International Journal of Computer Information Systems and Industrial Management Applications
ISSN 2150-7988 Volume 18(9s) 2026 pp. 1444-1454
https://doi.org/10.70917/ijcisim-2026-5484
Article

Modeling the Interdependent Dimensions of Urban Green Space Use: A Perception-Based Analysis in Tabuk City, Philippines

Loneza G. Carbonel[1], Lou Marshal M. Banggawan[2], Yeseleene C. Agacer[3], Evangeline Torres[4]

[1]Research Scholar, Department of Mathematics, R.V.S College of Arts and Science (Affiliated to Bharathiyar University), Sulur, Coimbatore, Tamil Nadu, India.
[2]Assistant Professor, Department of Mathematics, R.V.S College of Arts and Science (Affiliated t1Loneza G. Carbonel Associate Professor V, Kalinga State University, yapyapan1965@gmail.com ORCID 0009-0004-3179-2829 |
3University research associate 2, Kalinga State University, ORCID 0009-0007-2412-8606 yagacer@ksu.edu.ph| Evageline W. Torres, Assistant Professor II, Kalinga State University, ewtorres@ksu.edu.ph, ORCID 009-0007-4745-428X | 4Lou Marshal M. Banggawan, Associate Professor I, Kalinga State University, lmbanggawan@ksu.edu.ph, ORCID:0009-0001-0786-2688o Bharathiyar University), Sulur, Coimbatore, Tamil Nadu, India.

Abstract: This research explores the role of perception-based, interdependently identified factors on urban green space usage in Tabuk City, Philippines. The study, which involved 376 households via survey, examines four dimensions - green space usage, accessibility, environmental safety, and health perception - using descriptive statistics, correlation analysis, and multivariate models. The findings show a very high positive interrelationship between accessibility, safety, and health ($r > 0.80$), suggesting that these factors interact as a single construct perceived by users rather than separate factors. The findings of multiple regression reveal no significant individual effects, reflecting the presence of multicollinearity and implying that green space use reflects a synthesis of cross-influencing effects. The study provides evidence for abandoning mainstream single-variable approaches and embracing multidimensional urban experience-based approaches. This research offers methodological insights by reinterpreting multicollinearity as substantive evidence of interdependent perception and empirical validation for dimensionally inclusive urban green space planning in fast urbanizing regions.
Keywords: Urban green spaces; accessibility; environmental safety; perceived health impact; user perception; urban planning; environmental quality; Philippines

1. Introduction

Urbanization continues to transform cities across the Global South, often in ways that strain both environmental systems and everyday urban life. As land becomes more contested and infrastructure expands, green spaces—parks, tree-lined streets, and community open areas—are frequently reduced, fragmented, or pushed to the margins of planning priorities. Yet their value has become harder to ignore. Urban green spaces play a central role in regulating microclimates, mitigating the urban heat island effect, improving air quality, and supporting both physical and mental health (Kabisch et al., 2021; Kondo et al., 2020; World Health Organization [WHO], 2023). In dense and climate-vulnerable settings such as the Philippines, these functions are not just desirable—they are essential to sustaining livable urban environments (Porio, 2021).

In principle, urban green space systems should be planned with a degree of intentionality that reflects their importance. Ideally, they would be equitably distributed, accessible within walking distance, safe to use, and designed to maximize environmental and social benefits. Planning decisions, in such a system, would rely on integrated data—combining spatial analysis, environmental indicators, and community needs. Yet the reality in many cities diverges sharply from this ideal. In the Philippine context, green spaces are often unevenly distributed and embedded in

incidental forms, such as roadside vegetation or leftover parcels of land, rather than strategically designed public amenities (Gonzales et al., 2017; Saloma, 2021). Even when green spaces exist, they are not always usable in meaningful ways. A park that is difficult to reach, poorly maintained, or perceived as unsafe may remain underutilized despite being physically present.

