



# Environmental pollution mitigation through planning urban strategies in Vicente Paúl, Guayaquil. (April 2023)

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**Abstract**— Environmental pollution is a phenomenon that affects the quality of life of living beings and ecosystems on planet earth, currently, the Vicente Paúl sector of the city of Guayaquil presents various problems of environmental contamination, mainly due to informal trade, lack of green areas and poor waste management; in turn, these problems are triggered by the lack of equipment necessary to meet the needs of users. The objective of this study is to design an environmental mitigation plan to improve the quality of life of the inhabitants of the sector. A quantitative methodology was used to calculate the percentage of existing green areas in the study area using the ArcGIS program, and in addition, a visit to the sector was carried out to identify the causes of contamination to later elaborate a comparative analysis based on the 12 Criteria that Determine a Good Public Space. As a conclusion, we have that the application of the 12 criteria for the good use of public space, generates the possibility of obtaining a redistribution of public spaces that cause an implicit interaction of the space and generate activity around the residual spaces, generating an interest in intervention and sustainable environmental management as the interaction is fully configured.

**Keywords:** Environmental pollution, urban planning, waste management, informal trade, heat islands.

## I. INTRODUCTION

The Cisne Sector is located in the suburbs of Guayaquil. This area is of a commercial-residential type, in which various problems of environmental contamination can be witnessed, the most relevant being informal commerce and the deficient garbage collection system. This problem is due to the lack of intervention of the authorities in the sector, so much so that the urban regeneration program has not started in that place [1]. The area, as previously mentioned, is of a commercial-residential type, it has an improvised market of informal merchants who place their products along the streets where vehicles or pedestrians should travel normally; however, traders continue to expand this market over time.

In addition, instead of contributing to the reduction of the problem, the people of the sector choose to throw the waste from their homes on the sidewalks and do not respect the established collection schedules, going so far as to fill the spaces with accumulations of garbage, which to worsen the in this situation, "recyclers" generate more pollution by opening the waste bags and spreading all this waste [2].

Another of the problems present in the sector is the scarcity of green infrastructures such as planned networks of natural or semi-natural areas, this causes problems in the ecosystem and the conservation of the sector's biodiversity.

In the sector you can witness pollution of all kinds, both waste, acoustic, light and especially thermal [3]. A suitable place to live would be one in which the problems do not exist, which is possible, but it would be rethinking the development of the sector, focusing on the aspects, such as the formality of the vendors, creating spaces where they can carry out their sales, which would imply better control of the merchants [4]. Regarding waste control, it is common knowledge that it is more of a social than a logistical problem, since most people do not have recycling habits, in addition to always looking for the most comfortable, so the implementation of more garbage cans is not the only option to take into account [5], campaigns can also be carried out to encourage recycling in the community and thus solve both environmental and social problems.

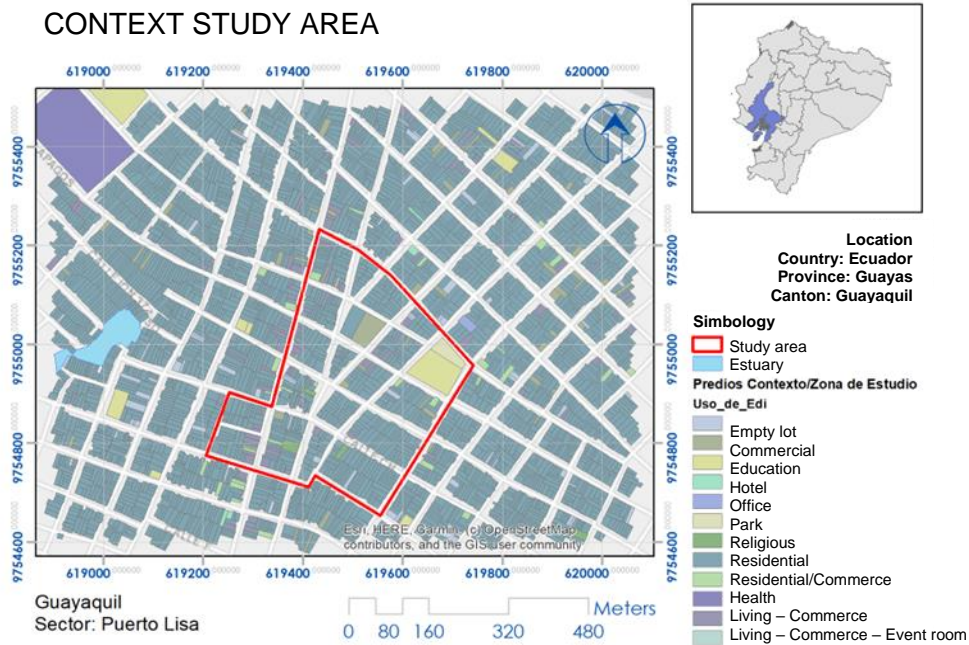


Fig. 1. Context study area. Note: Own elaboration in ArcGIS

## II. MATERIALS AND METHODS

Within the evaluation of public spaces, there are various criteria of how their use can be evaluated depending on quality and efficiency factors, for which 12 key criteria have been established that allow a better analysis to be developed and characterization of public space as a model of live safe and free of barriers.

