The Eurasia Proceedings of Health, Environment and Life Sciences (EPHELS)
ISSN: 2791-8033

The Eurasia Proceedings of Health, Environment and Life Sciences (EPHELS), 2026

Volume 21, Pages 77-82

ICVALS 2026: International Conference on Veterinary, Agriculture and Life Sciences

Determining the Impact of Urbanization on Green Spaces Using NDVI Analysis: The Case of Konya City

Taha Kagan Aydin
Konya Technical University

Abstract: Rapid population growth and urbanization processes lead to significant changes in land use/cover, particularly in developing cities, often resulting in the reduction of green spaces. In this study, the impact of urbanization on vegetation Dynamics in Konya, located in the Central Anatolia Region of Türkiye, was analyzed using the Normalized Difference Vegetation Index (NDVI). Landsat satellite images from 2015 and 2025 were utilized to reveal the temporal and spatial variations in vegetation density. The analysis of NDVI values indicates that vegetation cover has notably decreased, particularly in areas experiencing urban expansion. Considering the development pattern of Konya over the last decade, it is evident that urban growth has predominantly occurred over agricultural lands and natural vegetation areas, leading to an overall declining trend in NDVI values. However, localized increases in NDVI were also observed in green spaces such as parks and recreational areas. This finding suggests that urbanization does not produce exclusively negative impacts; rather, its effects are strongly dependent on the nature of urban development and planning approaches. In conclusion, the case of Konya demonstrates that urbanization generally leads to a reduction in vegetation density. NDVI based analyses prove to be an effective tool for evaluating the ecological impacts of urban growth. The integration of such analyses into sustainable urban planning processes contributes to the protection and enhancement of green spaces and supports the development of scientifically informed strategies aimed at mitigating ecological impacts.

Keywords: NDVI, Urbanization, Vegetation change, Urban growth

Introduction

The rapid increase in global population and urbanization processes are leading to significant changes in land use and land cover, especially in developing countries. The most prominent feature of these changes is the decrease in vegetation. Cities, as centers where economic and social activities are concentrated, tend to experience higher spatial growth compared to surrounding areas (Rosyadi & Azahra, 2020). The limited availability of land in city centers is causing people to expand their settlements towards the periphery or outskirts of the city (Suprayogi & Rochani, 2021; Hafiz et al., 2025). In developing regions, the outward expansion of urban areas from the center leads to the depletion of natural areas and agricultural lands, the transformation of vegetation into an impermeable surface, and environmental problems such as transportation costs and traffic congestion, negatively impacting sustainability and urban development (Li et al., 2015; Magina et al., 2024; Hafiz et al., 2025).

Significant changes in land cover/use occur in urban areas as a result of population growth and economic development due to intense human activity and impact (Li et al., 2011). Increased construction leads to a decrease in green areas and disruption of the ecological balance. Therefore, quantitatively determining the effects of urbanization on vegetation is of great importance for sustainable urban planning. While remote sensing techniques and Geographic Information Systems (GIS) software are reliable, economical, and consistently effective tools for monitoring environmental changes in urban and rural areas (Selçuk et al., 2021;

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Polat & Yalçın, 2020), the Normalized Difference Vegetation Index (NDVI) stands out as a method with high potential, particularly in determining land loss and monitoring vegetation (Yasin et al., 2022).

Indexes like NDVI provide reliable results in the analysis of vegetation and impermeable surfaces (Ullah et al., 2020). NDVI is analyzed through the normalized difference between near-infrared (NIR) and red bands obtained from satellites. High NDVI values indicate vegetation density, while low or negative values indicate settlement areas, bare surfaces, and water bodies (Hasyim et al., 2025).

This study aims to reveal the effect of urbanization on vegetation in Konya city over a 10-year period between 2015 and 2025 using NDVI analysis. Konya province was chosen as the study area due to its rapid urban development in recent years (Figure 1). In the study, NDVI values were calculated from satellite images of two different periods and increases and decreases in vegetation amount were revealed through temporal change analyses. In this respect, the study aims to evaluate the spatial and quantitative aspects of changes in urban growth and vegetation density.

