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RESEARCH ARTICLE

Parques urbanos naturales y gestión sostenible: Estudio de caso de Lago Agrio, Ecuador.

Vinueza Quinga Alina Alexandra [1], Cerbone Sánchez Eduardo Joel [2], Parrales Daza Gigi Narcisa [2]

[1] Universidad Estatal Amazónica, Centro de Investigacion, Santa Clara, Pastaza EC160150, Ecuador.

[2] Green Amazon, Research Center, Nueva Loja EC210150, Ecuador

Correspondencia: aa.vinuezaq@uea.edu.ec + 593 0987036481

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Resumen: El estudio analiza la contribución de los parques urbanos naturales Parque Turístico Nueva Loja (PTNL) y Parque Ecológico Recreativo Lago Agrio (PERLA) en la gestión sostenible del cantón Lago Agrio, Ecuador. Se aplicó un diseño metodológico mixto que combinó entrevistas semiestructuradas a gestores, observación directa y encuestas estructuradas a visitantes (n=168). Los resultados evidencian que, en el ámbito social, ambos parques favorecen la cohesión comunitaria, el bienestar físico y la recreación, aunque el PTNL presenta mayores avances en accesibilidad y educación ambiental, mientras que PERLA destaca por su aporte a la salud percibida. En el ámbito ambiental, se confirma su función como refugios de biodiversidad y espacios de conservación, con programas de reforestación y señalética ambiental; no obstante, persisten limitaciones en eficiencia energética, certificaciones internacionales y gestión integral de residuos. En el plano económico, los parques generan externalidades positivas a través de la dinamización de microemprendimientos y el aumento de la plusvalía inmobiliaria, aunque mantienen dependencia de recursos externos y ausencia de esquemas innovadores de financiamiento. En conjunto, los hallazgos confirman que el PTNL y el PERLA son pilares de la sostenibilidad urbana amazónica, aunque requieren fortalecer cuatro ejes prioritarios: accesibilidad universal, institucionalización de programas de educación ambiental, adopción de energías renovables y certificaciones verdes, y mecanismos de economía circular y financiamiento sostenible.

Palabras claves: matriz FODA, herramientas pedagógicas, recomendaciones académicas

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Prof. Carlos Mestanza-Ramón, PhD.
Editor-in-Chief / CaMeRa Editorial
editor@greenworldjournal.com

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Urban natural parks and sustainable management: Case study of Lago Agrio, Ecuador.

Abstract: The study analyzes the contribution of the Parque Turístico Nueva Loja (PTNL) and Parque Ecológico Recreativo Lago Agrio (PERLA) urban nature parks to sustainable management in the Lago Agrio canton, Ecuador. A mixed methodological design was applied, combining semi-structured interviews with managers, direct observation,

and structured surveys of visitors (n=168). The results show that, in the social sphere, both parks promote community cohesion, physical well-being, and recreation, although PTNL shows greater progress in accessibility and environmental education, while PERLA stands out for its contribution to perceived health. In the environmental sphere, their role as biodiversity refuges and conservation areas is confirmed, with reforestation programs and environmental signage; however, limitations persist in energy efficiency, international certifications, and comprehensive waste management. Economically, the parks generate positive externalities by stimulating micro-enterprises and increasing real estate value, although they remain dependent on external resources and lack innovative financing schemes. Overall, the findings confirm that the PTNL and PERLA are pillars of Amazonian urban sustainability, although they need to strengthen four priority areas: universal accessibility, institutionalization of environmental education programs, adoption of renewable energy and green certifications, and circular economy and sustainable financing mechanisms.

Keywords: SWOT matrix, pedagogical tools, academic recommendations

1. Introduction

Urban parks have accompanied humanity since ancient times, evolving from sacred sites and private gardens of the elite to becoming public assets accessible to all citizens. In ancient civilizations such as the Persian and Roman, gardens were symbols of power and spiritual contemplation, while in the Middle Ages they were reserved for monarchies and aristocracies (Chiesura, 2004). With the French Revolution, access to these spaces was gradually democratized, transforming them into places for citizens to meet and express themselves culturally (Harnik, 2012).