Within the criteria of public space, accessibility plays an important role in the development and movement of users from one place to another without impediments that affect their physical or special conditions, universal accessibility prevailing as a meeting point between physical and social differences within a territory [7].

Social interaction within the public space is generated mainly by the accessibility that the space provides and encourages the activities and sense of relevance of the place to appropriate and generate active meetings, sessions thus configuring an active community that uses these meeting points as mobilizers of users.

Public space in South America has a common denominator determined by insecurity and lack of protection, another relevant point adopted by Jan Gehl's theory, which prioritizes the safety of people through illuminated spaces, safe paths and promoting their protection through plant borders and permeable barriers that divide the roads into independent spaces, establishing a differentiation according to the tracks.

The purpose of public space functionality is to structure an environment with various uses, attributes, activities and services for the community, such as establishing areas for contemplation, recreation, meeting, climatic comfort, among others.

The connectivity of functional public spaces promotes and encourages the guided movement of users, which is why they are taken to various services and activities that generate interest and active permeability of the public space.

The comfort within the public space is rooted in the functionality around the services that it can offer such as seats, drinking fountains, vegetation that generates shade, public toilets, and maintenance facilities.

The aesthetics and design are part of a conjugated factor between the use of the landscape and the integration of architectural elements that generate coherence and general harmony. An aspect close to aesthetics is environmental sustainability and how beauty is generated through green elements, blue spaces, and sustainable consumption of resources, as well as maintenance of the space as such and the waste produced.

Another criterion of important allusion is the cultural and historical context generated by the public space proposals based on their identity and how an area that incorporates landmarks, historical references and cultural programs has developed in history or given rise.

As conformation and adhesion criteria is the adaptability and flexibility as part of the transformation of the public space, it must be able to adapt the spaces to different uses and activities throughout the use and time that configure a more dynamic and flexible environment. activities of relevance or interest to the community to increase the vitality and dynamism of the sector.

The mitigation of environmental pollution factors explores the circumstances of the territory according to the arrangement and

choice of plant species, built elements and waste disposal or exposure to exogenous pollutants such as noise or pollution that directly affects public space [8].

As a final criterion, it is the maintenance of public space and its management as a multi-diverse space for the analysis of resources and services that guarantee that it prevails over time and adapts to the present urban dynamics so as not to lose functionality and relevant use.

### III. METHODOLOGY

Commerce and informal work have become one of the main sources of income for citizens at the national level in January 2023, the unemployment rate in Ecuador was 3.8%, according to the summary of the National Institute of Statistics and Census [9]. In the year 2020, the International Labor Organization carried out an analysis of the situation of the characteristics and employment worldwide, where Ecuador was the fourth country in Latin America with 60% more informality in work [10], Guayaquil being a Of the cities with an economically active population of 1,260,987 people, of this value, 49.8% belong to the informal sector while 4.9% are totally unemployed [11].

Informal commerce in the city of Guayaquil is present in most sectors and is constantly growing due to the need of citizens to seek sustenance for their daily lives, since a large part of the population does not have a stable job. In this sector, the lack of equipment that allows merchants to carry out their activities without inconvenience or generating the problems, both urban and environmental, is evident [4].

To carry out the research, the ArcGIS program was used, it is a complete system that allows collecting, organizing, managing, analyzing, sharing and distributing geographic information, it is used to put geographic knowledge at the service of all sectors of the government, the company, the science, education and media [12]. ArcGIS is described as a visualization tool that with the help of georeferenced will allow calculating and demonstrating the percentage of green areas that currently exist in the area through geolocation. This tool aims to combine the geographic location of the data obtained through a database of satellite images of the USGS company and specific shapefiles of the area, provided by the Geo - Portal of the Municipality of Guayaquil.

A comparative analysis was carried out according to the visit of the study sector and based on the 12 Criteria that Determine Good Public Space [13], to identify the causes that have been generating environmental contamination. All the results can be process on evaluations in Geographic Information Systems using ArcGIS program, the percentage of green areas in the sector was identified.