This points to a deeper issue. The challenge is not simply the lack of green spaces, but the absence of planning frameworks that align spatial allocation with how people actually experience and use these environments. Existing research in the Philippines has contributed important insights, but often in isolated strands. Some studies have mapped the distribution and structure of urban vegetation, revealing clear spatial inequalities (Gonzales et al., 2017). Others have examined governance and policy constraints, highlighting gaps in implementation and enforcement (Paredes, 2022). More recent work has explored accessibility and health outcomes, showing that proximity to green spaces can influence stress levels, physical activity, and overall well-being (Barquilla, 2023; Dela Cruz et al., 2022). These contributions are valuable, yet they remain fragmented. They tend to focus on one dimension at a time—space, policy, or perception—without bringing them together into a unified planning approach.

Attempts to address these issues through policy and design have also encountered limitations. Regulations such as Presidential Decree No. 1216 mandate the inclusion of open spaces in residential developments, but compliance is inconsistent and often overshadowed by competing land-use priorities (Paredes, 2022). Case studies of urban parks in Philippine cities further suggest that even designated green spaces may suffer from underutilization, overcrowding, or inadequate maintenance, limiting their effectiveness (Castilla et al., 2024). The result is a pattern that is familiar in many urban areas: green spaces exist, but they do not fully function as intended. And when that happens, the consequences extend beyond aesthetics. Poorly planned green spaces reduce environmental benefits, limit recreational opportunities, and reinforce social inequalities, particularly for communities with fewer alternatives (Rigolon et al., 2021; Nesbitt et al., 2019).

At this point, the limitation of current approaches becomes more apparent. Spatial models can tell us where green spaces are located, but not necessarily whether people feel comfortable using them. Perception studies capture how people experience these spaces, but often stop short of informing actual planning decisions. Optimization models, on the other hand, offer tools for efficient resource allocation but typically rely on purely quantitative inputs, overlooking the subjective dimensions that shape real-world usage (Meerow & Newell, 2019; Li et al., 2022). What remains missing is a framework that brings these elements together—one that treats human perception not as an afterthought, but as a central input in planning decisions.

This study responds to that gap by examining how perception-based dimensions of urban green spaces interact to shape usage and whether these dimensions operate as independent predictors or as a unified experiential construct. Rather than assuming that accessibility, safety, and health benefits operate independently, the research explores how these factors interact and how they can be interpreted to generate empirically grounded insights relevant to urban green space planning. Specifically, this study aims to: (1) assess the condition of green spaces in terms of usage, accessibility, environmental safety, and perceived health impact; (2) analyze the interrelationships among these dimensions; and (3) evaluate whether these factors operate as independent predictors or as a unified experiential construct influencing green space utilization.

Underlying these objectives is a broader proposition—that urban green space planning becomes more meaningful when it accounts for how people actually experience space, not just how it is distributed on a map. A small, accessible, and well-maintained park may contribute more to community well-being than a larger but neglected one. This is the kind of nuance that conventional models often miss, and it is precisely what this study attempts to capture.

From an academic perspective, the study contributes to ongoing efforts to bridge methodological divides in urban research. By combining descriptive and multivariate analysis, the study offers an empirically grounded approach to understanding how user perceptions shape green space utilization. From a policy standpoint, the research provides a potential decision-support framework for local governments, particularly in resource-constrained settings where

planning choices carry significant trade-offs (Porio, 2021; Paredes, 2022). At a practical level, it speaks to everyday urban realities—where the presence of green space does not always translate into meaningful use, and where planning decisions can either reinforce or reduce these gaps.

Seen through the lens of the Create-A-Research-Space (CARS) model, the trajectory of this study becomes clearer. The importance of urban green spaces is well established, forming the broader territory of inquiry. What remains uncertain is how to integrate spatial, environmental, and perceptual dimensions into a single, operational framework—this defines the niche. The present study occupies that niche by proposing and empirically examining how perception-based dimensions interact as a unified construct influencing green space use. In doing so, it moves toward a more comprehensive understanding of urban green space planning—one that is both analytically rigorous and grounded in lived experience.

