

**LA CALIDAD ESTA EN TODAS PARTES: UNA PROPUESTA DE
INVESTIGACION PARA AVALUAR LA SUSTENTABILIDAD
MEDIOAMBIENTAL DE LOS PARQUES URBANOS**

**QUALITY IS EVERYWHERE: A RESEARCH PROPOSAL TO ASSESS
ENVIRONMENTAL SUSTAINABILITY OF URBAN PARKS**

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Resumen: Además de ser quizás la forma más refinada de espacio público, los parques urbanos a gran escala son catalizadores de la mejora medioambiental en las concentraciones urbanas, ya que proporcionan una multiplicidad de servicios que van desde la purificación del aire hasta la regulación térmica o sonora. La literatura reporta que la sustentabilidad ambiental de los parques urbanos ha sido un tema cuyo estudio ha sido atomizado, sin una consideración holística. El objetivo de este artículo es presentar una propuesta de investigación para estimar la sustentabilidad ambiental de un parque urbano de tamaño considerable. La propuesta incluye el desarrollo de un esquema de evaluación que considera ocho factores de evaluación. Para cada factor, se desarrollan indicadores globales, sin que el modelo profundice en cada uno de ellos, ya que el enfoque de este trabajo enfatiza en la amplitud de la cobertura. Los factores a considerar fueron: paleta vegetal, tipo de superficie, protección contra la erosión eólica, consumo de agua, regulación térmica, regulación sonora, capacidad de captación de agua y reciclaje de materiales orgánicos. Se presenta una discusión general del modelo. Por último, se delimitan las conclusiones del estudio y se reconocen las limitaciones del modelo propuesto.

Palabras clave: servicios ecosistémicos, evaluación de la sostenibilidad, huella ecológica, gestión de espacios verdes, urbicida.

Abstract: Besides being the most refined form of public space, large-scale urban parks are conceived as catalysts for environmental improvement in urban settings. These spaces provide a multiplicity of services, ranging from air purification to thermal or sound regulation. The related literature reports that the environmental sustainability of urban parks is a topic whose study has been atomized, without a holistic consideration. The objective of this paper is to present a research proposal for estimating the environmental sustainability of an urban park of large size. The proposal includes the development of an evaluation scheme that considers eight evaluation factors. For each factor, global indicators are developed, without delving deep into in each one of them, because the approach emphasizes the breadth of coverage. The factors to be considered were vegetal palette, surface type, protection against wind erosion, water consumption, thermal regulation, sound regulation, water capture capacity and recycling of organic materials. A general discussion of the model is presented. Finally, conclusions are drawn from the study, and the limitations of the proposed model are acknowledged.

Keywords: ecosystem services, sustainability assessment, ecological footprint, green space management, uricide.

INTRODUCCIÓN

Urban parks, particularly those of large scale, play a crucial role in urban settings. These entities are often considered the most refined format of public space due to the multifunctionality of their conformation. Urban parks rise to a wide variety of services related to naturalness, while promoting the encounter between heterogeneous social groups (Campbell et al., 2019).

Contemporary scientific conceptions of urbanism stress the undesirable consequences of urbanization processes when sustainable considerations and practices are not taken into account. In this sense, urban parks are conferred with the capacity to cope with the degradation derived from rapid urbanization. Moreover, it is recognized that urban parks have the potential to slow down, even halt and reverse the degradation processes that would eventually lead to urbicide, i.e., the death of the city (Carrión-Mena, 2023).

The evolution of research regarding the assessment of urban parks sustainability is still incipient. It was not possible to identify a comprehensive work in this area. To date, it has only been possible to identify a few publications that focus on conceiving an evaluation model. The pioneering conceptual contributions of Vélez-Restrepo, (2009), García & Guerrero (2006) and Craz & Boland (2004) are recognized in terms of suggesting plausible avenues for the study of the sustainability of urban parks.

An urban park is an entropic, complex, and multifunctional system that provides a wide variety of environmental, social, and economic services (Sandoval-Chávez et al., 2024). If the park is provided with the pertinent resources and proper management is exercised, the "park" system sets in motion several complex, intricate and highly interacting processes, including hydrological, biochemical, social and economic processes, to mention just a few. However, when attempting to approach the study aimed at estimating the level of sustainability of urban parks, the intense interaction between the environmental, social and economic axes is often overlooked.

