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URBAN LANDSCAPE DESIGN IN MOROCCO: CLIMATE, CULTURE, AND POLICY IMPACTS

Urban landscape design in Moroccan cities exemplifies the complex challenges posed by the intersection of diverse climatic conditions-spanning Mediterranean, desert, and semi-arid zones-and deeply rooted cultural practices. These geographic and cultural factors significantly shape how residents interact with public spaces, particularly in regions affected by extreme temperatures, high humidity, and seasonal variations. Despite the critical importance of outdoor spaces for social interaction and well-being, residents face persistent barriers to outdoor engagement. These include insufficient shaded areas, poorly maintained pedestrian pathways, and limited access to functional and aesthetically pleasing green spaces. The absence of water elements, such as fountains, artificial lakes, or sustainable cooling features, further compounds the discomfort experienced in urban environments, particularly during the hot season.

Survey data collected across Moroccan cities sheds light on public preferences and priorities, revealing a strong demand for shaded walkways, climate-responsive designs, and accessible green infrastructure that fosters year-round outdoor activities. Residents emphasized the aesthetic and functional benefits of water-efficient features and well-maintained pedestrian pathways, highlighting their potential to transform urban spaces into inclusive and enjoyable environments. However, the effectiveness of these spaces is further undermined by policies such as Daylight-Saving Time, which misalign with local cultural rhythms and climatic realities, reducing opportunities for outdoor activities during optimal hours and exacerbating public dissatisfaction.

This article draws on survey insights to analyze the interplay between environmental, cultural, and policy-related factors that influence the usability of urban public spaces in Moroccan cities. It identifies critical areas for improvement and offers actionable recommendations to address these challenges. Proposed strategies include the strategic placement of shading structures, the integration of innovative water features that prioritize sustainability, and the development of climate-responsive green infrastructure tailored to local conditions. By aligning urban planning efforts with Morocco's unique climatic zones and cultural practices, cities can create vibrant, functional, and inclusive environments that enhance

community well-being, support outdoor engagement, and promote sustainable urban development in the face of climate change.

Keywords: Urban landscape design; hot climates; climate-responsive design; green infrastructure; sustainable water features; public space accessibility; cultural adaptation.

Formulation of the Problem. Urban landscapes in Moroccan cities are failing to meet the growing demands for comfort, accessibility, and resilience. The challenges arise from a lack of adaptation to diverse climate zones-Mediterranean, desert, and semi-arid-which each impose unique pressures on public spaces. High temperatures, seasonal extremes, and the absence of shading or cooling elements leave urban areas unprepared for the environmental realities of hot climates.

These limitations are further compounded by inadequate infrastructure, including poorly maintained pathways and minimal access to functional green spaces. Beyond environmental challenges, cultural practices, such as evening social activities, are increasingly at odds with current urban designs and policies. The implementation of measures like Daylight Saving Time has created further disruption, misaligning outdoor activity patterns with the climatic and social rhythms essential to Moroccan lifestyles.

This disconnect reveals a systemic issue: urban planning strategies often neglect the intricate interplay between climate, culture, and urban usability. Without addressing these gaps, Moroccan cities risk exacerbating social inequities and reducing the quality of life for residents. A problem-centered approach is necessary to reframe urban landscapes as spaces that actively respond to both cultural and environmental contexts, fostering inclusivity, functionality, and resilience.

Analysis of Research and Publications. Urban landscape design in hot climates has been extensively studied, with researchers emphasizing the importance of climate-sensitive strategies to enhance public space usability and sustainability. Foundational works, such as Givoni's research on climate-responsive urban design, underline the value of shading and vegetation in reducing thermal stress [1]. These principles are especially relevant to Moroccan cities, where extreme temperatures necessitate infrastructure that mitigates heat and encourages outdoor engagement [3, 14].

Contemporary studies further explore the role of urban greenery in promoting outdoor activities and mitigating urban heat islands. For instance, vegetation and green infrastructure have been shown to improve thermal comfort, particularly in Mediterranean and semi-arid regions, which share climatic similarities with parts of Morocco [3, 15 and 19]. Additionally, research on sustainable water-efficient designs

highlights the dual benefits of water features, such as fountains and artificial lakes, in cooling urban spaces and enhancing their aesthetic appeal [7, 15].

