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Environmental Education and Sustainability in the Installation of Recycling Points in the city of Itaquaquecetuba/SP

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Educação Ambiental e Sustentabilidade na Instalação de Ecopontos na cidade de Itaquaquecetuba/SP

RESUMO

Objetivo - Este estudo tem como objetivo analisar os impactos da instalação de ecopontos na conscientização ambiental e na redução do descarte irregular de resíduos na cidade de Itaquaquecetuba.

Metodologia - Foi realizada uma pesquisa qualitativa, contemplando uma revisão da literatura e análise documental, para avaliar a implementação e os efeitos dos ecopontos na cidade.

Originalidade/relevância - A pesquisa destaca a importância da educação ambiental como ferramenta para promover a sustentabilidade, evidenciando o papel dos ecopontos na mudança de comportamentos relacionados ao descarte de resíduos.

Resultados - Os resultados indicam que a instalação de ecopontos em Itaquaquecetuba contribuiu para a diminuição do descarte irregular de resíduos, ao mesmo tempo em que fortaleceu a conscientização sobre reciclagem e manejo adequado de materiais.

Contribuições teóricas/metodológicas - A pesquisa integra teorias sobre gestão de resíduos e educação ambiental, aplicando a análise documental para compreender o impacto dos ecopontos na transformação social e ambiental.

Contribuições sociais e ambientais - O estudo conclui que a educação ambiental, juntamente com a implementação de ecopontos, pode ter um impacto positivo na promoção da sustentabilidade e na proteção do meio ambiente, engajando a comunidade na gestão responsável de resíduos.

PALAVRAS-CHAVE: Ecopontos. Conscientização ambiental. Sustentabilidade urbana.

Environmental Education and Sustainability in the Installation of Recycling Points in the city of Itaquaquecetuba/SP

ABSTRACT

Objective – This study aims to analyze the impacts of installing recycling points on environmental awareness and reducing irregular waste disposal in the city of Itaquaquecetuba.

Methodology – A qualitative research approach was adopted, including a literature review and documentary analysis, to evaluate the implementation and effects of recycling points in the city.

Originality/Relevance – The research highlights the importance of environmental education as a tool to promote sustainability, highlighting the role of recycling points in changing behaviors related to waste disposal.

Results – The results indicate that the installation of recycling points in Itaquaquecetuba contributed to a reduction in irregular waste disposal while strengthening awareness of recycling and proper material management.

Theoretical/Methodological Contributions – The study integrates theories on waste management and environmental education, using document analysis to understand the impact of recycling points on social and environmental transformation.

Social and Environmental Contributions – The study concludes that environmental education, combined with the implementation of recycling points, can positively impact sustainability promotion and environmental protection by engaging the community in responsible waste management.

KEYWORDS: Recycling points. Environmental awareness. Urban Sustainability.

Educación Ambiental y Sostenibilidad en la Instalación de Puntos de Reciclaje en la ciudad de Itaquaquecetuba/SP

RESUMEN

Objetivo - Este estudio tiene como objetivo analizar los impactos de la instalación de puntos de reciclaje en la conciencia ambiental y la reducción del descarte irregular de residuos en la ciudad de Itaquaquecetuba.

Metodología - Se realizó una investigación cualitativa, incluyendo revisión de literatura y análisis documental, para evaluar la implementación y efectos de los puntos de reciclaje en la ciudad.

Originalidad/Relevancia - La investigación destaca la importancia de la educación ambiental como herramienta para promover la sostenibilidad, destacando el papel de los puntos de reciclaje en el cambio de comportamientos relacionados con la eliminación de residuos.

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Resultados - Los resultados indican que la instalación de puntos de reciclaje en Itaquaquecetuba contribuyó a reducir la disposición irregular de residuos, al mismo tiempo que fortaleció la conciencia sobre el reciclaje y el adecuado manejo de materiales.

Contribuciones Teóricas/Metodológicas - La investigación integra teorías sobre gestión de residuos y educación ambiental, aplicando análisis documental para comprender el impacto de los puntos de reciclaje en la transformación social y ambiental.