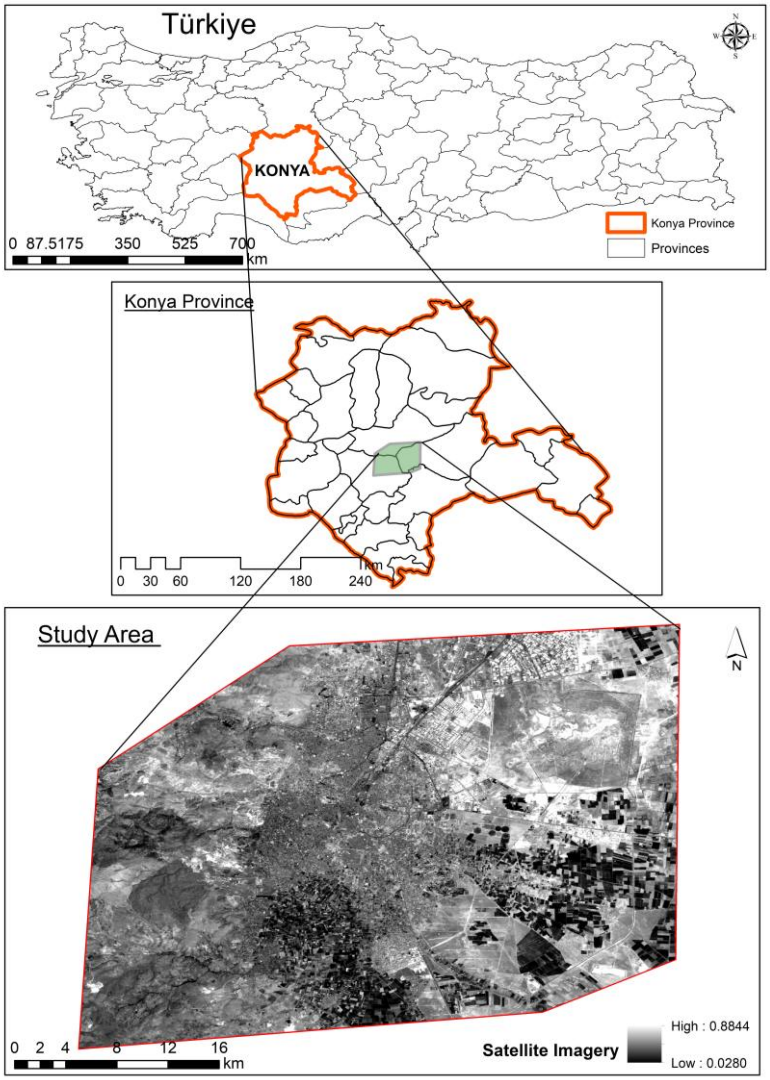

Figure 1. Konya location map.

Field of Study and Methodology

Located in the Central Anatolia Region, Konya province, situated at 37.87 degrees North latitude and 32.50 degrees East longitude, comprises the central districts of Selçuklu, Karatay, and Meram, and possesses the potential for continuous development and growth. The region is surrounded by extensive agricultural areas with semi-arid climate characteristics and exhibits changes in land use/cover due to urbanization pressures. With

these characteristics, the study area constitutes a suitable example for analyzing the relationship between urbanization and vegetation.

Landsat 8 satellite images from 2015-2025 were used in the study area, which was determined to represent Konya's urban fabric and its immediate development periphery. Atmospherically corrected visible and near-infrared bands were obtained via the Google Earth Engine (GEE) platform. Cloud filtering was applied to determine vegetation change, and median composites were created from images from the summer period (June-September). NDVI values were calculated to determine vegetation density.

Based on the findings, a ΔNDVI difference analysis was created between two periods using NDVI images. ΔNDVI values were divided into three classes: vegetation decrease, stable, and vegetation increase. The classification results were transferred from the GEE platform to ArcGIS software for visualization and spatial analysis. Finally, the area sizes corresponding to the classifications were calculated to reveal the quantitative dimension of the change. The data were organized according to the boundaries of the study area, and the classification results were visualized using appropriate symbology.