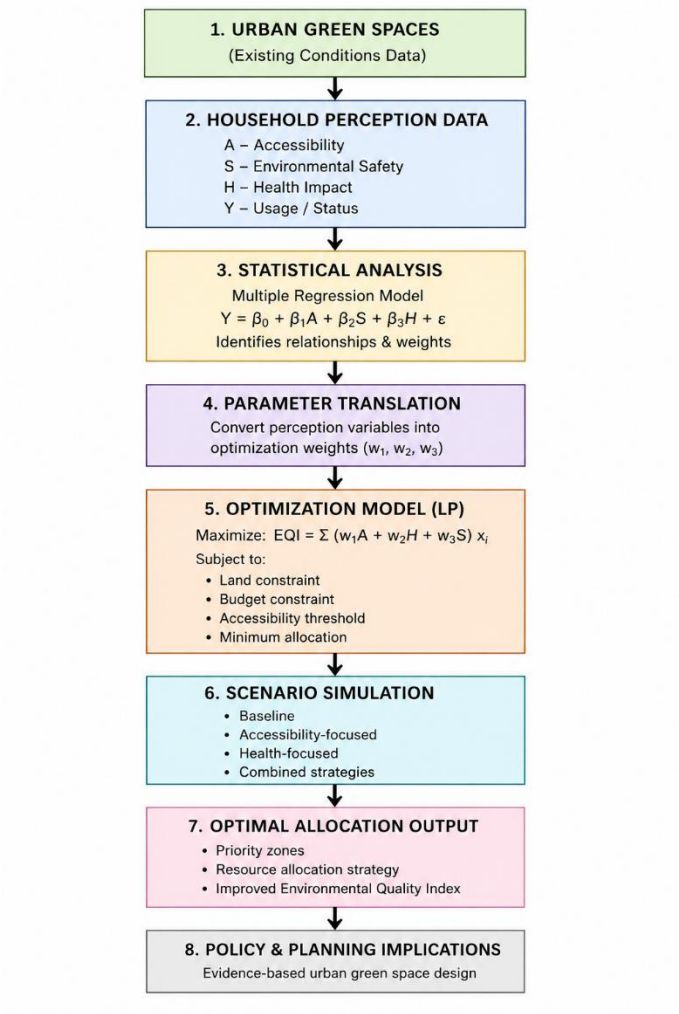

Figure 1. Conceptual Framework

The conceptual framework positions green space usage as a function of interrelated perception-based dimensions. Accessibility, environmental safety, and perceived health impact are treated as overlapping constructs that jointly shape user behavior. Rather than functioning as independent predictors, these variables are hypothesized to form a unified experiential construct that influences utilization. The framework thus emphasizes multidimensional perception as the central mechanism linking green space conditions to user engagement.

2. Literature Review

Urban green spaces have become a defining element of sustainable urban development, not simply as passive environmental features but as active infrastructures that influence ecological stability, human health, and social equity. In contemporary urban research, they are increasingly framed as nature-based solutions that address multiple urban challenges simultaneously—ranging from climate adaptation to public well-being (Kabisch et al., 2021; Haaland & van den Bosch, 2021). Their relevance is particularly pronounced in rapidly urbanizing regions, where environmental degradation and population pressures converge. Within this context, the need to understand not only the presence but also the effectiveness of green spaces has intensified, prompting a diverse body of literature that spans spatial analysis, public health, and optimization modeling.

One dominant stream of research has focused on the spatial distribution and accessibility of urban green spaces. Using geographic information systems (GIS) and remote sensing, studies have documented persistent inequalities in green space provision across cities. For example, Wolff et al. (2020) analyzed accessibility patterns in European cities and found that compact urban development often reduces equitable access to green spaces despite overall efficiency gains. Similarly, Dai (2021) demonstrated that socioeconomically disadvantaged populations in urban areas tend to have significantly less access to green infrastructure. These studies are methodologically robust, relying on spatial metrics and network-based accessibility measures. However, they tend to operationalize accessibility primarily in terms of distance or area coverage, thereby overlooking qualitative dimensions such as perceived safety, usability, and experiential value. As a result, while they effectively identify where green spaces are lacking, they provide limited insight into how these spaces function in practice.

Closely related to spatial studies is the literature on environmental justice and equity in green space distribution. Nesbitt et al. (2019) and Rigolon et al. (2021) provide compelling evidence that access to urban vegetation is unevenly distributed, often reflecting broader socioeconomic disparities. These studies extend the discussion beyond spatial metrics by situating green space within the context of social inequality. Their findings suggest that simply increasing green space quantity does not necessarily lead to equitable outcomes, as issues of accessibility and quality remain critical. However, while these works highlight disparities, they stop short of offering actionable frameworks for reallocating resources or optimizing green space provision in a way that addresses these inequities.