### IV. RESULTS

Using Geographic Information Systems through the ArcGIS program, the percentage of green areas in the sector was identified, thus obtaining the following data (Fig. 2):

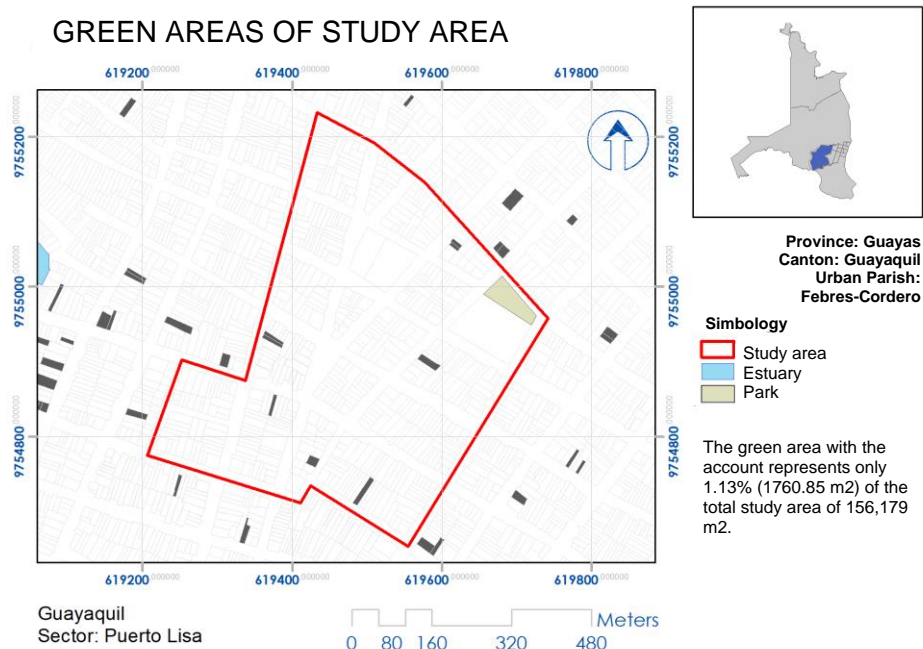


Fig. 2. Identification of green areas. Note: Own elaboration in ArcGIS

After visiting the sector to identify the main causes of contamination in the sector, it was obtained that they are the following:

- Informal trade
- Lack of green areas
- Poor garbage collection system



Fig. 3. Informal trade and poor waste management. Note: Google maps.

Having determined which are the main causes of the problem, a comparison was made based on the 12 Criteria that Determine a Good Public Space only considering those that are related to environmental contamination. Once the criteria have been determined, the method of analysis will be as follows:

Criterion name → Relationship with environmental pollution → Sector-specific relationship

Table 1 Axes of city types and their comparison. Note: Prepared by the authors

Criterion	Relationship with environmental pollution	Industry-specific relationship
1. Traffic Protection		
2. Security in Public Spaces		
3. Protection Against Unpleasant Sensory Experiences	X	Due to the presence of large piles of garbage, uncomfortable experiences (olfactory-visual) are generated, the lack of green areas prevents the sensation generated by exposure to high temperatures, pollution, and noise from being appeased.
4. Spaces for Walking		
5. Spaces of Permanence		
6. A Place to Sit		
7. Possibility to Observe		
8. Opportunity to Talk		
9. Places to Exercise		
10. Human Scale		
11. Possibility of Taking Advantage of the Weather		
12. Good Sensory Experience	X	There are no public spaces to promote links with nature, nor urban furniture that contributes to the mitigation of environmental contamination in the sector.

After applying the established methodology, it was obtained as a remarkable result that the sector lacks green areas, informal commerce generates environmental pollution of various types because there is no urban equipment necessary for commercial activity to develop correctly and efficiently. , poor waste management is the result of a deficient garbage collection system and the bad habits of citizens; Being so, it is evident that in this part of the city there is no quality of life.



**Proposal.** - This proposal seeks to be an alternative to mitigate environmental pollution in the specified sector "Vicente Paul". It is decided to develop a commercial plaza, where it is intended to relocate the vendors that are currently located in the "floor mall"; It is also planned as an open space so that all residents have access to the shopping mall. It is proposed to create stands, where vendors can offer their products, and thus avoid the informal commerce existing on the site that produces the accumulation of garbage in the streets of this place and various social problems such as insecurity in public spaces and the traffic.