Results

According to the NDVI change analysis results for the period 2015-2025, vegetation decreased in an area of 187.61 km2 (18.30%) in and around Konya city center, increased in an area of 79.91 km2 (7.79%), and remained stable in an area of 757.93 km2 (73.91%) (Table 1). The fact that the areas showing vegetation decrease are significantly greater than the areas showing increase indicates that the vegetation change in the study area is generally on a downward trend.

Table 1. Area distribution of NDVI change classes in the Konya area for the period 2015-2025

Class	Area (km^2)	Percentage (%)
Vegetation Decrease	187.61	18.30
Stable	757.93	73.91
Vegetation Increase	79.91	7.79
Total	1025.45	100.00

When the NDVI change map is examined, it is seen that vegetation reduction is spatially concentrated in areas where rapid construction has taken place in recent years, especially in the city center and its immediate surroundings (Figure 2). This situation indicates that urban growth is putting pressure on natural vegetation areas, especially along new development axes.

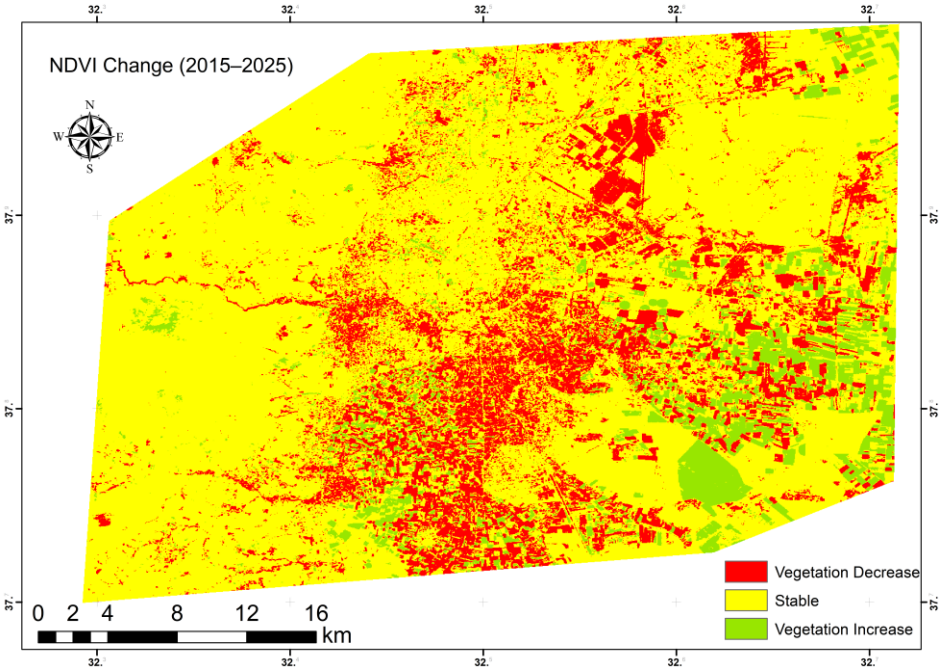

Figure 2. NDVI change distribution in Konya (2015–2025)

Comparing the NDVI maps for the years 2015-2025 reveals significant changes in the spatial distribution of vegetation (Figure 3). While the 2015 NDVI map shows that vegetation density is more distinctly preserved in areas close to the city center, the 2025 NDVI map shows a decrease in this density in and around the city center. This indicates that the impact of urban growth on vegetation is also a determining factor in spatial structure.