However, significant gaps remain in integrating cultural rhythms into urban planning for hot climates. Existing literature on the Middle East and North Africa suggests that culturally adapted urban designs, which align with practices like evening leisure activities, can significantly improve the functionality of public spaces [11, 18]. Unfortunately, these insights are often missing from climate adaptation frameworks, which predominantly focus on environmental factors while overlooking socio-cultural dynamics.

The impact of urban policies, such as Daylight-Saving Time, has also been underexplored. Studies indicate that such policies, which misalign with local climatic and cultural rhythms, disrupt outdoor activity patterns and reduce the usability of public spaces [6, 19]. In Moroccan cities, these misalignments exacerbate existing challenges, including poorly maintained pathways and limited access to shaded areas and cooling features.

By incorporating survey data from Moroccan cities, this article addresses these gaps and provides new insights into the interplay of climate, culture, and policy in urban landscape design. The findings highlight the urgent need for integrated planning strategies that prioritize cultural adaptability alongside environmental resilience, creating urban spaces that are both functional and inclusive.

The Objective of the Article. This article aims to address the challenges of urban landscape design in Moroccan cities by integrating survey data and proposing actionable strategies for improvement:

- Analyze the interaction between climate, culture, policies, and public space usability using survey findings;
- Examine the impacts of diverse climate zones (Mediterranean, desert, semi-arid) on urban design needs;
- Propose strategies to enhance thermal comfort and accessibility through shaded areas, water features, and green infrastructure;
- Evaluate the effect of policies like Daylight Saving Time on outdoor engagement patterns;
- Provide a framework for inclusive, climate-responsive, and culturally adaptive urban landscapes.

Main part. Moroccan cities, situated across diverse climatic zones-Mediterranean, desert, and semi-arid-exhibit distinct outdoor activity patterns influenced by environmental conditions. In Mediterranean areas, residents often prefer daytime outdoor activities, particularly in spring and autumn, when temperatures are milder and conducive to engagement in public spaces. However, in desert and semi-arid regions, extreme heat during midday forces a shift in activity

patterns. Survey data reveals a pronounced preference for early morning and late evening activities in these areas, reflecting the need to avoid peak heat hours. This trend is especially prevalent during the summer months, when over 70% of respondents in desert regions reported avoiding outdoor activities altogether during midday.

These preferences underscore the critical importance of climate-sensitive urban planning. In hot climates, the usability of outdoor spaces depends heavily on the integration of design elements that mitigate thermal discomfort. Shaded areas, for instance, play a vital role in providing relief from intense sunlight, enabling residents to engage with public spaces even during warmer periods of the day. Similarly, vegetation, when strategically placed, not only offers shade but also enhances thermal comfort by reducing surrounding temperatures through evapotranspiration processes. These findings align with established research highlighting the effectiveness of urban greenery in improving thermal conditions in hot and arid regions [3, 14].

Furthermore, survey participants emphasized the need for spaces that are intentionally designed to accommodate early morning and evening activities. Features such as well-lit pathways, shaded seating areas, and strategically located cooling zones can transform urban landscapes into accessible and inviting environments. These interventions are particularly important in desert and semi-arid zones, where the availability of such features is limited, further restricting outdoor engagement (Fig.1).

Accessibility and the quality of public spaces are critical factors influencing their usability and appeal. In Moroccan cities, survey findings indicate widespread dissatisfaction with public space accessibility, particularly due to poorly maintained pedestrian pathways and limited connectivity between green areas and urban neighborhoods. These issues are most prominent in densely populated and economically constrained areas, where residents face significant barriers to accessing well-maintained public parks or gardens. Pedestrian pathways often fail to meet the needs of users, with uneven surfaces, inadequate shading, and minimal infrastructure for people with mobility challenges. These deficiencies not only discourage walking as a leisure activity but also limit the integration of green spaces into residents' daily routines.

