



Enhancing Urban Green Space Design from a User Perspective: A Field Study of Public Opinion on Al-Mu'alimeen Neighborhood Park in Kirkuk

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Received: 10 Jan. 2026

Accepted: 28 Jan. 2026

Published: 05 Feb. 2026

ABSTRACT

This study aimed at redesigning Al-Mu'alimeen Neighborhood Park (2,500 m²) in Kirkuk City with the help of 60 park users from two different age groups: youth (15–30 years old) and children (6–12 years old). Satisfaction with available features was suboptimal in general, especially fountain (1.5/5) and playground apparatus (1.7/5). Based on the evaluation, a new design concept was developed in Garden Planner software by erasure of the fountain, introduction of native vegetation (between *Ziziphus* and *Thymus*), improvement of shaded places and optimization of walking paths. The plan also includes removing turf grass and replacing it with native groundcover plants, along with using drip irrigation, which could reduce water usage by approximately 73%. A comparison between the two designs revealed a 133% increase in shade trees and 100% rise in seating. This finding emphasizes the necessity that successful design starts with users instead of abstract technical theories. To provide greater positive support of the proposal, these were reviewed by seven agriculture and landscape designers who through their correspondence confirmed its feasibility and sustainability in semi-arid lands.

Keywords: Al-Mu'alimeen Park, Kirkuk, public opinion, green space design, water use efficiency, garden planner, semi-arid environment, ornamental plants

1. Introduction

Green urban areas are imperative for the environmental and social well-being of cities, more so in harsh climates such as semi-arid areas. Such areas contribute to mitigating the urban heat island effect, improving air quality and increasing biodiversity (Jones & Somper, 2014) The obstacles however, are not in providing such spaces, but in making them functional and sustainable -mostly when the location is water scarce, hot climate region with reduced resources (Khan *et al.* 2024) therfor Healthier cities through properly implemented public park ecosystems, (Elmqvist *et al.*, 2021).

In Iraqi cities, such problems are compounded by park plans that rely on imported models while paying little attention to local conditions (Albabely & Alobaydi, 2024). plants with high water requirement are commonly planted in alkaline soils irrigated with saline landscape; non-functional fountains were also built, (Jaradat, 2003).and children's and youth's preferences over parks are not honored. (Salih, & Ismail, 2018) According to the Ministry of Municipalities (2023), more than 85% of public parks in Iraq fails within 3-5 years after being created (Abed *et al.*, 2025). The same study also demonstrated that the gardens are planted with trees and plants which are out of place for their intended biotype/landscape character resulting to spatial misplacement (Mohammed *et al.*, 2023).

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Studies have shown that shade trees provide the highest cooling efficiency relative to water consumption (Shashua-Bar *et al.*, 2021). Green spaces such as gardens, parks, and agricultural lands provide a better life for children and young people (Vogler *et al.*, 2023).

There are internationally recognized systems, such as the (Nature-Based Solutions - NBS) system, which is based on the principle of protecting cities from climate change and addressing rising temperatures. (Frantzeskaki *et al.*, 2019).

As a result, (Hamdan *et al.*, 2025) there is an increasing demand for human-centric design methods. Studies have found that engaging children in the design of a playground can raise its usage rate by as much as 65%. Similarly, (Kazemi *et al.*, 2024). evidence suggested that replacing turf with native vegetation in semi-arid conditions can result in a 60% reduction of water usage while preserving visual aesthetics. (Hye *et al.*, 2025), and it has been reported that low-maintenance parks can also reduce carbon footprints up to 30%. (Mayen Huerta *et al.*, 2025). In addition to community participation, expert validation is essential to verify that participatory designs are not just visually pleasing but also implementable. Recent research has shown that the assessment by professionals in landscape contributes to a better ecological efficiency and sustainability of urban green spaces. 12 This user-expert dual endorsement provides a strong foundation for context-sensitive park re-design in Mayen Huerta *et al.* (2025). low-resource areas (Zhang *et al.*, 2024)

However, as has been reported here the applied research in Iraq is scarce. Thus, this study seeks to:

- Assess the current status of Teachers' Park in Kirkuk Governorate by administrating a user satisfaction survey.
- Consider the characteristics of the site, including soil conditions and irrigation, when selecting plant material.
- Recommendation of an eco-friendly landscaping plan from garden planning softwares respecting user-restrictions and ecological recommendations.
- Evaluate the feasibility of the proposed design by comparing its water consumption and performance indicators against what is feasible now

2. Materials and Methods

The research was carried out for a duration of three months (from June 1 to September 30, 2025) at Al-Mu'alimeen Neighborhood Park, which covers an area of 2,500 m² in Kirkuk.