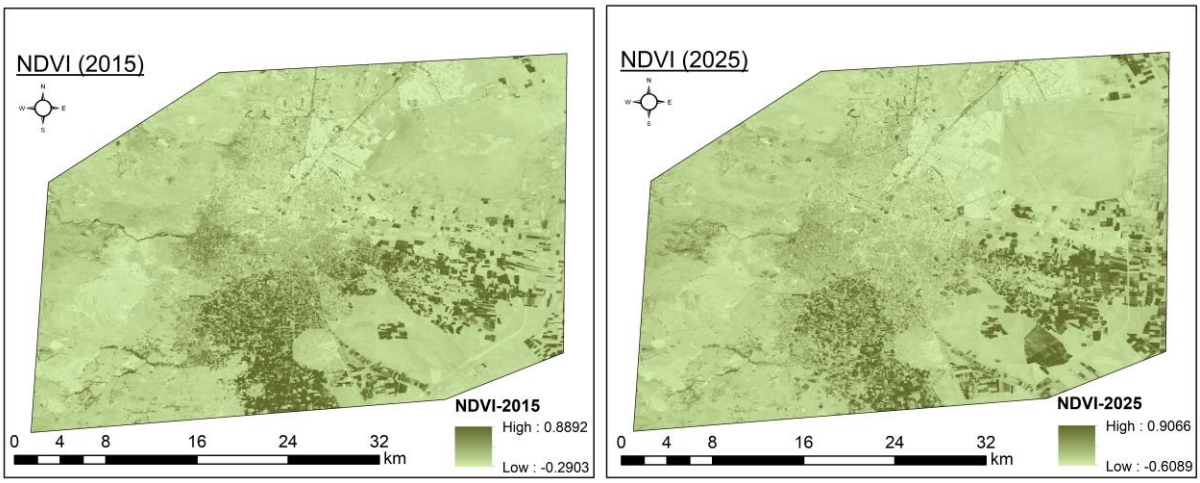

Figure 3. Comparative spatial distribution of NDVI 2015-2025

Discussion and Conclusions

The findings of this study are important in terms of comparing them with literature studies addressing the relationship between urbanization and vegetation and evaluating their results.The effects of urbanization on vegetation have been expressed with similar results in many studies conducted in different geographies. For example, in the study conducted by Weng & Lo (2001) in the Zhujiang Delta, they detected approximately a 30% decrease in NDVI values in urban areas. Similarly, Yasin et al. (2022), in their long-term evaluations, stated that urbanization increased fourfold and that there were significant losses in vegetation during this process. Bhomi et al. (2024) determined a loss of approximately 23.5 km2 of forest cover between different periods. Magidi et al. (2022) revealed that vegetation density decreased in various land cover classes during the urbanization process. These findings show that the reducing effect of urbanization on vegetation yields similar results in different geographies. This study similarly shows that the NDVI value decreased by 18.3%, revealing the impact of urbanization on natural and semi-natural areas. A study by Hwang et al. (2022) in Seoul indicated a 39% greening trend in the pixel-based area, with only 7% showing brown discoloration. This suggests that afforestation and green space creation practices in urban areas can have positive effects on NDVI values. Indeed, this study also demonstrates that vegetation change exhibits regional differences and that the impact of urban growth varies spatially.

In conclusion, a decrease of 18.3% and an increase of 7.8% in vegetation were detected in the study area. The decrease in vegetation is largely attributed to the transformation of agricultural areas and natural vegetation into urbanized areas, transportation infrastructure, and other impermeable surfaces. The increases in vegetation observed in some regions are thought to reflect the impact of newly formed afforestation areas, parks, recreation areas, and irrigated areas.

NDVI-based analyses are used as an important tool in evaluating the ecological impacts of urban growth. Integrating such analyses into urban planning processes significantly contributes to the creation of sustainable cities, the protection and development of green spaces, and the adoption of scientifically based decisions aimed at maintaining ecological balance.

Recommendations

The use of NDVI-based monitoring approaches in urban planning processes is important for sustainable land management. Priority should be given to protecting and increasing green spaces, especially in rapidly urbanizing areas. Furthermore, promoting practices such as urban greening and afforestation will contribute to reducing the ecological impacts of urbanization.

Scientific Ethics Declaration

* The author declares that the scientific ethical and legal responsibility of this article published in EPHELS journal belongs to the author.

Conflict of Interest

* The author declares that there is no conflict of interest

Funding

*I declare that I have not received any financial support or funding.

Acknowledgements or Notes

* This article was presented as an oral presentation at International Conference on Veterinary, Agriculture and Life Sciences (www.icvals.net) held in Konya/Türkiye on April 02-05, 2026.

* This study utilized the Google Earth Engine (GEE) platform for data processing and analysis.

References

Bhomi, A. K., Poudyal, R., Tolange, S. K., & Chaudhary, S. (2024). Assessing the impact of urban expansion on forest cover using LULC maps, NDVI, and NDBI: A case study of Kathmandu District. *Journal on Geoinformatics, Nepal*, 1–7.

