



# Co-Diagnosing Urban Forests: Assessing Public Space Quality in İnciraltı Urban Forest

*Kentsel Ormanların Birlikte-Tanısı: İnciraltı Kent Ormanı'nda Kamusal Mekân Kalitesinin Değerlendirilmesi*

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## Öz

*Çalışma; İzmir'de yer alan İnciraltı Kent Ormanı'ndaki kamusal mekân kalitesini, Vatandaş Tasarım Bilimi çerçevesinde uygulanan Birlikte-Tanı (Co-Diagnosis) yöntemiyle değerlendirmektedir. Araştırma; erişilebilirlik, güvenlik, konfor ve sosyallik gibi kamusal mekân deneyimlerinin farklı kullanıcı grupları tarafından nasıl algılandığını ve yaşandığını incelemektedir. Mekânsal gözlemler, yarı yapılandırılmış görüşmeler (n=26), kullanıcı anketleri (n=158) ve davranış haritalama çalışması (n=9.185 gözlem) ile karma yöntem yaklaşımı benimsenmiştir. Bulgular; gölgelik alanlar, oturma düzenleri, tuvaletler ve kapsayıcı erişim açısından mekânsal eşitsizliklere işaret etmektedir. Yaşlı bireyler, kadınlar ve özel gereksinimli kullanıcılar; zemin malzemeleri, yetersiz aydınlatma ve aşırı hava koşullarına karşı koru-nak eksikliği nedeniyle mekânsal rahatsızlıklar bildirmiştir. En yaygın sorunlar arasında başıboş köpekler, yetersiz toplu taşıma ve bakım eksikliği yer almıştır. Tüm sınırlılıklara rağmen alan, fiziksel ve rekreatif aktiviteler için yoğun biçimde tercih edilmektedir. Açık Hava Tiyatrosu'nun yeterince kullanılmaması ve kültürel programların eksikliği ise sosyal canlılık açısından kaçırılmış fırsatlar olarak değerlendirilmiştir. Bu kapsamda, çevresel dayanıklılığı, kapsayıcılığı ve yaşanabilirliği artırmaya yönelik tasarım stratejileri önerilmiştir.*

**Anahtar Kelimeler:** Birlikte-Tanı, Kamusal mekân, Kamusal mekân kalitesi, Kent ormanı, Kentsel tasarım

## ABSTRACT

*The study presents a comprehensive assessment of public space quality in the İnciraltı Urban Forest in İzmir, Türkiye, through a participatory approach known as Co-Diagnosis within the framework of Citizen Design Science. The research investigates how accessibility, safety, comfort, and sociability are perceived and experienced by diverse user groups in a major coastal green space. A mixed-methods strategy was employed, combining spatial observation, semi-structured interviews (n=26), user surveys (n=158), and a systematic behavioral mapping study (n=9.185 observed users). The findings reveal spatial inequalities in shade, seating, restrooms, and inclusive access. Elderly individuals, women, and users with special needs expressed spatial discomfort due to inappropriate surface materials, insufficient lighting, and the lack of protective shelters during extreme weather events. The most commonly reported challenges included uncontrolled dog presence, limited public transportation, and poor maintenance. Despite these limitations, the area remains a popular destination for physical and recreational activities. The study highlights the underutilization of the İnciraltı Open-Air Theater and the absence of cultural programming as missed opportunities to strengthen social vitality. A set of urban design strategies is proposed to enhance the environmental resilience, inclusiveness, and liveability of the site*

**Keywords:** Co-diagnosis, Public space, Public space quality, Urban design, Urban forest

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## INTRODUCTION

Cities are more than their physical form; they are dynamic networks where social relations, cultural narratives, and ecological processes converge. The sustainable and just governance of these urban systems depends on the creation of public spaces that are inclusive, universally accessible, and conducive to everyday life (Carmona, 2019). Serving as essential settings for interaction, public spaces shape the social fabric by nurturing interpersonal bonds, promoting overall health, and sustaining a community's collective identity (Gehl, 2011). Accordingly, the qualitative appraisal and participatory transformation of public spaces are now recognized as essential components of progressive urban planning practice.

Urban green spaces have increasingly been recognized as essential infrastructures for sustainable cities, providing environmental benefits, fostering community well-being, and enhancing public health and equity (Wolch et al., 2014). However, many urban forests and parks still reflect inequalities in spatial design and access. These inequalities are often invisible in traditional urban planning frameworks, which tend to overlook lived experiences and socio-spatial dynamics (Low, Taplin, & Scheld, 2005). In particular, the İnciraltı Urban Forest in İzmir, Türkiye, despite being one of the city's largest coastal public spaces, reveals several spatial discomforts for different user groups, including elderly individuals, women, and people with disabilities. Surface materials, the lack of shelters, poor lighting, and limited amenities affect how these spaces are accessed and experienced on a daily basis. Yet, these aspects remain underexplored in both municipal assessments and academic literature. Addressing such deficiencies requires tools that go beyond observational audits and integrate the voices of users into the evaluation of public space quality.

Recent literature advocates for participatory approaches that embrace experiential knowledge and co-creation as integral to spatial analysis (Mehta, 2014; Gehl, 2011; Manzini, 2015). However, there is still a gap in operationalizing these frameworks through reproducible methodologies in everyday urban contexts. In particular, studies combining citizen science with urban design to assess comfort, accessibility, and inclusiveness in large urban forests are limited.

The study responds to that gap by applying a *Co-Diagnosis* approach within the Citizen Design Science (CDS) (Muüller et al., 2018; Özden & Velibeyoğlu, 2023) framework to the İnciraltı Urban Forest. It investigates how spatial qualities, specifically accessibility, safety, comfort, and sociability, are perceived and negotiated by users. The study employs a mixed-methods approach that integrates spatial observations, behavior mapping, surveys, and interviews to analyze spatial justice and design potential in the area.

By foregrounding experiential knowledge and everyday user perspectives, the research aims to contribute to emerging debates on just green infrastructure, participatory planning, and inclusive spatial governance. The study is organized as follows. First, it presents a literature review on spatial quality and participatory evaluation. Then, it introduces the methodology and tools used in fieldwork. The results section outlines the main findings through multiple data sources. Finally, the discussion links these findings to broader debates in public space literature and concludes with recommendations for inclusive design in urban green spaces.

### 1. Theoretical Framework

The discourse on public space quality has undergone a significant transformation over the last few decades. Originally grounded in the evaluation of formal, functional, and aesthetic dimensions of space, contemporary approaches increasingly emphasize relational, experiential, and affective qualities (Carmona et al., 2010; Mehta, 2014). Scholars and practitioners alike now recognize that the effectiveness of a public space cannot be determined solely by its physical attributes but must account for how people interact with, experience, and co-produce it (Whyte, 1980; Gehl, 2011).

Core concepts such as accessibility, safety, comfort, and sociability have emerged as key indicators for equitable public space (Carr et al., 1992). These dimensions reflect not only physical conditions but also users' perceived affordances and constraints. For instance, a path may technically be

accessible, but poor lighting or unwelcoming spatial cues may deter certain groups from using it—illustrating how spatial inclusion is often shaped by perceptions as much as by infrastructure (Madanipour, 1996).

Despite this shift in theory, empirical assessments of public space quality often remain limited to ecological, economic, or recreational metrics, especially in large-scale urban green areas such as urban forests (Wolch et al., 2014). Evaluations of these spaces frequently rely on standardized metrics, such as vegetation cover, species diversity, or visitor numbers, while neglecting the socio-spatial processes that influence daily use, particularly among marginalized populations including women, the elderly, children, and individuals with disabilities. (Low et al., 2005). In rapidly urbanizing contexts, these gaps become more pronounced, as public spaces face growing pressures from privatization, commodification, and climate instability (Mitchell, 2003; Anguelovski et al., 2018).