This finding aligns with broader research, which underscores the importance of walkable pathways in enhancing community engagement and encouraging outdoor activities [12, 14]. Effective pathways, when well-maintained and shaded, can connect parks, gardens, and recreational areas, transforming isolated green spaces into cohesive networks that foster greater social interaction and inclusivity.

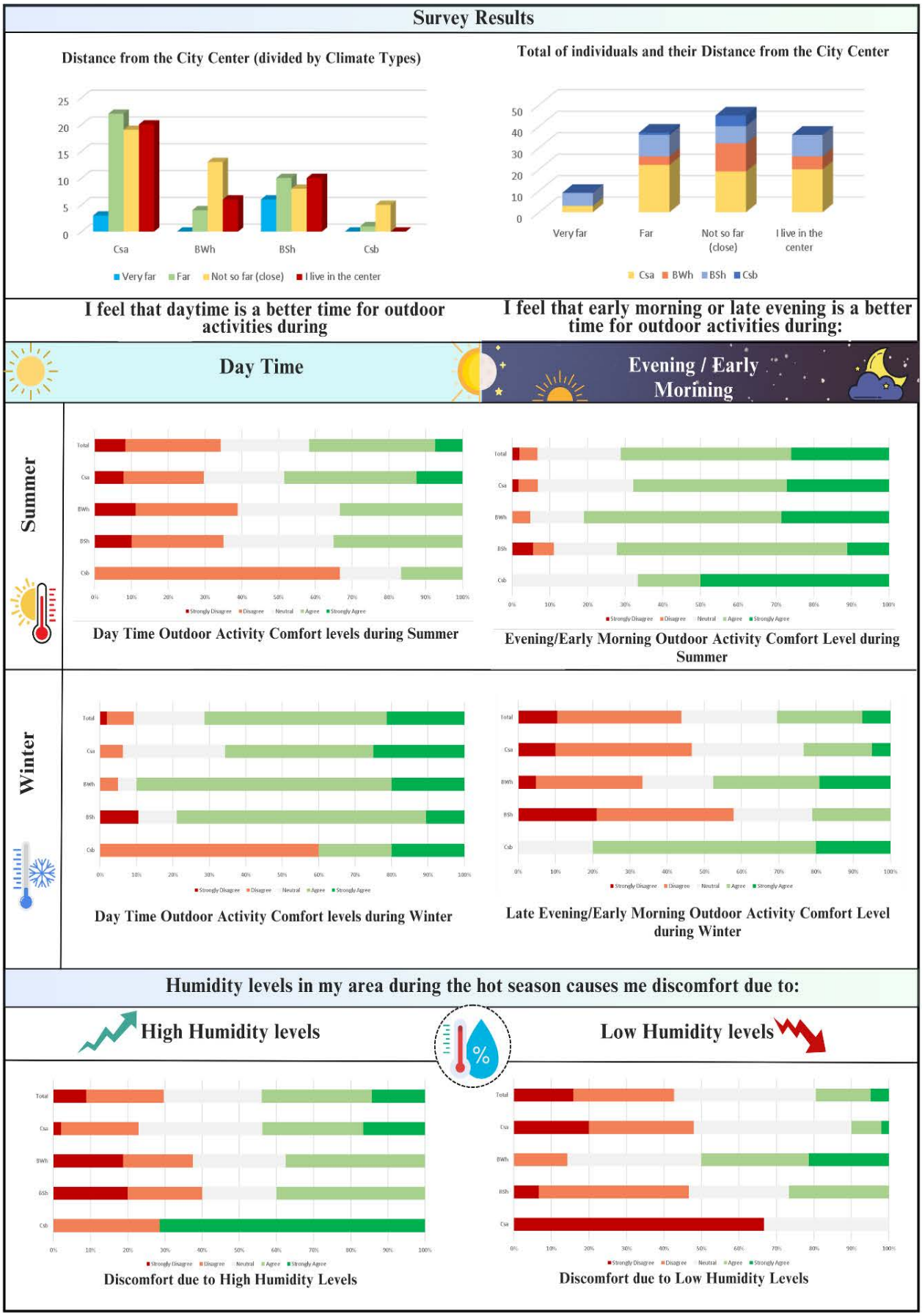

Fig. 1. Climate and Comfort: A Comparative Analysis of Outdoor Activity Preferences in Mediterranean, Desert, and Semi-Arid Cities