The Industrial Revolution marked a turning point: mass migration to cities and precarious living conditions drove demand for green spaces that provided recreational, hygienic, and aesthetic benefits. Iconic parks such as Central Park in New York and El Retiro in Madrid reflect this shift towards green urban planning **(Jim & Chen, 2009)**. Subsequently, the International Congress of Modern Architecture (CIAM, 1933) reinforced the need to integrate green spaces into urban planning, highlighting their role as environmental regulators, generators of social cohesion, and supports for urban identity.

Currently, the concept of sustainable development, as outlined in the Brundtland Report (ONU, 2023), requires balancing economic growth, social inclusion, and environmental protection. Urban natural parks, conceived as multifunctional green infrastructures, are now critical spaces for adapting to climate change, reducing pollutants, providing ecosystem services, and improving the physical and mental health of citizens (Kabisch et al., 2015; Tzoulas et al., 2007). In addition, they play an educational and cultural role by serving as venues for environmental awareness and strengthening collective identity (Wolch et al., 2014).

In Ecuador, urban parks are part of a complex relationship between environmental conservation and rapid urbanization. The Amazon region, and in particular the Lago Agrio canton, faces challenges of disorderly urban expansion, pressure on ecosystems, and social inequalities (MAATE, 2022). In this context, the PERLA and PTNL parks are local benchmarks for conservation, recreation, and environmental education. The former, created in 2009 with support from OCP Ecuador, seeks to restore the forests surrounding the lagoon and provide a refuge for species. The latter, inaugurated in 2015, strengthens the Amazon's natural and cultural heritage with a focus on sustainable tourism. Both parks are administered by public institutions with different management models, but lack a comprehensive assessment of their sustainable impact (GAD Lago Agrio, 2025; OCP, 2021).

Despite progress, the literature shows a lack of systematic information on the social, environmental, and economic management of Amazonian urban parks, which limits the formulation of evidence-based public policies and the implementation of long-term urban conservation strategies (Martínez, 2014; Moreno Flores et al., 2023).

The overall objective of this study is to identify the role of urban nature parks—Parque Turístico Nueva Loja and Parque PERLA—in the sustainable management of the Lago Agrio canton, through a comparative analysis of their social, environmental, and economic dimensions. Specifically, it seeks to analyze their contribution to social cohesion and citizen well-being, examine their contribution to biodiversity conservation and urban environmental management, and evaluate their economic impact through income generation, productive chains, and land value appreciation, in order to provide empirical evidence to guide public policies and sustainability strategies in Amazonian contexts.

2. Materials and methods

2.1. Location

The study was conducted in the Nueva Loja Tourist Park and Lago Agrio Ecological Recreation Park, located in the city of Nueva Loja, Lago Agrio Canton, Sucumbíos Province.

The Nueva Loja Tourist Park, located in the center of the city of Nueva Loja, covers 30.9 hectares, of which 80% is tropical rainforest undergoing regeneration and 20% is infrastructure comprising administrative, tourist, cultural, and wildlife assistance areas. (Figure 1)

Figure 1. Location map of Nueva Loja Tourist Park

On the other hand, the Lago Agrio Ecological Recreation Park is located in the northern part of the city of Nueva Loja. It covers 110 hectares and includes primary and regenerating tropical rainforest, a lagoon, and infrastructure consisting of administrative, tourist, and recreational areas. (Figure 2)

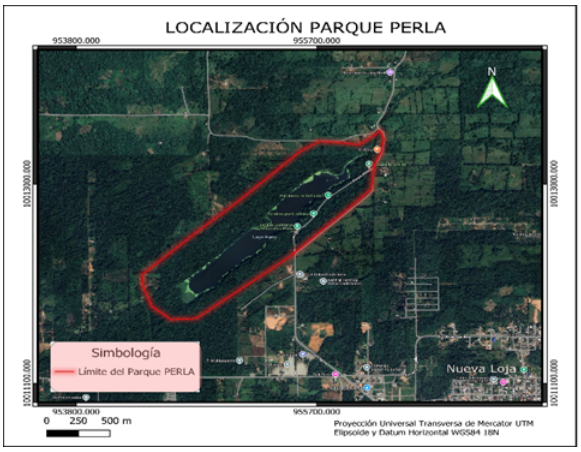

Figure 2. Location of Lago Agrio Ecological Recreation Park

2.2. Study design

With regard to the methodological design, a mixed study was adopted due to the complex nature of the research problem and the need to understand both subjective perceptions and objective data related to the sustainable management of urban natural parks. The mixed approach combines the strengths of qualitative and quantitative research, allowing for triangulation of information and a comprehensive view of the phenomenon under study **(Creswell & Clark, 2017)**.