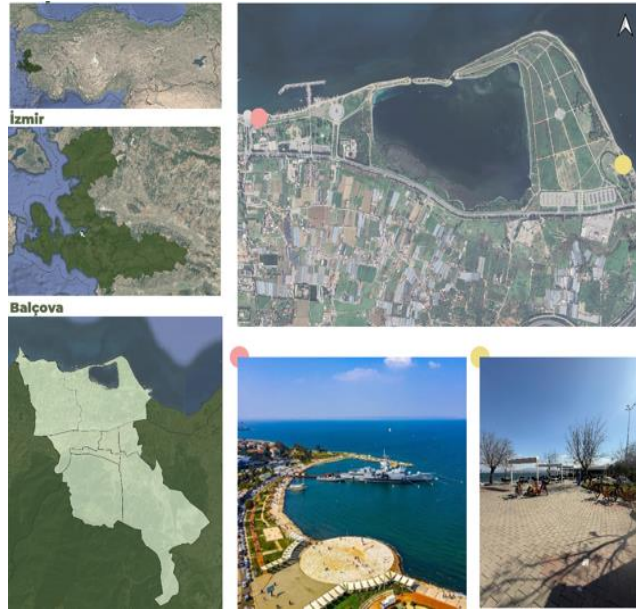
To address these limitations, participatory evaluation methods have gained traction in urban design and planning literature. Tools such as behavioral mapping, participatory audits, and co-diagnosis techniques enable planners to capture users' lived experiences and spatial narratives (Manzini, 2015). This aligns with broader shifts in the governance of public space toward co-production, citizen science, and deliberative urbanism, which emphasize the epistemic value of everyday knowledge (König, 2020). A growing body of literature underlines the potential of CDS, a hybrid methodology that combines participatory design, scientific observation, and spatial analysis as a means to diagnose spatial inequalities and propose user-informed design solutions (Özden & Velibeyoğlu, 2023). CDS serves not only as a data collection mechanism but also as a civic learning platform that empowers citizens as legitimate co-producers of urban knowledge. By positioning everyday users as both observers and interpreters of space, CDS expands the conventional boundaries of spatial diagnosis and evaluation (König, 2020). In this context, the co-diagnostic approach extends participatory evaluation by positioning users not merely as respondents but as active interpreters of spatial quality. Rather than treating public space assessment as an expert-driven or solely performance-based exercise, co-diagnosis conceptualises evaluation as a shared process of knowledge production grounded in lived experience. This perspective builds on foundational scholarship that understands public space as shaped by needs, rights, and meanings, and on observational traditions that foreground everyday practices and behavioural patterns in urban environments (Whyte, 1980).

Co-diagnosis, therefore, operates at the intersection of citizen science and participatory design by translating experiential perceptions such as accessibility barriers, perceived safety, thermal discomfort, or patterns of informal appropriation into analyzable spatial evidence. It aligns with broader debates on justice and contested access in public space, where inclusion is understood as both material and experiential (Mitchell, 2003). Particularly in large urban green areas, where inequalities may be subtle and temporally uneven, experience-based diagnostic approaches can reveal whose comfort and visibility are prioritised and whose are marginalised within everyday spatial practices (Anguelovski et al., 2018). Co-diagnosis is thus conceptualised as a structured evaluative mechanism that integrates situated observation, participatory interpretation, and design-oriented analysis. It moves beyond consultation toward co-produced problem framing and evidence generation, enabling spatial improvement strategies to be grounded in both technical expertise and citizen-generated insight.

## 2. Case Study: İnciraltı Urban Forest, İzmir

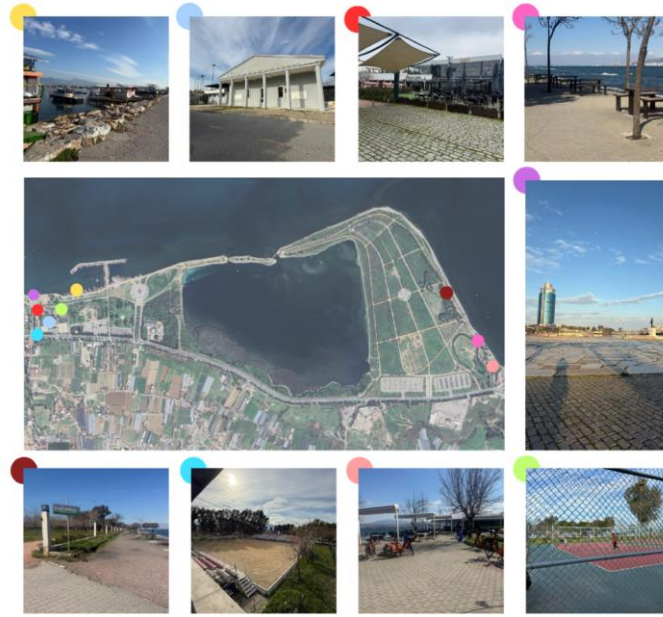
Located along İzmir's southern coastal corridor, the İnciraltı Urban Forest forms part of a wider ecological and recreational network that connects coastal landscapes, metropolitan green infrastructure, and peri-urban open spaces. Beyond its role as a local recreational area, the site functions as a strategic interface between urban development pressures, coastal ecosystems, and large-scale environmental planning agendas. Understanding the spatial quality of the İnciraltı Urban Forest therefore requires situating the site within this broader metropolitan and ecological context, rather than treating it as an isolated public space. İnciraltı Urban Forest and its surroundings, one of the city's most important green areas, has been subject to various spatial interventions and

investment initiatives at different times. The İnciraltı region stands out in the city's memory as an area where agricultural production took place and where city dwellers used to go for recreation. The İnciraltı Urban Forest is situated between Yenikale Burnu and Üçkuyular (Figure 1). One of İzmir's most important lungs, the Urban Forest is approximately 3.5 times the size of Kültürpark (İzmir Büyükşehir Belediyesi, 2018). The İnciraltı Urban Forest, a first-degree natural conservation area, contains an important wetland area known as Çakalburnu Dalyanı (Eğercioğlu & Ercoşun, 2015). This area, which is of critical importance in terms of biodiversity, is home to various bird and plant species. The following figures provide a spatial and analytical overview of the İnciraltı Urban Forest, including its functional zoning, usage patterns, and identified spatial challenges.



**Figure 1.** İnciraltı Urban Forest, İzmir, Türkiye (via Google Earth, Ege Telgraf, 2025)

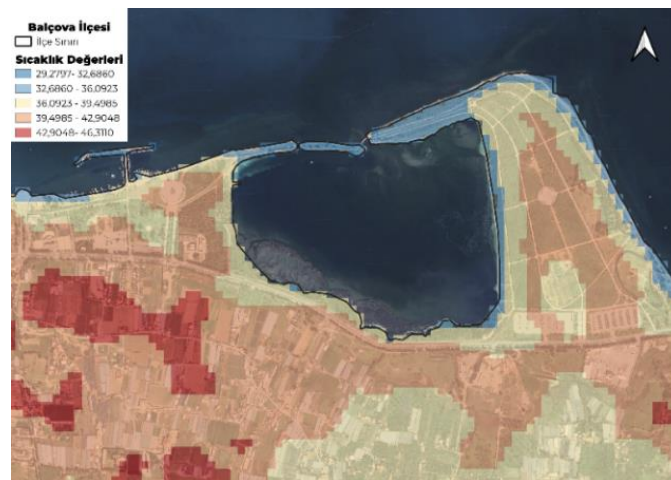
İnciraltı Urban Forest is characterised as a multifunctional public space distinguished by its coastal ecosystem and diverse recreational functions. The area accommodates a wide range of user groups and spatial practices, including playgrounds, picnic areas, sports facilities, an open-air theatre, and small-scale fishing harbors (Figure 2). Although the İnciraltı Open-Air Theatre previously hosted festivals, award ceremonies, and folk performances, it is currently inactive. The surrounding zone includes various sports fields, green areas, and commercial facilities. The site offers European-standard facilities for volleyball, football, basketball, tennis, beach volleyball, beach football, and handball. The fishing harbor areas are particularly active on weekends, when residents gather for informal social activities. Additionally, the area includes a disability service center and an accessible public café.