A third major body of literature examines the health and well-being impacts of urban green spaces. Systematic reviews and meta-analyses have consistently shown that exposure to green environments is associated with reduced stress, improved mental health, and increased physical activity (Twohig-Bennett & Jones, 2018; Kondo et al., 2020). More recent studies have refined these findings by exploring specific mechanisms, such as stress recovery and attention restoration (Haaland & van den Bosch, 2021). While this body of work provides strong empirical support for the benefits of green spaces, it is largely correlational in nature. The reliance on observational data and self-reported measures limits its ability to inform causal relationships or guide concrete planning decisions. Moreover, these studies typically treat health outcomes as dependent variables, without considering how these insights can be translated into planning models that inform resource allocation.

In response to these limitations, recent research has begun to explore advanced measurement techniques for assessing green space exposure. For instance, Zhang et al. (2023) utilized street-level imagery and machine learning to quantify perceived greenery, offering a more nuanced understanding of how individuals visually experience urban environments. Similarly, Li et al. (2022) employed spatial optimization techniques to assess urban greenery distribution, integrating environmental and infrastructural data. These methodological advancements represent a shift toward more sophisticated and multidimensional analyses. However, they remain largely descriptive and do not fully integrate subjective perception with decision-making frameworks.

Parallel to these developments is a growing body of work on optimization and decision-support models in urban planning. Mathematical programming approaches, including linear programming and multi-objective optimization, have been applied to allocate land resources efficiently while balancing environmental and social objectives. Artmann et al. (2019) highlight the potential of such models to improve green space planning by incorporating spatial equity considerations. Meerow and Newell (2019) further argue that resilience-based planning requires integrative

frameworks capable of addressing multiple urban systems simultaneously. While these studies demonstrate the potential of optimization techniques, they are often limited by their reliance on quantitative inputs, such as land availability and population density, without incorporating qualitative dimensions such as user perception or experiential quality.

Despite advances in spatial, health, and perception-based research, a critical gap remains in understanding whether key dimensions of green space experience operate independently or as interdependent constructs. While many studies model accessibility, safety, and health outcomes as separate predictors, emerging evidence suggests that these factors may be highly correlated, reflecting a unified perception of environmental quality. However, this interdependence has rarely been examined empirically or interpreted as a substantive phenomenon rather than a statistical limitation. Addressing this gap is essential for developing planning frameworks that reflect how users actually experience urban green spaces.

A smaller but increasingly important strand of research focuses on perception-based evaluation of green spaces. Studies in this area emphasize that the effectiveness of green spaces is not determined solely by their physical attributes but also by how they are perceived and experienced by users. For example, Sugiyama et al. (2010) found that perceived safety and attractiveness significantly influence the likelihood of park use, even when objective accessibility is high. More recent work by Kyttä et al. (2016) integrates participatory mapping with spatial analysis to capture user experiences in urban environments. These studies underscore the importance of subjective dimensions in shaping green space usage. However, they often remain disconnected from formal planning models, limiting their practical application in decision-making processes.

When these strands of literature are examined collectively, several patterns and gaps emerge. First, there is a clear consensus on the importance of urban green spaces for environmental sustainability and human well-being. Second, there is substantial methodological diversity, reflecting the complexity of the topic. However, these approaches are largely siloed. Spatial studies prioritize distribution, health studies focus on outcomes, while there remains a lack of empirical work that rigorously examines whether perception-based variables function independently or as an integrated construct shaping green space usage. Perception studies, meanwhile, highlight experiential dimensions but lack integration with planning tools. This fragmentation results in a significant gap: the absence of frameworks that simultaneously consider spatial, environmental, and perceptual dimensions in a unified model.