The literature suggests that a systemic conception of public space is needed. Indeed, public space is a superordinate concept, that is, a suprasystem to which urban parks belong. The above constitutes a premise to identify and understand the factors that affect the sustainability of these spaces and how the interaction between the many processes takes place (Jansson & Lindgren, 2012; Chan et al., 2018) . A Mexican

standard highlights the enormous importance of conceiving public space in terms of a systemic entity and has made explicit its requirements and characteristics (SEDATU, 2021) .

From an environmental standpoint, several studies have attempted to address the factors affecting the sustainability of urban parks. To mention just a few, the role of vegetation has been addressed in depth, in particular issues related to the conformation of trees and other forms of vegetation, species inventory, surface area covered or allergenicity of species (Guillen-Cruz et al., 2021 ; Cariñanos et al., 2017; Daniels et al., 2018). Air purification, perhaps the most recognized environmental service of vegetation, has also been studied in depth. The advent of systems such as i-Tree Eco, ENVI-met or CFD renewed the study of the ability of vegetation in urban parks to remove, filter or intercept pollutants, as well as to capture and deposit carbon and particulate matter (Lin et al., 2019; Meissner et al., 2019; Rackley, 2017). Regulation services, including thermal comfort (Kumar & Sharma, 2022 ; Wei et al., 2022 ; Aram et al., 2020), as well as acoustic comfort (Mohammadzadeh et al., 2023; Ren, 2023). Other environmental factors in urban parks, such as soil quality, wind protection or recycling practices, have received less attention (Ranasinghe et al., 2019; Pan et al., 2019) ; Chifari et al., 2017) .

Charoenkit & Piyathamrongchai (2019), Parés-Franzi et al. (2006) and Oke et al. (1989) conducted studies to assess the overall environmental sustainability of urban parks. The scope of these studies was limited to a specific set of indicators and restricted by the particularities of the case studies presented. Thus, so far, research efforts aimed at estimating the environmental sustainability of urban parks are perceived as isolated and fragmented.

Not much has been published on a comprehensive scheme of indicators to assess the environmental profile of an urban park. The study of this topic seems to concentrate on monodisciplinary issues. The available studies delve deep into a particular factor, or at most a small set of factors, without a systemic appreciation. Given the importance of the urban park system as a multifunctional space, it is somewhat perplexing that the study of the environmental sustainability of this relevant format of public space is lagging behind. The perceived inertia in the evolution of the subject can be explained by the fact that the "urban park" system is a very complex entity conceived as a non-spontaneous space of naturalness in which, just from an environmental perspective alone, several disciplines would be involved in the study of this multifaceted

space. Within this framework, this paper aims to establish a research proposal for the development of a model to estimate the level of sustainability of a large-scale urban park.

Method

A prospective research proposal is purported. This proposal considers a scheme for an eventual cross-sectional study through a dual inductive-deductive approach. The proposal goes through three phases. In the first phase, a group of seven experts from the following disciplines was formed: architecture, agronomy, sociology and administration. In the second phase, environmental sustainability indicators and their relative importance were identified and agreed upon. Finally, in the third phase, the evaluation framework with the proposed model is established.

Results

A panel of experts held three sessions to discuss the research team's proposal. After several suggestions and adjustments, the group of experts reached an acceptable degree of agreement (Friedman's ANOVA, $p < 0.240$). Table 1 shows the eight agreed indicators of environmental sustainability.