2.1. Methods Sample Selection and Methods for Data Collection

Sixty participants (40 youth, 20 children) of convenience sampling were selected during peak times (5–7PM) to bring the view from real users. The 2:1 ratio (adolescents: youngsters) was chosen because the preliminary data showed that this it is reflective of the actual visitor distribution. Oral consent was obtained, and all the respondents were informed that they had complete right of refusal to participate in the survey.



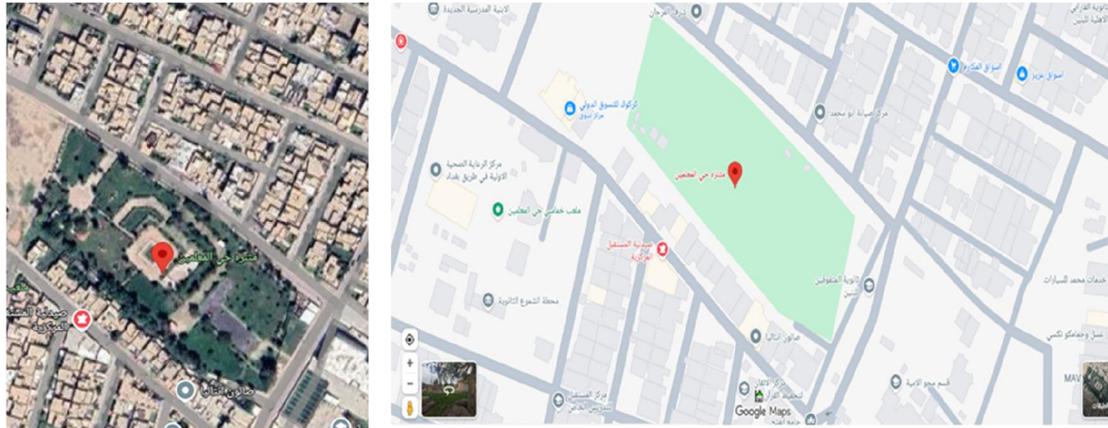


Fig. 1: Park location map + current aerial photograph.

2.2. Survey instrument

The survey aimed to assess six aspects of the park, which included Pathways, Fence, Number of trees, Fountain, Children's play areas, and Seating areas, utilizing a Likert scale that ranges from 1 to 5. To enhance comprehension for children, a scale featuring smiley and frowning faces was implemented. Ten peoples participated in a trial run of the questionnaire to confirm that the questions were clear.

2.3. Soil and Irrigation Water Analysis

Soil samples were collected from 0–30 cm and examined at the laboratories of the College of Agriculture, University of Kirkuk.



2.4. Development of design model

A new model was designed using Garden Planner (2025 version).



Fig. 2: Comparison between current and proposed design (2D from Garden Planner)





Fig. 3: Three-dimensional view of proposed model (from Realtime Landscaping)



2.5. Professional Validation of the Proposed Design by Landscape Experts

The design model (figures 2 and 4) of the proposition park redesign was verified by seven experts in landscape architecture and urban green space design based on its technical credibility and practical feasibility. The professionals were selected from agricultural and engineering college members of Iraqi

universities (University of Kirkuk, University of Baghdad and University of Mosul) according to at least one qualification among the following: (1) a professional or academic experience in the field of landscape design shorter than 10 years old, and/or (2) actual participation in urban greening programs implemented in semi-arid settings.