**Figure 2.** Spatial and functional characteristics of İnciraltı Urban Forest and its surrounding coastal recreational areas (clockwise: (a) Coastal edge and small-scale fishing harbor along the shoreline., (b) Inactive İnciraltı Open-Air Theatre structure within the recreational zone. (c) Semi-covered gathering and seating area integrated with commercial units. (d) Public seating and promenade area along the coastal frontage. (e) Large-scale paved waterfront space adjacent to high-rise coastal development. (f) Multi-purpose sports complex including football and basketball courts. (g) Open recreational field and event space. (h) Peripheral access road and informal parking area. (i) Aerial view of İnciraltı Urban Forest illustrating coastal lagoon ecosystem, green corridors, and distributed recreational facilities.

Access to İnciraltı Urban Forest is provided by various transportation alternatives, including private vehicles, public transportation, and bicycles. In addition to public transportation access to the area via ESHOT and minibus lines, the surrounding bicycle paths increase the accessibility of the area. There is a parking lot and a caravan parking lot in the area.

Balçova District has a hot climate, with temperatures reaching up to 46°C in summer. In İnciraltı Urban Forest, in July 2024, air temperatures reached 33°C in coastal areas due to sea breezes, while temperatures rose to 42°C in inland areas with dense impervious surfaces (Figure 3).



**Figure 3.** İnciraltı Urban Forest - Surface Temperature Map (Source: Created in Qgis using Landsat 8 satellite image data from July 2024.) Credit: Müge Tikik

Within the area, there are a limited number of climate-sensitive urban furniture elements such as canopies and shaded seating areas (Figure 4). The insufficient number of urban furniture in the area and the lack of integration of seating elements with plant shading cause a decrease in thermal comfort, especially during the summer months, limiting the potential of the area.



**Figure 4.** Top cover and top-covered seating units in İnciraltı Urban Forest

Besides, regarding the historical context of the area, in the 1940s, it was used as an area where city residents swam in the sea and picnicked, but in the 1970s, coastal activities decreased due to sea pollution, and greenhouse activities gained momentum due to the potential of warm groundwater. In the 1980s, the construction of the Balçova Dam and the opening of the Özdilek Shopping Center in the 1990s led to a decline in agricultural activities due to factors such as a drop in the groundwater level and increased salinity (Kayın, 2012)

Construction activities in the İnciraltı region began in 1971 with the construction of accommodation units for athletes as part of the Mediterranean Games, and the buildings continued to be used as İnciraltı Student Dormitories. In 1989, the İnciraltı region was declared a “tourism center,” and with the “cloverleaf intersection and highway site plan,” development pressure in the region increased, and the ecological balance began to deteriorate. To prevent urbanization pressure, the region was declared a first-degree natural conservation area by the İzmir No. 1 Cultural and Natural Heritage Protection Board with its decision dated July 1, 1999, and numbered 8050 (Kayın, 2012; Yüksel, 2013).

The other two critical intervention proposals affecting the spatial development processes of the İnciraltı region are the EXPO area proposal and the İzmir Gulf Crossing Project. The intensive construction and physical interventions proposed within the scope of these projects not only transformed the spatial character of İnciraltı but also weakened the urban green space fabric and threatened the habitats of species living in Çakalburnu Dalyanı. As a result, these projects were canceled in accordance with court decisions and public reactions (Hacıoğlu, 2020). Initially utilized as a rubble disposal site in 1987 and officially designated as a landfill in 1994, the area continued to serve this function until 1999. Following its closure, the İzmir Metropolitan Municipality undertook rehabilitation efforts, culminating in its conversion into an urban forest in 2006 (Figure 5).

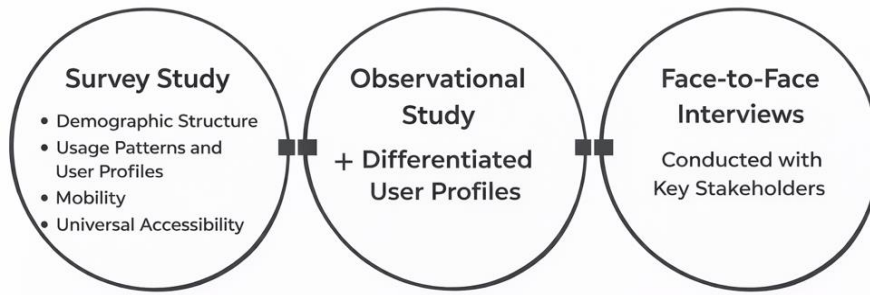


**Figure 5.** Spatial changes in İnciraltı Urban Forest and surrounding area (via: Google Earth)

Through a combination of behavioral mapping, spatial observation, user surveys, and interviews, the study seeks to uncover latent forms of spatial exclusion and identify inclusive design strategies.

### 3. Methodology

The study adopts a mixed-methods research design grounded in the Citizen Design Science (CDS) paradigm. CDS is an emerging transdisciplinary methodology that synthesizes participatory urbanism, spatial analysis, and citizen science to generate data-rich, experience-driven insights into urban environments using co-diagnosis process (Saad & Horelli, 2010; Berntzen & Johannessen, 2016; Müller, et al. 2018; Özden, Velibeyoğlu, 2023). Co-diagnosis was operationalised as a structured participatory evaluation process combining on-site observation, guided citizen walk-throughs, mapping exercises, and moderated reflection sessions. While the conceptual grounding of co-diagnosis as an experience-based evaluative approach is discussed in the theoretical framework, this section details its procedural implementation within the case study. The approach positions everyday users as both data contributors and co-interpreters of urban space, thereby enhancing democratic participation while strengthening empirical design processes. Merging participatory processes with systematic empirical inquiry, the methodology assesses the spatial quality of the İnciraltı Urban Forest through three core instruments: structured surveys, systematic behavioral mapping, and semi-structured interviews. Each method was selected to reveal a unique but complementary perspective on the site's spatial dynamics (see Figure 7). Figure 6 summarises the three-step methodological structure and illustrates how co-diagnosis is operationalised through triangulated data sources.



**Figure 6.** Three-step methodology schema of the study

Co-diagnosis is adopted in this study as an experience-based and co-productive evaluation approach that bridges expert-led spatial assessment with everyday user knowledge. Unlike conventional public space audits that primarily rely on predefined indicators and observational checklists, co-diagnosis treats users as legitimate interpreters of spatial quality, enabling the joint identification of problems, their perceived causes, and context-sensitive design implications. Within the Citizen Design Science (CDS) paradigm, co-diagnosis serves as a structured mechanism to translate lived experiences such as perceived insecurity, thermal discomfort, or exclusionary micro-barriers into spatial evidence that can inform urban design and governance. The conceptual positioning is particularly relevant for large urban green spaces, where inequities may be subtle, temporally variable, and unevenly experienced across user groups.

The co-diagnosis process was implemented through a stepwise protocol designed to ensure both spatial coverage and methodological triangulation: (i) problem framing and spatial segmentation, where the study area was divided into two functional zones to guide observation routes and sampling; (ii) systematic behavioural mapping, where trained observers recorded user types, activities, and spatial distribution across multiple time intervals on weekdays and weekends; (iii) on-site survey administration, capturing perceived accessibility, safety, comfort, and sociability through structured items; (iv) semi-structured interviews, eliciting experiential narratives on unmet needs, exclusion perceptions, and improvement suggestions; and (v) joint interpretation through triangulation, where findings across the three instruments were cross-checked to identify convergent patterns and site-specific design implications.