Table 1. *Indicators for estimating the environmental sustainability of urban parks.*

Indicator	Description	Variable/attribute	Level or unit	References
Vegetable palette	Species and number of plant elements	Adequacy to the region.	Ordinal categories via weighting algorithm	Vegetable palette
State of conservation	Ordinal categories via weighting algorithm	Morales-Vasquez, et al. (2018), Bae and Ryu, (2015a),	of each type	State of conservation
Wind protection	Presence of protective barriers	Type of barrier	Level of protection	Ranasinghe et al. (2019).
Water consumption	Volume of water for irrigation	Treated water	Water consumption	Volume of water for irrigation
Thermal regulation	Gradient	Internal/external temperature (air)	Temperature in (o)C	Brown, Vanos, Kenny, and Lenzholzer (2015), Avdan

				and Jovanovsk (2016).
Sound regulation	Indoor/outdoor gradient	Internal/external sound pressure	Sound pressure level in dB	Lee et al. (2018), Cohen and Castillo (2017)
Rainwater harvesting	Permeable and impermeable surface radius	Type of coverage	% permeable coverage	EPA (2007), Lancaster (2014). Haaland and van den Bosch (2015).
Recycling of organic matter	Ability to close the nutrient cycle	Type of recycled material	Volume of recycled material	Chifari et al. (2017).

Source: own elaboration based on expert consensus

- a. Vegetation would be surveyed during the active stage considering two factors: a) species suitability and b) conservation status. Basic and standard dendrometry-based practices and appreciation techniques would help assess both factors (USDA, 2018) . The census would include trees whose diameter at breast height (1.30 m) was equal to or greater than 0.10 m (Lin et al., 2019; Nowak & Crane, 2000). Applicable characteristics and quality attributes of shrubs and herbs would be reported.
- b. Three forms of surface area would be studied in relation to the park's total area: natural, protected, and impervious vegetation. To measure these ratios, the Google Earth© satellite platform would be used and on-site inspections would be carried out.
- c. This indicator would be based on Meissner et al. (2019) and NSW (2017) , the quality of wind protection of the surrounding areas of the park in the west, west-southwest, south-southwest, and south orientations would be simplified into four categories. A photographic memory of each windbreak would be maintained.
- d. This variable would be studied in conjunction with the annual volume of treated water supplied by the city's water utility, if any.
- e. At least six adjacent to city avenues or streets and six non-adjacent points of the park would be studied. A visual inspection would allow the selection of points to be studied. Air and soil monitoring strategies would be combined.

- f. Sound pressure levels (dBA) would be monitored at the same points as above. A calibrated digital sound level meter would be used to take sound pressure readings in accordance with current regulations.
- g. The ratio of permeable to impervious surfaces would be determined and a photographic memory would be maintained.
- h. The volume of recycled organic matter and type would be monitored. Also, the capacity to produce organic mulch to close the biological cycle of natural materials would be evaluated (This is Agriculture, 2018) .

Discussion

The proposed indicators are feasible to investigate, their operational definitions do not involve highly specialized measurements. The proposed scheme tends to consider a wide variety of environmental sustainability factors rather than delving deep into each of them.

The vegetal palette factor concentrates on defining general but relevant aspects of the vegetation and does not go into depth on the of the characteristics that determine other more specific aspects, such as the quantification of carbon sequestration or pollutant seepage. These indicators can be quantified via the adoption of the iTree Eco system. In the same way, an indicator for rainwater capture capacity is suggested without going in depth to study the texture of existing soils in particular or conducting complex edaphic studies. Environmental protection barriers can be studied by visual inspection and classified on an ordinal scale, without falling into particularities derived from plant species. For its part, the factor related to water consumption does not consider factors such as field capacity, nor does it make infiltration studies necessary; it only concentrates on the characterization of permeable and non-permeable surfaces. Factors related to thermal and sound regulation are addressed in a simple and practical manner, without the complications indicated in current standards that stipulate the use of specialized equipment. Finally, the recycling of organic materials is left open to include pruning products, leaf litter and in general other residues that can form organic mulch, an essential element to preserve supporting ecosystem services in urban parks (EEA, 2018; Tolk et al., 1999).

The proposed indicator scheme allows for an approach to the environmental determinants that identify areas in which a park is sustainable, while providing the opportunities to address the lags. The model is

adaptable to any geographic area, as it is founded in general terms, rather than specifics. The usefulness of this will be clear, conditioned on an understanding this does not take considerable time away from the primary purpose.

Conclusions

Based on the results, it is possible to conclude that a research proposal to study the environmental sustainability of large-scale urban parks is plausible. This proposal aims to approach the estimation of environmental sustainability in urban parks through a synthetic vision that privileges a general view, giving less attention to a particular environmental indicator.