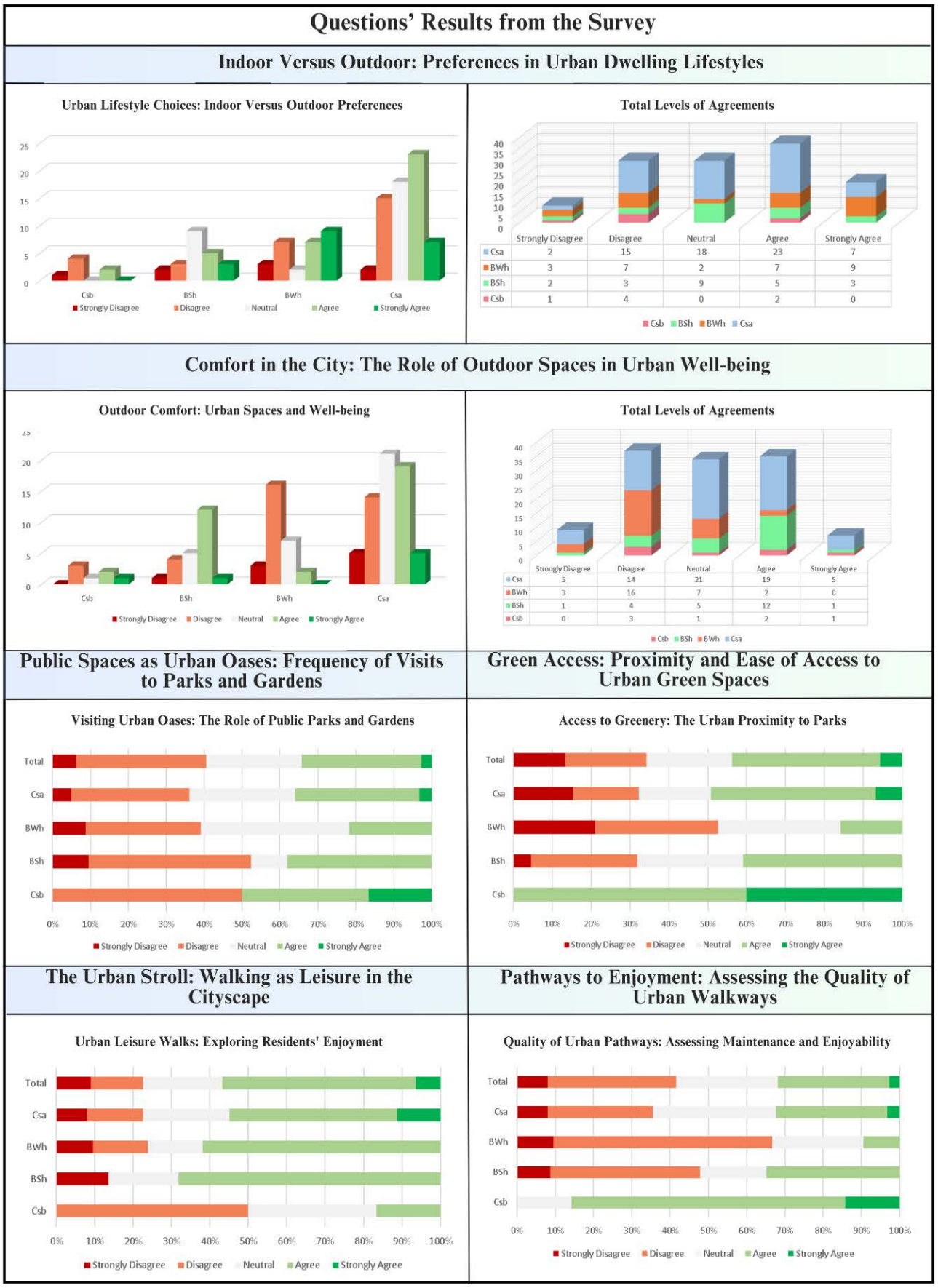

Fig. 2. Urban Greenery and Pedestrian Pathways: Evaluating Accessibility, Maintenance, and Public Use of Outdoor Spaces