Figure 7 shows the locations of systematic observation points established to guide behavioural mapping and on-site surveys across the İnciraltı Urban Forest. Observation points were selected to ensure spatial coverage of different functional zones and user intensities, supporting the triangulation of observational, survey, and interview data.



**Figure 7.** Study Area: İnciraltı Urban Forest, İzmir, Türkiye (via Google Earth)

The fieldwork was conducted in two spatial zones of İnciraltı Urban Forest. In Zone 1, face-to-face interviews, on-site surveys, and structured observations were carried out over a seven-day period between 17.02.2025–20.02.2025 and 28.02.2025–02.03.2025. Data collection took place daily between 09:00 and 20:00 in order to capture variations in spatial use throughout the day. In Zone 2, face-to-face interviews and survey implementation were conducted on 03.03.2025. The temporal design allowed for the observation of weekday and weekend dynamics, peak usage hours, and variations in recreational intensity.

### 3.1 Participant Profiles

Participants were approached on-site through voluntary participation during fieldwork sessions. In addition, a digital survey was administered to complement face-to-face data collection and to broaden participation across different user groups. Considering the visitor profile of the area, the digital survey was disseminated through established communication networks among key local actors, including members of the tennis club, healthcare workers in the vicinity, and small-scale business operators within the fishing harbor. These networks facilitated the wider circulation of the survey and enabled engagement with frequent and semi-regular users of the site.

The study employed stratified purposive sampling to ensure representation across gender, age, mobility needs, and activity preferences (Figure 8). Participants represented a broad range of user groups, including elderly individuals, women, people with disabilities, children, and local workers. Fieldwork took place on both weekdays and weekends, across varying time intervals, to account for temporal differences in public space use.

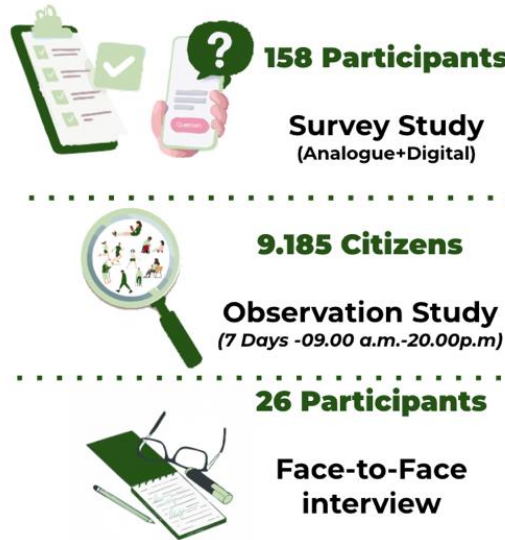


Figure 8. Number of participants in the study

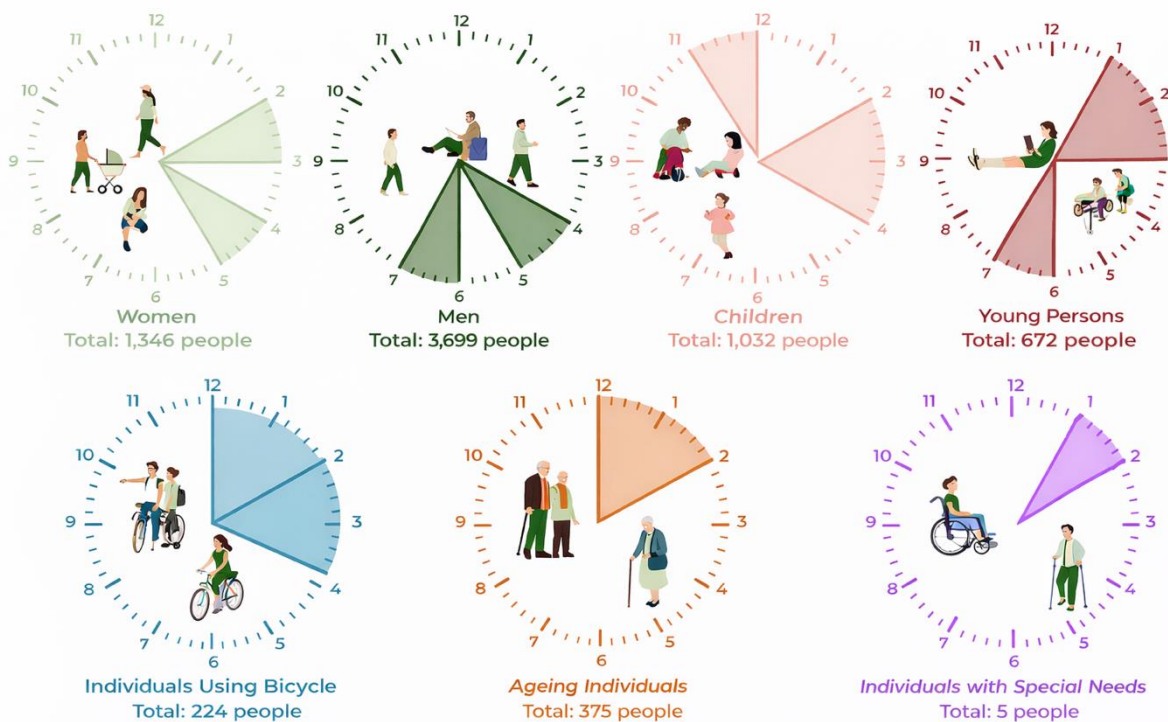
The structured survey was completed by a total of 158 participants, representing a demographically diverse group in terms of age, gender, and educational attainment. Gender distribution was relatively balanced, with 51% of respondents identifying as female (n=81) and 49% as male (n=77).

In terms of age distribution, the majority of respondents were between 45 and 64 years old, with the 45–54 age group comprising 23% of the sample and the 55–64 group accounting for another 23%. The 35–44 age group represented 21% of participants, followed by those aged 25–34 (13%) and 18–

24 (17%). Notably, only 3% of respondents were aged 65 and over, indicating limited representation of senior citizens in the survey.

Regarding educational background, more than half of the participants (50%) reported holding an associate degree or undergraduate qualification. An additional 27% completed high school education. The proportion of those holding a master’s degree was relatively low (6%), while PhD holders constituted only 1% of the sample. A small percentage of participants (9%) had completed primary or secondary school education, and only 1% reported being literate without formal schooling. The demographic results indicate a sample predominantly composed of middle-aged, moderately to highly educated individuals, with a near-even gender distribution. This composition provides a representative basis for analysing perceptions of spatial quality, although the underrepresentation of elderly individuals may suggest a need for targeted outreach in future studies.

Behavioral mapping conducted in the İnciraltı Urban Forest resulted in the systematic observation of 9,185 individuals across different zones and time slots. Among these, men constituted the largest group with a total of 3,699 observed users, followed by young individuals (n = 2,672) and children (n = 1,032). Participant characteristics are summarised in Figure 9, which provides an overview of the sample composition in terms of age, gender, and user profiles.



**Figure 9.** Behavioural mapping results illustrating the spatial distribution of user activities across different functional zones of the İnciraltı Urban Forest. The figure highlights concentration patterns, underused areas, and activity overlaps observed during weekday and weekend time intervals.

### 3.2 Data Collection and Fieldwork Procedures

The data collection process combined structured observation, face-to-face interviews, and survey instruments. On-site engagement focused on identifying spatial strengths, perceived deficiencies,

accessibility barriers, safety perceptions, and patterns of use. Observational findings were documented systematically and cross-referenced with participant responses to enhance analytical reliability.