Limitations

This research proposal was limited to delineating a sustainability assessment scheme for urban parks of considerable scale. Other formats of urban parks, such as community or neighborhood parks, were not considered. Likewise, the factors suggested are of a general nature, without going in depth into the study of each one of them. Finally, it is recognized that sustainability consists of three axes (environmental, social and economic), however, this work only concentrates on the environmental axis only.

References

- Aram, F., Solgi, E., Baghaee, S., Higuera García, E., Mosavi, A., & Band, S. S. (2020). How parks provide thermal comfort perception in the metropolitan cores; a case study in Madrid Mediterranean climatic zone. *Climate Risk Management*, 30, 100245. <https://doi.org/10.1016/J.CRM.2020.100245>
- Avdan, U., & Jovanovsk, G. (2016). Algorithm for Automated Mapping of Land Surface Temperature Using LANDSAT 8 Satellite Data. *Journal of Sensors*, 2016 (1480307), 8. <https://doi.org/https://doi.org/10.1155/2016/1480307>
- Bae, J., & Ryu, Y. (2015). Land use and land cover changes explain spatial and temporal variations of the soil organic carbon stocks in a constructed urban park. *Landscape and Urban Planning*, 136, 57-67. <https://doi.org/10.1016/J.LANDURBPLAN.2014.11.015>
- Brown, R. D., Vanos, J., Kenny, N., & Lenzholzer, S. (2015). Designing urban parks that ameliorate the effects of climate change. *Landscape and Urban Planning*, 138, 118-131. <https://doi.org/10.1016/j.landurbplan.2015.02.006>

- Campbell, L. K., McMillen, H., & Svendsen, E. S. (2019). The Written Park: Reading Multiple Urban Park Subjectivities Through Signage, Writing, and Graffiti. *Space and Culture*, 120633121882078. <https://doi.org/10.1177/1206331218820789>
- Cariñanos, P., Casares-Porcel, M., Díaz de la Guardia, C., Aira, M. J., Belmonte, J., Boi, M., Elvira-Rendueles, B., De Linares, C., Fernandez-Rodriguez, S., Maya-Manzano, J. M., Perez-Badia, R., Rodriguez-de la Cruz, D., Rodriguez-Rajo, F. J., Rojo-Ubeda, J., Romero-Zarco, C., Sanchez-Reyes, E., Sanchez-Sanchez, J., Tormo-Molina, R., & Vega Maray, A. M. (2017). Assessing allergenicity in urban parks: A nature-based solution to reduce the impact on public health. *Environmental Research*. <https://doi.org/10.1016/j.envres.2017.02.015>
- Carrión-Mena, F. (2023). Urbicide. The Liturgical Murder of the City. In F. Carrión-Mena & P. Cepeda-Pico (Eds.), *Urbicide. The Death of the City* (pp. 25-45). Springer Nature Switzerland. <https://doi.org/10.1007/978-3-031-25304-1>
- Chan, C.-S., Si, F. H., & Marafa, L. M. (2018). Indicator development for sustainable urban park management in Hong Kong. *Urban Forestry & Urban Greening*, 31, 1-14. <https://doi.org/10.1016/j.ufug.2018.01.025>
- Charoenkit, S., & Piyathamrongchai, K. (2019). A review of urban green spaces multifunctionality assessment: A way forward for a standardized assessment and comparability. In *Ecological Indicators* (Vol. 107, p. 105592). Elsevier B.V. <https://doi.org/10.1016/j.ecolind.2019.105592>
- Chifari, R., Lo Piano, S., Matsumoto, S., & Tasaki, T. (2017). Does recyclable separation reduce the cost of municipal waste management in Japan? *Waste Management*, 60, 32-41. <https://doi.org/10.1016/J.WASMAN.2017.01.015>
- Cohen, M., & Castillo, O. (2017). Noise in the city. Acoustic pollution and the walkable city. *Demographic and Urban Studies*, 32 (1), 65-96. <https://doi.org/10.24201/edu.v32i1.1613>
- Cranz, G., & Boland, M. (2004). Defining the Sustainable Park: A Fifth Model for Urban Parks. *Landscape Journal*, 23 (2), 102-120. <https://doi.org/10.3368/lj.23.2.102>
- Daniels, B., Zaunbrecher, B. S., Paas, B., Ottermanns, R., Ziefle, M., & Roß-Nickoll, M. (2018).