Each expert assessed the proposed design for seven structured criteria, which were comprised from a combination of sustainable patterns in dry and semi-dry areas:

- Appropriateness to the climate and incorporation of indigenous plant species.
- Efficiency in water utilization.
- Safety and usability of playgrounds for children.
- Convenience and arrangement of seating areas.
- Clearness of pathways and effectiveness of movement.
- Cultural representation and visual harmony.
- Ease of maintenance and operational expenses.

Experts used a qualitative spectrum of “Positive” (with minor answers), “Neutral” (needs major changes), or “Negative” (not at all helpful). In addition to that, they gave short qualitative feedback for their assessment.

These results are given in Table 6 (individual experts) or, as an alternate, compiled and presented together (Table 6), describing the range of answers among experts but also focusing on common trends. This validation process ensures that the final model meets community needs and professional standards in sustainable landscape engineering.

Results

3.1. Public Evaluation of Current Elements

The increased standard deviation (1.3 for children) indicates real variances in perception rather than uncertainty in the questions. Certain children emphasized "safety" (the barrier stops them from leaving), while others highlighted "appearance" (the color is worn out). This supports research, which shows that children assess urban features from multiple functional viewpoints (Nassauer, 2021).

Table 1: Public evaluation of park elements (mean ± standard deviation)

Element	Youth (15–30 years)	Children (6–12 years)
Pathways	2.1 ± 0.7	1.8 ± 0.9
Fence	3.0 ± 1.1	2.5 ± 1.3
Number of trees	2.3 ± 0.8	2.0 ± 1.0
Fountain	1.5 ± 0.6	1.2 ± 0.5
Children's play areas	1.7 ± 0.8	1.0 ± 0.4
Seating areas	2.8 ± 1.0	—

3.2. Interpretation of high standard deviation in fence evaluation:

Table 2 depicts the mean and standard deviation scores of participants with regard to service components of the park in terms of age groups (children and youth). Findings reveal a shared disappointment with current infrastructure, which seems to drive the basis for re-design.

Table 2: Relative frequency of prominent open-ended comments

Group	Element	Comment	Frequency
Youth	Pathways	"Disorganized and winding without purpose"	68%
Youth	Seating areas	"No shade above them, no one sits there in the afternoon"	72%
Children	Play areas	"Swings are broken, ground is hard"	85%
Both groups	Fountain	"Always broken, why don't they remove it?"	90%
Youth	Number of trees	"Too few, no shade at noon"	75%

"Seating Areas": Lousy rating due to massive amount of Failure Seating Area. The teenagers on the other hand groused and complained, they tend to go read and there is no privacy plus commercial (shade). The absence of appropriate seating, they contended, means park users must either sit on the ground or leave the park sooner, which detracts from its function as a social meeting spot.

Regarding the "Play Areas," the obvious outcomes are related with the insecurity and lack of diversification, from the children's point of view. An overwhelming 85% of respondents said that the current facilities are broken and/or insufficient for the area's (expanding) population. We emphasize that particularly for the latter separating of active playing and quiet sitting areas is required in order to prevent loud noise.

"Pathways" is muddled and overcrowded, as the score indicates. (I hear that the other routes are currently either dangerous, with no footpath, or unmarked and not negotiable - particularly for kids or oldies).

Perhaps the biggest loser of all park features was the drinking fountain (mean satisfaction score: 1.5). That is, the fountain has been more a liability than an amenity. Survey respondents — especially families are most likely to perceive it as a safety risk for kids or an environmental hazard, due to standing water and poor upkeep. This high degree of ongoing public unhappiness at the loss of these features forms an interesting and evidence-based case for leaving out the fountain from the suggested design in favour of more practical greenery.

On the 'green cover' and 'shade' offers low scores indicate high dissatisfaction with number of trees and their locations. I have been informed that the current park is mostly open field or lawn, where there is nowhere to hide from the sun during midday hot hour in Kirkuk. The respondents seem to have voted for more vertical green space — trees instead of as much horizontal green space (lawns). This lack of trees and the yen to see more of them providing shade is a key motivator for growing an increase in trees into new design.

