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LANDSCAPE STRATEGIES TO RESTORE THE GARDENING AREAS OF THE GRADUATE SCHOOL OF THE UNIVERSIDAD NACIONAL DE TRUJILLO, PERÚ.

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Abstract: Green spaces should be adapted to the design, activity, and configured to the nature of the city for proper maintenance and care. The objective was to propose landscaping strategies to recover the gardening areas of the Graduate School of the Universidad Nacional de Trujillo, Perú. With a total green area of 5,225.1 m^2, this qualitative, observational, and direct interview research respected bioethical guidelines for data reliability. It was possible to recover and adapt 87.5% of the green areas for landscaping development and characterized the predominant flora, composed of 22 species from 14 families. The associated birdlife has 20 species from 14 families and 4 orders, predominantly the Passeriformes order. The main pruning waste is Stenotaphrum secundatum, 1000 kg monthly. The concept of a "garden city" was proposed, along with implementation strategies. It is concluded that landscaping improvements sensitize the senses and aptitudes and foster institutional identity.

Keywords: Garden, landscape, green area, recovery, strategies.

1. Introducción

Landscape components—anthropogenic, biotic, and abiotic—are not just a collection of elements; they are an integrated whole, structured in a specific and interrelated sequence. Nature is a fundamental and decisive component of a sustainable urban and architectural landscape. It helps generate a unique and specific identity for an area without disturbing the environment, instead highlighting and rescuing its inherent characteristics.

It's not only necessary to transform the capacity to live, but society must also create the conditions for interaction and promote population participation, reinterpreting their needs and the geomorphological characteristics of their surroundings. There is a connection between the environment, the landscape, and its inhabitants, which generates emotions that connect with life. If this connection were absent, users—both locals and tourists—would abandon those areas, leaving them desolate.

Holguín and Campos (2017) suggest that the design, composition, and operational elements determine the form and adaptation of urban space to new needs, creating a new spatial focus that

generates vitality and special personalization of public space. Public spaces should be adapted to the design, space, activity, and configured to suit the nature and green areas of the community, all while keeping the investment low. This is considered the ideal way to achieve good and permanent maintenance and care.

Abad (2016) explains that physical and experiential characteristics, urban expression, and interrelation with the environment generate "a sense of belonging, territory, identity, legibility, accessibility, memory, connectivity, and the improvement of the urban landscape". Similarly, Lynch (2008) based his theory of the urban image on five elements that are visualized and interrelate to form the final image: paths, edges, districts, nodes, and landmarks.

Another theory by Friedmann (1998) posits that civil society, the private sector, and the state form a collective, meaning that "urban programs" depend not only on state professionals and construction entrepreneurs but also on the community's needs. Therefore, urban development is not only cooperative but also a social and economic transformation.

Ebenezer Howard created a fundamental work on the new urbanism model of the early 20th century, which later influenced the "Garden City" concept starting in the 1940s (Montiel, 2015). The Garden City concept is based on a central, consolidated city core surrounded by garden cities that are directly related and connected to the main one but sufficiently separate to be independent, thus relieving human and urban accumulation in the main city. This relates to Howard's explanation of the benefits between the country and the city, supported by his "Three Magnets Theory".

Modernity and current lifestyles are affecting the capacity for attention and information management, causing mental fatigue, loss of attention, irritability, and impulsivity. Green areas allow people to overcome these effects and enhance their capacity to pay attention, promoting psychological development, improving the quality of life and housing, and ultimately influencing personal well-being. Green areas promote well-being, such as mental health and stress reduction. Some researchers suggest this could be a potential option for improving mental health in the United States of America (Beyer, et. al., 2014).

Despite this philosophical framework, the reality is clear: there are increasingly fewer green areas and landscape socialization spaces that encourage creativity and the performance of physical, academic, and relaxation activities. These green areas could be used for reading, drawing, and painting, as well as for exercise and making music, both vocally and instrumentally.