Contradictions within the literature further highlight this gap. While some studies emphasize the quantity of green spaces as the primary determinant of benefits, others argue that quality and accessibility are more critical (Haaland & van den Bosch, 2021). Evidence suggests that increasing green space coverage alone does not guarantee improved outcomes; rather, the effectiveness of these spaces depends on how they are designed, maintained, and perceived. This tension points to the need for integrative approaches that move beyond single-dimensional metrics.

Overall, the current state of the literature reflects a field that has generated substantial knowledge but lacks coherence in application. Existing studies provide valuable insights into individual aspects of urban green spaces, yet they do not fully align with the objectives of developing actionable, data-driven planning tools. In particular, there is a lack of empirical work that integrates perception-based variables into formal optimization frameworks. This gap is especially critical in rapidly urbanizing contexts, where planning decisions must balance environmental, social, and economic considerations under resource constraints.

This study addresses these limitations by proposing an empirical examination of how perception-based variables interact and whether they function as independent predictors or as a unified construct in shaping green space usage. By examining how variables such as accessibility, safety, and perceived health impact interact, the study seeks to bridge the divide between human-centered and systems-based approaches. In doing so, it contributes to the development of more comprehensive and practically applicable models for urban green space planning, aligning closely with the identified gaps in the literature.

While optimization models offer valuable planning tools, their reliance on purely quantitative inputs limits their ability to capture experiential dimensions, reinforcing the need for perception-based empirical approaches such as the one adopted in this study.

3. Methodology

This study employs a cross-sectional quantitative design supported by qualitative contextual insights to examine how household perceptions of green spaces influence usage patterns. The methodological structure focuses on examining how residents experience green spaces and analyzing the interrelationships among perception-based dimensions and their combined influence on usage patterns.

3.1 Research Design

The study combines quantitative modeling and qualitative interpretation within a single analytical framework. The quantitative component examines the relationships between key perception variables—accessibility, environmental safety, and health impact—and the usage of green spaces. Qualitative responses were used illustratively to support and contextualize quantitative findings. This integration ensures that the resulting model is both analytically rigorous and grounded in actual community conditions.

3.2 Study Area and Sampling

The research was conducted in selected urban barangays of Tabuk City, Philippines, chosen for their relatively dense population and varied distribution of green spaces. A total of 376 households were selected using stratified random sampling, ensuring representation across different zones within the barangays. This sampling approach allows for a more balanced assessment of green space conditions and perceptions across diverse local contexts.

3.3 Data Collection

Data were collected using a structured survey questionnaire complemented by open-ended questions. The instrument was designed to measure four key dimensions:

- Usage (Status of green spaces)
- Accessibility
- Environmental Safety
- Perceived Health Impact

All quantitative items were measured using a 5-point Likert scale, ensuring consistency and sensitivity in capturing respondent perceptions. The questionnaire was pre-tested for clarity and reliability prior to full deployment. Ethical protocols were followed, including informed consent and voluntary participation.

In addition, qualitative responses were gathered to provide deeper insight into how residents interpret accessibility barriers, safety concerns, and health benefits. These narratives were used to contextualize quantitative findings and validate model assumptions.

3.4 Variable Operationalization

The study defines:

- Dependent Variable:
  Usage (Y) – frequency and extent of green space utilization
- Independent Variables:
  Accessibility (A) – ease of reaching and using green spaces

Environmental Safety (S) – perceived security and maintenance
Health Impact (H) – perceived physical and mental benefits

Composite scores were computed for each variable based on survey responses.

3.5 Statistical Analysis

To address the objective of examining relationships among perception variables, a multiple linear regression model was employed:

$$Y = \beta_0 + \beta_1 A + \beta_2 S + \beta_3 H + \epsilon$$

The analysis aimed to identify patterns of association rather than strict causal inference, given the potential overlap among perception variables. Diagnostic tests were conducted to assess multicollinearity and model fit. The regression results were used to assess the independence and stability of perception-based predictors and to examine the presence of multicollinearity.

In addition to multiple regression, multicollinearity diagnostics were conducted using Variance Inflation Factor (VIF) analysis. Given the high intercorrelations among predictors, supplementary analysis using composite indexing was applied to examine whether accessibility, safety, and health perception form a unified latent construct influencing usage.