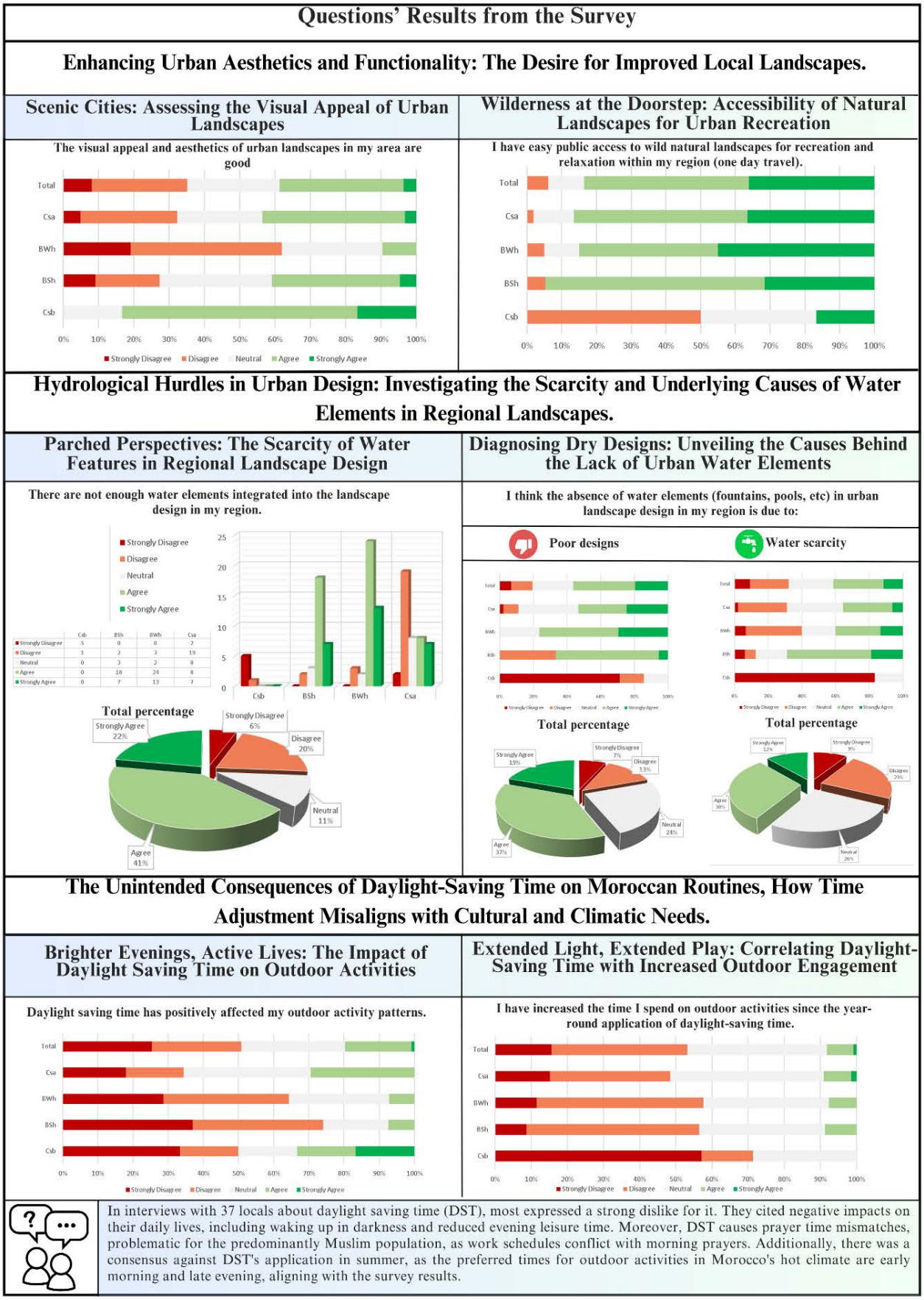

Fig. 3. Challenges and Opportunities in Moroccan Urban Design:
Aesthetic Preferences, Water Scarcity, and Cultural Adaptation to Daylight-Saving Time

Survey respondents also highlighted the scarcity of green spaces within walking distance of their homes, a factor that significantly limits their ability to use public spaces regularly.