The Universidad Nacional de Trujillo (UNT) is a bicentennial university located in the heart of the city of Trujillo. The university city or main campus has an area of 439,506.13 m^2, and its green coverage or gardening areas vary, sometimes ranging from 74,993.92 m^2 to 105,052.92 m^2, which is equivalent to 17.1% to 23.9% (Rodríguez-Soto et al., 2025). The university campus hosts approximately 1,215 professors, 1,000 technical and administrative staff, and 15,000 students from 12 faculties with 44 study programs daily.

Special mention should be made of the Graduate School, located in the heart of the university campus. It has an approximate student population of 3,000 students across 59 master's and 23 doctoral programs, respectively. It has a total area of 7,279 m^2, with 5,225.1 m2 designated for green or gardening areas. However, only 2,193.9 m2 correspond to planted green space, accumulating only 42% of its total area designated for landscape or gardening areas.

Currently, the educational process is detached from modern trends; there is no data available on the impact assessment of green areas on the teaching and learning process. The dissociation of nature from man has led to a "denaturalization and insensitivity" toward one's own naturalness, affecting activities in various areas, including education, causing a loss of both physical and mental balance, according to psychological studies (Gareca and Villarpando, 2017).

Given all these points and the logistical potential of the Graduate School, we firmly believe it can serve as a model for implementing landscape strategies to recover more green areas and promote a lifestyle with a harmonious balance among education, science, art, and sport. Therefore, the general

objective was to evaluate and propose different landscape strategies to restore the gardening areas of the Graduate School of the Uniersidad Nacional de Trujillo, Perú.

2. Materials and Methods

Biological Material

Lignocellulosic waste from gardening pruning. Specifically, pruning waste from *Stenotaphrum secundatum* (Walter) Kuntze, known as "grass".
Earthworm *Eisenia foetida* (Savigny), "California red worm," donated by the applied biochemistry experimental station of the Faculty of Biological Sciences at the Universidad Nacional de Trujillo, Perú.
Cuttings of *Bougainvillea spinosa* (CAV) Heimerl.
Stolons of *Stenotaphrum secundatum* (Walter) "Kuntze" "grass".

Methods

Type and Design of Research

Type**:** Action research.
Design: Non-experimental.

Category, Subcategory, and Categorization

Independent Category: Landscape Strategies; Subcategory: Architectural and Urbanistic.
Dependent Category: Urban Image; Subcategory: Artificial and Natural.

Study Setting

The Graduate School is located in the central front section of the university campus of the Universidad Nacional de Trujillo, Perú. G.P.S. Coordinates: Zone 17 L, East coordinates: 716210.02 m E; North coordinates: 9102526.66 m S. Google Maps Plus Code: VXP6+7R Trujillo. It has a total area of 7,279 m^2, with 5,225.1 m^2 designated for green or gardening areas. Boundaries: To the right, it borders the "Vicente Gonzáles de Orbegoso y Moncada" civic plaza; to the left, the astronomical observatory; in front, the currently under-construction law pavilion; and at the rear, the environmental engineering pavilion.

Beneficiary Population

The entire university community, consisting of 1,215 faculty members, 908 specialist technicians from research laboratories and administrative staff, approximately 15,000 undergraduate and graduate students, and visitors who frequent the university campus daily or pass through the Graduate School's peripheral areas. Due to its strategic location, everyone passes through its facilities at some point during the day, whether to go to their faculties, to use exits 1, 2, or 3, to visit the central library, to conduct business at the treasury office, to the university bookstore, or simply to enjoy time for socialization and recreation in the civic plaza.

Analysis and Diagnosis of Green Areas and the Landscape of the Graduate School

A biologist from the research team, specializing in biotechnology and bioengineering, supported by an architect specializing in landscaping and urban planning, surveyed every space designated for green areas, noting the following characteristics:
State of conservation of the green area: good, poor, or absent.
Stratification or zones of the green areas: front, intermediate, and rear.
Measurement (area/metrage) of each area and zone designated for gardening.
Determination of irrigation points for each gardening area and zone.
Characterization of the predominant flora in the gardening areas.
Characterization of the accompanying birdlife in the gardening areas.

Characterization and quantification of gardening pruning waste.
Production and quantification of compost and earthworm humus.
Recommendations for improving and beautifying the landscape.