3.6 Composite Index Construction

Due to high multicollinearity among perception variables, a composite index representing overall perceived green space quality was constructed by averaging standardized scores of accessibility, safety, and health perception. This approach allows examination of their combined effect while avoiding instability in regression estimates.

4. Results and Discussion

This section presents the findings in alignment with the specific objectives of the study. Each subsection integrates quantitative results, visual representations, and critical interpretation grounded in existing literature and theory.

Identify Existing Urban Green Spaces

Table 1. Types and Distribution of Urban Green Spaces

Type of Green Space	**Frequency**	**Percentage (%)**
Tree-lined Roads	232	61.7
School Green Areas	65	17.3
Garden / Open Fields	29	7.7
Church Green Areas	25	6.6
City Green Parks	20	5.3
Children's Parks	5	1.3
Total	**376**	**100.0**

The findings show that tree-lined roads constitute the dominant form of green space, accounting for more than half of all identified areas. In contrast, formal recreational spaces such as city parks and children's parks remain limited.

This pattern suggests that green space provision in the study area is largely incidental rather than planned, a condition also observed in Philippine urban settings (Gonzales et al., 2017). While tree-lined roads contribute to

environmental functions such as shading and air quality improvement, they do not fully support active recreational use or social interaction.

The imbalance between incidental and formal green spaces reflects a structural issue in urban planning—one where environmental considerations are integrated into infrastructure but not developed as standalone public amenities.

Assess Status of Green Spaces

Table 2. Mean Perception Scores

Green Space Type	Usage (Y)	Accessibility (A)	Safety (S)	Health Impact (H)
Church Green Area	2.10	2.25	2.35	2.40
Garden/Open Fields	2.25	2.40	2.50	2.55
Tree-lined Roads	2.32	2.38	2.55	2.60
School Green Area	2.28	2.50	2.60	2.65
City Green Park	2.40	2.55	2.63	2.70
Average	**2.27**	**2.42**	**2.53**	**2.58**

All dimensions fall within a moderate range, suggesting that while green spaces are available, their overall performance remains suboptimal. Among the different types, city parks and school green areas obtain relatively higher scores, indicating that structured and well-maintained environments tend to provide greater perceived value to users. This observation is consistent with prior findings that emphasize the importance of quality and usability over mere availability in determining the effectiveness of green spaces, as discussed by Kondo et al. (2020).

In contrast, lower scores for church areas and open fields point to potential limitations related to accessibility, maintenance, or design. The results further reveal an important insight: commonly available green spaces are not necessarily the most valued or most utilized. For instance, tree-lined roads, despite being the most prevalent, do not register the highest usage levels. This reinforces the distinction between simple presence and functional utility, highlighting that frequency of occurrence does not automatically translate to meaningful engagement.

Examine Relationships Between Variables

Table 3. Correlation Matrix

Variables	Usage	Accessibility	Safety	Health
Usage	1.00	0.90	0.88	0.86
Accessibility	0.90	1.00	0.84	0.87
Safety	0.88	0.84	1.00	0.91
Health	0.86	0.87	0.91	1.00

The correlation matrix reveals consistently strong positive relationships among all variables. This indicates that improvements in accessibility, safety, and health perception are associated with increased usage.

However, the strength of these correlations ($r > 0.80$) also suggests multicollinearity, meaning that these variables are not independent. Instead, they appear to represent overlapping dimensions of user experience.

This finding challenges traditional models that treat accessibility or safety as separate predictors (Wolff et al., 2020). Instead, it supports a more integrated perspective, where user perception is shaped by a combination of factors that operate simultaneously.

Table 4. Regression Results

Variable	Coefficient (β)	p-value
Accessibility	0.2661	0.742
Safety	0.0903	0.915
Health Impact	0.5239	0.591

The regression results indicate that none of the individual predictors are statistically significant despite high overall model fit. This pattern is consistent with severe multicollinearity, where overlapping variance among predictors prevents reliable estimation of independent effects. Rather than indicating a lack of relationship, this finding suggests that accessibility, safety, and perceived health impact operate as interdependent dimensions of a broader experiential construct.

This finding is particularly important, as it suggests that green space usage cannot be effectively enhanced by focusing solely on a single factor. Instead, improvements must occur concurrently across multiple dimensions, supporting a more integrated perspective. Such an interpretation aligns with systems-based approaches in urban planning, as emphasized by Meerow & Newell (2019).