According to the 3-step methodology of the study, the structured survey captured users' perceptions of demography, accessibility, safety, comfort, spatial experiences, safety and inclusion and comfort in the forest (Figure 10). Figure 10 presents variations in public space use based on user profiles, activity types, and time periods, highlighting how spatial preferences and usage intensity differ across functional zones of the İnciraltı Urban Forest. According to the three-step methodology of the study, the structured survey was organised around six thematic domains: demographic structure, usage and user profiles, mobility patterns, public space experience and needs, inclusion and comfort, and public space safety (Figure 10). These domains were designed to capture multi-dimensional perceptions of spatial performance within the forest. Figure 10 outlines the thematic structure of the survey instrument, which was designed to capture spatial, social, and experiential dimensions of public space use.



**Figure 10.** Thematic structure of the structured survey instrument used in the co-diagnostic assessment.

Additional sections gathered demographic data, mobility modes, visit frequency, and activity preferences. Items were primarily Likert-scale and multiple-choice, and the survey was administered face-to-face by trained researchers using tablets. Secondly, behavioral observation followed an adapted version of Jan Gehl's protocol (Gehl, 2011) (Figure 11).

Observers documented user types (e.g., solo walkers, families, elderly), activity types (active vs. passive), and spatial distribution across four daily intervals (morning, midday, afternoon, evening) during weekdays and weekends. The total observed users were 9.185, recorded at designated locations along the coastal promenade, rest areas, theater zone, and forest paths. Thirdly, semi-structured interviews were conducted with everyday users, municipal officials, accessibility advocates, and neighborhood residents. The questions explored spatial experiences, unmet needs, exclusion perceptions, and suggestions for improvement. Each interview was audio-recorded with consent and transcribed for thematic analysis.

When determining the days on which fieldwork would be conducted, fieldwork was carried out on all 7 days of the week in order to observe the area at its busiest and to observe different users. To experience the area under different weather conditions, the fieldwork was first conducted during the period of February 17–20, 2025 (Monday–Thursday), when cold weather conditions were prevalent. The following week, as the weather warmed up, fieldwork was conducted between February 28, 2025, and March 2, 2025. Due to the inability to reach a sufficient number of individuals with special needs during the 7-day fieldwork, a one-day fieldwork was conducted at the İnciraltı Disability Center on March 3, 2025, to increase inclusivity. The İnciraltı Urban Forest was divided into two functional zones to guide observation and ensure spatial coverage. Surveys and interviews were conducted on-site in shaded or semi-enclosed locations to support comfort and openness. Ethical protocols were

followed; verbal informed consent was obtained from all participants, and anonymity was guaranteed.

### 3.4 Data Analysis

The collected data were analyzed through a multi-dimensional strategy combining quantitative, spatial, and qualitative techniques. Survey (37 questions) data were subjected to descriptive statistical analysis to identify overarching patterns in user perceptions of comfort, safety, and accessibility. Inferential statistical procedures, particularly cross-tabulations were employed to explore correlations between demographic variables such as age, gender, and mobility status, and respondents' spatial experiences. Spatial data derived from behavioral observations were processed and visualized through heatmaps and distribution diagrams, enabling the identification of intensively used areas, behavioral clusters, and underutilized zones within the İnciraltı Urban Forest. These spatial representations facilitated the recognition of physical imbalances and revealed critical insights regarding the accessibility and inclusiveness of different micro-locations (Gehl, 2011).

Interview transcripts were analysed using a thematic analysis approach. First, all transcripts were read repeatedly to build familiarity and to note preliminary impressions. Second, open coding was conducted to label meaning units related to spatial experiences, barriers, and perceived qualities. Third, codes were iteratively clustered into higher-order themes through axial coding, resulting in thematic categories such as spatial discomfort, perceived exclusion/marginalisation, environmental vulnerabilities, and proposed design improvements. Fourth, themes were reviewed against the full dataset to ensure internal coherence and distinctiveness. Finally, qualitative themes were systematically compared with survey patterns and behavioural mapping outputs to strengthen interpretive validity and to identify where experiential narratives aligned with or diverged from observed spatial behaviours.

## 4. Findings and Results

This section presents the key findings derived from the survey, behavioural mapping, and interview data, focusing on patterns of use, perceived spatial qualities, and identified challenges within the study area.

Survey responses reveal diverse usage patterns and temporal preferences among visitors to the İnciraltı Urban Forest. When asked about the primary purpose of the site, the majority of respondents emphasized its value as a space for physical activity and exercise, including walking, running, and cycling. These uses were followed by a strong appreciation for the forest's role as a recreational and natural relaxation area, indicating that its function as an everyday escape from urban stress is highly valued (Figure 11).

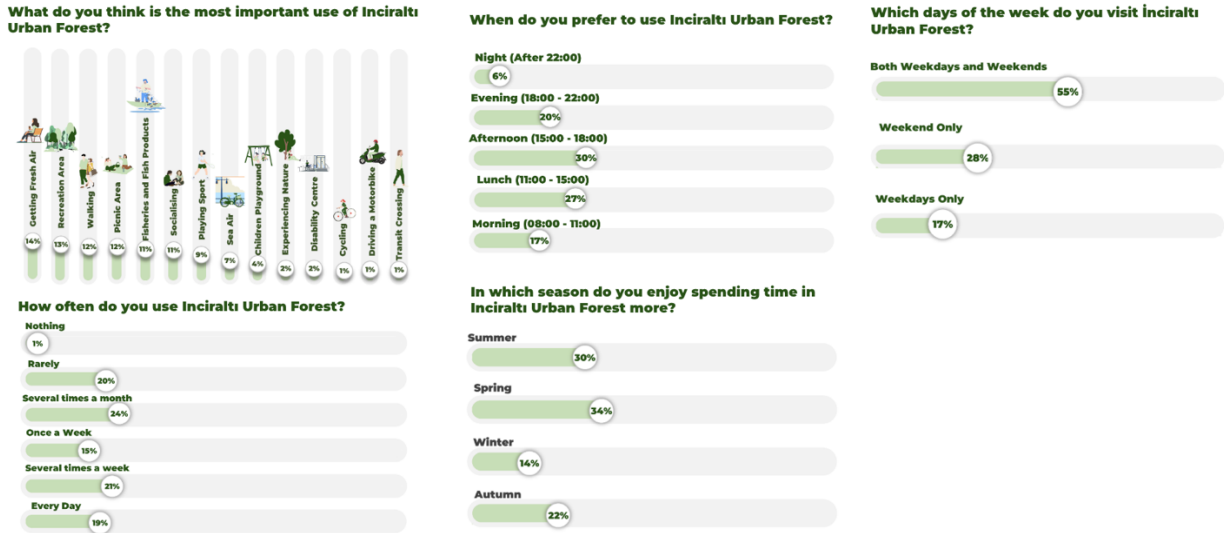


Figure 11. Usage patterns and user preferences

More than half of the participants (57%) reported using cars, followed by public transportation (26%), walking (11%), and cycling (6%). While some degree of modal diversity exists, the dominance of car usage raises concerns about environmental sustainability, traffic congestion, and equity of access. In terms of public transportation connectivity, 80% of respondents reported being able to reach the area through direct routes, while 17% required one transfer and 3% required two or more transfers. Although the high percentage of direct access is promising, even minimal transfer needs can disproportionately affect users with mobility constraints or limited time availability.

The survey also explored participants' willingness to use shared micromobility solutions such as bicycles or e-scooters. Nearly half (48%) indicated a willingness to use these options for short trips in the İnciraltı-Balçova region, while an equal proportion (48%) were unwilling, including some participants who cited special needs or physical limitations. This suggests that while shared mobility could play a supplementary role in increasing access, inclusive design considerations are critical. Respondents were also asked whether sufficient pedestrian and cycle paths exist in the area. A narrow majority (55%) answered affirmatively, while 44% stated there was a deficiency, pointing to a perceived gap in non-motorized mobility infrastructure.