On the one hand, the qualitative approach was based on semi-structured interviews with park staff and direct observation of management practices, which made it possible to identify internal processes, organizational dynamics, and perceptions of the parks' social, environmental, and economic contributions. This type of approach is essential when seeking to understand specific contexts and meanings attributed by the actors involved (Denzin & Lincoln, 2017).

In contrast, the quantitative approach was applied through structured surveys of park visitors in order to obtain statistical data on public perception of sustainability and management. This perspective made it possible to measure trends, identify patterns, and validate inferences through descriptive analysis. The inclusion of quantitative techniques contributes to the objectivity and representativeness of the study (Bryman, 2016).

This design was chosen in response to the need to articulate multiple sources of evidence: on the one hand, to gain an in-depth understanding of management practices and, on the other, to assess users' social perceptions. This achieves methodological complementarity that strengthens the validity of the findings and allows recommendations to be formulated that are applicable to public management and sustainable urban planning (Tashakkori & Teddlie, 2010).

2.3. Population and Sample

The study population consists of visitors to the urban natural parks of Lago Agrio: the Nueva Loja Tourist Park (463,850 users between 2022 and 2025) and the Lago Agrio Ecological Recreation Park (79,446 visitors between 2020 and 2025), according to the database of official records provided by the administrators. To ensure representativeness, the sample calculation formula for finite populations (Hernández Sampieri et al., 2014) was applied, with a confidence level of 95% (z = 1.96), p = 0.20, q = 0.70, and an error of ±8%, resulting in 84 respondents for each park. This procedure, based on probabilistic sampling, ensures external validity and reduces bias (Fowler Jr, 2013), while triangulation with qualitative techniques reinforces the reliability of the analysis **(Creswell & Clark, 2017)**. Although the margin of error reflects logistical limitations inherent to the Amazonian context (Bryman, 2016), the sample is considered statistically acceptable for comparing the sustainable management of both parks.

$$n = \frac{z^2 * N * p * q}{e^2(N-1) + z^2(p * q)}$$

Where:

N = Sample size

N = Population

z = Selected confidence level

p = Probability of success

q = Probability of failure

e = Acceptable margin of error

Table 1. Elements and percentages for establishing the sample of respondents from the Nueva Loja Tourist Park and Lago Agrio Ecological Recreation Park.

Code	Description	PERLA	PTNL
N	Population	15889	154617
Z	Confidence level	1,96	1,96
p	Prob. Success	20	20
q	Prob. Failure	70	70
e	Estimation error	8	8
n	Sample	84	84

Source: Own elaboration

2.4. Instruments and Data Analysis

The research adopted a mixed design that combined semi-structured interviews with administrators and technicians (20 open-ended questions) and structured surveys of visitors (15 items: 5 sociodemographic questions and 10 questions on perceptions of management). The interviews allowed us to explore the social, environmental, and economic spheres from the perspective of managers (Romero-Vargas et al., 2020), while the surveys facilitated the identification of trends and levels of citizen satisfaction under criteria of validity and reliability (Fowler Jr, 2013). Quantitative data were processed using descriptive statistics in Microsoft Excel, and qualitative data were analyzed using an inductive content approach to identify emerging categories and interpretive patterns **(Elo & Kyngäs, 2008)**. Methodological triangulation strengthened internal validity and integrated subjective perceptions with statistical evidence, allowing for a comprehensive understanding of sustainable management **(Creswell & Clark, 2017).**

In addition, a qualitative compliance categorization system was applied to the three dimensions of analysis (social, environmental, and economic). The indicators were classified into three levels: Adequate (when both parks comply), Moderate (when only one complies and the other partially complies), and Deficient (when neither complies). This procedure, based on comparative approaches (Ragin, 2014) and urban sustainability assessment methodologies **(Gómez-Baggethun & Barton, 2013; Kabisch et al., 2017)**, made it possible to synthesize the results in comparative matrices and establish strengths and weaknesses, providing a replicable methodological framework for the assessment of Amazonian urban parks.

