EUROPEAN ACADEMIC RESEARCH
Vol. X, Issue 2/ May 2022

Impact Factor: 3.4546 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

GUT Matrix – (Gravity, Urgency, and Tendency) as a Method to Diagnose the Physical, Chemical, and Environmental Impacts of Solid Waste at Campo da União in Recife, Pernambuco

FLAVIANA GOMES ALVES DA SILVA
Master's student at the Polytechnic School of the University of Pernambuco (UPE/POLI)
CARLOS FERNANDO GOMES DO NASCIMENTO
Master's student at the Federal University of Pernambuco (UPE/POLI).
MICHELE JOYCE PEREIRA DOS SANTOS
Master's at the Polytechnic School of the University of Pernambuco (UPE/POLI).
Kalinny Patricia Vaz Lafayette
PhD and Associate Professor at the Polytechnic School of the University of Pernambuco (UPE/POLI)
LUCIANA CÁSSIA LIMA DA SILVA
Master's student at the Polytechnic School of the University of Pernambuco (UPE/POLI).
IGOR SILVA SANTOS
Master's student at the Polytechnic School of the University of Pernambuco (UPE/POLI)

Abstract

The development and construction processes in some areas have been growing in recent years, bringing with it an increase in environmental degradation. Solid waste comes from various activities, considered one of the causes of environmental impacts due to population growth. Due to the environmental problems caused by poor destination and inadequate final disposal of these wastes, this article aimed to evaluate the environmental impacts in the community of Campo da União, in Recife, Pernambuco, through the GUT method - (severity, urgency, and trend). As for the evaluation method, the GUT Matrix identified and prioritized the environmental impacts as well as the photographic survey and mapping of critical points of waste accumulation. It was then observed that the environmental problems come from the emission of greenhouse gases, soil and groundwater contamination, obstruction of waste collection points, floods, diseases from waste vectors, and others. Given the context, it is evident that solid waste, when incorrectly disposed of, negatively impacts the environmental quality of the affected areas.

Keywords: Waste management; environmental impacts; GUT matrix; sustainability.

INTRODUCTION

Environmental problems arising from human actions are topics of discussion worldwide. According to Qureshi et al., (2019) and Oláh et al., (2020), socio-political organizations bring to light their social, economic, and ecological responsibilities as relevant aspects in decisions and actions concerning managing waste.

The city of Recife, Pernambuco suffers from problems of irregular disposal of solid waste. According to data reported by the Municipal Maintenance and Street Cleaning Authority (EMLURB), the total municipal solid waste (MSW) is approximately 826,500 tons/year. In the first half of 2021, 254,500 tons of solid waste were collected, about 0.85 kg/inhab./day, considering the current estimated population. It entails the public power the expense with the logistics of collection and adequate final destination about BRL 3.2 million.

Waste, when in large quantities, not respecting consumption standards and without proper treatment, can generate air pollution, soil degradation, contamination of water, groundwater, and intensification of floods, causing inconvenience to residents. In addition, it increases the incidence of diseases caused by vectors from the accumulation of garbage (Rajesh, 2020; Joub et al., 2021; Nguyen and Johnson, 2020).

Inadequate disposal of solid waste causes damage to the environment and public health with the population facing soil pollution, visual pollution, impairment of urban drainage systems, in addition to reducing the useful life of these components (Silva et al. 2018). Such environmental problems are caused, in part, by the lack of public policy management. In this perspective, linearity is a trend in the region, which does not observe the possibility of reuse or sustainable disposal (Guterres, 2018; Santos, 2018).

The tasks defined according to the integrated management of sustainable actions aim to prioritize objectives that minimize the generation of waste, reduce their impacts, develop guidelines for reuse, treatment, and adequate final disposal (Ibrahim; Alola, 2020; Li et al., 2020). These guidelines must follow the objectives proposed between the National Solid Waste Policy (PNRS) and the plans defined by the municipal management related to cleaning services and the proper handling of solid waste.

