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Assessing the impact of urban and rural development and land use changes on urban and rural surface temperatures (LST) using Landsat images from 2003 to 2023, case study area of Aslandoz Township

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Background and Objective: Land surface temperature is a fundamental indicator in monitoring energy balance models at the land surface at regional and global scales. Given the limitations of meteorological stations, remote sensing can be a suitable alternative for estimating land surface temperature. The main objective of this research is to monitor land surface temperature and land use changes and urban development using satellite images from 2003 and 2023. The results of the 20-year land use map showed that very visible urban development was observed throughout the entire Aslandoz Township. If this development is done with minimizing damage to the environment and forests, it will be very positive.

Methodology: In this study, Landsat satellite images from 2003 and 2023 were used to investigate and assess the feasibility of using solar radiation energy. ENVI software was used to perform calculations using ArcGIS software to prepare maps. One of the applications of thermal images is to prepare thermal maps to determine isothermal zones.

Results and Findings: The results of the LST map showed that the land surface temperature in Aslandoz Township has increased significantly, so that in 2003 the land surface temperature was 42.49, and in 2023 this figure has increased to 49.92. The results of the integration of land use maps and land surface temperature showed that the lowest temperature in both years was attributed to water and forest use, which is due to high humidity, and the highest temperature was attributed to soil and residential use. Soil use in 2003 was 42.09 and in 2023 was 49.86, and residential use in 2003 was 42.57, and in 2023 the highest value for residential use was 42.57, which is a significant figure. The reason for this very high temperature and the difference in use is that if an area is devoid of vegetation or has sparse coverage, evaporation and transpiration are low and the temperature increases.

Keywords: Object-oriented classification, landsurface temperature, landuse, Landsatimages, Aslandoz.

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Extended Abstract

Introduction:

Cities often have specific climatic conditions, which are called urban climates. Urban climate is characterized by differences in the city's climatic variables (air temperature, humidity, speed and direction, rainfall) compared to the less dense surrounding areas. Research shows that urban areas are warmer than the surrounding rural areas, and this phenomenon is commonly known as the "urban heat island". With the change of season, in addition to the process of absorbing ultraviolet radiation and emitting infrared radiation, in each area, the roofs of buildings, streets and dark surfaces absorb heat and re-emit it in the air. Given that all the roofs in Tehran are dark in color. These surfaces cover half of the area of Tehran and absorb and retain heat emitted from the sun. This phenomenon increases the temperature of residential areas by 2 to 15 degrees Celsius and is called the heat island phenomenon (Chen et al., 2009, 1). Rapid urban expansion due to significant changes in land use and land cover has had negative impacts on the natural circulation system of the global environment (Kakeh Mami et al., 2017). Changes in land use, development of urban and agricultural areas, and deforestation lead to changes in regional and local temperature regimes (Akbari et al., 2015). Land surface temperature is an important indicator in studying patterns of land surface energy balance and land-atmosphere interactions at regional and global scales (Moradi et al., 2016).

Methodology:

In this study, Landsat satellite images from 2003 and 2023 were used to investigate and assess the feasibility of using solar radiation energy. ENVI software was used to perform calculations using ArcGIS software to prepare maps. One of the applications of thermal images is to prepare thermal maps to determine isothermal zones.

Also, meteorological data from the city was used to examine the temperatures recorded by the stations. The images were taken in the summer season to avoid high cloud and snow cover and high solar radiation intensity, and Google Earth software was used to obtain better accuracy. ENVI 5.3 software was used to make atmospheric and radiometric corrections, and ARC GIS 10.5 software was used to extract the relevant maps. After taking the images and making the relevant corrections on the desired images, the following steps were taken to achieve the desired results. In order to classify land use, the object-oriented classification method was used in the eCognition Developer64 software. In the object-oriented classification method, spectral information is merged with spatial information and pixels are segmented based on shape, texture and gray tone in the image surface with a specific scale and image classification is performed based on these segments (Faizizadeh, 2007). In segmentation, pixels are segmented by different algorithms in different sizes with different spectral and shape ratios and are classified into various objects based on spectral and spatial characteristics. During this process, image objects were created according to their homogeneity or heterogeneity based on scale, color, shape, smoothness coefficient and compression shape parameters.

