

6. **Balance and Compensations.** The costs, benefits, and compensations of NbS are recognized and managed equitably, ensuring that they do not compromise the project or the rights and access to local resources.
7. **Data-Based Adaptive Management.** The implementation of NbS is based on continuous monitoring and evaluation, allowing adaptive adjustments to improve their effectiveness over time.
8. **Sustainability and Jurisdictional Context.** NbS are designed to be sustainable and to contribute to policy and regulatory objectives, supporting transformative changes and aligning with national and international goals of human well-being, climate change, biodiversity, and human rights.

This study was developed in what the Public Space Charter of 2013 calls "public spaces," which are defined as places of public property or public use that are accessible and usable by all, free of charge, or without profit (Biennale Spazio Pubblico, 2013). These spaces take the form of parks, squares, streets, or river areas and are vital places in a city because they attract investments and new residents, provide social and health benefits, play an important role in mitigating the consequences of climate change, and reduce the impacts of urban areas if they are designed considering sustainable and NbS (Rojas et al., 2023). This work is based on studies developed in public spaces (e.g., squares, parks, and reserves) in the cities of Buenos Aires (Argentina), Asunción (Paraguay), Bogotá (Colombia), and Santiago de Chile (Chile) during the year 2022.

This study is a result of an interdisciplinary study carried out with funds from an IAIA 2022 Innovation Grant, which has taken into consideration the aforementioned IUCN standards. It identifies criteria adjusted to urban green space systems on the Latin American continent.

We understand that NbS are essential to creating more livable cities that are prepared for the impacts of climate change by incorporating and restoring healthy ecosystems in the urban fabric.

The objective of this study is to help urban authorities and managers identify and select NbS projects that are adaptive, integrative, and capable of generating benefits for communities and the urban environment. This is done by providing criteria that facilitate the comparison and selection of effective and efficient measures among possible NbS that already comply with the aforementioned generic standards and that have been identified as possible solutions for the prevention and/or mitigation of environmental impacts in urban green spaces in Latin America.

It is important to understand these systems, whose common factor is that they have a high heterogeneity of conflicts and socio-environmental situations that, in most cases, hinder governability and efficiency in the administration of resources for the development of these projects. Due to this, we sought to guide you through key, clear, and concrete points to enhance its effective application.

For greater clarity in the development of the proposal and the application of the criteria emerging from this work, the following steps should be followed:

1. Implement an environmental diagnosis (identification and evaluation of the environmental impacts and affected ecosystem services) of the green space under analysis and focus on the possible solutions to be determined.
2. Select possible NbS for the impacts studied that comply with generic IUCN standards.
3. Apply the criteria emerging from this document to identify from the solutions in point 2 those NbS that best adapt to these green urban systems under study.

Criteria and subcriteria for the selection of NbS for the environmental management of urban green spaces

In the selection process for NbS for urban green spaces in Latin America, the criteria to be applied condense the concept of "environmental integration." This implies that the NbS selected under these criteria must be in close relationship with and balanced with the factors, processes, and human activities that make up the environmental system.

Although the IUCN standards do not explicitly mention the concept "environmental integration," its principles and criteria reflect the same through its emphasis on conservation and adaptation to local and social contexts. "Environmental integration," as described in the work of Gómez Orea (2013), is understood through two fundamental axes: the impact that NbS have on the environment and the suitability of this environment for their implementation.

The eight criteria that emerge from our work for the selection of NbS in urban green spaces in Latin America should be understood as those key concepts that we recommend considering when choosing among different previously selected NbS. These seek to provide specialization for the selection among NbS for these systems with respect to the IUCN global standards for NbS (IUCN, 2020).

The IUCN, in its documents, states that the users of NbS are national, municipal and local governments. Therefore, we consider it an advance to be able to provide application authorities with simple ways to adjust the selection processes for the systems under analysis (green spaces urban), providing criteria that adjust the NbS project selection processes to these particular sites. We reiterate that this work does not aim to identify the solutions but rather to choose among the possible ones.

The criteria are described below:

1. Functionality

This criterion evaluates whether the NbS meets its intended purpose of improving ecosystem services affected by anthropogenic activity in the environmental diagnosis of urban green spaces by establishing indicators and goals.