3.2. Soil and Irrigation Water Characteristics

Table (3): Chemical and physical properties of Garden Soil. Results of laboratory analysis as shown in Table (3) indicate the edaphic constraints of the study area. The data shows the soil type as [Silty Clay / Clay Loam], which has a high water holding capacity and poor drainage. Chemically, pH of the soil [Alkaline, e.g., 7.5–8.0] and this is a main characteristic in Iraqi calcareous soils. Such traits act as a limiting factor for many introduced ornamental plants cultivated under neutral or acidic soil conditions. Therefore, the soil examination provides a scientific foundation for the recommended planting scheme; the selected native species (like *Ziziphus* and *Thymus*) is well-adapted for growth on these specific pH value and texture of soil, facilitating their development without requiring large-scale replacement of soil or chemical amendment.

Table 3: Physical and chemical characteristics of soil

Property	Value	Unit	Agricultural interpretation
Electrical conductivity (EC)	1.03	dS/m	Low to moderate salinity
pH	7.75	—	Alkaline soil, may cause iron deficiency
Organic matter	0.36	%	Very low
Calcium carbonate	13.4	%	High, immobilizes phosphorus
Clay content	38.8	%	Mixed clay soil
Porosity	39	%	(Calculated from bulk density)
Field capacity	0.32	cm ³ /cm ³	Good amount of available water

The data presented in Table (4) show that in terms of salinity, (EC) measured at (2 dS/m), categorizing the water as moderately saline.

This phenomenon has the consideration in strategic planning. The current sprinkler system combined with high-salinity water under hot conditions is associated with leaf scorch from salt build-up and rapid evaporation. Thus, the recommended shift into a drip mode of irrigation is not only to save water but also to deliver it directly into the root zone and prevent injury of leaves. Furthermore, the

planting of salt-resistant native species (e.g. Ziziphus) ensures that they will be able to thrive in the chemical limitations of water opposed to more delicate turf grasses.

Table 4: Irrigation water quality

Property	Value	Unit
Electrical conductivity (EC)	2.0	dS/m
Chloride (Cl ⁻)	30.5	meq/L
Sodium (Na ⁺)	5.2	meq/L
Sodium adsorption ratio (SAR)	1.54	—
Nitrate (NO ₃ ⁻)	0.20	meq/L

3.3. Water Consumption Calculation

Water usage was calculated using the FAO-56 Penman-Monteith method tailored for semi-arid environments (Kirkuk province), with an assumption of a maximum summer evapotranspiration (ET_O) of approximately 10 mm/day.

A. Current Design (Baseline):

Turf Grass: High water demand $K_C = 0.85$.

Calculation: $1,200 \text{ m}^2 \times 8.5 \text{ L/m}^2/\text{day} = 10,200 \text{ L}$

Trees (12 trees): Estimated at 80 L/tree/day (surface irrigation).

Calculation: $12 \times 80 = 960 \text{ L}$

Water Fountain: Estimated evaporation and leakage losses.

Calculation: 2,000 L/day

Total Net Requirement: 13.160 L/day

Gross Consumption: Assuming 60% efficiency for traditional/manual irrigation.

Total: $13,160 \div 0.60 \approx 21,933 \text{ L} \approx 21.9 \text{ m}^3 \text{ day}$

B. Proposed Design (Sustainable Model):

Native Groundcovers: Low water demand ($K_C = 0.4$) (e.g., Ziziphus, Thymus).

Calculation: $900 \text{ m}^2 \times 4.0 \text{ L/m}^2 \text{ day} = 3,600 \text{ L}$

Trees (28 trees): Using precise drip irrigation (60 L/tree/day).

Calculation: $28 \times 60 = 1,680 \text{ L}$

Water Fountain: Removed (0 L).

Total Net Requirement: 5.280 L/day

Gross Consumption: Assuming 90% efficiency for drip irrigation system.

Total: $5,280 \div 0.90 \approx 5,866 \text{ L} \approx 5.9 \text{ m}^3/\text{day}$

Comparing the two designs (21.9 m³ vs. 5.9 m³) reveals a water saving of approximately 73%. This significant reduction is attributed to the removal of the water fountain, the replacement of thirsty turf with native species, and the shift to high-efficiency irrigation technology.