Regarding user preferences for potential local services in the forest, small cafés (36%) and drinking water fountains (25%) were most desired. Respondents also expressed interest in shaded rest areas, bicycle parking, and public toilets, highlighting the need for supportive micro-infrastructure to enhance comfort and stay duration. Participants also identified their biggest access-related challenges. The most frequently cited barrier was "insufficient public transport capacity" (28%), followed by "intensity of vehicle traffic" and "difficulty walking on pedestrian paths." These results reinforce the necessity of improving last-mile connectivity and pedestrian safety, especially in a context where environmental sustainability and equitable access are critical planning goals (Figure 12).

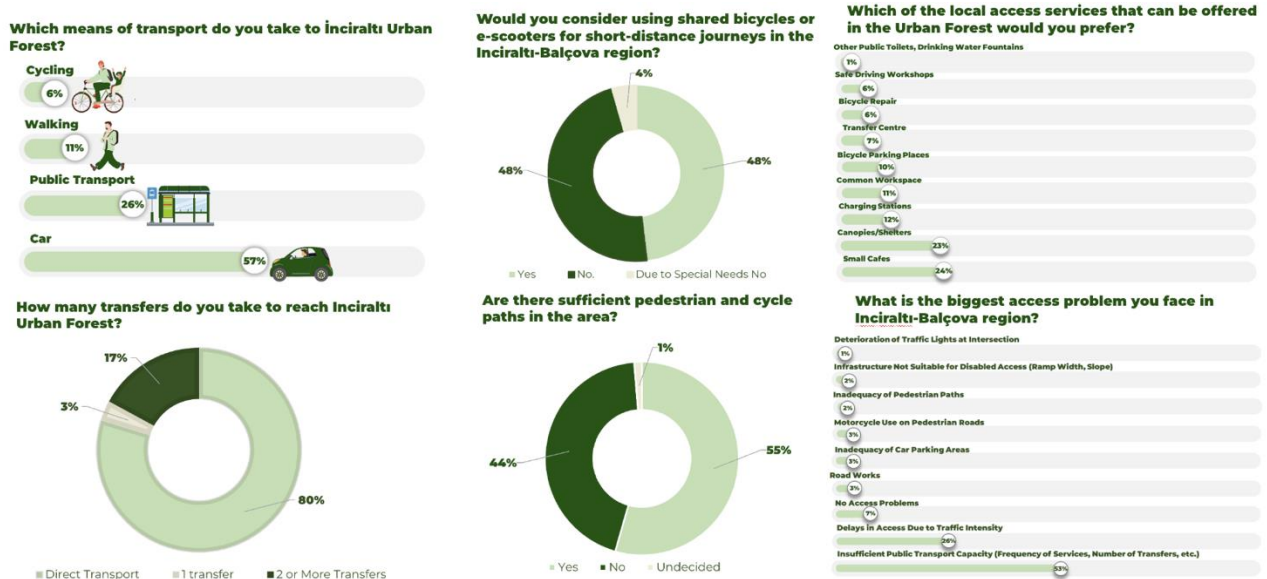


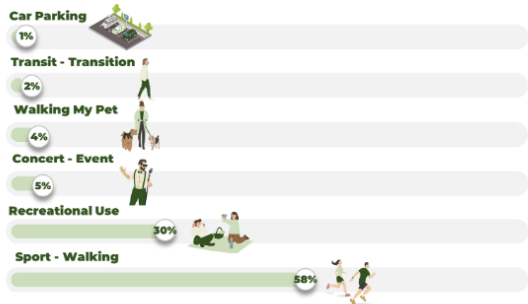
Figure 12. Accessibility and mobility preferences

Survey data indicate that the İnciraltı Urban Forest is primarily used for physical activity (50%) and recreational purposes (30%), followed by more occasional uses such as pet walking, attending events, or transit. These dominant activities emphasize the space’s function as a health-promoting and restorative environment within the city. Cross-tabulated data by age group reveal that individuals aged 55–64 are the most active in “sports and walking” purposes, while those aged 35–44 use the space more intensively for “recreational” purposes.

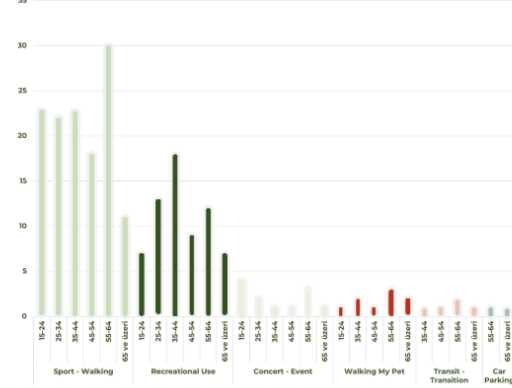
However, users reported several unmet needs and environmental limitations. The most frequently cited deficiencies include the lack of shade structures and urban furniture such as benches, tables, and trash bins. Although basic services such as public toilets and café areas are available, these were considered insufficient to meet the growing demand for comfort and extended use. Shade and seating are especially critical in a coastal region subject to intense sun exposure and heat during summer months. When asked about the main spatial problems encountered in the area, participants most often identified the presence of uncontrolled stray dogs, inadequate shade, lack of seating, and insufficient cleanliness. Safety concerns, both perceived and experienced, were also highlighted, especially among women and elderly users. The need for better lighting, more accessible paths, and user-friendly infrastructure was recurrently emphasized.

The combined findings from both usage patterns and perceived deficits underscore a mismatch between the forest’s physical infrastructure and the lived experiences of its users. While the space offers considerable ecological and social value, the absence of inclusive and comfort-enhancing design elements limits its full potential as a democratic public resource (Figure 13).

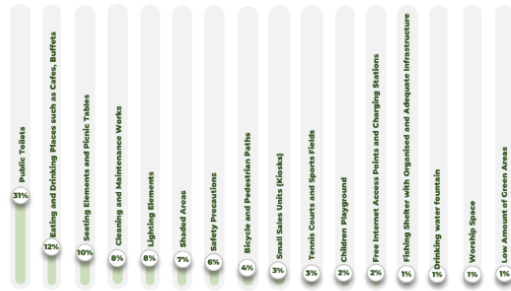
**For which purpose(s) do you usually use İnciraltı Urban Forest?**



**What do people by age group usually do?**



**Simple and daily needs are important. What do you think is missing in the İnciraltı Urban Forest?**



**What are the main problems you see in İnciraltı Urban Forest?**



**Figure 13.** The public space experience, needs, and perceived deficiencies

Survey results suggest significant limitations in spatial inclusion and climate adaptability within the İnciraltı Urban Forest. Although the space is perceived as open and public, actual accessibility for users with assistive needs remains limited. Only 22% of respondents (n = 35) reported using auxiliary aids such as wheelchairs, walking sticks, or strollers, indicating both a low representation of mobility-impaired users and potential exclusionary spatial features. Among those who did use such devices, the most frequently reported difficulties included inappropriate surface materials, the lack of accessible paths, insufficient disabled parking areas, and the absence of tactile surfaces for the visually impaired. A major concern raised by users pertains to the site’s vulnerability during extreme weather events. Approximately 77% of participants reported that they avoid using the area during periods of excessive heat, strong winds, or rainfall. The primary reasons for this avoidance included a lack of top cover (42%), unsafe conditions caused by slippery or uneven surfaces (25%), puddles and poor drainage infrastructure (10%), and a general absence of climate-responsive furniture and sheltered areas. Seasonal distribution charts reveal that discomfort due to lack of cover and infrastructure is disproportionately felt by women and older adults, groups who are already more susceptible to climate-related stressors.