The consistently high correlations among variables ($r > 0.80$) provide substantive evidence that users do not perceive accessibility, safety, and health benefits as separate attributes, but as integrated aspects of overall environmental quality. This challenges conventional modeling approaches that treat these factors independently and suggests the need for multidimensional planning strategies.

Composite Effect

The composite index demonstrates a clearer and more consistent positive association with usage compared to individual variables, suggesting that integrated perception measures better capture user experience.

5. Conclusion

This research shows urban green space use is explained by neither accessibility, nor perception of safety and health, but rather by integrated perception of accessibility, safety and health. The presence of strong multicollinearity among these variables is not merely a statistical limitation but reflects the inherently interconnected nature of user perception. They demonstrate the need to shift from unidimensional to holistic and user-focused planning methods. The analysis reframes multicollinearity as substantive evidence of user perception, and thus contributes to methodological and practical debates in urban planning, especially in low-resource and fast-growing environments.

Consistently moderate ratings across the key dimensions suggest not failure but rather underperformance, reflecting potential missed opportunities. The elevated scores with parks and school grounds reflect the role of design, maintenance, and accessibility in green space quality assessment. Most importantly, the research reveals that accessibility, safety, and perceived health benefits are highly correlated but not individually linked to usage patterns, suggesting multicollinearity and, more thoughtfully, the interdependence of experiential aspects of green spaces. This indicates that the use of green space is the product of a constellating set of factors, a conclusion that augments both affordance approaches to urban green and more systems-centred urban infrastructural planning.

The study advances methodology by providing empirical support for multidimensional, perceptual urban green space planning and furnishes insights for harnessing user perceptions as a lens for holistic and user-friendly green space planning approaches. From a policy standpoint, the findings challenge provision-oriented planning paradigms and emphasize the need to prioritize quality, accessibility, and experiential coherence over quantity-based metrics. Despite the study's limitations (decision-making based on perceptions, dealing with multicollinearity and spatial modelling), they do not undermine the study's core message: planning for urban green spaces needs to shift its focus from provision to user experience. In the end, the study offers a paradigm shift in green infrastructure planning that views successful use through the lens of the integration and harmonization of multiple and complementary aspects of user experience rather than volume-based metrics driven by provision-based approaches.

6. Recommendations

This study offers insights into the need for reprioritizing the planning, assessment and implementation of urban green infrastructure. Instead of primarily planning towards provision goals, it is important to consider functional quality and perceived quality of the spaces, with accessibility, safety, and perceived health benefits as interrelated factors.

In terms of policy change, local public units should shift their focus from compliance-based management towards evidence-based planning that takes into account community perception. This can be achieved through regular surveys or community planning processes, ensuring that park investments align with user perceptions rather than solely spatial considerations.

Subsequent research should make use of latent variable methods, such as structural equation modeling, to continue exploring how perception variables are interdependent. Spatial data analysis using GIS would also help to better understand the relationship between experiential and physical accessibility. Longitudinal research is encouraged to measure the temporal impacts of changes in green space quality on perception.

Finally, we recommend additional research to investigate interaction effects between perception variables using statistical techniques, and to investigate longitudinal changes in green space use. Incorporation of socioeconomic and demographic variables would also allow for considering the variability of green space perception and access.

In summary, these recommendations highlight the need to focus on more than quantity in urban green space development; it is important to achieve consistency, user-friendliness and holistic design and decision-making processes.