Contribuciones Sociales y Ambientales - El estudio concluye que la educación ambiental, junto con la implementación de puntos de reciclaje, puede tener un impacto positivo en la promoción de la sostenibilidad y la protección del medio ambiente, involucrando a la comunidad en la gestión responsable de los residuos.

PALABRAS CLAVE: Puntos de reciclaje. Consciencia ambiental. Sostenibilidad urbana.

1. INTRODUCTION

The concern for environmental preservation has become increasingly urgent in light of the challenges faced by contemporary society. Global environmental changes demand profound shifts in the economic, technological, and cultural aspects of society; in this context, according to Reigota (1998), environmental education promotes pedagogical proposals focused on raising awareness, changing behavior, developing skills, evaluation capacity, and the participation of learners.

As stated by Goodland (1995), the need to preserve the environment for future generations has driven the search for innovative and effective solutions to the environmental problems we currently face. Among these, the increasing generation of solid waste and its improper disposal are considered priorities due to their impact on water, air, and soil pollution, biodiversity, and public health. Effective waste management in Itaquaquecetuba is crucial to mitigate the impact of the growing generation of solid waste, ensuring the protection of the environment, public health, and quality of life for future generations.

It is of utmost importance to emphasize that after waste disposal, a sense of shared responsibility must prevail, from individual separation by the consumer to reaching the most appropriate or least polluting destination (Fiorillo, 2020, p. 457). In Brazil, the issue of improper waste disposal is particularly relevant. Despite advances in environmental legislation (Jacobi; Besen, 2011) and increased awareness about the importance of recycling and proper waste disposal (Gonçalves, 2003), we still face significant challenges in waste management.

The city of Itaquaquecetuba presents an interesting and relevant case for the discussion on environmental education and sustainability in the proper management of solid waste. This city is located in the state of São Paulo, Brazil, with a population of approximately 370,000 inhabitants in 2022 (IBGE, 2022). The city faces significant challenges related to improper waste disposal, resulting in environmental and public health issues. The implementation of effective waste management measures, such as the expansion of the selective collection system and raising public awareness, is crucial to address this situation.

According to Jacobi and Besen (2021), recycling points are spaces designated for the correct disposal of different types of waste, aiming for environmentally appropriate final destinations. The installation of these recycling points has the potential to reduce improper waste disposal and promote environmental awareness in the local community. Through the

recycling points, it is expected that the population of Itaquaquecetuba/SP will have access to information and resources that contribute to environmental awareness and behavior change.

Given the above, this article seeks to analyze the impacts of the installation of recycling points in the city of Itaquaquecetuba/SP, both on environmental awareness and on the reduction of improper waste disposal. For this purpose, bibliographic research and document analysis were conducted to understand the effects of this initiative on the community. It is believed that the results obtained can contribute to the improvement of public policies related to environmental education and solid waste management in the city.

2. THEORETICAL FRAMEWORK

2.1 Improper Waste Disposal

Although often used interchangeably, the words "garbage" and "solid waste" actually represent different concepts. As explicated in the Aurélio Dictionary (Ferreira, 2001, p. 1042), garbage is defined as discarded debris swept from various places such as homes, streets, and gardens. It mainly consists of useless items and rubble. In contrast, solid waste has intrinsic value and can be effectively separated, recycled, or repurposed with significant economic potential.

According to Silva (2018), improper waste disposal is a practice that occurs when waste is discarded in inappropriate locations, such as vacant lots, rivers, lakes, and others. This practice is common in many cities in Brazil and around the world and can be caused by various factors, such as a lack of information about the importance of proper waste disposal, inadequate infrastructure for waste collection and treatment, among others.

To combat improper waste disposal, it is necessary to raise public awareness about the importance of proper waste disposal. As highlighted by Fernandes (2020), there needs to be a behavioral change within society and the creation of public policies to encourage recycling and selective collection.