Overall, the lack of universal design elements and climate-resilient infrastructure poses a critical barrier to year-round, inclusive use of the forest. While the İnciraltı Urban Forest provides valuable ecological and recreational functions, its spatial shortcomings limit its usability, especially under extreme environmental conditions. These insights highlight the urgent need for adaptive design strategies that promote equity, safety, and resilience in coastal urban green spaces (Figure 14).

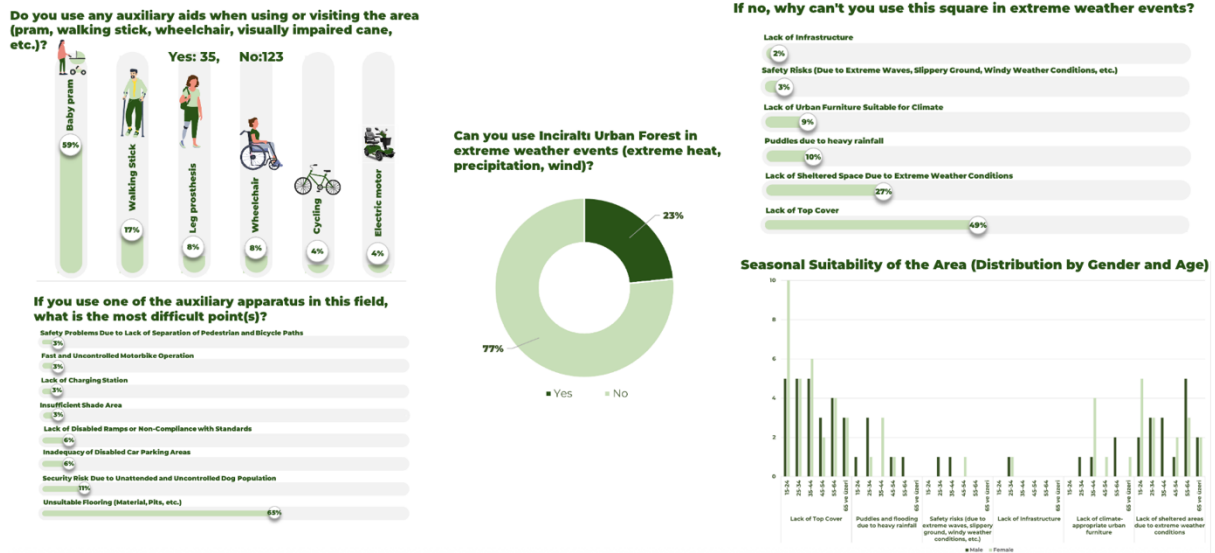


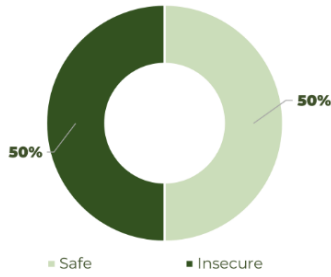
Figure 14. Inclusion, accessibility, and climate resilience in the public space

Survey findings reveal a pronounced divide in perceptions of safety within the İnciraltı Urban Forest. While 50% of respondents described the area as generally safe, the other half expressed feelings of insecurity. When evaluating overall safety on a five-point scale ranging from 1 (very unsafe) to 5 (very safe), the most common response among participants was a score of 2 (unsafe), reported by 34% of respondents, while only 8% rated the site as “very safe.”

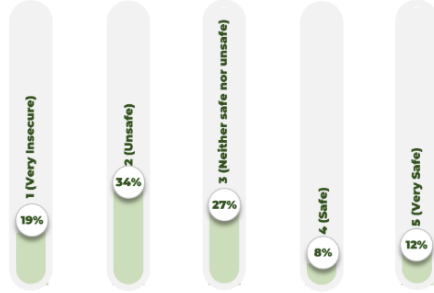
Further analysis of the reasons for perceived insecurity highlights several spatial and operational deficiencies. The most cited concern (45%) was the ineffective and inconsistent supervision of the area, followed by a lack of organized social activities (15%), insufficient cleanliness and maintenance (11%), and a lack of information or signage (6%). The absence of lighting and security personnel was also implicitly cited in open-ended responses as contributing to discomfort, particularly during late hours or in secluded zones. The insights point to a need for enhanced place management strategies, including the integration of passive and active security measures, improved visibility, and regular programming to increase perceived social presence. The perception of safety is a critical determinant of who uses the space, when, and how especially for women, elderly individuals, and parents with children.

Overall, the safety concerns identified in this study reinforce the broader finding that physical accessibility alone is insufficient. Psychological comfort, perceived safety, and social cohesion are equally important dimensions of inclusive public space planning (Figure 15). When safety perceptions were examined through a gender lens, notable differences emerged. Female participants more frequently reported concerns related to inadequate lighting, limited visibility in densely vegetated areas, and feelings of vulnerability during evening hours. In contrast, male participants tended to evaluate safety primarily in relation to physical maintenance and activity intensity rather than perceived personal risk. These findings suggest that safety in the İnciraltı Urban Forest is experienced in a gender-differentiated manner, highlighting the importance of gender-sensitive design and management strategies in urban green spaces.

## How do you assess the security of İnciraltı Urban Forest?



## If you were to rank the safety of İnciraltı Urban Forest from 1 (lowest) to 5 (very safe), how many points would you give?



## If your answer is unsafe, what are your concerns about safety in the area?

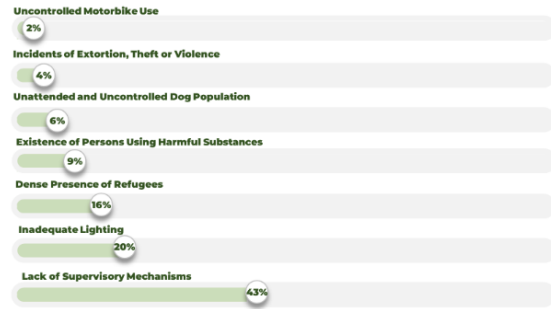


Figure 15. Perceptions of public space safety

The survey findings focused on users' satisfaction levels, perceived shortcomings, and suggestions for improving the İnciraltı Urban Forest. A notable insight was that 67% of participants were unfamiliar with the İnciraltı Open-Air Theatre, a significant underutilized amenity within the site. Among those aware of it, dissatisfaction centered on its irregular and ineffective use, particularly the lack of programming and structured events. This underlines the potential of the theater as a latent space for cultural activation and civic engagement. Participants were also asked which user groups they believe most frequently occupy the space. Families with children (32%), young people (26%), and elderly individuals (15%) were seen as the dominant users, with tourists, cyclists, and individuals with disabilities mentioned less frequently. This perception aligns with behavioral and survey data, revealing the absence or low visibility of certain user profiles due to spatial or social constraints.

When asked how the urban forest could be improved, respondents emphasized the need for better lighting, safety precautions, shaded rest areas, and urban furniture such as benches and toilets. Other frequent suggestions included adding food and beverage kiosks, creating inclusive play areas, and expanding green space. Notably, these requests varied by age group: younger participants prioritized recreational and social uses, while older participants focused on comfort and accessibility.

In sum, these responses highlight the importance of integrating soft infrastructure, such as cultural programming, amenities, and micro-interventions, alongside physical improvements. Enhancing the spatial quality of İnciraltı Urban Forest requires not only infrastructural upgrades but also attention to inclusivity, social vitality, and long-term place stewardship (Figure 16).