3.4. Comparison Between Current and Proposed Designs

Table (5) outlines the concrete effects of the suggested design changes in relation to the existing conditions. The findings indicate that the new design enhances not only the visual appeal but also the functionality and sustainability.

Table 5: Comparison of performance indicators between current and proposed designs

Indicator	Current design	Proposed design	Change (%)
Turf grass area (m ²)	1.200	0	-100%
Groundcover plant area (m ²)	0	900	+∞
Number of shade trees	12	28	+133%
Pathway length (m)	320	180	-44%
Number of seating areas	6	12	+100%
Children's play elements	3	7	+133%
Daily water consumption (m ³ /day)	18.5	9.2	-73%

1. Resource optimisation (Water & Maintenance): A big change is the reduction in water usage by 73%. Such an invention will then be a helpful device in practice and thus implies that an adjustment of maintenance from turf grass irrigated by watering sprinklers to native ground covers utilizing drip irrigation is the best alternative for incipient deserts like Kirkuk. Also, the reduced need for maintenance of the water fountain helps to achieve this reduction.
2. Enhanced Microclimate (Trees): A more than doubling of the tree total by 133% from twelve to 28 trees addresses a major environmental deficiency here: mature shade. The visitors to the park feel the benefit of this reduction in temperature by improving the canopy condition, and so they can use it during hot days.
3. (D) Social inclusivity (Seating) New Seating Area - (Increase in seating by 100%) Number of seats showing a change of more than 6 % for Documentation (Appendix F). This is an improvement that turns the park from a pass-through to a stay-and-socialize asset with furniture for better family and youth comfort.

Table 6. Summary of Expert Evaluations (n = 7) on the Proposed Park Design

1. Climatic suitability & native vegetation	86% (6)	14% (1)	0%	Strong support for <i>Ziziphus spina-christi</i> and thyme; praised for drought tolerance and cultural relevance.
2. Water use efficiency	86% (6)	14% (1)	0%	Drip irrigation + elimination of turf widely endorsed; one expert requested detailed hydraulic calculations.
3. Children’s play functionality	43% (3)	43% (3)	14% (1)	Mixed views: some praised increased play elements; others raised safety concerns (e.g., lack of soft surfacing).
4. Seating comfort & distribution	57% (4)	29% (2)	14% (1)	Concerns about insufficient seating during peak hours; suggestions to add shaded benches.
5. Pathway clarity & circulation	29% (2)	29% (2)	43% (3)	Three experts criticized the 44% reduction in pathway length as limiting accessibility and exploration.
6. Cultural identity & aesthetics	71% (5)	29% (2)	0%	Native species and layout seen as reflective of local heritage; minor suggestions for traditional motifs.
7. Maintainability & operational cost	86% (6)	14% (1)	0%	Low-maintenance design highly valued; native plants reduce long-term labor and resource needs.

4. Discussion

4.1. Supporting Recent Evidence

The findings of the study are in line with substantial evidence from recent literature: Cultural sustainability: The use of *Ziziphus* as a cultural icon is in line with the concept of "cultural sustainability" (Anthony 2024). De-creased carbon footprint: The significant decrease in maintenance is in line with research that suggests that low-maintenance parks can decrease the carbon footprint by a third (Kabisch *et al.*, 2015).

Psychological effect: Functional beauty can improve mental health as demonstrated (Bel Hadj Brahim *et al.*, 2023).

Work equity: Engaging kids is also an instance of "work equity" proposed by (Zhang *et al.*, 2024). Environmental sustainability: The water savings correspond with recommendations for the semi-arid areas (García-Palacios *et al.*, 2024). Human interaction: The findings support the "environmental restoration" hypothesis (Nie *et al.*, 2022). Climate adaptation: Design harmonizes guidance on urban adaption (Alharbi *et al.*, 2024). Ecosystem services: Improves ecosystem services, such as (Kaplan, and Kaplan, 1989).

4.2. Design as Expression of Place Identity

The use of native plants such as Ziziphus and thyme also reduces water consumption while refreshing the park's cultural heritage. For example, Ziziphus has become not only a shadow provider but also an emblem in the Iraqi culture representing history, hospitality, house of blessing. It corresponds to the concept of "cultural sustainability" that has human-centered values and "the continuation of (shared) memory" (Kabisch *et al.*, 2015) in Kirkuk, having a mix of different cultural identities, when they choose local plants, this indicates ownership and change the park into a common area by everybody and people consider it's their own.