The resolution of the National Environment Council (CONAMA), No. 404, of November 11, 2008, in its article 3, defines urban solid waste as waste generated in residences or any activity that produces waste with domestic attributes. It also includes waste resulting from the cleaning of public areas in urban environments. However, hazardous waste that poses health or environmental risks due to its intrinsic characteristics of flammability, corrosivity, reactivity, toxicity, or pathogenicity is excluded from this resolution (CONAMA, 2008, p. 1).

The United Nations (UN), through Agenda 21, defines waste or waste(s) as follows:

> Solid waste includes all household remnants and non-hazardous waste, such as commercial and institutional waste, street garbage, and construction debris. In some countries, the solid waste management system also deals with human waste, such as excrement, incinerator ash, sediments from septic tanks, and sewage treatment facilities. If these wastes exhibit hazardous characteristics, they must be treated as hazardous waste (São Paulo, 2014, p. 274).

The National Solid Waste Policy (PNRS), Law 12,305/2010, defines solid waste as:

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> XVI - solid waste: material, substance, object, or item discarded as a result of human activities in society, for which final disposal is carried out, proposed to be carried out, or required to be carried out, in solid or semi-solid states, as well as gases contained in containers and liquids whose characteristics make it unfeasible to discharge them into the public sewage system or bodies of water, or require technically or economically unviable solutions in view of the best available technology (Brasil, 2012, p. 11).

According to the PNRS (Law 12.305/2010), the term "waste" or "reject" refers to solid waste that has undergone all viable and economically feasible treatment and recovery processes. When no other option is available, the only possibility left for these materials is environmentally appropriate final disposal (Brasil, 2012, p. 11).

For the purposes of this work, we will consider the impacts of garbage disposal, which can be considered to originate from individual improper disposal, as well as disposal carried out by companies or municipalities. Improper disposal in public roads, rivers, and other unsuitable locations can cause aesthetic degradation (visual pollution), aggravation of flooding, and the spread of diseases. When there is no household collection, it is recommended that food waste be composted and that waste be buried (Jardim, 1995).

Calderoni (1999) defines "urban dynamics" as the generation of waste, which is exacerbated by the constant expansion of the urban population and its concentration in city centers. The byproduct of "urban dynamics" has a multifaceted meaning for those who depend on it. Thus, labeling it as "useless" would be inaccurate, since there is a relativity of values that are added to items considered unusable by capitalist consumer society.

2.2 Classification of Solid Waste

Several criteria are used to classify solid waste, each establishing its own set of parameters based on the object of examination and/or the distinctive characteristics of the waste. According to the PNRS (Law 12,305/2010), solid waste is classified according to its origin and its hazardous nature. Additionally, the Brazilian Association of Technical Standards (ABNT) distinguishes the various types of solid waste as follows (ABNT, 2004):

a) Degree of Hazardousness:

- **Class I Waste** – In this category, the waste is hazardous and comprises substances that exhibit one or more characteristics such as reactivity, flammability, pathogenicity, corrosivity, and toxicity. If these characteristics are not handled or disposed of correctly, they can pose a threat to the environment and public health. Industrial and hospital waste are two examples of Class I waste (Silva, 2013).
- **Class II Waste -** Solid waste that falls into the category of non-hazardous and non-inert exhibits characteristics such as combustibility, biodegradability, or solubility in water. This type of waste includes domestic solid waste, such as Municipal Solid Waste (MSW) (Silva, 2013).
- **Class III Waste -** When subjected to the solubilization test, non-hazardous and inert solid waste do not present any of their components dissolved in concentrations that exceed the safety levels of drinking water, excluding spectrum, color, turbidity,

and taste. This category of waste encompasses waste generated by demolition and construction activities, including glass and wood (ABNT, 2004, p. 5).

b) **Regarding its Origin:** The most commonly employed classification method is based on the item's origin, primarily because it facilitates the identification of the source and allows for the evaluation of management strategies and accountability for their implementation (Massukado, 2004).

