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Impacts of Recently Developed Squatter Settlements Transformation Projects on Urban Heat Islands: A Comparative Study in the City of Ankara

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Abstract: Urban redevelopment projects, in various scales and scopes, have recently emerged as major operations that have (re)shaped urban fabric of Turkish cities. The city of Ankara, being the capital of Turkey, has dramatically experienced urban redevelopment projects including squatter settlement transformation that has raised large scale clearances and constructions in different parts of the city. Squatter settlements, lacking of infrastructure and basic urban services, were replaced by residential blocks. The newly proposed housing development has been raised as a model with upgraded infrastructure, designed landscape and paved roads; and quickly became an ideal for all squatter settlements in Turkey. However, the effect of these newly developed residential districts on urban heat island (UHI) has been rarely discussed. In this regard, this paper intends to discuss the impacts of the urban transformation projects on urban climate by particularly focusing on Yeni Mamak housing development district in Ankara. The paper will be grounded on a comparative study based on the former and current settlement fabric of the area. In doing so, it is intended to reveal the critical role of the newly developed housing areas in mitigating the impacts of the UHI.

Introduction

As highlighted in recent environmental studies, there are few areas in the world that can be considered "natural". Nearly half of the earth's surface is (in)directly affected by human interventions (Milliga, 2010), and covered by the gray surfaces especially in urban areas. Since increased urbanization, compared to rural areas, introduces a population growth; creating a sense of sustainable community has emerged as a critical agenda.

Due to certain conditions, the energy used by the human is scattered in the form of waste heat. This and the heat from solar radiation can be entrapped by urban structures which causes the rise in temperature of densely built-up urban zones. This effect is known as Urban Heat Island Effect (UHI) (Gago, Roldan, Pacheco-Torres and Ordonez, 2013). UHIs which are directly related to climate change and global warming affect negatively not only occupants of urban zones but also

their connected ecosystems located far away. As a result of this, a multidisciplinary-agenda which necessitates strategies in various scales from planning to architectural details should be raised.

Multi-scale Framework on Urban Heat Island (UHI)

Urbanization introduces a built environment that mostly results in UHI;

- Canyon radiative geometry (loss of long-wave radiation and decrease of effective albedo of the system) due to exchange between buildings and skyline, multiple reflections of shortwave radiation
- Thermal properties of materials (albedo characteristics)
- Anthropogenic heat released from combustion of fuels
- Urban greenhouse (increase in incoming long-wave radiation from the polluted and warmer urban atmosphere)
- Reduction of evaporating surfaces (more energy for sensible heat and less energy for latent heat)
- Reduction in turbulence of heat within streets

The term ‘urban canyon’ characterizes the set of streets that cut through dense blocks of buildings, especially skyscrapers, resembling the natural canyon. The variation of urban geometry can influence the increase or decrease of temperature, the wind speed and direction, the form of radiation received by shortwave and released heat through long waves. The urban geometry is measured the maximum intensity of urban heat islands by H/W ratio. (H= Height of the building, W=Track width related to a street) (Nakata-Osaki, Souza and Rodrigues, 2015)

Regarding this argument, adaptation and design of the green and open spaces for mitigating the undesirable impacts of the climate change, have been developed as one of the prevailing tasks in architecture, landscape architecture and urbanism fields. Recently emerged landscape-based approaches -"Landscape Urbanism", "Green Infrastructure" or "Landscape Infrastructure"- have raised fresh lenses in the (re)programming of urban lands to mitigate the negative effects of UHI (Allen, 2012; Benedict and McMahon, 2006). Urban strategies and practices developed for different world cities –such as Berlin and London- clearly demonstrate the need for an integrated green infrastructure that operates in various scales and that collaborates with architecture. Green

infrastructure strategies are being developed, even in cities where green areas cover a considerable amount of surface. Such strategies basically aim to generate a porous urban surface that highly contribute to the control of urban climate.

From green to gray: UHI and Urban Redevelopment Project in Yeni Mamak

Housing areas and transportation infrastructures have been prevailing in the development of a continuous and integrated green infrastructure in cities. Their critical contribution to urban climate strategies become undoubtedly evident when the recent investments in both fields –housing areas and transportation- are considered. In this scope, the city of Ankara, experiencing numerous urban transformation projects by 1990s, is a noteworthy case to discuss the impacts of housing areas and infrastructures on urban climate issues.