Data Collection Techniques and Instruments

The collected data was tabulated on forms according to the dimensions:
Architectural: Information was gathered using the observation technique, verifying the green areas and zones, as well as their condition and design.
Urbanistic (Contextual and Morphological): The observational technique was used via a technical form. The flora and birdlife of the landscape were verified and characterized.
Artificial (for improving community and social image): An artificial-type observational technical form was used for data collection, verifying the boundaries, paths, and surrounding edges for landscape interrelation.
Natural (for landscape improvement): The observational technique (natural sub-category) was also used, verifying the landscape and opportunities for improvement and natural interrelation with the environment. This methodology is based on the forms proposed and used in the thesis "Urban architectural strategies to recover the urban image of San Pedro street in the city of Chepén, 2019" (López, 2019).

Ethical and Moral Considerations

The authors declare that the data obtained was not manipulated and reflects the sentiments of each participant interviewed at every stage of the research development.

Strategies for the Recovery and Improvement of the Gardening Areas' Landscape

After the specialized team's analysis and diagnosis, strategies were proposed for the care, maintenance, improvement, and beautification of the gardening areas and the surrounding landscape of the Graduate School. This would serve as a model for implementing a "Garden University City", integrating hierarchy, organization, and landscape design to increase identity with the alma mater through a sensory and spiritual experience. In this era, education is more efficient when based on generating experiences and feelings, increasing curiosity, attention, concentration, and the desire for learning, which leads to better academic performance and personal well-being (Gutiérrez, 2006).

3. Results

The following tables and figures are presented after the observation, consensus, and critical and specialized analysis of the problem.
Table 1 shows the stratification of the gardening zones or areas (front, interior, and rear) with their corresponding uppercase letters, from A to J. It also indicates the area measurement for each zone, totaling 5,225.1 m^2. The table also shows the state of conservation, noting that only 651.1 m^2 are in good condition, 1,895.8 m^2 are in poor condition, and almost 2,700 m^2 have no gardening activity. Therefore, the state of conservation is deficient. Furthermore, the water intake points essential for irrigation across the entire area were found to be deficient in number for the needs of all irrigation areas. The type and flow rate of irrigation were also identified as inadequate.

Table 1: State of Conservation, Stratification, Area Measurement, and Irrigation Points for Implementing Landscape Strategies to Restore the Gardening Areas of the Graduate School of the Universidad Nacional de Trujillo, Perú.

DISTRIBUTION AND CHARACTERISTICS OF THE ZONES AND AREAS FOR GARDENING							
zone/area of jardinería	zone/area coding	zone/area	zona/area conservación	water intakes zone/area	irrigation type zone/area	flow rate 1” pipe intake	Sprinkler Flow rate ½” pipe

(qualitative)	(unit)	measurement (m^2)	(qualitative)	1" pipe (unit)	(qualitative)	(2-3 m^3/h)	(0.5-1m^3/h)
Front	A-B-C-D	1,895.80	Poor condition	3	Heavy	Inadequate	Recommended
Interior	E-F-G	651.10	Good condition	3	Heavy	Inadequate	Recommended
Rear	H-I-J	2,678.20	Absent	0	Non existent	Inadequate	Recommended
TOTAL	10	5,225.10	Deficient	Deficient	Inadequate	Inadequate	Recommended