To this end, the "Mais Vida nos Morros" Program, developed by the City of Recife Administration, is a project that aims to ensure greater efficiency in guaranteeing community satisfaction with the resolution of environmental problems. The latter, in turn, aims at collaboration and conservation interventions, as well as the positive impacts generated in the community under study. Some areas are revitalized to ensure proper access and adequacy of spaces.

Integrated solid waste management projects are essential to define the purpose of disposal of these tailings, using content that promotes the action plan, discriminating the volume, characterization of waste, and final destination, as well as seeking solutions that help decision-making managers in the optimization of environmental processes, (Paillé, Valéau and Renwick,2011; Ahmed, Nathaniel and Shaabaz, 2021).

The lack of plans and action taken by managers are evidenced in several locations in the country, such as Campo da União-Recife/PE. In that place, the lack of waste management is perceived when verifying inadequate waste disposal in areas that are considered critical, thus having a proliferation of environmental, structural, social, and health problems.

From this perspective, quality tools, such as the GUT matrix - (Gravity, Urgency, and Tendency), contribute to the understanding of some processes. It intends to transform information into environmental actions, as they are instruments that define better alternatives for the procedures and methods studied, considering critical analyzes based on the discussion of results, because of the objectives defined in the planning (Diaz-elsayed et al., 2020; Adedoyin, Alola and Bekun, 2020; Rajesh and Rajendran, 2020; Nathaniel and Adeleye, 2021).

For Fáveri and Silva (2016), through the GUT matrix, the manager can act based on a schedule, identifying which problems must be solved first, with the differential of the simplicity of application, assigning values to each situation in an objective way. This tool can be used in several scenarios as an aid for decision making, applied many times as a complementary tool to other quality management tools.

The objective of this article was to use the prioritization tool in solving environmental problems, considering the actions and management of solid waste at inappropriate disposal points in Campo da Union/ Recife-PE. In addition, mitigating environmental issues with the insertion of participatory and collaborative urbanism of users through the collective stimulus of the transformation process is the focus of good management.

THEORETICAL FOUNDATION

Environmental impacts and premises in human actions

Some research shows that environmental awareness in recently developed countries along with interest in environmental issues is increasing (Araújo et al., 2018). In Brazil, the population in general attributes the contextualization of the meaning of the environment to the fauna and flora, excluding, in turn, man as the main protagonist of primary environmental disasters (Ribeiro; Nascimento and Van bellen, 2009).

According to Mucelin and Bellini (2008), everyday actions often mask the problems in the environment due to lack of information, making them imperceptible. Even contemplating cases of aggression to the environment, everyday habits contribute to the urban dweller not reflecting on the consequences caused in the environment. Thus, the high amount of waste generated by human actions compromises the improvement and logistics of the environment and must be avoided and/or minimized (Araújo et al., 2018). These activities carried out by man, such as incorrect disposal of solid waste at critical points that affect local logistics, cause remarkable fragments in nature.

Environmental impacts and incorrect disposal of waste cause visual pollution; however, these problems occur every day and are considered normal (Mucelin and Bellini, 2008; Conke, 2018). This issue reflects on socio-environmental education, and it is worth noting that the applicability of the guidelines established to minimize environmental impacts are hampered by the lack of socio-political interaction between social spheres.

It is of great importance to integrate public policies for waste collection to ensure that the concepts are assimilated and applied in the daily practice of the communities involved. This would guarantee the sustainability of operations and savings for the government to employ in other necessary actions. (Moura et al., 2020).

The guidelines and public policies contained in the PNRS aim at minimizing or mitigating environmental impacts and consider strategies and methods, in addition to establishing instruments to control the treatment of urban solid waste, analysis of the life cycle, and awareness of the goods of durable consumption (Yoshida, 2012; Demajorovic, Augusto, and Souza, 2016).

To guarantee the effectiveness of the guidelines and the performance of the city hall in the face of basic environmental conditions, some strategies must be adopted: implementing garbage collection in all households, with adequate frequency; overseeing the implementation of the household waste

collection; monitoring home collection services; implementing an inspection program for the execution of urban cleaning services.