Results and Discussion:

By integrating the land use map and land surface temperature, it can be concluded that the lowest temperature in both years is attributed to water. Considering that water use has a very high heat capacity, water has a very low surface temperature, and land use and residential area have the highest temperature in both years. Land use in 2003 with a value of 42.09 and in 2023 with a value of 49.86 and residential use in 2003 with a value of 42.57 and in 2023 the highest value for residential use is 42.57, which is a significant figure. The reason for this very high temperature and the difference in different uses is firstly due to the season of image collection and secondly because if an area is devoid of vegetation or the vegetation is sparse and scattered, evaporation and transpiration are low and the temperature increases. In places where the pasture faces the sun and the vegetation is sparse and scattered, we see a significant increase in surface temperature.

Conclusion

Having knowledge of changes is very effective and useful for policy-making and decision-making of managers. For this reason, in this article, in the first step, land use changes were carried out with the most accurate object-oriented method in the Ekagnition software. The changes that occurred in the last 20 years in Aslandoz County were carried out. According to the change map of map 3 and 4, significant changes in urban development and to a greater extent urban dispersion were clearly proven, as well as the destruction of agriculture and forests and for the construction of urban development. The results of the surface temperature according to the maps showed that in 2003, the surface temperature of the earth was 42.49, and this figure has increased to 49.92 in 2023. This figure, which is a significant figure, indicates a slow and dangerous increase in the temperature of the earth's surface and human manipulation of nature and an increase in industrial pollutants, an increase in cars, the consequences of which include the melting and melting of natural glaciers, disruption of the climate of the region, and dozens of other hazards. By matching land use with the map of changes in land surface temperature, it was shown that temperature changes in different land uses were different based on type and structure. While water accounts for the lowest temperature in both years, taking into account that water use has a very high heat capacity, water accounts for a very low surface temperature, and land use and residential areas have the highest temperature in both years.

Declarations

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Authors' Contribution

Authors contributed equally to the conceptualization and writing of the article. All of the authors approved the content of the manuscript and agreed on all aspects of the work declaration of competing interest none.

Conflict of Interest

The authors declare no conflict of interest.

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References

Ahmadi, M., Ashurlu, D., and Narangi Fard, M., 2012, Temporal-spatial changes of thermal and applied patterns of Shiraz city using TM and ETM measuring data. Remote sensing and GIS of Iran, 4(4): 55_68.

Akbari, E., Ebrahimi, M., Fiezizadeh, B., and Nezhadsoleimani, H., 2016, Evaluating Land Surface Temperature related to the Land use Change Detection by Satellite Image (Case study: Taleghan Basin). *Geography and Environmental Planning*, 26(4): 151-170.

Alavi Panah, K., 2009, Thermal Remote Sensing and its Application in Earth Sciences. Second Edition, Tehran, University of Tehran Press.

Arekhi,S. (2025). Prediction of land use changes using multi-temporal images and CA-MARKOV model (Case study: Gorgan City). Journal of Sustainable Urban & Regional Development Studies (JSURDS), 6(3), 121-138.

Amini Bazyani, S., Zare Abyaneh, H., and Akbari, M., 2014, Estimation of Surface Temperature and Cropping Intensity in Hamedan Province Using Remote Sensing Data. Physical Geography Research Quarterly, 46(3): 333-348.

Asghari, S., and Emami, H., 2019, Monitoring the earth surface temperature and relationship land use with surface temperature using of OLI and TIRS Image. Researches in Geographical Sciences, 19(53): 195-215.

Ashraf, B., Faridbhosseini, A., and Mianabadi, A., 2012, The Investigation of Mashhad's Heat Island Using Satellite Images and Applying Fractal Theory. GEOGRAPHY AND ENVIRONMENTAL HAZARDS, 1(1): 35-48.

Chen, Q.J., Ren, Z. and Li, C.Ni. 2009 Urban Heat Island Effect Research in Chengdu City
Based on MODIS Data In Proceedings of 3rd International Bioinformatics and Beijing, China, 11-13 June, 1-5

Darvishi, S., rashidpour, M., and soleimani, K., 2019, Analysis of Land Use Role in the Formation of Thermal Islets of Marivan County Using Landsat Satellite Images. Geography and Development Iranian Journal, 17(54): 143-162.

Darvishi, S., Soleimani, K., and Rashidpour, M., 2019, Impact of vegetation indices and urban surface characteristics on land surface temperature changes (Case study: Sanandaj city). Journal of RS and GIS for Natural Resources, 10(1): 17-35.

Faizizadeh, B., and Hilali, H., 2010. Comparison of base pixel, object-oriented and effective parameters in land use coverage classification in West Azarbaijan Province. Geographical Research Journal, 71: 73_84.

Farhanj, F., and Akhoondzadeh, M., 2017, Fusion of _8 Thermal Infrared and Visible Bands with Multi-Resolution Analysis Contour let Methods. International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 77-81.