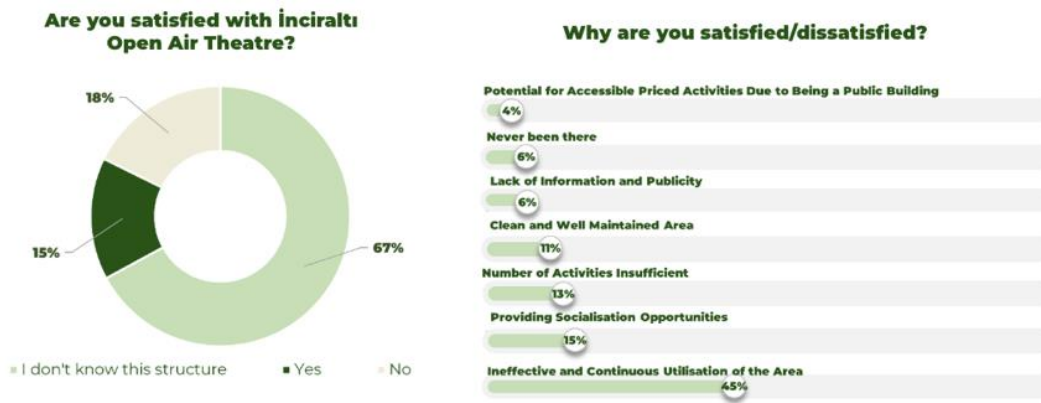


Figure 16. Suggestions for improving the quality of the public space

## 5. Discussion and Conclusion

This section synthesizes the empirical findings by situating them within broader debates on public space quality, spatial justice, and participatory urban design, rather than reiterating descriptive results. The study set out to assess the spatial quality and inclusiveness of the İnciraltı Urban Forest through a participatory methodology rooted in the CDS framework. The findings reveal a multidimensional landscape of experiences, needs, and challenges associated with this coastal urban green space. While the forest serves as a vital recreational and restorative area for many residents, persistent spatial inequalities, accessibility barriers, and perceptions of insecurity limit its full potential as a universally inclusive public environment.

The primary takeaway is that physical presence alone does not ensure spatial justice or perceived comfort. Despite its regular use by families, middle-aged cohorts, and recreational users, the space presents significant challenges for vulnerable populations such as elderly individuals, people with disabilities, and women, who report discomfort, heightened safety concerns, and limited physical accessibility, especially during periods of extreme weather. These patterns reinforce the central hypothesis of this research: that public space quality cannot be adequately evaluated without integrating users' subjective and lived experiences.

Beyond confirming existing debates on public space quality, this study advances the literature by demonstrating how co-diagnosis, operationalised through the Citizen Design Science framework, enables the identification of spatial inequalities that remain largely invisible in conventional evaluation approaches. While previous studies have highlighted accessibility, comfort, and safety as core dimensions of public space quality (Carr et al., 1992; Mehta, 2014; Carmona et al., 2010), the findings from İnciraltı Urban Forest show that these dimensions are not only infrastructural but also deeply experiential and relational. In particular, the combined use of behavioural mapping, surveys, and interviews reveals how perceptions of insecurity, thermal discomfort, and exclusion are unevenly distributed across user groups and temporal conditions, reinforcing arguments that spatial justice cannot be assessed through physical metrics alone (Carmona et al., 2010; Mehta, 2014; König, 2020).

From a practical standpoint, several key implications emerge. First, there is an urgent need for micro-scale design interventions, such as shaded rest areas, accessible surfaces, and inclusive seating that can accommodate a wider range of users. Second, perceived insecurity can only be addressed through a combination of physical improvements (e.g., lighting, signage) and social programming that enhances the presence of diverse user groups throughout the day. Third, underutilized infrastructure like the Open-Air Theatre presents an opportunity for revitalization through cultural programming and community-based events.

These findings matter because they highlight how urban green spaces, even when abundant, may not be equitably accessible or experientially inclusive. The spatial diagnosis presented here illustrates that inclusivity is not just a matter of formal access but of sustained comfort, safety, and participation. Without targeted investments and participatory management, such spaces risk reproducing social inequalities under the guise of public provision.

One unexpected result was the particularly low visibility of individuals with disabilities, despite their representation in the general population. This absence speaks not only to physical barriers but also to symbolic exclusions and a lack of invitation embedded in the spatial language of the park. Addressing this requires not only infrastructural upgrades but also a shift in governance and design culture.

In conclusion, this study confirms that spatial quality assessments must go beyond ecological and formal metrics to incorporate behavioral, perceptual, and affective data. The findings demonstrate that citizen-generated knowledge can illuminate exclusionary patterns and guide inclusive design solutions. As cities grapple with climate uncertainty, demographic shifts, and demands for more equitable public realms, the lessons from İnciraltı suggest that participatory spatial diagnosis can serve as both an evaluative tool and a catalyst for more just urban transformations.

While the study presents a comprehensive spatial diagnosis, several limitations must be acknowledged. First, the behavioral observations, although extensive, were conducted during specific months and may not reflect seasonal variations in user patterns. Second, the sample sizes for certain demographic groups, such as individuals with disabilities and elderly participants, were relatively small, limiting the generalizability of some conclusions. Third, while triangulation of data sources was used to enhance reliability, self-reported data from surveys and interviews may carry subjective biases. These constraints suggest caution when interpreting specific subgroup analyses and point to the need for longitudinal and diversified studies in the future.

The study also opens several avenues for future inquiry. One promising direction is to replicate the Citizen Design Science approach across different urban green spaces in diverse socio-ecological contexts to examine patterns of inclusion and exclusion more comparatively. Subsequent studies may address the enduring impacts of micro-scale interventions, including the provision of shade structures and universally accessible rest areas, on user behavior and perceived safety. Furthermore, research into the contributions of cultural programming and social activation to spatial equity would enrich the discourse on how design and governance intersect in shaping public space transformation.

From a strategic perspective, the findings suggest that improving public space quality in large urban forests requires context-sensitive interventions that operate across multiple scales. At the site level, strategies such as enhancing shade provision, improving path continuity, and addressing perceived safety through spatial design can directly respond to experiential deficits identified through co-diagnosis. At a broader governance level, the study highlights the need for participatory evaluation mechanisms that can inform long-term planning decisions by systematically incorporating user experiences into green infrastructure strategies. In this sense, co-diagnosis functions not only as an evaluative tool but also as a strategic bridge between everyday use patterns and urban design decision-making.

The main theoretical contribution of this study lies in reframing spatial quality assessment as a co-produced and experience-driven process. By embedding co-diagnosis within the Citizen Design Science methodology, the research moves beyond expert-led audits and static indicators, offering a replicable approach that foregrounds everyday user knowledge as a legitimate form of spatial evidence. This perspective contributes to emerging discussions on just green infrastructure and inclusive urban governance by demonstrating how participatory spatial diagnosis can function not

only as an evaluative tool, but also as a catalyst for more equitable and responsive urban design practices.

Beyond confirming existing discussions on public space quality and participatory planning, this study contributes to broader theoretical debates by demonstrating how co-diagnosis functions as a distinct knowledge-production mechanism within planning and design processes. By operationalizing user experiences as structured analytical input rather than descriptive feedback, the study extends co-production debates toward a more diagnostic and evaluative dimension. This perspective reframes participation not only as a means of inclusion, but as a methodological tool capable of generating context-sensitive planning knowledge. In this sense, the findings contribute to theoretical discussions on participatory urbanism by bridging experiential data, spatial analysis, and decision-oriented design thinking.

### **Compliance with Ethical Standard**

**Conflict of Interest:** *The author(s) declares that they do not have a conflict of interest with themselves and/or other third parties and institutions, or if so, how this conflict of interest arose and will be resolved, and author contribution declaration forms are added to the article process files with wet signatures.*

**Ethics Committee Approval:** *The data used in this study were originally collected by the İzmir Planning Agency as part of their public space monitoring activities, with prior ethical clearance obtained by the institution. This research constitutes a secondary analysis of anonymized data.*

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