Environmental education is a delicate topic to be discussed; however, carrying out educational and motivating projects through social activities and debates on recycling and environmental preservation in the community is essential to integrate it into solid waste management and public policies, propagating the social, political, and economic improvement of the place arising from the anthropic environmental integration.

METHODOLOGY

The GUT matrix is a quality tool and aims to prioritize actions to solve problems according to the alternatives observed in more complex analyzes (Nascimento, Santos and Almeida, 2018).

The method was developed by researchers Charles Kepner and Benajamin Tregoe, in 1981, where the main purpose was to qualify and prioritize sets of rational actions considering gravity, urgency, and tendency as parameters in actions and helping strategies (Fernandes, 2015).

Therefore, the choice of the GUT matrix as a support tool for decision-making was a management definition to assist in the effective measures of correction or eradication of the mapped problems from the previous diagnosis carried out regarding the degree of impact.

In the GUT matrix, it is necessary to identify the problems and, for them to be analyzed, assign values from 1 to 5 for the characteristics: gravity, urgency, and tendency, where the points of the GUT scale assigned to each problem are multiplied, giving origin to a resulting value as can be seen in detail in (Table 1). Thus, management actions can be guided by the maximum values obtained (Martins et al., 2017; Fáveri and Silva, 2016).

Table 1. Variables considered in the GUT Matrix.

ACRONYM	CLASSIFICATION	CONCEPT
G	**GRAVITY**	Represents the impact of the problem if it happens. It is analyzed on some aspects, such as: tasks, people, results, processes, organizations, etc. Its effects are always verified in the medium and long term.
U	**URGENCY**	Represents the deadline, the time available or necessary to solve a certain analyzed problem. The greater the urgency, the less time available to resolve this issue.
T	**TENDENCY**	Represents the growth potential of the problem, the probability that the problem will become larger over time. It is the evaluation of the tendency of growth, reduction or disappearance of the problem.

Source: Adapted from Periard, (2011).

The GUT method was applied, assigning the score according to (Table 2), obeying the criteria of gravity "G", urgency "U" and tendency "T" of each

problem found, multiplying the deterministic factors (G* U*T). From these scores, it was possible to catalog the environmental incidences and inappropriate disposal in a prioritization matrix, facilitating the analysis of the data obtained and the taking of corrective and preventive decisions.

Table 2. Scoring of the GUT method.

POINTS	GRAVITY	URGENCY	TENDENCY
	Consequence if nothing is done	**Time frame for decision**	**Proportion of the problem in the future**
5	Extremely serious harm	Immediate action is required	Immediate worsening
4	Very severe	With some urgency	Worsening in the short term
3	Severe	As soon as possible	Worsening in the medium term
2	Somewhat serious	Can wait a little	Worse in the long term
1	No gravity	No hurry	It won't get worse

Source: Adapted from Martins et al. (2017).

A survey of photographs was carried out to register areas with the accumulation of garbage and regions degraded by the proper disposal of these components, identifying the type of solid waste, its characteristics, and origin.
As for the statistical analysis, the computer program "Statistica 10.0" was used to understand the main variables that influence the results of the study. The data used in the program started from a categorical (text), qualitative, and, later, quantitative analysis that allowed the formation of groups analyzed together. For this, it was necessary to generate a 2x4 matrix of independent variables (assigned values) that served as a basis for defining the dependent variables.
The choice of dependent variables was subdivided into incorrect waste disposal (%), disease proliferation (%), and soil contamination depth (meters) through the application of the GUT method. All data underwent statistical treatment, considering the mean and standard deviation, generating a surface and the Pareto diagram.

As for the temporal analysis, the program QGIS 3.22.0 was used, which predicts the spatial patterns assigned to the region under study. In this way, Google MAPS was used to identify the points that contained a volume of solid waste (m^3) and, later, the same area was evaluated for space-time changes.