Ghodousi,V. , Nazmfar,H. and Rahmati,M. (2025). Land use changes and simulation of urban growth and development (Case study: Ardabil city). Journal of Sustainable Urban & Regional Development Studies (JSURDS), 6(3), 168-185.

Kakeh Mami, A., Ghorbani, A., Kayvan Behjoo, F., and Mirzaei Mosivand, A., 2017, Comparison of visual and digital interpretation methods of land use/cover mapping in Ardabil province. Journal of RS and GIS for Natural Resources, 8(3): 121-134.

Karenia, C.NS.G., 2016, spatial Geotechnologies and Gis tools for urban planners applied to the Analysis of urban heat island case caracas citevenezuela. 9 th lnternational Conference on Urban Climate jointly with 12 th symposium on the urban Environment, 1-5.

Kaviani, A., Sohrabi, T., and Daneshkar Araste, P., 2013, Estimation of land surface temperature using NDVI in MODIS and Landsat ETM+ imageries. Journal of Agricultural Meteorology, 1(1): 14-25.

Lu, D., and Weng, Q., 2008, A survey of image classification methods and techniques for improving classification performance.

Moradi, M., Salahi, B., and Masoodian, S., 2016, Analysis of land surface temperature gradient of Iran using MODIS Terra and Aqua data. Physical Geography Research Quarterly, 48(4): 517-532.

Oke, T.R. 1973. City size and the urban heat island. Atmospheric Environment 7: pp.769-779

Parvar, Z and Shayesteh, K. (2017). Predicting urban change and development trends using multi-temporal satellite images and geographic information system (case study: Bojnourd city). Environment, 43(3), 513-527.
doi: 10.22059/jes.2017.225385.1007382.

Pijanowski, B.C., Brown, D.G., Shellito, B.A., and Manik, G.A., 2002, Using neural networks and GIS to forecast land use change; A Land Transformation Model. Computers Environment and Urban Systems, 26: 553-575.

Ronald, C., Estoque, M., and Yuji, M., 2017, Effects of landscape Composition and pattern on land surface temperature An urban heat island study in the megacities of Southeast Asia. National Library of Medicine, 15(577): 349-359.

Rozensten, O., Qin, Z., Derimian, Y., and Karnieli, A., 2014, Derivation of land surface temperature for landsat – 8 TIRS using a split window algorithm. Sensor, 4(14): 5768-5780.

Sobrino, A., Juan, C., Jimenez-Munoz. Leonardo Paolinib, (2014). Land surface temperature retrieval from LANDSAT TM 5. Remote Sensing of Environment, 90:pp. 434-440.

Sorapipatana, C. and Exell, R. H. B. 1989. Mesoscale mapping of daily insolation over Southest Asia from satellite data. Solar and wind technology. 6 (1): 59-69.

Sharghi Z, Basiri M, Faramarzi Asl M. (2025). Investigating the process of physical development of the new city of Sahand using Landsat satellite image. *jgs*. *25*(79), URL: http://jgs.khu.ac.ir/article-1-4199-fa.html.

Shekh ahe eslami, A. , noruzi, M. and Ahmadi, A. (2021). An analysis of the physical expansion of Kermanshah using Landsat satellite images. Geography and Human Relationships, 3(3), 149-167.
doi: 20.1001.1.26453851.1399.3.3.11.0

Shi, Y., Katzschner, L., Ng, E., 2017, Modelling the fine- scale spatiotemporal pattern of urban heat island effect using land use regression approach in a megacity. Science of the Total Environment, 618(15): 891-904.

Shekh ahe eslami, A. , noruzi, M. and Ahmadi, A. (2021). An analysis of the physical expansion of Kermanshah using Landsat satellite images. *Geography and Human Relationships*, *3*(3), 149-167

Valizadeh Kamran, K., Gholamnia, K., Eynali, G., and Moosavi, M., 2017, Estimation land surface temperature and extract heat islands using split window algorithm and multivariate regression analysis (Case Study of Zanjan). Research and urban planning, 8(30), 35-50.

Wang, Y., Ch, B., Hu, s.w., Myint, Ch., feng, Ch., Chow, W.T.L., and Passy, P.F., 2018, Patterns of land change and their potential impacts on land surface temperature change in Yangon Myanmar. Science of the Total Environment, 643: 738-750.

Zhong, X., Huo, X., Ren, C., Labed, J., and Li, Z, L., 2016, Retrieving Land surface temperature from hyperspectral thermal infrared data using a multi-channel method. Sensors, l5(16): 671-687.