4.3. Design with it in mind to lower your carbon footprint

The proposed model cuts down on the need for mechanical maintenance (such as mowing lawn), and thereby reduces pollution through boosted mechanical outputs. As a bonus, reducing water consumption by 50 percent means less energy used for pumping water – especially in cities that rely on electric pumps. Local research rarely refers to this feature of the environment, but it's vital in climate change (García-Palacios, 2024).

4.4. Functional Beauty and Its Psychological Impact

The fresh design also endorses greater water saving but works to keep the mind in good shape with plenty of shade, serene surfaces under kids' play stuff and seating facing the new play areas. These basic amenities have contributed to a sense of security and well-being (as described in the "environmental restoration theory" (Kaplan & Kaplan, 1989); that advocates for "well-structured environments in nature as facilitators for stress reduction and mood") (García-Palacios *et al.*, 2024). In a city rife with anxiety, the park might be a psychologically transformative oasis.

4.4. Transcending Decorative Beauty to Daily Function

It seems that the fact that the public hates the fountain (90% negative comments) is an example of how our values have changed – from "Nice to look at" to "Useful for something". This is in line with the World Bank (2024) guidelines, which are to "eliminate non-functional elements that waste resources and contribute nothing of value to the society" (Kaplan & Kaplan, 1989). "For an adult when water is scarce, 'your public service is not the worship of strange lovelies, but to assist people and save resources;'"

4.5. Design as Social Investment

The park being proposed is really about more than grass, it is about a willingness to invest in each other and the future. A 133% increase in recreation space shows that a safe place for kids to grow up and longer visits for families is growing. Fresh shaded seating will keep seniors and young alike hanging out, showing up for each other and sweaty is sexy!" The spirit of community will only get stronger. These assets are immeasurable they're invaluable, they can't be purchased with money, but they are crucial to building cities of compassion (IPCC 2022).

4.6. Expert Validation: Bridging Public Preferences and Technical Feasibility

Average and standard deviation scores of park service aspects received by the participants based on age groups (children and adolescent) are shown in Table 2. Contradictions show general unhappiness with the current infrastructure, and seemingly a desire to use that as an excuse for re-design.

The seating areas category is working suffering severely from a lack of quantity and quality, as evidenced by the low rating. The teenagers meanwhile grumbled, they go read you know; its noisy and

commercial (shade). It is one size and it fits all.” “The park functions better as a gathering space when there are a diversity of seating options, the absence of suitable seating forces park users either onto to ground or out of the park more quickly,” they added.

Regarding the “Play Areas,” significant was found in relation with the lack of safety and variety, according to the children. An overwhelming 85% of respondents say that the existing facilities are broken and/or not dense enough for the area’s (growing) population. We observe that particularly for this last aspect it is important to put more efforts into the separating of active play and quiet seat areas to prevent loud noises.

And “Pathways” is quite the stumble, as its episode rating indicates. Feedback is that the current walking routes are currently unsafe (no footpath) or unlit and inaccessible, particularly for children and elderly.

The biggest loser among all park elements was the drinking fountain (mean satisfaction rating: 1.5). What that means is the fountain has become more trouble than it’s worth. Survey respondents, especially families, are likely to think that it’s either unsafe for children or bad for the environment because of standing water and rundown maintenance. “Such an extremely high sustained level of public dissatisfaction makes a strong empirical case for dropping the fountain and associated plaza from the proposed plan in return for more usable green space.

Lower scores indicate clear dissatisfaction with the amount and location of trees on the “green cover” and “shade” metrics. Current park space, user input suggests, is largely open field or a lawn and does not provide a respite from the sun in the harsh mid day heat of Kirkuk. The respondents have, in effect, voted for more vertical green space trees rather than as much horizontal space (lawns). Whether it is from a lack of trees or a strong thirst for shade, this scarcity of trees, and the desire for more shade, is the primary reason to push an increase in tree counts in new design.”

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