Assess the Accuracy of Classified Remotely Sensed Imagery: Example of Landsat 8 OLI Across Kigali City-Rwanda. International Journal of Engineering Works Kambohwell Publisher Enterprises, 4(1), 10–20. https://doi.org/https://doi.org/10.5281/ZENODO.268398
11- Samer Hadi Kazem Al-Jashami. (2018). Spatial analysis of heat islands in the city of Najaf using geographical techniques. Journal of Geographical Research, 27(1), 327. https://doi.org/10.36328/0833-000-027-012
12- Santamouris, M. (2014). Cooling the cities – A review of reflective and green roof mitigation technologies to fight heat island and improve comfort in urban environments. Solar Energy, 103, 682–703. https://doi.org/10.1016/j.solener.2012.07.003
13- Sheriza Mohd Razali. (2012). A method of mapping forest fuel types in peat swamp forest. African Journal of Agricultural Research, 7(12). https://doi.org/10.5897/ajar11.1456
14- Stehman, S. V. (1996). Estimating the kappa coefficient and its variance under stratified random sampling. Photogrammetric Engineering and Remote Sensing, 62(4), 401–407.
15- Rania Adham Sayed Mohamed. (2012). The new cities in Egypt between the target and reality, the case of the Sixth of October City. Department of Architecture and Planning, 204. https://doi.org/#
16- Verma, R., & Garg, P. K. (2020). Urban Green Space and Land SurfaceTemperature in Lucknow Urban Green Space and Land Surface Temperature in Lucknow Ravi Verma , Pradeep Kumar Garg. December. https://doi.org/10.1002/essoar.10506196.1
17- Werner, T. T., Bebbington, A., & Gregory, G. (2019). Assessing impacts of mining: Recent contributions from GIS and remote sensing. The Extractive Industries and Society, 6(3), 993–1012. https://doi.org/10.1016/j.exis.2019.06.011
18- Wu, C., Li, J., Wang, C., Song, C., Haase, D., Breuste, J., & Finka, M. (2021). Estimating the Cooling Effect of Pocket Green Space in High Density Urban Areas in Shanghai, China. Frontiers in Environmental Science, 9(May), 1–14. https://doi.org/10.3389/fenvs.2021.657969
19- Yang, C., He, X., Wang, R., Yan, F., Yu, L., Bu, K., Yang, J., Chang, L., & Zhang, S. (2017). The effect of urban green spaces on the urban thermal environment and its seasonal variations. Forests, 8(5), 1–19. https://doi.org/10.3390/f8050153
20- Yin, J., Wu, X., Shen, M., Zhang, X., Zhu, C., Xiang, H., Shi, C., Guo, Z., & Li, C. (2019). Impact of urban greenspace spatial pattern on land surface temperature: a case study in Beijing metropolitan area, China. Landscape Ecology, 34(12), 2949–2961. https://doi.org/10.1007/s10980-019-00932-6
21- The electronic portal the 6th of October City Development Authority. (n.d.). Retrieved August 25, 2021, from http://www.6october.gov.eg/default.aspx
22- EarthExplorer. (n.d.). Retrieved August 25, 2021, from https://earthexplorer.usgs.gov/.

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