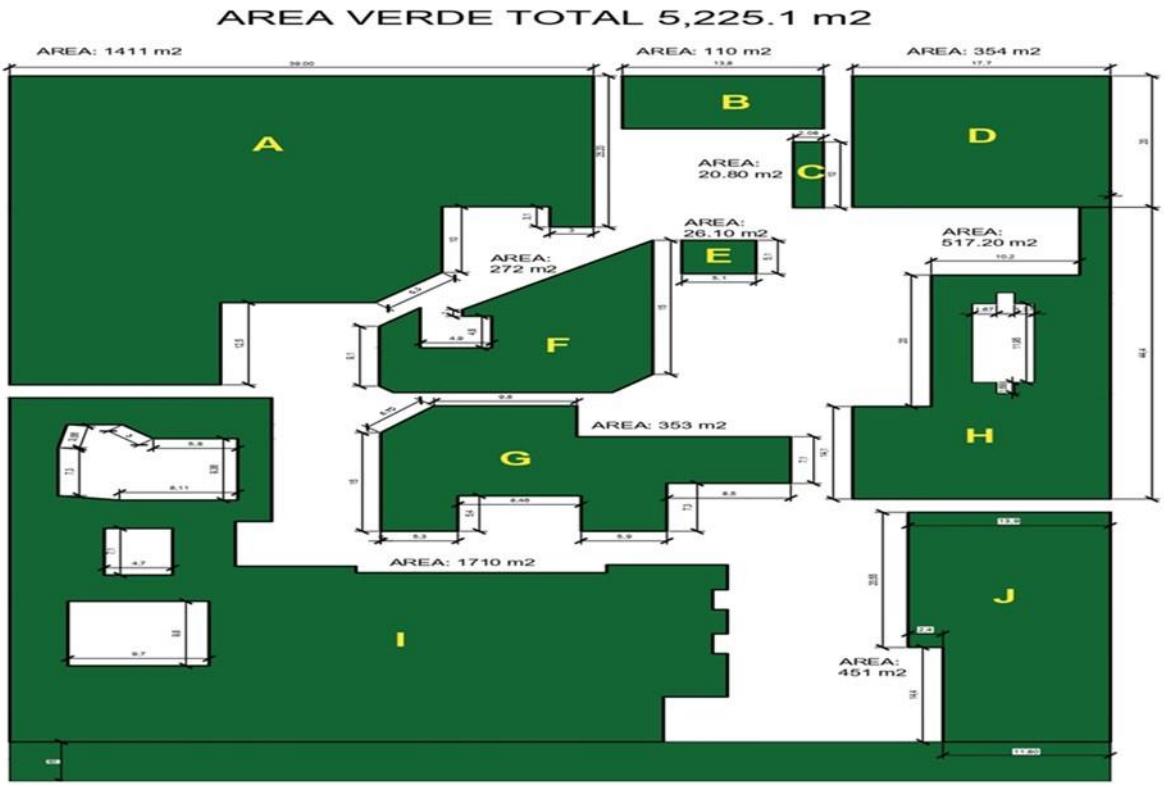

Figure 1: Zoning of the Total Green Area for the Implementation of Landscape Beautification Strategies as a "Garden City" Model in the Graduate School.

In the figure 1 highlights the entire area designated for landscape improvement and beautification of the gardening zones, totaling **5,225.10 m^2**. It also specifically indicates the area in m^2 for each zone from A to J.

Table 2: Characterization of Flora and Quantification of the Main Lignocellulosic Pruning Waste from 2,500 m2 of Gardening Areas at the Graduate School of the Universidad Nacional de Trujillo, Perú**.**

Characterization of the predominant flora in the gardens				Quantification of waste	
N°	Scientific Name	Common Name	Family	Kg/1month	Kg/6 months
1	*Dysphania ambrosioides* (L.) Mosyakin & Clemants	Paico		05	25

2	*Alternanthera ficoidea* (L.) Sm.	Cock's Comb	Amaranthaceae	05	25
3	*Chenopodium murale* L.	Goosefoot		13	60
4	*Alternanthera pubiflora* (Benth.) Kuntze	White herb		08	40
5	*Stenotaphrum secundatum* (Walter) Kuntze.	St. Augustine grass		1000	5500
6	*Cynodon dactylon* (L.) Pers.	Bermuda grass	Poaceae	100	500
7	*Eleusine indica* (L.) Gaertn.	Goose grass		90	480
8	*Mesembryanthemum crystallinum* (L.)	Ice plant		12	60
9	*Aptenia cordifolia*	Heartleaf	Aizoaceae	90	480
10	*Trianthema portulacastrum* (L.)	Horse Purslane		13	60
11	*Codiaeum variegatum* (L.) Rumph. ex A.Juss.	Croton		12	60
12	*Acalypha sp.*	acalypha	Euphorbiaceae	10	50
13	*Lonicera etrusca* Santi	AEtruscan Honeysuckle	Caprifoliaceae	10	50
14	*Pelargonium* x *hortorum* L.H. Bailey	Geranium	Geraniaceae	10	50
15	*Bougainvillea spectabilis* Willd.	Bougainvillea	Nyctaginaceae	10	50
16	*Casuarina equisetifolia* (L.)	Australiano pine	Casuarinaceae	10	50
17	*Eucalyptus camaldulensis* Dehnh.	Eucalyptus	Myrtaceae	50	200
18	*Persea americana* Mill.	Avocado	Lauraceae	20	100
19	*Heptapleurum arboricola* Hayata	Schefflera	Araliaceae	07	40
20	*Sansevieria trifasciata* Prain	Snake plant	Asparagaceae	06	30
21	*Bidens pilosa* (L.)	Hairy	Asteraceae	05	30
22	*Plumbago caerulea* Kunth	Blue plumbago	Plumbaginacea e	14	60
22 especies			14 families	1,500 kg.	8,000 kg.