Assessment of urban green space structures and their quality from a multidimensional perspective. *Science of the Total Environment*. <https://doi.org/10.1016/j.scitotenv.2017.09.167>

EEA, E. is agriculture. (2018). *What is mulching or mulching [MULCHING or MULCH]*. <https://estoesagricultura.com/acolchado-mulching/>

EPA (2007). *Benefits of Low Impact Development: How LID Can Protect Your Community's Resources* (Issue Lid). www.epa.gov/nps/lid. www.epa.gov/nps/lid

García-Lorca, A. M. (1989). The urban park as a multifunctional space: origin, evolution and main functions. *Paralelo, 13*, 105–111.

García, S., & Guerrero, M. (2006). Environmental sustainability indicators in the management of green spaces. Monte Calvario urban park, Tandil, Argentina. *Revista de Geografía Norte Grande*. <https://doi.org/10.4067/S0718-34022006000100004>.

Guillen-Cruz, G., Rodríguez-Sánchez, A. L., Fernández-Luqueño, F., & Flores-Rentería, D. (2021). Influence of vegetation type on the ecosystem services provided by urban green areas in an arid zone of northern Mexico. *Urban Forestry & Urban Greening, 62*, 127135. <https://doi.org/10.1016/J.UFUG.2021.127135>

Haaland, C., & van den Bosch, C. K. (2015). Challenges and strategies for urban green- space planning in cities undergoing densification: A review. In *Urban Forestry and Urban Greening*. <https://doi.org/10.1016/j.ufug.2015.07.009>.

Jansson, M., & Lindgren, T. (2012). A review of the concept "management" in relation to urban landscapes and green spaces: Toward a holistic understanding. In *Urban Forestry and Urban Greening* (Vol. 11, Issue 2, pp. 139-145). <https://doi.org/10.1016/j.ufug.2012.01.004>

Kumar, P., & Sharma, A. (2022). Assessing outdoor thermal comfort conditions at an urban park during summer in the hot semi-arid region of India. *Materials Today: Proceedings, 61*, 356-369. <https://doi.org/10.1016/J.MATPR.2021.10.085>

Lancaster, B. (2014). *Rainwater Harvesting for Drylands and Beyond* (2nd.). Rainsource Press.

- Lee, E. S., Ranasinghe, D. R., Ahangar, F. E., Amini, S., Mara, S., Choi, W., Paulson, S., & Zhu, Y. (2018). Field evaluation of vegetation and noise barriers for mitigation of near-freeway air pollution under variable wind conditions. *Atmospheric Environment*, 175, 92-99. <https://doi.org/10.1016/J.ATMOSENV.2017.11.060>
- Lin, J., Kroll, C. N., Nowak, D. J., & Greenfield, E. J. (2019). A review of urban forest modeling: Implications for management and future research. In *Urban Forestry and Urban Greening* (Vol. 43). Elsevier GmbH. <https://doi.org/10.1016/j.ufug.2019.126366>
- Meissner, C., As, W., & Weir, D. (2019). *Advances in CFD forest modeling in wind resource assessment*. www.dataforwind.com.
- Mohammadzadeh, N., Karimi, A., & Brown, R. D. (2023). The influence of outdoor thermal comfort on acoustic comfort of urban parks based on plant communities. *Building and Environment*, 228, 109884. <https://doi.org/10.1016/J.BUILDENV.2022.109884>
- Morales-Vásquez, E., Sandoval-Ruiz, C. A., & Saldaña-Vázquez, R. A. (2018). Urban park vegetation cover predicts the removal of human food waste by animals. *Urban Forestry & Urban Greening*. <https://doi.org/10.1016/j.ufug.2018.04.009>.
- Nowak, D. J., & Crane, D. E. (2000). The Urban Forest Effects (UFORE) model: quantifying urban forest structure and functions. In: Hansen, Mark; Burk, Tom, Eds. *Integrated Tools for Natural Resources Inventories in the 21st Century. Gen. Tech. Rep. NC-212. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station. 714-720.,212*. <https://www.fs.usda.gov/treesearch/pubs/18420>.
- NSW (2017). *Wind erosion: NSW Environment Camp; Heritage*. Office of the Environment & Heritage. <https://www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/wind-erosion>
- Oke, T. R., Crowther, J. M., McNaughton, K. G., Monteith, J. L., & Gardiner, B. (1989). The Micrometeorology of the Urban Forest [and Discussion]. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 324 (1223), 335-349. <https://doi.org/10.1098/rstb.1989.0051>
- Pan, D., Yang, S., Song, Y., Gao, X., Wu, P., & Zhao, X. (2019). The tradeoff between soil erosion