Characterization of the study area

Campo da União is located in the Macaxeira Neighborhood, in the northern part of the city of Recife, in the state of Pernambuco, at coordinates 8°00'21.1"S, 34°55'56.3"W. The region has approximately 21,000 inhabitants in approximately 5,810 households, with an average of 3.5 people per household and an average monthly income of BRL 1,300.00. The city of Recife

has an area of 218,843 km² (IBGE, 2020); the area under study is approximately 0.09 km².

Household waste collection is a service offered by the Recife City Hall, through EMLURB/PE, for residential solid waste. The collection is limited to 100 liters per day per household, using compactor trucks, according to the days and times established for each neighborhood in the city.

Community actions can contribute to the management of waste in communities, by providing information on the reuse of waste and/or disposal in inappropriate places. As awareness of environmental preservation is evidenced through the direct action of residents, it is important to make them protagonists of their acts by recognizing their role in society.

In this context, visiting the neighborhood helped identify environmental issues, using photographic resources and visual inspection. It was possible to seek support in theoretical bases such as scientific articles, monographs, dissertations, theses, among other bibliographic sources on the subject, to diagnose and prioritize the resolution of advances in environmental impacts, in addition to their origin and cause.

RESULTS AND DISCUSSIONS

Diagnosis of observed environmental problems

Inadequate disposal of solid waste was verified in several points of the community. Today, that is one of the environmental problems that concern the public authorities and threatens nature and the health of communities in Recife. (Table 3) shows some of these surveys from the places under study.

Table 3. Summary of the diagnosis of solid waste carried out *in loco*.

POINTS ANALYZED	ENVIRONMENTAL PROBLEMS OBSERVED	DISCUSSIONS
1	**CRITICAL GARBAGE POINTS CIVIL**	Inadequate disposal of construction and demolition waste, pruning, and household waste.
2	**CONSTRUCTION WASTE**	The volume of waste generated by human actions disintegrates the drainage system, where inadequate disposal results from the lack of information on the community's confinement points.
3	**SOLID WASTE ON STAIRS, STREETS AND ALLEYS**	Inadequate disposal of solid waste at access interconnections makes it difficult for residents to pass and radiates the proliferation of vectors, in addition to causing surface permeabilization caused by mold, mildew, and contaminated water,

4	**SOLID WASTE ON SURFACE DRAINAGE**	With the inadequate disposal of solid waste near the surface drainage of sewage, it is observed that it can obstruct the passage causing an increase in the level of contaminated water in the streets, odor, soil infertility, etc.
5	**SOLID WASTE ON SLOPES AND HILLS**	This problem is recurrent when waste is improperly deposited at the base or body of the slope, sewage is dumped in the open on the ground, which may rupture, causing loss of human lives.
6	**FRAGILITY OF PUBLIC HEALTH**	It is necessary to seek alternatives for the final destination of waste, reusing them with direct interaction between waste collection, composting, and recycling.
7	**PUBLIC PERFORMANCE / PUBLIC INVESTMENTS**	Public and/or financial investment is the starting point in the application of necessary technologies and improvement of the waste management infrastructure.
8	**SOCIAL AND ENVIRONMENTAL EDUCATION**	The education process must be gradual, to promote improvements to the environment.

Source: Adapted from Nascimento et al., (2019).

During on-site inspections, critical points of solid waste were located. They constitute the application of the GUT method, prioritizing them in terms of their nature and providing alternatives for management, minimizing these affected points. The lack of public collection action exacerbates this situation, as seen in (Figures 1 (a) and (b)).

Figure 1. (a) and (b) Critical garbage site due to the absence of public collection services.

Source: Authors, (2021).

For Marques (2005), the consumption of non-recyclable products should be considered one of the major causes of environmental degradation when not controlled, that is, carried out beyond the limits of need. It can seriously compromise the sustainability and proliferation of vectors, as they become excessive and unnecessary, determining the extraction of more resources to

meet demand. In this way, in some points, it is also observed the inadequate disposal of construction and demolition waste, pruning, and domestic waste. Those are some of the critical points that must be analyzed since the input is also formed of other waste, which does not facilitate the recycling of these materials shown in (Figure 2).