REFERENCES

1. Artmann, M., Inostroza, L., & Fan, P. (2019). How smart growth and green infrastructure can mutually support each other—A conceptual framework for compact and green cities. *Ecological Indicators, 96*, 10–19. https://doi.org/10.1016/j.ecolind.2017.07.001
2. Barquilla, C. A. M. (2023). Greenspace proximity and stress reduction among urban residents in Pasig City. *Urban Forestry & Urban Greening, 79*, 127789. https://doi.org/10.1016/j.ufug.2023.127789
3. Castilla, D. G., Reyes, M. L., & Santos, R. J. (2024). Urban green spaces and human wellbeing: Assessing the carrying capacity of parks in Danao City, Philippines. *Journal of Environmental Planning and Management*. https://doi.org/10.1080/09640568.2023.2173456
4. Dai, D. (2021). Racial/ethnic and socioeconomic disparities in urban green space accessibility. *Urban Forestry & Urban Greening, 58*, 126952. https://doi.org/10.1016/j.ufug.2020.126952
5. Gonzales, L. P., Magnaye, M. A., & Briones, N. D. (2017). Distribution and structure of urban green spaces in Metro Manila, Philippines. *Urban Forestry & Urban Greening, 22*, 47–54. https://doi.org/10.1016/j.ufug.2017.01.002
6. Haaland, C., & van den Bosch, C. K. (2021). Challenges and strategies for urban green-space planning in cities undergoing densification: A review. *Urban Forestry & Urban Greening, 61*, 127118. https://doi.org/10.1016/j.ufug.2021.127118
7. Kabisch, N., Korn, H., Stadler, J., & Bonn, A. (2021). Nature-based solutions to climate change mitigation and adaptation in urban areas: Perspectives on indicators, knowledge gaps, barriers, and opportunities. *Sustainability, 13*(4), 1725. https://doi.org/10.3390/su13041725
8. Kondo, M. C., Fluehr, J. M., McKeon, T., & Branas, C. C. (2020). Urban green space and its impact on human health. *International Journal of Environmental Research and Public Health, 17*(7), 2328. https://doi.org/10.3390/ijerph17072328
9. Kyttä, M., Broberg, A., Haybatollahi, M., & Schmidt-Thomé, K. (2016). Urban happiness: Context-sensitive study of the social sustainability of urban settings. *Environment and Planning B: Urban Analytics and City Science, 43*(1), 34–57. https://doi.org/10.1177/0265813515600121
10. Li, X., Zhang, C., Li, W., & Ricard, R. (2022). Assessing urban greenery using spatial optimization models. *Landscape and Urban Planning, 224*, 104421. https://doi.org/10.1016/j.landurbplan.2022.104421
11. Meerow, S., & Newell, J. P. (2019). Urban resilience for whom, what, when, where, and why? *Urban Geography, 40*(3), 309–329. https://doi.org/10.1080/02723638.2016.1206395
12. Nesbitt, L., Meitner, M. J., Girling, C., Sheppard, S. R. J., & Lu, Y. (2019). Who has access to urban vegetation? A spatial analysis of distributional equity. *Landscape and Urban Planning, 181*, 51–79. https://doi.org/10.1016/j.landurbplan.2018.08.017

13. Porio, E. (2021). Urbanization and climate change vulnerability in Philippine cities. *Asian Journal of Social Science, 49*(2), 123–140. https://doi.org/10.1163/15685314-bja10029
14. Rigolon, A., Browning, M. H. E. M., & McAnirlin, O. (2021). Green space and health equity: A systematic review. *Landscape and Urban Planning, 210*, 104064. https://doi.org/10.1016/j.landurbplan.2021.104064
15. Sugiyama, T., Leslie, E., Giles-Corti, B., & Owen, N. (2010). Associations of neighbourhood greenness with physical and mental health: Do walking, social coherence, and local social interaction explain the relationships? *Journal of Epidemiology & Community Health, 64*(7), 563–568. https://doi.org/10.1136/jech.2009.084921
16. Twohig-Bennett, C., & Jones, A. (2018). The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. *Environmental Research, 166*, 628–637. https://doi.org/10.1016/j.envres.2018.06.030
17. Wolff, M., Haase, D., & Haase, A. (2020). Compact city development and green space accessibility: The impact of densification on green space availability in European cities. *Landscape and Urban Planning, 196*, 103731. https://doi.org/10.1016/j.landurbplan.2019.103731
18. Zhang, Y., van Dijk, T., Tang, J., & van den Berg, A. (2023). Green space accessibility and urban well-being: A systematic review. *Cities, 131*, 103987. https://doi.org/10.1016/j.cities.2022.103987
19. World Health Organization. (2023). *Urban green spaces and health: Evidence review*. WHO Regional Office for Europe.