Table 2 characterizes the predominant flora and quantifies the main lignocellulosic pruning waste. It shows 22 different species belonging to 14 families. The Amaranthaceae family is the most represented with 4 species. However, the Poaceae family, with only 3 species, contributes the largest weight of lignocellulosic waste (approximately 1,200 kg monthly), mainly from the pruning of St. Augustine Grass (*Stenotaphrum secundatum*). This species alone produces approximately 1,000 kg monthly, or an average of 5,000 kg of pruning waste every 6 months. The total monthly volume of pruning waste accumulates to 1,500 kg per month, or 8,000 kg every 6 months on average, collected from approximately 2,500 m^2 of green área.

Table 3: Production of Biofertilizers from the Main Lignocellulosic Waste Collected from the Pruning of 2,500 m2 of Gardening Areas at the Graduate School of the Universidad Nacional de Trujillo, Perú.

Biofertilizers: Compost and earthworm humus for 100 days of bioprocessing.					
Collected Lignocellulosic Waste 2500 m^2 (Kg)		Cow manure (kg)	Carbon/Nitrógen Ratio	Composting (kg) 70-dias	Eartworm Humus (kg) 30-días
1/month	1,500	500	3:1	1,600	1,100
6/months	8,000	2,700	3:1	8,200	5,600
Projection for Lignocellulosic Waste Collection in 5,225.1 m2/Year	17,500	6,000	3:1	18,000	12,000

Table 3 shows the production of biofertilizers compost and humus from the lignocellulosic waste collected from 2,500 m^2 of gardening. It confirms that 1,600 kg of compost can be obtained in 70 days of bioprocessing, and 1,100 kg of Eisenia foetida "earthworm humus" can be obtained in 30 days. The projection of annual production of both compost and humus from the pruning waste of the entire available gardening area (5,225.10 m^2) is also noted. This ensures the production of 18,000 kg of compost and 12,000 kg of humus for use in soil improvement and subsequent landscape beautification of the Graduate School's green áreas

Table 4: Characterization of the Birdlife Associated with the Flora in the Gardening Areas of the Graduate School of the Universidad Nacional de Trujillo, Perú.

Birdlife associated with gardening areas and their conservation status or vulnerability					
N°	**Scientific Name**	**Common Name**	**Order**	**Family**	**Conservation Status**
1	*Zonotrichia capensis*	American Sparrow		Emberizidae	
2	*Sicalis flaveola*	Saffron Finch			
3	*Thraupis episcopus*	Blue-gray Tanager		Thraupidae	
4	*Piranga flava*	Hepatic Tanager	Passeriformes		
5	*Molothrus bonariensis*	Shiny Cowbird		Icteridae	
6	*Icterus graceannae*	Graceful, Oriole			Stable
7	*Notiochelidon cyanoleuca*	Blue-and-white Swallow		Hirundinidae	
8	*Amazilia amazilia*	Amazilia Hummingbird		Tochillidae	