Figure 2. Critical garbage sites due to the absence of public collection services.

Source: Authors, (2021).

The waste collection is essential to segregate waste according to its nature, as some of these materials can be reused and, therefore, must have another type of treatment. Environmental awareness is a slow process; incorrect deposition causes issues that affect local health, local visual problems, deterioration of concrete parts due to localized humidity, odors, and the dispatch of leachate that contaminates rainwater and soil.

The reuse of civil construction waste is a proposal for environmental innovation to minimize the extraction of natural materials from riverbeds, etc. Thus, the increase in population generates waste of various types. One of them is the Construction and Demolition Waste, part of the visual of the streets and sidewalks of the community shown in (Figure 3 (a) and (b)).

Figure 3. Construction and demolition waste on sidewalks (a) and avenues (b).

Source: Authors, (2021).

Application of the GUT Matrix resulting from visual analysis

The use of the GUT Method is one of the essential tools for classifying environmental problems. In (Table 4), the criteria can be observed in order to assess the inappropriate disposal of waste. These criteria are subjective and, therefore, considered according to the characteristics of the studied location, with solid waste classified individually for improved decision-making.

Table 4. Variables for diagnostic assessment.

SEGMENT	DETERMINANT VARIABLES FOR THE ASSESSMENT OF THE DIAGNOSIS	G	U	T	SCORE
SOLID WASTE	Inadequate disposal on slopes	5	5	5	**125**
	Impairment of health	5	5	5	**125**
	Public investments	5	5	5	**125**
	Deficiency in surface drainage	5	5	4	**100**
	Soil contamination	5	4	5	**100**
	Problems in sewer galleries	5	4	5	**100**
	Improper disposal on stairs, streets, and alleys	5	4	4	**80**
	Public performance	4	4	5	**80**
	Environmental degradation by anthropic action	5	4	4	**80**
	Recycling performance	5	4	3	**60**
	Civil construction materials	4	3	4	**48**
	Local growth deficit	4	3	4	**48**
	Air pollution / visual pollution	3	3	4	**36**
	Environmental education/social action	3	3	4	**36**

Source: Nascimento et al., (2019).

The values were presented on a rating scale ranging from 40 to 100, with 40 being the lowest value – grade 3; 60 being considered an intermediate data – grade 2; 100 being the highest value - grade 1. According to the data presented in (Table 4), the sector of public investments and commitment to health had a higher score, as this factor comes from finance for the development of new methodologies for improving infrastructure and solid waste management, both obtaining 100 points and rank 1 priority order.

Studies carried out by Costa et al. (2017) corroborated these results, since, on a prioritization scale, the data obtained by the authors for the issue of public investments was 125 points. Still on the dimensioning of costs, solid waste has direct integrity with the morphology and social roughness discussed by (Rodrigues, Filho and Pereira, 2016).

Other factors such as public action, environmental degradation, and environmental education are critical scenarios, occurring in areas where the perspective and dissemination of environmental knowledge is precarious. Environmental awareness is on the agenda, but it is a constructive process since there must be integrity with citizens and with local public authorities to

repair the damages with proposals for intervention and environmental preservation.

It is also observed that some residences do not have a simple sanitation system, discarding the waste directly into the soil and compromising the resistance of the slopes. It obtained a classification of grade (I), with more than 100 points. These environmental problems are recurrent from this incorrect disposal that compromises the health of the residents and makes the place vulnerable and, above all, a critical point of waste disposal.

The incorrect disposal of waste alters the ecological system, proliferating the appearance of exempt, diseases, loss of vegetation cover in green areas, erosion, and soil contamination caused by leachate, altering its physical-chemical characteristics and its fertility (Rufo, and Picanço, 2013). Thus, when deposited in inappropriate sites and then removed, they generate strong odors and emission of methane and carbon dioxide into the atmosphere (Andrade and Alcântara, 2016).