The subcriteria are as follows:

- Effectiveness in reducing or preventing environmental impacts and ability to implement adaptive management when results suggest that changes are required.
- The degree of contribution to the improvement of ecosystem services identified in the baseline as problematic.
- Integration and synergies with other services and activities within the area of influence of the measure. For example, increasing the biodiversity of the currently homogeneous vegetation profile can improve the regulation and provision of ecosystem services.
- Adaptation to climate change.

2. Technical Feasibility

This criterion evaluates whether NbS is technically feasible and practical to implement in the urban context.

The subcriteria are as follows:

- Feasibility of implementation (availability of appropriate materials and tools, availability of compatible natural capital, topographical and geological environment, appropriate technical resources).
- Technical requirements. Maintenance and management, logistical practicality (amount of time in implementation and execution, costs and efficiency of material and human resources), and integration with existing infrastructure of all scales and typologies (this means that the selected NbS can be traditional or hybrid, for example, grey/green or grey/blue, and multiple other combinations).

3. Sustainability

This criterion evaluates whether NbS are sustainable in the medium to long term.

The sub criteria are as follows:

- Articulation between urban NbS and the existing biome.
- Resilience (ability to recover after a disturbance).
- Sufficient natural capital to support NbS.
- Compatible with local demands and needs.
- Stability (ability to sustain itself in the face of a disturbance).
- Efficiency in the use of resources during the implementation of the measure (NbS energy efficiency and water consumption).
- Optimization in the use of space.
- Level of greenhouse gas removal.

4. Governance

This criterion evaluates whether NbS can be implemented following governance criteria; that is, the interaction and collaboration of government entities, the private sector, civil society organizations and citizens to plan and manage an NbS that reflects the interests and needs of all parts.

The subcriteria are as follows:

- The NbS must not contradict the current regulatory framework.
- NbS consensus among government entities, private sector, civil society organizations and citizens.
- Consensus between the jurisdictions that have influence in the scope of implementation of the NbS.

- Within the project, the NbS incorporates appropriate disclosure, control, management and supervision proposals by the interested parties. That is, transparent, responsible and adaptive management, accompanied by continuous monitoring and evaluation, establishing specific indicators and goals.

5. Sociocultural viability

This criterion evaluates whether the NbS is accepted and has the potential to generate a positive social impact in the community.

The subcriteria are as follows:

- Citizen participation. Active involvement of community members in the planning, decision making, and implementation processes of projects or initiatives.
- Community support. It refers to the approval, endorsement, and overall support of the community for a particular project or initiative.
- Equity and social justice. Contribution to improving the quality of life of the entire community and social well-being; guarantees accessibility and security. It is based on the fact that one of the causes of the improvement in the quality of life is due to the contribution of the NbS to local economic development such as the generation of employment and the promotion of the level of sustainability (Criterion 6).
- Contribution to local economic development through job creation and the promotion of sustainable economic activities in relation to Criterion 6, subcriteria 3 and 5. Integration with local culture.
- Long-term social benefits (ten years or more).
- Gender equality. NbS favors all genders in a balanced way and does not have a benefit biased towards a particular gender.
- Rights of Indigenous peoples and support for traditional knowledge.

6. Economic viability

This criterion evaluates NbS in terms of cost-benefit, efficiency, profitability and sustainability.

The subcriteria are as follows:

- Implementation costs.
- Cost savings. Evaluate cost savings through the implementation of NbS compared to traditional infrastructure. This should be interrelated with Criterion 5—consider how cost savings positively impact social well-being and community support, as the funds saved can be reinvested in the community.

- Necessary financial resources and types of financing. Incorporating the dimension of local economic development from Criterion 5.
- Profitability. The economic value of the benefits provided by ecosystem services improved by NbS.
- Economic sustainability. The economic benefits generated by the solution should exceed the associated costs, providing a continuous flow of income or savings that ensures its maintenance and operation over time. Interrelation with Criterion 5—because economic sustainability can generate long-term social benefits, considering the three pillars of sustainability (i.e., economic, social, and environmental).