3. Results and discussion

3.1. Contribution of the Nueva Loja Tourist Park and PERLA Park to sustainable management in the social sphere

The analysis of social indicators at the Nueva Loja Tourist Park (PTNL) and the Lago Agrio Recreational Ecological Park (PERLA) revealed four key dimensions: inclusion, employment and entrepreneurship, environmental education, and health and well-being. In terms of inclusion, the PTNL has partially accessible infrastructure, such as ramps and adapted bathrooms, which explains why 89% of visitors perceive it as an inclusive space, compared to 82% who consider that PERLA does not meet this criterion. In terms of employment and entrepreneurship, both parks generate direct and indirect opportunities and facilitate the marketing of local products, with 98% of respondents at the PTNL and 88% at PERLA reporting that they had purchased handicrafts or food. Environmental education is provided on an ad hoc basis, without permanent programs, although 94% of visitors to the PTNL said they had received information about flora and fauna, compared to 63% in PERLA. Finally, in terms of health and well-being, both parks are recognized as urban green lungs, with 33%

of respondents in the PTNL and 45% in the PERLA citing clean air as the main benefit, in addition to reporting recreational activities such as yoga, hiking, and sports, which contribute to strengthening physical and mental health.

Table 2. Comparison of social indicators between PTNL and PERLA

Indicator	PTNL (n=84)	PERLA (n=84)	Compliance category
Inclusion (accessibility)	89% yes	18% yes	Partial
Initiatives observed	98%	88%	Compliant
Environmental education	94%	63%	Partial
Clean air benefit	33%	45%	Compliant
Satisfaction with the visit	42% excellent, 25% good	29% excellent, 26% good	Partially compliant

In other words, the research results corroborate that urban parks perform a complex and multidimensional social function, in line with the findings of Chiesura (2004), who highlights the role of green spaces as promoters of community cohesion and psychological well-being. In this context, the Nueva Loja Tourist Park (PTNL) stands out for its advances in accessibility and the development of environmental education initiatives, which coincides with the findings of Kabisch et al. (2015), who recognize green infrastructure as a mechanism capable of promoting social equity in urban environments. For its part, the Lago Agrio Recreational Ecological Park (PERLA) stands out as a privileged setting for the promotion of physical and psychosocial well-being, as it is a space for family recreation and direct contact with nature. This condition is supported by Álvarez and Del Caz (2024), who emphasize that the renaturalization of cities is a fundamental strategy in the face of current socio-environmental challenges, positioning the incorporation of vegetation as an indispensable element for the construction of healthier, more sustainable, and more inclusive urban territories. Accordingly, the perception of PERLA visitors reinforces the idea that urban parks not only fulfill ecological functions, but also operate as catalysts for health, recreation, and community resilience, contributing to the consolidation of a more cohesive and environmentally conscious citizenry in the Ecuadorian Amazon.

In terms of employment and micro-enterprises, both parks contribute to local economic revitalization, confirming the study by Wolch et al. (2014) on the role of parks in environmental justice and community development. However, the absence of permanent environmental education programs limits the consolidation of a critical and environmentally conscious citizenry, an aspect that should be a priority in state policies.

Likewise, the gap in universal accessibility is striking: while the PTNL has implemented basic adapted infrastructure, the PERLA requires urgent interventions in infrastructure and inclusive signage. This inequality in access to urban ecosystem services reproduces patterns of inequality, as pointed out by Rigolon (2016) in studies on socio-environmental justice.

3.2. Contribution of the Nueva Loja Tourist Park and PERLA Park in the environmental sphere

Analysis of environmental management in urban parks reveals substantial differences in the implementation of conservation measures, resource management, and ecological monitoring. In terms of efficient resource management, none of the parks has consolidated energy or water efficiency programs. While PERLA has proposed the future installation of solar panels, PTNL depends on the public power grid. However, both have developed reforestation campaigns with native species aimed at protecting water sources and mitigating erosion processes.