9	*Pyrocefalus rubinus*	Vermillion Flycatcher		Tyrannidae	
10	*Passer domesticus*	House Sparrow		Passeridae	
11	*Coereba flaveola*	Bananaquit		Coerebidae	
12	*Mimus longicaudatus*	Long-tailed Mockingbird		Mimidae	
13	*Spinus magellanicus*	Hooded Siskin		Fringillidae	
14	*Troglodytes aedon*	House Wren		Troglodytidae	
15	*Columba livia*	Rock Dove	Columbiformes	Columbidae	
16	*Zenaida meloda*	Pacific Dove			
17	*Columbina cruziana*	Croaking Ground Dove			
18	*Forpus coelestis*	Pacific Parrotlet	Psittaciformes	Psittacidae	
19	*Aratinga erithogenys*	Red-masked Parakeet			
20	*Falco sparverius*	American Kestrel	Falconiformes	Falconidae	
20 Species			4 orders	14 families	good

Table 4 describes the characterization of the birdlife associated with the flora in the gardening areas. It found that the 20 species belong to 4 orders. The Passeriformes order is the largest, with 14 species, and the American Sparrow (Zonotrichia capensis) and the House Sparrow (Passer domesticus) are the most representative species of the order, belonging to the Emberizidae and Passeridae families, respectively. It is important to note that all species have a good conservation status report

Table 5: Analysis and Improvement Proposals for the Landscape Beautification of Green Areas as a "Garden City" Model in the Graduate School of the Universidad Nacional de Trujillo, Perú.

Landscape and architectural strategies for beautifying garden áreas		
Data Collection Technique: Direct observation by specialists and personal surveys of undergraduate, graduate students, visitors, and administrative staff of the Universidad Nacional de Trujillo.		
Dimensión	**Analysis**	**Strategies for Improvement**
Architectural	Indicators analyzed: height, design, and characteristics of the buildings. 80% of the buildings have 2 stories and 20% have 4 stories, all made of concrete and brick in good condition, with a school design. Nearby buildings are scarce, and green areas predominate. In the front, there is a building under construction with similar characteristics. In the rear, there is a 2-story building with wide hallways and windows. To the left and right, there are no buildings, only green areas.	The architectural conditions allow for the implementation of vertical gardening strategies on both exterior and interior walls, especially on balconies, hallways, and skylights, particularly in the Zone E skylight. This area is in the administrative zone and receives the highest foot traffic from the public, students, and visitors.

Urbanistic	Indicators used in the analysis were context and morphology. The trend is 90% positive, with 10% rated as regular because an unfinished construction project in the front negatively impacts urban beauty. However, the urban core is positive and favors the implementation of actions for landscape beautification	Integrate the landscape improvement and beautification proposals by expanding the "Garden City" concept throughout the entire university campus. This will create spaces that promote open-air art, music, and theater, reaffirming the idea that the landscape influences academic performance and intellectual creativity.
Artificial	Indicators of paths and edges were analyzed: 100% of the area corresponds to paths; three sides have perfect delineation with sidewalks in good condition. The rear side has no sidewalk. Regarding the edges, a simple-design road without a border runs along the right lateral wing. This road connects the parking lots of the Graduate School and Chemical Engineering, disturbing the tranquility one experiences while walking through the green areas. Therefore, the architectural characteristics are adequate to influence landscape improvement and beautification	The "Garden City" idea is reinforced by accessibility and the good condition of its sidewalks and walkways. Its strategic location makes it a center of attraction, which would be the ideal place for meetings and sports activities such as gymnastics, aerobics, walking, and cycling. Additionally, implement solar-powered study modules and technified irrigation to maintain the landscape.
Natural	Indicators of topography and vegetation were analyzed: The predominant topography is flat in 90% of the area, facilitating vehicular and pedestrian traffic throughout all areas. The vegetation, for the most part, lacks organization and planning; only 10% is adequately arranged and designed. Adaptation, improvement, and intervention strategies are necessary to beautify the landscape, considering the characteristics of a "Garden City" design	Propose a landscape integration through the comprehensive design of a permaculture system, optimizing the efficient use of water, soil, air, light, and space for appropriate and sustainable beautification. This involves integrating arboreal, ornamental, aromatic, and fruit flora in line with the "Garden City" model, fostering an ideal habitat for the accompanying birdlife and creating an environment for sensory stimulation and institutional identity

This Table 5 describes the analysis of the dimensions Architectural, Urbanistic, Artificial, and Natural and their corresponding strategies for landscape beautification of the green areas as a "Garden City" model

4. Discusión.

Green areas must be preserved because they represent a picturesque longing for the countryside within the city, which is and will always be the natural, cultural, and economic heritage (Domínguez, 2019). The origin and recognition of the meaning of green areas is due to the fact that, besides their

recreational, social, environmental, and ornamental use and benefit, they involve integrating a dynamic and holistic concept and management of these areas (SEDUVI, 2020).