This challenge is particularly acute in suburban and peri-urban areas, where urban planning often prioritizes vehicle infrastructure over pedestrian-friendly designs. Enhancing accessibility requires targeted investments in creating interconnected networks of walkable pathways that link urban neighborhoods to green infrastructure. Regular maintenance schedules and participatory planning processes can further ensure that these spaces remain functional and responsive to community needs [14, 18] (Fig.2).

Water Features in Urban Design. Water features, such as fountains, artificial lakes, and pools, play a vital role in enhancing the usability and aesthetic appeal of public spaces, particularly in hot climates like those of Moroccan cities. Survey data indicates a strong public demand for the integration of water elements in urban landscapes, with respondents citing their importance in creating inviting environments and mitigating the effects of extreme heat. These features provide not only physical cooling but also psychological relief, as they evoke a sense of tranquility and connection to nature.

Despite their benefits, the presence of water features in Moroccan public spaces remains limited, particularly in arid and semi-arid regions where water scarcity is a pressing issue. The challenge lies in balancing the demand for cooling elements with the need for sustainable water management. Research supports the implementation of water-efficient designs, such as fountains with recirculating systems and artificial lakes that use treated wastewater, as viable solutions to address these constraints [6, 7]. These strategies ensure that water features can be introduced without placing additional strain on local water resources.

Survey respondents also highlighted the absence of shaded seating areas near existing water features, which limits their usability during peak heat hours. Combining water features with shaded structures, such as pergolas or tree canopies, can significantly enhance their effectiveness, allowing residents to enjoy the cooling benefits while being protected from direct sunlight. Additionally, strategically locating water features in high-traffic areas, such as parks and plazas, can amplify their impact by attracting more users and fostering social interaction.

Urban planners must also consider the cultural significance of water in Moroccan contexts, where traditional designs often incorporate fountains as central elements of courtyards and communal spaces. Drawing inspiration from these cultural traditions can create designs that resonate with local communities while addressing contemporary urban challenges.

Sustainable water features, therefore, serve a dual purpose: they enhance the livability of public spaces while preserving cultural heritage and identity [15, 19] (Fig. 3). Daylight Saving Time significantly affects outdoor activity patterns in Moroccan cities, often clashing with the cultural and climatic realities of the region. Traditionally, residents in hot climates prefer to engage in outdoor activities during the cooler evening hours. However, the implementation of Daylight-Saving Time disrupts these rhythms by extending daylight into warmer periods of the day, reducing the usability of public spaces when they are most needed.

Survey data reveals widespread dissatisfaction with Daylight Saving Time, particularly among residents of desert and semi-arid regions, where extreme heat during the afternoon makes outdoor activities impractical. Respondents highlighted the difficulty of adjusting to these altered schedules, which limit opportunities for evening leisure and social interaction. These disruptions are compounded by insufficient infrastructure in urban spaces, such as inadequate lighting and shading, which fails to accommodate activity patterns shifted by Daylight Saving Time [6, 19].

The impact of Daylight-Saving Time on public space engagement extends beyond comfort to broader concerns about community well-being and inclusivity. In cities where access to green spaces is already limited, policies like Daylight Saving Time exacerbate the challenges of creating functional and welcoming public spaces. Moreover, these disruptions affect specific groups, such as families and older adults, who are more dependent on accessible and comfortable outdoor environments.

To address these challenges, policymakers and urban planners must adopt more culturally and climatically adaptive approaches. For instance, region-specific exemptions or adjustments to Daylight Saving Time could allow evening activities to align with cooler hours. Urban designs can also mitigate the effects of Daylight-Saving Time through features such as enhanced lighting, shaded seating, and cooling zones, ensuring the usability of public spaces regardless of policy shifts [7, 12].