Yeni Mamak housing development area, neighboring the Sincan-Kayaş commuter line and canalized Hatip Creek, is situated on a peculiar terrain at the east part of Ankara. Formerly, as presented in 1957 Ankara map, the site was part of a green corridor that was extending from Demirlibahçe to Kayaş. This green fabric was identifying a characteristic landscape, which was formed by orchards, truck gardens and creek, and was serving as recreational field (*mesire*) in the city. However, the landscape of the site was dramatically changed by 1950s, the time when the city was faced with rapid urban growth. At that time, the housing demand of the migrants triggered the development of squatter settlements, which were lacking infrastructure and basic urban services, in Ankara (Uzun, 2005). Natural reserve areas in and at the periphery the city -valleys, hills and slopes- became favorable grounds in the construction of squatter settlements. The increased number of squatter settlements[1] generated an unfavorable environment, and has dramatically changed the urban landscape. By 1990, urban redevelopment and urban transformation projects, which introduced new residential blocks in the place of the squatter settlements, have raised. By introducing an upgraded infrastructure and designed environment, these projects quickly became a model for squatter settlements all around the country. However, the impacts of the changing landscape of the newly planned housing blocks on urban climate have been barely discussed.

[1] As stated by Uzun; "In 1980, more than 75% of the urban population lived in Ankara's squatter settlements" (Uzun 2005, 186)

Spontaneous landscape and permeable ground of the squatter settlements were replaced by paved surfaces that cause a disadvantageous environment in terms of UHI.

At that point Yeni Mamak urban transformation project, which is analyzed in Table 1, covering 14 neighborhoods, is a noteworthy case in Ankara. However, this paper concentrates on a particular fragment of the project area, which was bordered by rail track and canalized Hatip creek at the north, and by 19 Mayıs Boulevard at the south in Üreğil neighborhood.

Table 1: Changing built and landscape fabric of the selected housing development area in Yeni Mamak between 1957 and 2013 [The table was developed based on the 1957, 1982, 1993 and 2013 Ankara Maps (1:25.000) and aerial photographs of the time].

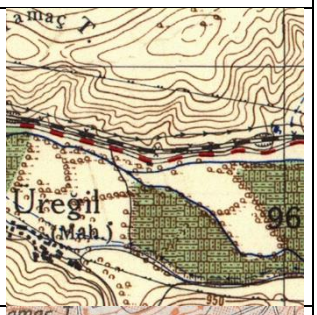
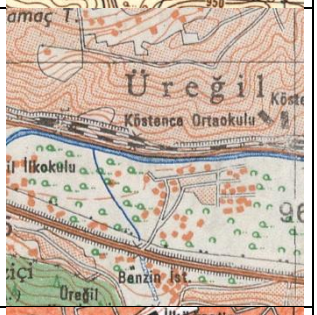
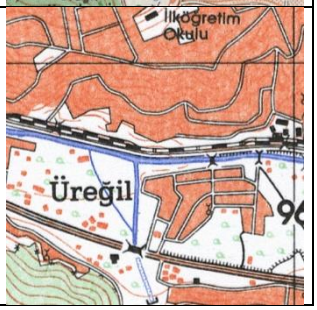
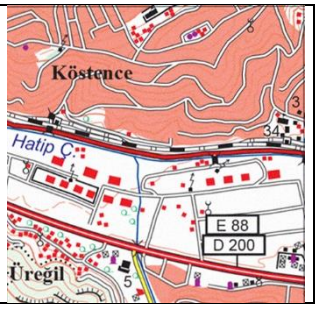
	Built & Landscape Fabric	Main Building Typology	Field/Surface Condition	
1957	Rural landscape *Mesire*	-	Truck garden Deciduous trees Hatip Creek	
1982	Sub-urban zone (low density built fabric, spontaneous landscape)	Single/ low-rise units	Decidous trees Partially paved paths/streets Canalized Hatip Creek	
1993	Sub-urban zone (medium density built fabric, spontaneous landscape)	Single low-rise units, low-storey buildings	Decidous trees Canalized Hatip Creek Paved vehicular paths/streets	

Table 1 (continued):

2013	Yeni Mamak Urban Transformation Site (high-rise housing and public services: school, regional places, health center, etc)	High-rise blocks	Housing landscape Canalized Hatip Creek Densely paved (asphalt and concrete) surfaces	

Conclusion

This article concentrates on establishing the strategies of mitigating the adverse effects of the UHI in the design of Yeni Mamak urban transformation project which directly affect urban temperature on local scale. Being aware of the potentials offered by landscape-based strategies in the (re)programming of housing areas will be –undoubtedly- valuable for professionals who are responsible for decision-making on the design phase of such projects. The selected housing area, comprising a spontaneous landscape, transportation infrastructure and canalized Hatip Creek, has an undervalued/undiscovered potential within the urban fabric of Ankara. In this regard, the examination of the selected housing area in terms of UHI will introduce a critical data and argument for many studies that can be developed in the future.

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