The adopted parameters must be evidenced by the decision-making in places of risk areas, as this scenario can worsen and make landslides caused by human action imminent. The use of the GUT tool can minimize and propose priorities for the restoration of degraded areas, Fáveri and Silva (2016).

In addition, it is understood that health is on a scale of degree 1, with 100 points, considering that this problem is due to the lack of care and the incorrect disposal of waste in urban drainage sites and close to the ditches of rainwater collection. Also, it causes clogged channels, exudation of sewage water contaminating the soil, and the proliferation of vectors that intensify diseases.

According to the data obtained from the GUT Matrix, it is clear that decision-making must be carried out by the government for the most degraded places, considering technical factors and local geography. The rehabilitation of critical points can be minimized by the constant action of selective collectors and with social participation promoting an accessible and clean place.

The use of methodologies for social inclusion of the community in the improvement of the environment is still limited; however, it is essential to raise awareness amongst the residents to minimize the incorrect disposal of solid waste. The waste can be reused through the recycling process. Moreover, educational initiatives might foster better attitudes from the population, avoiding grave, urgent, and tending problems, Gouveia (2012).

To propose improvements and minimize environmental impacts as well as incorrect waste disposal, some social actions and activities were developed, such as restoration of living environments, projects, and lectures

focused on sustainability, together with the public policies that promote residents as protagonists of local improvements.

From the values obtained through the qualitative analysis regarding the use of the GUT tool, a statistical analysis was performed using the ANOVA method (single factor). The results are statistically different according to the P-value which was less than 5% and F (80.21) > $F_{critical}$ (2.78). In face of this behavior, it is verified that the data are significant, with a relationship between the independent and dependent variables. The results can be seen in (Table 5).

Table 5 – Single-factor ANOVA test for analysis of variables.

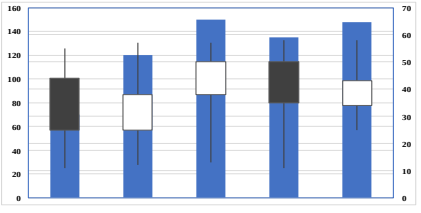
Source of variation	*SQ*	*gl*	*MQ*	*F*	*P-value*	*F critical*
Between groups	62835.19643	3	20945.07	80.21425	1.64693E-19	2.7826
Within groups	13577.92857	52	261.114			
Total	76413.125	55				

Source: Authors, (2021).

To understand the significance, the variables that had a score of 125 with (priority level 1) were chosen and it is known that the lack of public investments and mitigating actions cause several problems - one of them is related to health. In addition, improper disposal of waste can compromise the stability of slopes in risk areas, increasing, in turn, soil contamination because there are no specific projects that minimize these problems.

In (Figure 4), there is the distribution of the compatible variables, where the averages and error analysis were considered to a better discuss the viability of the data used against the GUT matrix method. It is possible to identify that, in some grouped regions, values were presented with median rates equal to 42% and 47% while in region 3 the data were dispersed around 50%, characterized by the lack of greater economic development concerning the variables with scores between 36 (grade 3) and 80 (grade 2).

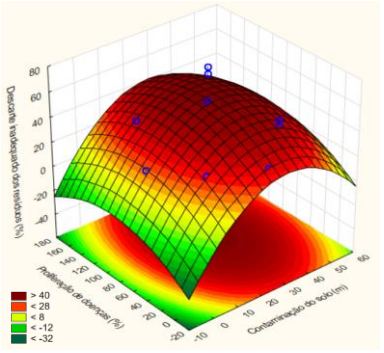
Figure 4. Results of the boxplot for analysis of means and normal distribution.

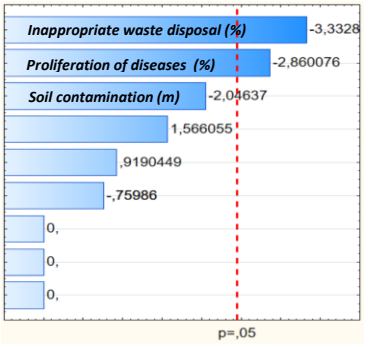


Source: Authors, (2021).