Public green areas are considered to include urban forests, community gardens, protected natural areas, parks, plazas, gardens, sports fields, medians, embankments, and canals, and also less conventional areas such as cemeteries and green roofs (Sudipto et al., 2012). The unequal distribution of green areas is strongly influenced by social levels and groups, as well as by age, gender, and other community difference axes (Ferguson et al., 2018). The implication of green area distribution is very important because it provides vital information for measuring their impacts on the community (Alam et al., 2014). The amount of green area needed to maintain the dynamics and planning of an urban area or city is calculated based on the available plant coverage per individual. Various standards, both quantitative and qualitative, must be met for the green area (Flores-Xolocotzi, 2017).

The preceding can be corroborated in Table 1 and Figure 1, where it is seen that the Graduate School has a total area of 5,225.10 m^2 designated for green areas. However, only 651.1 m^2, corresponding to 12.5%, are in good condition, and a large percentage, 87.5%, are in poor condition or have no gardening activity. This violates the provisions of Peruvian law 31199 (Law of Management and Protection of Public Spaces, 2021, and regulated in 2023), which stipulates against the denaturalization of common and public use or conditioning the purposes and freedom of use for the population. In this case, the beneficiaries include approximately 30,000 people faculty, undergraduate and graduate students, visitors, and technical and administrative staff of the Universidad Nacional de Trujillo.

According to law 31199 (2021), the green area designated per person should be 9 m^2. This is not met in this case, where there is only approximately 0.4 m^2 per person. This calculation considers the 13,000 students exclusively from the Graduate School who are currently conducting their academic activities remotely.

Recognizing this problem, the university's senior management has promoted emblematic projects, funded through canon resources, for landscape improvement and environmental sustainability in the surroundings of various faculties and schools. The Graduate School, with one of the largest green areas at the university, is one of the beneficiaries.

For Mexico City, the average index of green area per inhabitant was 14.4 m^2, with 10 m^2 of wooded area. The 78.1 km^2 of wooded area corresponds to 12.8% of the total urban area, and 34.8 km^2 of grasses, shrubs, and sports areas represent 5.7% of the total. Meanwhile, only 18.5% was covered by trees, grasses, and shrubs, including areas for sports practice (Núñez, 2021).

The efficient use of this resource in green area irrigation is not only a step toward efficiency but also toward environmental and corporate sustainability , as it's an economically important cost for any industry that uses it. Due to limited budgets, cities often fail to use technified irrigation (modern, efficient irrigation) for the maintenance and adequacy of green areas. This leads to the worst practice: gravity irrigation, which facilitates water loss and inefficient irrigation , causing waterlogging, wilting, and plant death due to excess water. This reflects poor management of the resource and the green spaces (ANA, 2018). As observed in this case (Table 1), there is inefficient and inadequate resource management due to the type of irrigation and the lack of technification, which is why applying the improvement strategies for the efficient and sustainable beautification of the gardening areas is recommended.

Floral diversity definitely beautifies the landscape. The "Garden City" concept proposed by Howard at the beginning of the 20th century reinforces this great idea of building gardens with a wide variety of ornamental, fruit, and aromatic plant species. This promotes care and management strategies, such as replacement or formative pruning , ensuring that each species has optimal space and necessary light for its photosynthetic metabolism and vitality , thereby mitigating the effects of global warming. However, these pruning and maintenance activities generate a large amount of lignocellulosic waste , which can be an alternative for the production of amendments and fertilizers. These would then be returned to the soil for enrichment and use by the plants, or to gain more space for agricultural and

gardening practices. Table 2 shows the characterization of the predominant flora and the waste generation from maintenance and pruning, highlighting 22 species from 14 families. An average of 1,500 kg of waste can be generated monthly, which, if managed properly, will become biofertilizers, as seen in Table 3. The production of both composting and humus aligns with the findings of Cabos (2023), who suggests producing biofertilizers and biogas in an anaerobic fermentation using lignocellulose-rich residual material. The study also characterizes the waste, pointing out that St. Augustine grass (Stenotaphrum secundatum), or "grama," is the primary pruning residue. The researchers agree that this "grama" is the main material for making biofertilizers (Ramírez, 2021).