Similarly, with regard to waste management, the PTNL has a structured program for sorting solid waste (organic, inorganic, and recyclable), accompanied by environmental signage aimed at educating visitors. In contrast, the PERLA maintains a limited scheme focused on the collection of plastic bottles, while the rest of the waste is transferred to the municipal landfill.

In addition, in terms of biodiversity conservation, PERLA contributes by maintaining records of fauna, with 115 species of birds, 20 species of fish, and 44 species of mammals, although it lacks updated floristic inventories. The PTNL, for its part, contributes to conservation with reforestation and conservation programs, largely represented by interpretive signage and the operation of an ex situ wildlife care center, unique in the province of Sucumbíos, specializing in the rehabilitation of rescued species.

In terms of certifications and management tools, none of the parks have international environmental accreditations such as ISO 14001 or Green Flag. However, PERLA won the Green Award in 2017 for its contribution to conservation, while PTNL maintains management plans and environmental licenses.

Table 3. Comparison of environmental indicators between PTNL and PERLA

Indicator	PTNL (n=84)	PERLA (n=84)	Compliance category
Energy and water efficiency	Not comply	Partial	Deficient
Waste management	Comply	Partial	Moderate
Biodiversity conservation	Comply	Partial	Moderate
Environmental certifications	Not comply	Not comply	Deficient
Reforestation and protection	Comply	Comply	Appropriate

In summary, the findings confirm that both the PTNL and PERLA contribute to environmental sustainability, albeit with limitations in terms of planning and structural management. The biological diversity recorded in both parks supports the findings of Gómez-Baggethun and Barton (2013), who argue that urban green spaces are critical refuges in the face of habitat fragmentation. In this sense, the PTNL wildlife center represents added value by transcending its recreational function and establishing itself as an active conservation initiative, in line with documented experiences in Latin American parks (Beninde et al., 2015).

The lack of energy and water efficiency programs highlights a gap in relation to global trends that promote green infrastructure and nature-based solutions to mitigate climate change (Kabisch et al., 2017). Similarly, the absence of environmental certifications limits international visibility and access to funds earmarked for ecological transition, an aspect considered key to urban sustainability in Latin American contexts (Lamy et al., 2021).

It should be noted that in the area of waste management, the findings reveal that, although the PTNL has implemented initial waste sorting measures, significant gaps remain in relation to the lack of composting and energy recovery systems. According to Manea et al. (2024), these practices have been shown to be strategic pillars of sustainability in urban parks, as they help reduce pressure on landfills, facilitate the generation of usable by-products, and strengthen circular economy dynamics in urban and peri-urban contexts. Recent empirical evidence confirms that combining sorting and recycling programs with decentralized composting schemes not only reduces the environmental footprint but can also become a source of additional income and a catalyst for the active participation of local communities (Lakshmi Narayana Prasad & Karthikeyan, 2020). From this perspective, the absence of such practices in the parks studied limits their ability to establish themselves as benchmark green infrastructures, highlighting the need to incorporate technological innovations and governance models that integrate advanced recycling, urban composting, and energy recovery as central components of sustainable environmental management.

3.3. Economic contribution of urban parks Nueva Loja Tourist Park and PERLA Park

The economic analysis of urban parks reveals a tension between revenue generation and the financial sustainability of their management.

In terms of profitability, PERLA generates income through entrance fees (USD 1), canoeing activities (USD 1), and zip-lining (USD 3), reaching an average monthly revenue of between USD 1,000 and 2,000. These amounts, transferred to the municipality, are insufficient to cover operating costs, so profitability is rated as not met. In the case of PTNL, access is free and income is limited to the leasing of spaces and minor income from food sales, which does not represent direct income for the park, which depends exclusively on state allocations.

In terms of sustainable income, PERLA maintains a stable flow derived from tourism services, which ensures a partial level of sustainability. PTNL, on the other hand, generates smaller amounts of income from rentals, donations, the sale of fish food and other food items, and occasional activities such as fairs, which help to finance the feeding of wildlife, although without stability over time.

In turn, long-term value creation can be seen in both parks. In PERLA, the value of nearby land increased by between USD 6,000 and USD 7,000, associated with improved roads and accessibility. The PTNL, for its part, promoted urban regeneration through road, electrical, and security infrastructure, transforming a previously marginal area into an attractive space for investment and tourism.