The indication is that a drainage project should be carried out in the study area, as well as the monitoring of the geological behavior. To better contextualize this point, the results are presented in the surface graph, considering the correlations of the 3 independent variables such as inappropriate waste disposal, the proliferation of diseases caused by transmitting agents, and soil contamination, as in (Figures 5a and 5b), respectively. Furthermore, the correlation of these variables had significant results at the 5% variance shown in the Pareto diagram.

Figure 5. (a) Response surface regarding the variables that influence the inappropriate disposal of waste and the proliferation of diseases (b) Pareto diagram.





Source: Authors, (2021).

Temporal analysis

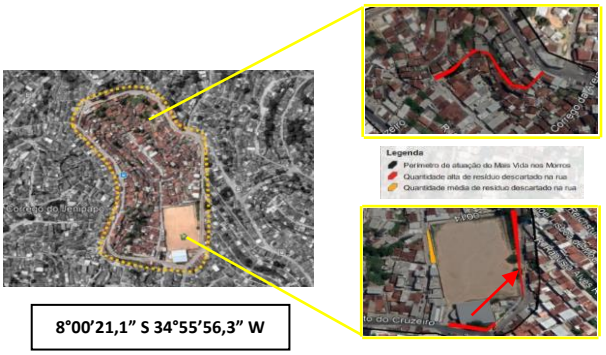
Geoprocessing techniques serve to monitor the occupation of a given region in terms of use and occupational area. It also brings a set of technologies, treatments, and methods used to georeference the data obtained through data analysis focusing, above all, on qualitative and quantitative studies against the presentation of the interventions carried out in the place.

The temporal analysis carried out in (Figure 6) indicated that the solid waste discarded in the access roads went through an intervention process, where its volume varied between 8 m^3 to 10 m^3. They were transported to an organization that operates in the treatments of these materials. In addition, in the region of the field indicated by a (red arrow), more than 3 m^3 of solid waste is cataloged in color (orange); in the same way, more than 6 m^3 of waste improperly disposed of in the regions (red) were found.

These residues bring many problems to the community, such as floods, diseases, problems with drainage, and the proliferation of insects that can cause serious diseases. Therefore, in (Figure 6) the interventions requested by municipal authorities were met and the area in (orange) was classified as a region with a lower volume of waste. The problem of disposal in the access roads was not eliminated, but it decreased, due to the campaigns carried out by the social action and responsible programs of the community.

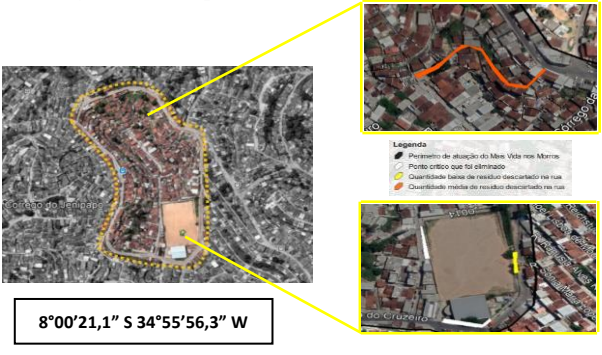
The region of the soccer field in (yellow) (Figure 7) was classified as having a low amount of discarded waste and the critical points in the color (white) were definitively eliminated. In this region, eco points were allocated to minimize the bad disposal of waste and, above all, minimize environmental impacts.

Figure 6. Temporal analysis (before interventions).



Source: Authors, (2021).

