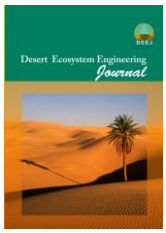
DEEJ (2025) 14 (1) 1-2

University of Kashan

Desert Ecosystem Engineering Journal

Journal homepage: http://deej.kashanu.ac.ir



Estimation of Water Requirements for Urban Green Infrastructures in Kish Island

Mahmoud Behrouzi,[1] Ahmad Nohegar,[2*] Panisa Hassanzadeh[3]

Received: 01/05/2024 Accepted: 22/06/2025

Extended abstract

Introduction: Since 1993 (1372 SH), Kish Island has experienced significant population growth and urban expansion, particularly in its coastal areas. This development led to the creation of extensive green infrastructure, including wide streets, neighborhood parks, and numerous gardens, primarily featuring diverse plant species. However, climate change presents substantial challenges for these urban landscapes. Rising temperatures and limited water resources intensify the need for a strategic approach to urban greenery, focusing on increasing and diversifying tree and ornamental plant species adapted to harsh urban conditions.

Currently, there is a paucity of information regarding the irrigation requirements of urban green spaces on Kish Island. A practical, standardized method for measuring these water needs is also lacking. This deficit in understanding creates significant challenges for both plant health and urban landscape managers, leading to inefficiencies and disruptions in water resource management. Therefore, this research aims to calculate the monthly and annual water requirements of Kish Island's urban green spaces using the WUCOLS (Water Use Classification of Landscape Species) method developed by the University of California.

Method and Materials: To determine the monthly and annual water requirements of urban green spaces on Kish Island, we first conducted field observations and utilized existing land-use maps, an AutoCAD map of Kish Island, and calculated the total area of urban green spaces. Based on these analyses, we categorized the urban green spaces into seven distinct types:

1. Green spaces alongside streets, industrial estates, and the sewage treatment plant
2. Traffic islands (Refuges)
3. Green spaces within administrative and educational centers
4. Green spaces in urban squares
5. Urban-coastal parks and gardens
6. Green spaces in commercial, tourism, and sports centers, including the Olympic complex
7. Green blocks and green spaces within neighborhoods and residential complexes

Following this classification, we calculated the water requirement for the mixed greenery of Kish Island using the guidelines proposed by the Water Use Classification of Landscape Species (WUCOLS) method from the University of California.

Results: The study found that the total annual water requirement for Kish Island's 756.6 hectares of urban green space is approximately 12.5 million cubic meters. Urban parks and gardens, along with street traffic islands (refuges), emerged as the areas with the highest water demand, each requiring over one million cubic meters annually.

1. PhD. Climatology, Department of Environmental Hazards - Marine Science Research Institute, University of Tehran, Tehran. Iran; Email: behrouzi.mahmoud@guest.ut.ac.ir

2. Professor, Department of Disaster Engineering, Education and Environmental Systems, Faculty of Environment, University of Tehran, Tehran, Iran; Email: nohegar@ut.ac.ir

3. Ph.D. student, Department of Disaster Engineering, Education and Environmental Systems, Faculty of Environment, University of Tehran, Tehran, Iran; Email: panisahassanzadeh@ut.ac.ir

DOI: 10.22052/deej.2025.254229.1041

Monthly analysis revealed that May, June, and July exhibit the highest water requirements, while December and January show the lowest, a trend that directly mirrors the island's evaporation rates. Generally, water demand begins to increase in February, coinciding with rising temperatures and evapotranspiration, and continues to climb until August. It then gradually decreases from September to January before the cycle restarts. This pattern represents the typical annual water demand cycle for Kish Island's green spaces.
Overall, the calculated annual water requirement for the entire green space of Kish Island stands at about 2.5 million cubic meters per year, with an estimated error of 5%.

Discussion and Conclusion: Urban landscape vegetation is a vital component of the urban environment, offering numerous environmental, social, and economic benefits. Environmentally, it fosters biodiversity, provides crucial habitat and food sources for urban wildlife, prevents soil erosion, and improves drainage. Green spaces also act as air purifiers and temperature regulators, effectively mitigating the urban heat island effect and reducing noise pollution. Socially, urban vegetation enhances recreational opportunities, strengthens residents' connection to nature, and significantly contributes to creating sustainable and livable cities. Economically, benefits include increased property values and, with proper design, a reduction in urban flash floods. Achieving these benefits necessitates a strong focus on sustainable water management for urban landscapes, especially in water-scarce regions where irrigation demands for urban vegetation compete with other essential water needs. A review of existing literature highlights a limited understanding of irrigation requirements for urban green spaces, posing a significant challenge to the broader adoption of green infrastructure like green walls, green roofs, rain gardens, and bio retention systems. The present study demonstrates that the WUCOLS method is a practical approach for providing an initial estimate of urban green space water demand. However, for optimal results, this estimation should ideally be refined based on the specific health and aesthetic conditions of the urban vegetation. Our findings indicate that Kish Island has approximately 756.6 hectares of urban green spaces, which, combined with natural forests (3938.5 ha), cover a total of about 4695 hectares of the island. The annual water requirement for Kish Island's urban green space, calculated using the California method, is 5.12 million cubic meters. The highest water demand occurs from May to August, decreasing thereafter until January. Water demand then rises again with increasing temperatures and plant growth, following an annual cyclical pattern.

Keywords: Vegetation Coefficient, Effective Precipitation, Irrigation Efficiency, Water requirement, Kish.