Conclusion. Urban landscape design in Moroccan cities must address the interplay of diverse climatic conditions, cultural practices, and infrastructural limitations to create functional and inclusive public spaces. This study highlights key barriers to outdoor engagement, including extreme heat, poorly maintained pathways, limited green infrastructure, and the scarcity of water features. Survey findings underline the public's strong demand for shaded walkways, accessible parks, and sustainable cooling solutions, all of which are critical for enhancing the usability and appeal of urban spaces.

Daylight Saving Time further complicates the usability of public spaces by misaligning with traditional activity patterns, reducing the opportunities for outdoor leisure during cooler evening hours. This misalignment, combined with inadequate

urban designs, exacerbates the challenges faced by residents in regions with extreme climates. Addressing these issues requires a comprehensive approach to urban planning that integrates both cultural and climatic considerations.

The article proposes actionable strategies, including the integration of shading structures, sustainable water elements, and climate-responsive green infrastructure, to mitigate these challenges. These recommendations aim to align urban designs with the needs of diverse communities while fostering year-round engagement and resilience in the face of climate pressures. By adopting these strategies, Moroccan cities can transform their public spaces into vibrant, inclusive, and sustainable environments that enhance the quality of life for all residents.

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ЛАНДШАФТНИЙ ДИЗАЙН В МІСЬКОМУ СЕРЕДОВИЩІ МАРОККО: КЛІМАТ, КУЛЬТУРА, ПОЛІТИКА

Міський ландшафтний дизайн у містах Марокко є прикладом складних проблем, пов’язаних із перетином різноманітних кліматичних умов, що охоплюють Середземномор’я, пустелі та напівзасушливі зони, і глибоко вкорінених культурних практик. Ці географічні та культурні фактори суттєво впливають на те, як мешканці взаємодіють із громадськими просторами, особливо в регіонах, на які впливають екстремальні температури, висока вологість і сезонні коливання. Незважаючи на критичну важливість відкритих просторів для соціальної взаємодії та благополуччя, жителі стикаються з постійними перешкодами для спілкування на відкритому повітрі. До них належать недостатня кількість затінених зон, погано доглянуті пішохідні доріжки та обмежений доступ до функціональних та естетично привабливих зелених насаджень. Відсутність водних елементів, таких як фонтани, штучні озера чи стійкі системи охолодження, ще більше посилює дискомфорт, який відчувається в міському середовищі, особливо в жарку пору року.

Дані опитування, зібрані в марокканських містах, проливають світло на громадські вподобання та пріоритети, виявляючи високий попит на затінені доріжки, дизайн, що реагує на клімат, і доступну зелену інфраструктуру, яка сприяє активному відпочинку протягом усього року. Мешканці наголошували на естетичних і функціональних перевагах ефективних елементів і доглянутих пішохідних доріжок, підкреслюючи їхній потенціал для перетворення міських просторів на інклюзивне та приємне середовище. Однак ефективність цих

просторів ще більше підривається такими політиками, як перехід на літній час, які не відповідають місцевим культурним ритмам і кліматичним реаліям, зменшуючи можливості для активного відпочинку на свіжому повітрі в оптимальний час і загострюючи невдоволення громадськості.

Ця стаття спирається на дані опитування, щоб проаналізувати взаємодію між екологічними, культурними та політичними факторами, які впливають на зручність використання міських громадських просторів у марокканських містах. У ньому визначено критичні сфери, які необхідно вдосконалити, і запропоновано дієві рекомендації щодо вирішення цих проблем. Запропоновані стратегії включають стратегічне розміщення затінюючих структур, інтеграцію інноваційних водних об'єктів, які віддають пріоритет стійкості, та розвиток зеленої інфраструктури, що реагує на клімат, відповідно до місцевих умов. Поєднуючи зусилля з міського планування з унікальними кліматичними зонами та культурними звичаями Марокко, міста можуть створити яскраве, функціональне та інклюзивне середовище, яке покращить добробут громади, підтримує активність на природі та сприяє сталому міському розвитку в умовах зміни клімату.

Ключові слова: Ландшафтний дизайн; жаркий клімат; клімат-чутливий дизайн; зелена інфраструктура; стійкі водні об'єкти; доступність громадського простору; культурна адаптація.

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