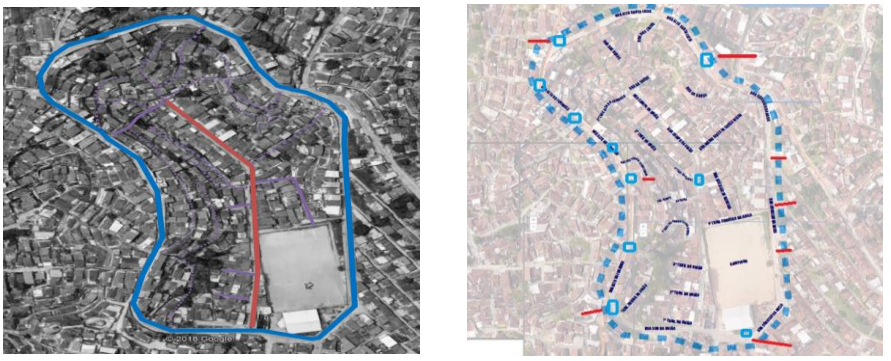
Figure 7. Temporal analysis (after interventions)



Source: Authors, (2021).

The collection points are used by the community, as mapped in (Figure 8).

Figure 8. Mapping of garbage collection points (blue squares)



Source: Authors, (2021).

From this perspective, professionals, who work directly with the waste generated to carry out the collection, package it in specific points. There is no synchronization between the activities carried out due to the insufficient number of trucks for this purpose, allowing residents to identify garbage collection points as critical points for this waste.

As for Eco-stations, they are called waste collection points and offer an alternative to the population for the disposal of old furniture, waste from small residential works, and other materials with a volume of up to $1m^3$/day. To minimize environmental impacts, a survey was carried out in the community, to find out which streets contribute to the critical points of garbage, clarifying the correct points of disposal, according to the type of waste and the time of collection for domestic garbage. Also, it is important to raise awareness amongst them to use the trash cans implemented by social actions. Thus, these bins are used for the resident to place their discarded garbage and not have them in the "open sky" before the scheduled collection time.

In this way, the recycling of some residues is fundamental for the constitution of the environmental practice. For the site under study, there are some points of support that lead to environmental education in the face of voluntary disposal shown in (Figure 9).

Figure 9. Support points for voluntary discards.

Source: Authors, (2021).

Some discarded critical points mapped in the temporal analysis served as a scenario for environmental and social revitalization projects. In (Figure 10), areas with more than 8 m^3 of organic and non-organic solid waste, after the interventions and applications of the paving projects, became a bus stop, which remains intact.

Figure 10. Revitalized areas as bus stops.

Source: Authors, (2021).

(Figure 11) shows the external area of the soccer field that served as a deposit for a volume of approximately 10 m^3 of solid waste. In addition, it could affect the health and well-being of everyone who was on site. To this end, an executive project proposal was developed to transform it into a living area

following regulatory standards. In this region, surface drainage was also carried out to avoid flooding at the site as some ditches were restored for better rainwater runoff.

Figure 11. Revitalized area as a living area.

Source: Authors, (2021).

FINAL CONSIDERATIONS

It was possible to conclude that the irregular deposition of solid waste is one of the factors that most impact the environment, leading to socioeconomic problems and affecting public health. Thus, environmental education programs are necessary so that people can understand the issues caused by the incorrect disposal of waste and that sustainability is one of the main criteria to be discussed for the well-being of citizens.

The GUT tool is one of the solutions that are used in several areas. One of them is the classification of environmental impacts caused by the incorrect disposal of solid waste. Thus, some points studied are a priority in decision-making, such as local health, which obtained a score of 100 points, characterized in grade I; the second is the incorrect deposition at the base of the slope, obtaining 125 points, characterized in grade I.

The solid waste deposition areas are considered critical with the worsening of soil sealing in addition to the occurrence of diseases and the proliferation of vectors, which directly affect the local community.

Environmental awareness is not something simple; however, it can be worked on with the cooperation of all, promoting direct participation in social actions for citizens. Solid waste management is a challenge, especially when dealing with a disadvantaged community. From this perspective, self-awareness activities, workshops, and lectures should be developed so that the

community collaborates with environmental preservation and citizens can understand their role in society contributing to the improvement of the environment where they live.

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