In terms of the production chain, both parks have boosted local micro-enterprises in crafts, gastronomy, and tourist services. The 98% percent of respondents in the PTNL and 88% in the PERLA reported having purchased products during their visit, in addition to the parallel development of restaurants, spas, and fairs linked to tourist flows..

Finally, in the area of cost savings through sustainable practices, PERLA does not report any relevant initiatives, while in PTNL, the sorting and sale of recyclable materials generates temporary resources for wildlife and environmental programs, although without structural continuity.

Table 4. Comparison of economic indicators between PTNL and PERLA

Indicator	PTNL (n=84)	PERLA (n=84)	Compliance category
Profitability	Partial	No comply	Deficient
Sustainable income	Partial	Comply	Moderate
Creating long-term value	Comply	Comply	Suitable
Production chain	Comply	Comply	Suitable
Sustainable cost savings	Partial	No comply	Deficient

The research findings confirm that, although Lago Agrio's urban parks generate positive economic externalities, their contribution is conditioned by structural dependence on external resources, which compromises the sustainability of their management in the long term. In this context, Timeus et al. (2020) argue that hybrid business models, based on coordination between public and private actors, represent a viable alternative by facilitating the equitable distribution of resources, responsibilities, and social benefits, while ensuring ecological and community preservation. Complementarily, Mohamed and Vadeveloo (2023) highlight the relevance of incorporating innovative financing mechanisms, such as crowdfunding and payments for urban ecosystem services (PUES), which strengthen the financial autonomy and resilience of parks as green infrastructure. Similarly, the Trust for Public Land (2024) report shows that investment in this type of infrastructure generates substantial returns—more than $201 billion in economic activity and around 1.1 million jobs—confirming its role as a driver of economic and social revitalization.

In the particular case of PTNL, its free access reinforces social inclusion but restricts the generation of its own income, creating a critical dependence on state subsidies. This scenario reflects

regional trends, where free access to urban parks in Latin America requires sustained public funding to prevent infrastructure deterioration (Gómez-Baggethun & Barton, 2013)). For their part, both the PTNL and PERLA have indirectly contributed to local economic development by increasing the value of surrounding land and stimulating micro-enterprises, which coincides with the findings of Wolch et al. (2014), who highlight the role of parks in urban regeneration and the creation of economic opportunities. However, the absence of diversified financing mechanisms, such as concessions, public-private partnerships, or environmental certifications, significantly limits their long-term sustainability potential (Kabisch et al., 2017).

In summary, the economic contribution of these parks is not limited to generating direct income, but extends to consolidating local production chains and strengthening regional economic resilience. However, progress must be made toward circular economy and green financing strategies that consolidate their role as pillars of sustainable development and ensure their viability in the Amazonian context.

4. Conclusions

The Lago Agrio PTNL and PERLA urban nature parks are essential hubs for social sustainability, providing spaces for community cohesion, recreation, and environmental education. The PTNL stands out for its advances in accessibility and educational initiatives, while PERLA contributes significantly to physical and recreational well-being. However, limitations persist in inclusive infrastructure and the institutionalization of permanent environmental education programs, which are critical aspects for ensuring equity and citizen participation.

As an environmental contribution, the two parks play a strategic role as biodiversity refuges and urban conservation areas, through reforestation and environmental signage initiatives. However, there are shortcomings in energy and water efficiency, a lack of international environmental management certifications, and weaknesses in integrated waste management. The PTNL wildlife center is a distinguishing feature, positioning the park as a provincial benchmark in wildlife rehabilitation and conservation.

Parks generate positive externalities by boosting micro-enterprises, increasing real estate value, and consolidating productive chains around tourism and services. Despite this, financial sustainability is compromised by dependence on external resources and the absence of innovative self-financing mechanisms, such as circular economy schemes or public-private partnerships.

The integrated results confirm that the PTNL and PERLA are pillars of local sustainability, articulating social, environmental, and economic dimensions. To consolidate themselves as models of sustainable management in the Amazonian context, progress must be made in four priority areas: (1) universal accessibility, (2) institutionalization of environmental education programs, (3) adoption of renewable energies and green certifications, and (4) development of innovative financing schemes that strengthen their long-term resilience.

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