

Journal of Urban Environmental Planning and Development

Vol 2, No 6, Summer 2022

p ISSN: 2783-3496 - e ISSN: 22783- 3909

<http://juep.iaushiraz.ac.ir/>

DOI: 10.30495/juepd.2022.689336

DOR: 20.1001.1.27833496.1401.2.6.6.1

Research Paper

Investigating the role of urban growth pattern in creating thermal islands in cities (Case study: Sari city)

Amir Bakhshi: ¹ Assistant Professor of Geography, Payame Noor University, Tehran, Iran

Seyed Hassan Rasouli: PhD Student, Geography and Urban Planning, Islamic Azad University, Central Tehran Branch, Iran

Nima Rahimi: M.Sc., Geography and Urban Planning, Payame Noor University of Tehran, Iran

Received: 2021/11/02 PP: 77-94 Accepted: 2021/12/07

Abstract

This study examines the role of urban growth pattern in the creation of thermal islands in cities (Case study: Sari city), the type of expansion of Sari city and then the characteristics of the city's thermal zones and identifies its relationship with the formation of urban thermal islands. The unplanned and increasing expansion of cities over the past half century has led to environmental problems. These environmental problems can endanger the quality of life of citizens and consequently their health. One of these problems is the phenomenon of urban heat islands. Urban heat islands are a phenomenon in which the temperature of some areas is higher than other neighboring areas. This phenomenon can be the result of the scattered growth of cities as well as the unplanned and vertical growth of some urban areas. Urban heat islands in different areas can have negative consequences; The first is the issue of human health that the presence of thermal islands in cities causes a phenomenon of lack of temperature comfort and also exacerbates air pollution, a phenomenon with which we are often involved in Iranian cities. This research is analytical, but it should be added that it will be practical in terms of purpose. In the practical dimension, the results can be used in urban decision-making and planning. Landsat 8 satellite data was used for this study. In this regard, after preparing the images, the temperature map of Sari city is prepared using remote sensing techniques and GIS software, and then the thermal islands are extracted. Similarly, the vegetation and land map will be prepared and the Shannon entropy coefficient and building density and population will be calculated and compared with urban heat islands. The results of this study show that the formation of thermal islands in the city of Sari depends on both types of urban growth and the creation of thermal zones has a significant relationship with the type of land cover, population density and construction. Also, most of the current thermal areas of Sari include areas that have been added to the city in recent decades. Also, in order to prevent the formation of new thermal zones and control the growth of existing thermal zones, according to the thermal characteristics of each zone, suggestions are presented.

Keywords: Urban growth pattern, thermal islands of cities, Sari city.

Citation: Amir Bakhshi, Seyed Hassan Rasouli, Nima Rahimi (2021): **Investigating the role of urban growth pattern in creating thermal islands in cities (Case study: Sari city)**, Journal of Urban Environmental Planning and Development, Vol 2, No 6, Shiraz, PP 77- 94.

¹. Corresponding author: Amir Bakhshi, Email: Amirbakhshi62@gmail.com, Tell: +989111265473

Extended Abstract

Introduction:

Given the growing population and involuntary migration to cities on the one hand and changing land cover on the other hand, the discussion of urban management and planning to control the existing problems is necessary and undeniable. It is necessary to achieve a comprehensive and complete plan for management, to have assumptions and predictions about the future, part of which can be achieved with urban development models. One of the consequences of this urban sprawl is rising temperatures. With the expansion of the city and urban planning after the 1930s, especially after World War II, local climate change occurred in the city. Humans, with the changes they make in their habitat, have created conditions that change the climate of cities and the temperature of the air. The expansion of cities and urbanization in large cities on the one hand, the scattered constructions on the outskirts of small cities on the other hand, as well as the growth of large industrial activities, have caused changes in the climate of urban areas. One of the effects of this urban climate change has been the emergence of a phenomenon called "urban heat islands". The present study deals with the causes of this phenomenon in the city of Sari and sees the reasons for its unplanned expansion of cities. To study this category, 8 thermal islands in Sari city are first identified using Landsat satellite images and two branches of cold thermal islands and warm thermal islands are divided. Then, the physical characteristics of those areas are studied with two approaches of horizontal expansion and vertical expansion to determine the effect of the type of growth of the areas on the formation of urban thermal islands.

Methodology:

This research is analytical method, but it should be added that in terms of purpose will be applied. In the applied dimension, the results can be used in decision-making and urban planning. Landsat 8 satellite data was used for this research. In this regard, first, after preparing the images, the temperature map of Sari city is prepared using remote sensing techniques and GIS software, and then the thermal islands are extracted. In the same way, a map of vegetation and land cover will be prepared and also Shannon entropy coefficient and building and population density will be calculated and compared with urban thermal islands.

Results and discussion:

The results of this study show that the formation of thermal islands in the city of Sari is dependent on both types of urban growth and the creation of thermal zones has a significant relationship with the type of land cover, population density and construction. Also, most of the current thermal areas of Sari include areas that have been added to the city in recent decades. Also, in order to prevent the formation of new thermal zones and control the growth of existing thermal zones, according to the thermal characteristics of each zone, suggestions are presented.

Conclusion:

According to the results of the research, the expansion of cities can intensify urban thermal islands both horizontally and vertically. The expansion of cities horizontally destroys the pristine green areas around, including agricultural lands, gardens and forests, and by changing the vegetation to man-made cover, the heat from the sun remains more on the surface of the earth and causes warmer. Becomes the city level. The vertical growth of the city can also lead to the formation of urban heat islands in two ways. The first case is the creation of urban valleys. This means that with the construction of heights and non-compliance with the withdrawal criteria of the master plan and other upstream documents, the proportion of the passage and the building is disturbed and causes trapping of heat from the sun, which increases the effects of urban heat islands. The second case shows its increase in population. With the increase of construction and height in urban areas, the population of the areas has increased and the amount of man-made heat production has increased. This heat can be caused by cooling appliances, cars as well as high electricity consumption. This heat itself intensifies the formation of thermal islands and also reduces the quality of life in Sari. Scattered urban growth is directly related to the formation of urban thermal islands. The scattered effect of the surface is such that this type of growth causes unintentional addition of areas to the city, and this created margin gradually becomes a part of the city with a cheap price that is attractive to the residents of the surrounding villages. And those who intend to live in the city. Thus, areas of the city that have recently and unintentionally been added to the city, with their uneven growth, cause the formation and intensification of urban heat islands. The type of land cover, depending on its type, can affect urban heat islands. Vegetation can reduce urban heat islands and anthropogenic cover can increase the intensity of thermal islands. We used two methods to study this category in Sari. After determining the

urban thermal zones and building density of each of the thermal zones of Sari, by examining the correlation between these two characteristics, it was found that increasing building density leads to the formation of urban thermal islands and this relationship is significant and positive. The result of this correlation showed that population density and intensity of urban heat islands have a significant and strong relationship with each other. This means that as the population of the areas increases, the intensity of the thermal islands in them increases.