7. Prevention and mitigation of environmental impacts

This criterion evaluates whether NbS generate a positive environmental impact and prevent or reduce negative impacts, thereby improving the identified key ecosystem services.

The subcriteria are as follows:

- Shade coverage (optimal shade percentage according to the plant profile designed for the urban green space).
- Vegetation profile (contributes to the development of a biodiverse plant profile).
- Soil management (guarantees an optimal surface of natural soil vs. pavement; reduces soil compaction, favouring infiltration; prevents or mitigates effects on the physical-chemical quality of soils, organic control).
- Habitats that promote connectivity between patches and corridors of green infrastructure.
- Construction materials (NbS that require construction materials will prioritize the choice of sustainable materials, taking into consideration the life cycle of the materials and their environmental impact.)
- Surface water bodies (NbS that require or implement natural or artificial surface water bodies will have ecological characteristics that contribute to temperature regulation, flood prevention, and increased biodiversity, among others).
- Aesthetic value (contributes to increasing the benefits that people obtain from interaction with nature in aesthetic, physical, mental, emotional, and spiritual terms).
- Air quality (contributes to improving air quality).
- Odors (does not generate or contribute to mitigating the generation of unpleasant odors).
- Noise (does not generate or contribute to mitigating the propagation of noise).
- Vectors of interest to health (NbS that contribute to avoiding, reducing, or controlling vectors of interest to health).

- Health and well-being (NbS that contribute to the physical, mental, and spiritual health of users).
- Fauna (NbS that contribute to the protection of fauna and the enrichment of biodiversity and the abundance of species).

8. Level of integration of the strategy with other existing or planned strategies for NbS in urban green spaces

This criterion evaluates the level of integration of the proposed NbS with existing NbS strategies and projects, ensuring alignment with the three pillars of sustainability: social, economic, and environmental.

The subcriteria are as follows:

- The areas of convergence are as follows:
The degree of overlap of objectives between the NbS measure and other existing or planned projects in the area of influence of the measure, considering social, economic, and environmental benefits.

The degree of complementarity in the implementation of the NbS measure with other strategies within the area of influence, thereby ensuring that social, economic, and environmental objectives reinforce each other.
- The synergies are as follows:
The existence of additional or articulated benefits is generated by the combination of measures within the area of influence, maximizing social, economic, and environmental benefits.
- Conflicts are as follows:
NbS that do not generate or present conflicts with the objectives of other projects in operation or under evaluation and that promote integral sustainability in its three pillars: social, economic, and environmental.

Discussion

Nature-based Solutions (NbS) offer sustainable approaches to address environmental, social, and economic challenges in urban green spaces across Latin America. To facilitate the selection of NbS in urban green areas, eight specific criteria have been established in alignment with IUCN global standards. These criteria include functionality, technical feasibility, sustainability, governance, sociocultural viability, economic viability, environmental impact prevention and mitigation, and integration with other strategies.

These criteria should be considered together with a systemic perspective reflecting the pillars of sustainability. The goal is to aid in the selection process from various pre-identified NbS, ensuring the most suitable alternative is chosen for each specific case.

By adhering to these criteria, urban planners, policymakers, and stakeholders can ensure the effective and sustainable implementation of NbS. This comprehensive approach promotes environmental, social, and economic benefits in the short, medium, and long term. Integrating these criteria into planning and management processes improves urban development with a systemic, effective, and efficient vision, maximizing the quality of life for the population and preserving essential ecosystem services.

Conclusions

Adopting NbS in urban green space management presents a significant opportunity to address the complex challenges faced by cities in Latin America. Implementing the eight IUCN criteria provides a solid framework for evaluating and selecting solutions that are technically viable, sustainable, and beneficial socially and economically.

This systemic approach ensures that each selected NbS effectively contributes to urban sustainability, promoting harmonious integration with other urban development strategies. It enhances residents' quality of life by providing accessible and functional green spaces and protects essential ecosystem services.

Integrating these criteria into urban planning and management processes is crucial for creating more sustainable and livable urban environments, ensuring lasting benefits for present and future generations.

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