УДК 711.4: 502.3

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THE ROLE OF GREEN AREAS IN REDUCING HEAT STRESS IN URBAN ENVIRONMENTS

The rise in average temperatures and the frequency of extreme hot days in cities contribute to the formation of the “urban heat island” effect. This phenomenon negatively affects public health, particularly in large urbanized centers. One of the most effective natural mechanisms for reducing heat load is provided by green areas, which, due to vegetation and specific microclimatic conditions, create more comfortable environments for human presence.

The aim of this study was to assess the role of parks in Kyiv as factors in reducing heat stress and increasing comfort levels for the population during the summer period, as well as to compare the results of observations with the data obtained by other researchers. The study was conducted in nine parks of the capital: «Nyvky», I. Bahrianyi Park, KPI Park, Syretskyi Park, «Orlyatko», Fomin Botanical Garden, T. Shevchenko Park, «Vidradnyi», and «Suputnyk».

Field research in Kyiv’s parks recorded a temperature decrease of 1–3°C compared to adjacent built-up urban areas. In addition, the relative humidity in green zones was found to be 5–12 % higher. These indicators demonstrate the formation of a more favorable microclimate within the parks. At the same time, even under objectively high temperatures, visitors’ subjective perception of comfort within parks declared more dramatic difference: a clear sense of coolness was observed in the green areas, by a large number of people who chose parks as places of recreation on hot days.

Moreover, in a number of cases, temperatures within park areas were the same or even slightly higher than at adjacent areas, the respondents in park areas stably reported that parks were much cooler than open areas. The possible explanation probably comes from the shading effect provided by green plants. Nevertheless, the psychological comfort coming from the green spaces of cities is been a proved effect, demonstrated in various research and a range of regularities were defined.

An analysis of scientific works confirms that green areas reduce urban air temperature on average by 1–3 °C, and in some cases even more. The research conducted by Chang & Li (2014) in and outside of 60 parks in Taipei city demonstrated that the horizontal transport of cool or warm air mass above parks and the evapotranspiration by trees provide a cool island larger than the boundaries of parks. Parks are also able to drive colling effect outside them by creating air circulation cooled by transpiration. At night trees cause a warming effect inside parks: the more paved area is present the more pronounced warming effect will be.

Mentes et al. (2024) showed that the cooling effect of urban parks on their surroundings is directly proportional to their size. As the size of the park increased, the land surface temperature decreased and the difference between the parks and the city center increased. Our research showed no significant difference in cooling effect of parks depending on their size outside the parks; however, the central parts of bigger parks were relatively cooler and thus the issue is probably effective with parks of generally bigger sizes – over 50 ha.

Geng et al. (2022) additionally noted that the local background climate strongly defines the intensity of cooling effect: urban parks at low latitudes have a greater cooling effect.

Growing pressure of climate changes calls for searching approaches to increase the cooling effect from park trees. The obvious action is to reduce the area of paved surfaces in favor of trees, shrubs, and other shadings. Night irrigation is also commonly recommended to further enhance this nighttime cooling.

International experience also highlights the key role of parks in maintaining the psychophysiological comfort of the population under climate change conditions (Tyrväinen et al., 2014; Aziz et al., 2021). Particularly important are large green spaces and dense tree vegetation, which provide shade and reduce heat load. A notable issue is that shading effect is mentioned as frequently as cooling effect, which was also demonstrated by the interviews, conducted within this research. Moreover, the subjective perception of coolness significantly exceeded the figures of measuring instruments.

Vasconcelos et al. (2024) showed that the relief from heat stress was perceived more intensively by elderly people, even if the difference was not that significant. This means that green spaces effect can be further intensified by the psychological predetermination, which could be built by information campaign to modify urban residents' behavior towards more frequent visits to the park areas and thus lower use of indoor conditioning systems and

energy conservation. Even small interventions in this case (streetside rows of trees) will be better perceived and thus provide greater effect to people (Elsadek et al., 2019).

Combining literature analysis with the results of this research makes it possible to conclude that urban green spaces not only mitigate the effects of thermal anomalies but also serve as an important element in ensuring the quality of life of the population. Modern approaches in urban planning should take into account not only economic and social aspects of development but also ecological factors that create a comfortable environment for humans. Kyiv's parks confirmed the universality of global scientific findings: even within a metropolis, local green spaces become centers of natural balance, contribute to improving residents' health, and create conditions for the sustainable development of the urban environment.

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