The predominant and accompanying flora in the university campus's green areas, including plazas and gardens, provide the habitat conditions for a diversity of birds. Table 4 highlights the representatives of the Passeriformes order as the most common, with 11 families. Key species include the American Sparrow (Zonotrichia capensis) and the House Sparrow (Passer domesticus). Other species representing important orders like Falconiformes, Psittaciformes, and Columbiformes were also recorded. These results are similar to those reported by Silva et al. (2012) in their work titled "Avifauna on the campus of the Universidad Nacional de Trujillo, Perú," conducted between May and August 2009.

The great diversity of bird species found in the Graduate School's green areas is due to the wide variety of plant species—including lumber, fruit, and ornamental trees, and even vegetables in nearby areas (Rodríguez-Soto et al., 2024). And bodies of water. Together, these create the conditions for the presence and coexistence of a large diversity of bird families, offering characteristics suitable for developing the "Garden City" concept. This concept integrates modern architecture and landscape design for a harmonious coexistence between members of society and their environment (Gutiérrez, 2006).

Table 5 presents the architectural analysis, proposals, and landscape strategies for the beautification of the green areas as a "Garden City" model for the Graduate School. This analysis aligns with Ortiz (2023), who proposes a procedure for implementing architectural and landscape strategies to improve the urban image of "Tumbes" Avenue (Tumbes-2022). The "Garden City" idea, proposed by Howard, managed to prevail over urban development trends and raised the alarm about the unplanned growth of cities. This influence was evident in the development of cities in Holland, Germany, and London (Montiel, 2015).

Furthermore, the analysis in Table 5 proposes landscape development as an opportunity to generate empowerment and a deeper sense of belonging to the alma mater. It's also an opportunity to develop art, science, sports, and creativity, fostering ingenuity, creativity, and technological innovation in the various specializations within the Graduate School and the university in general. Landscape improvement actions implemented in an educational center in Bolivia showed a 50% increase in academic performance, as well as improved self-esteem and creativity among students (Gareca, 2017).

5. Conclusions

As a result of the critical evaluation and analysis, various landscape strategies for the restoration and beautification of the gardening areas were proposed, including:

The entire area designated for gardening was stratified into three zones (front, interior, and rear) and 10 different sub-areas or plots for subsequent evaluation, restoration, and adaptation for the implementation of landscape beautification strategies.

The research successfully restored and adapted 87.5% of the green areas for landscape development in the gardening zones.

The characterization of the predominant flora and pruning waste highlights that it is composed of 22 species belonging to 14 families, with St. Augustine grass (Stenotaphrum secundatum) being the main residue, averaging 1,000 kg per month for every 2,500 m^2.

5,600 kilograms of Eisenia foetida "earthworm humus" were produced from composting 8,000 kilograms of lignocellulosic material collected from gardening pruning over 6 months.
The characterization of the birdlife associated with the gardening area found a dominance of 20 species from 14 families and 4 orders, with the majority of species belonging to the Passeriformes order.
Specific improvement proposals for the landscape beautification of the gardening areas were made as a "Garden City" model. This involved analyzing various dimensions, such as architectural, urbanistic, artificial, and natural, in addition to considering several indicators. This consolidated the implementation of various cutting-edge actions and techniques, such as: The development of vertical gardening; The implementation of outdoor gyms; Modules for drawing; Painting, reading, and music singing outdoors. These actions are expected to increase sensory and academic perception as well as institutional identity with the university

Conflicts of Interest

The authors collectively declare that they have no potential conflicts of interest regarding the research, authorship, or publication of this article.

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