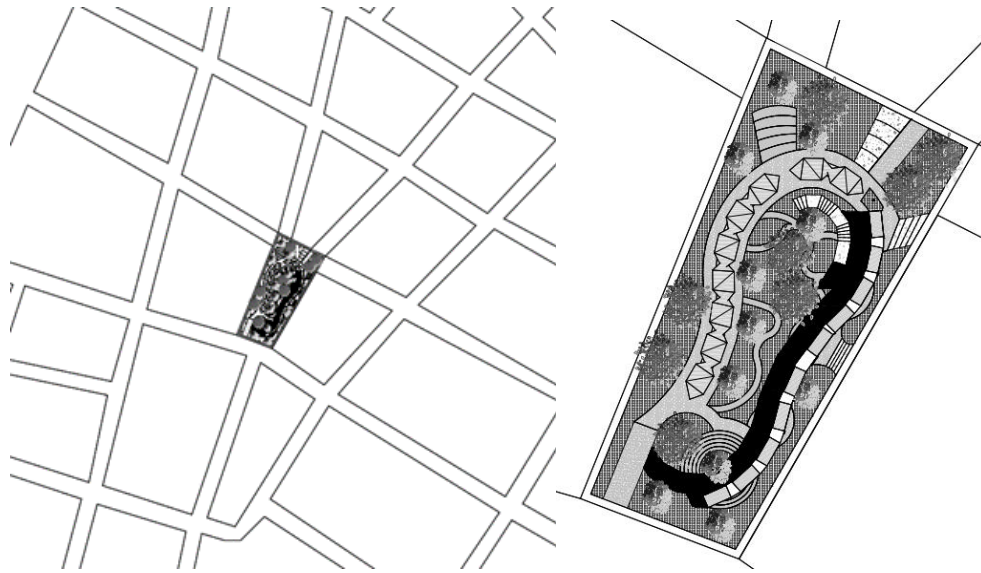


Fig. 4. Implementation of the proposal in the sector. Note: Own elaboration.

Green spaces are implemented to reduce air pollution, in addition to regulating the temperature and humidity of the environment. This shopping plaza will have street furniture to create a public space that meets the needs of users, in turn improves the quality of life for the proper coexistence of the community and create ties between them. In this way, spaces for permanence would be implemented, to walk, sit, observe, talk, and even take advantage of the weather; thus, fulfilling most of the criteria that determine a good public space.

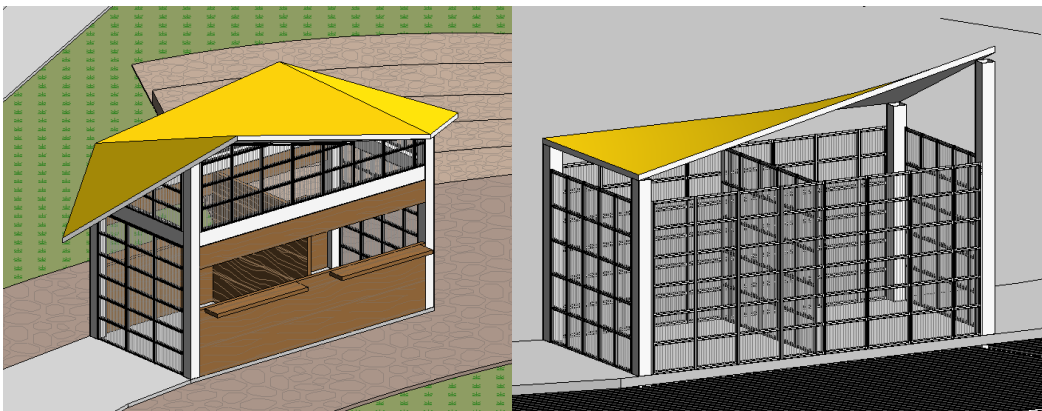


Fig. 5. Proposals for standard modules. Note: Own elaboration.

## V. DISCUSSION

With the Geographic Information Systems through the ArcGIS program and together with the analysis and visit to the study sector, it was possible to determine the causes that generate environmental contamination in it. It was shown that there is no quality of life for the inhabitants due to the absence of public space and the bad habits of citizens. "No child asks for something for Christmas that they don't know, and people will never ask for improvements in their cities that are not in their repertoire", with this phrase, Jan Gehl tries to make people understand that they must first find out about what needs they cannot meet in their cities and then express what they need to satisfy them.

Environmental pollution is a reality that daily affects the population, living beings and the planet, therefore, reducing environmental pollution is a priority; To start taking action, it is necessary to carry out an analysis and determine what factors cause it and look for solutions, these can be short or long term, since environmental contamination is not a small problem that can be solved in a matter of days or months. Oriented to the objective of this study, urban proposals were generated that can improve the problems that already exist and avoid more in the future. Nowadays, when talking about urban proposals, one should no longer think only that the city is by and for the citizens, if not also on the planet; what actions can be taken to avoid damage to the environment and what actions can be taken to reduce existing damage.

## VI. CONCLUSION

To reach a solution, the main causes that generate environmental pollution were determined, the existing informal trade in the sector was taken as a starting point to establish an urban proposal that could benefit both the inhabitants and the environment. The objective of this proposal is to create spaces where merchants can carry out their commercial activity in a formal, optimal way and in good conditions.

As a conclusion, we have that the application of the 12 criteria for the good use of public space, generates the possibility of obtaining a redistribution of public spaces that cause an implicit interaction of the space and generate activity around the residual spaces, generating an interest in intervention and sustainable environmental management as the interaction is fully configured.

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