Hafiz, A. A., Usman, F., Hidayat, A. R. T., & Zakiyah, D. M. (2025). Spatiotemporal dynamics of urban sprawl types in the peri-urban area of Malang Municipality, Indonesia. *Urban Science, 9*(8), 313.

Hasyim, A. W., Sukojo, B. M., Anggraini, I. A., Fatahillah, E. R., & Isdianto, A. (2025). Urban heat island effect and sustainable planning: Analysis of land surface temperature and vegetation in Malang City. *International Journal of Sustainable Development and Planning, 20*(2), 683–697.

Hwang, Y., Ryu, Y., & Qu, S. (2022). Expanding vegetated areas by human activities and strengthening vegetation growth concurrently explain the greening of Seoul. *Landscape and Urban Planning, 227*, 104518.

Li, G. Y., Chen, S. S., Yan, Y., & Yu, C. (2015). Effects of urbanization on vegetation degradation in the Yangtze River Delta of China: Assessment based on SPOT-VGT NDVI. *Journal of Urban Planning and Development, 141*(4), 05014026.

Li, J., Song, C., Cao, L., Zhu, F., Meng, X., & Wu, J. (2011). Impacts of landscape structure on surface urban heat islands: A case study of Shanghai, China. *Remote Sensing of Environment, 115*(12), 3249–3263.

Magidi, J., & Ahmed, F. (2022). Monitoring vegetation phenology using MODIS NDVI 250m in the City of Tshwane, South Africa. *South African Journal of Geomatics, 11*(2), 176–189.

Magina, F. B., Paul, B. N., & Lupala, J. M. (2024). Impacts of urban sprawl on people's livelihoods: Analysis of urban fringe neighbourhoods in Dar es Salaam, Tanzania. *International Planning Studies, 29*(2), 198–212.

Polat, P., & Yalçın, F. (2020). Erzincan ili arazi kullanımının 2000–2018 yılları arası CORINE sistemi ile değerlendirilmesi. *Doğu Coğrafya Dergisi, 25*(44), 125–150.

Rosyadi, A., & Azahra, M. F. (2020). Pemetaan presentase kepadatan bangunan menggunakan model regresi berdasarkan citra Landsat 8: Studi kasus Kota Bandung. *Jurnal Penginderaan Jauh Indonesia, 2*(1), 7–12.

Selçuk, S. F., Cebeci, M. S., Köker, B., & Yılmaz, Z. (2021). Konya ili arazi kullanım/örtüsü değişim analizi. *Türkiye Peyzaj Araştırmaları Dergisi, 4*(2), 100–114.

Suprayogi, R., & Rochani, A. (2021). Kesesuaian perubahan penggunaan lahan dengan rencana tata ruang di kawasan peri-urban. *Jurnal Kajian Ruang, 1*(2), 238–254.

Ullah, M., Li, J., & Wadood, B. (2020). Analysis of urban expansion and its impacts on land surface temperature and vegetation using RS and GIS: A case study in Xi'an City, China. *Earth Systems and Environment, 4*(3), 583–597.

Weng, Q., & Lo, C. P. (2001). Spatial analysis of urban growth impacts on vegetative greenness with Landsat TM data. *Geocarto International, 16*(4), 19–28.

Yasin, M. Y., Abdullah, J., Noor, N. M., Yusoff, M. M., & Noor, N. M. (2022). Landsat observation of urban growth and land use change using NDVI and NDBI analysis. *IOP Conference Series: Earth and Environmental Science, 1067*(1), 012037.

Author(s) Information

Taha Kagan Aydin
Konya Technical University - Vocational School of Technical Sciences, Ardıçlı Neighborhood, Rauf Orbay Road 42250, Selçuklu, Konya, Türkiye
ORCID iD: https://orcid.org/0000-0001-6903-0847
*Contact e-mail: *tkaydin@ktun.edu.tr*

*Corresponding author(s) contact e-mail

To cite this article:

Aydin, T.K. (2026). Determining the impact of urbanization on green spaces using NDVI analysis: The case of Konya city. *The Eurasia Proceedings of Health, Environment and Life Sciences (EPHELS), 21,* 77-82.