protection and water consumption in revegetation: Evaluation of new indicators and influencing factors. *Geoderma*,347 , 32-39. <https://doi.org/10.1016/J.GEODERMA.2019.02.003>

Parés-Franzi, M., Saurí-Pujol, D., & Domene, E. (2006). Evaluating the environmental performance of urban parks in Mediterranean cities: An example from the Barcelona Metropolitan Region. *Environmental Management*,38 (5), 750-759. <https://doi.org/10.1007/s00267-005-0197-z>

Rackley, S. A. (2017). *Carbon Capture and Storage* (2nd.). Butterworth-Heinemann.

Ranasinghe, D., Lee, E. S., Zhu, Y., Frausto-Vicencio, I., Choi, W., Sun, W., Mara, S., Seibt, U., & Paulson, S. E. (2019). Effectiveness of vegetation and sound wall-vegetation combination barriers on pollution dispersion from freeways under early morning conditions. *Science of The Total Environment*,658 , 1549-1558. <https://doi.org/10.1016/J.SCITOTENV.2018.12.159>

Ren, X. (2023). Combined effects of dominant sounds, conversational speech and multisensory perception on visitors' acoustic comfort in urban open spaces. *Landscape and Urban Planning*,232 , 104674. <https://doi.org/10.1016/J.LANDURBPLAN.2022.104674>

Sandoval-Chávez, D.-A., Vera-Bustillos, E., & Reyes-Escalante, A.-Y. (2024). Definition of Urban Park' Concept Upon a Systemic, Management and Multidimensional Perspective. In *Management Engineering in Emerging Economies* (pp. 97-119). Springer, Cham. https://doi.org/10.1007/978-3-031-54485-9_5

SEDATU. (2021). *NOM-SEDATU-001-2021, Public Spaces in Human Settlements*. Congreso de la Unión. <https://www.gob.mx/sedatu/prensa/publica-dof-nueva-nom-de-espacios-publicos-en-los-asentamientos-humanos>

Thees, O., & Olschewski, R. (2017). Physical soil protection in forests - insights from production-, industrial- and institutional economics. *Forest Policy and Economics*,80 , 99-106. <https://doi.org/10.1016/J.FORPOL.2017.01.024>

Tolk, J., Howell, T., & Evett, S. (1999). Effect of mulch, irrigation, and soil type on water use and yield of maize. *Soil and Tillage Research*,50 (2), 137-147. [https://doi.org/10.1016/S0167-1987\(99\)00011-2](https://doi.org/10.1016/S0167-1987(99)00011-2).

- USDA. (2018). *i-Tree Eco. Field manual for data collection*. <https://www.itreetools.org/tools/i-tree-eco>.
- Vélez-Restrepo, L. A. (2009). From the urban park to the sustainable park. Conceptual and analytical bases for the evaluation of the sustainability of urban parks. *Revista de Geografía Norte Grande*, 43, 31-49. <https://doi.org/10.4067/S0718-34022009000200002>
- Wei, D., Yang, L., Bao, Z., Lu, Y., & Yang, H. (2022). Variations in outdoor thermal comfort in an urban park in the hot-summer and cold-winter region of China. *Sustainable Cities and Society*, 77, 103535. <https://doi.org/10.1016/J.SCS.2021.103535>.

TABLA TRABAJO COLABORATIVO

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