- **Household Waste -** Waste generated in households consists of various materials. This includes items such as paper, old newspapers, plastic and cardboard packaging, as well as glass, cans, and organic matter such as food scraps and rags. Special household waste, which includes construction debris, batteries, tires, and fluorescent lamps, can be found within the broader category of household waste. It is noteworthy to consider that a fraction of approximately 90 thousand tons per day of the total urban waste produced in Brazil consists of domestic solid waste, also known as MSW, accumulating nearly 26 million tons annually. The estimated average generation rate in developing countries is about 0.5 kg per inhabitant per day (Oliveira, 1998).
- **Commercial Waste -** Commercial establishments are responsible for waste generation, with the majority coming from restaurants and hotels in the form of discarded food. Packaging waste, however, is mainly produced by supermarkets and stores (Silva, 2013).
- **Public Waste -** The presence of waste in public areas is often a combination of natural debris such as leaves, dust, sand, and twigs, as well as waste that is improperly and inadequately discarded by the population, including discarded rubble, unusable goods, papers, packaging, and food. The types of waste classified as "domestic" and "commercial" are categorized as household waste in urban cleaning ventures. These, along with public waste, constitute the majority of solid waste produced in urban areas (Silva, 2013).
- **Special Source Waste –** Many forms of waste are generated by industrial processes, including radioactive materials. Additionally, waste may be produced by transportation hubs such as ports, airports, and rail and road terminals. Agricultural activity also generates waste that must be properly managed. Finally, waste from healthcare services must be treated responsibly and safely.
- **Industrial Waste -** Waste produced by industrial activities is diverse in nature and varies depending on the manufactured product. Therefore, each type of waste must be analyzed individually. The ABNT NBR 10.004 standard is used to classify industrial waste, which separates waste into three categories: Class I (Hazardous), Class II (Non-Inert), and Class III (Inert) (Silva, 2013).
- **Healthcare Waste -** A variety of medical supplies are created in various locations, including hospitals, clinics, laboratories, pharmacies, veterinary clinics, and health centers. These supplies include needles, syringes, coagulated blood, gauze, dressings, cotton, removed organs and tissues, culture media, animals used in testing, as well as X-ray photographic films.

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The Figure 1 provides a succinct summary of the solid waste categorization process.

Figure 1: Classification framework of waste according to the object of study

STUDY OBJECT	CLASSIFICATION			
Regarding physical nature	Dry			
	Wet			
Regarding chemical composition	Organic matter			
	inorganic matter			
Regarding the degree of danger	Class I	Danger		
	Class II	Non-Hazardous	Class II A - Non-inert	
			Class II B - Inerts	
Regarding Origin	Household waste; commercial; public; from special sources; industrial; of health services.			
Regarding the degree of biodegradability	Easily degradable: materials of biogenic origin.	Moderately degradable: paper, cardboard and other cellulosic products.	Hardly degradable: rags, leather, rubber and wood.	Non-degradable: glass, metal, plastic.

Source: Adapted from Gomes (1989) and Oliveira (1998)

2.3 Integrated and Sustainable Waste Management

The integrated and sustainable management of solid waste encompasses a variety of tactics. These tactics include waste reduction at the source, material reuse practices, selective collection involving the inclusion of specialized recyclers, and even energy recovery from waste (Klunder, 2001).

According to Silva et al. (2019), integrated and sustainable waste management involves a set of actions aimed at reducing the quantity of waste generated, reusing and recycling materials, properly disposing of waste, and restoring degraded areas. This management should be carried out in an integrated manner, involving all sectors of society, from governmental agencies to businesses and the general population.

According to the National Survey of Basic Sanitation of 2008, one-third of Brazilian municipalities experienced flooding between 2004 and 2008. Additionally, 30.7% of municipalities attribute the cause of these floods to waste that was irresponsibly disposed of in public areas such as streets, avenues, lakes, rivers, and streams. Solid waste encompasses various classifications, including different characteristics, sources, and compositions. The management of different forms of waste is governed by precise laws that stipulate the duties of waste management through a variety of methods, such as collection, treatment, and final disposal (Jacobi; Besen, 2011). In addition to managing their own waste, public authorities have the task of regulating the flow of waste in their respective municipalities.

2.3.1 Waste Management in the São Paulo Metropolitan Region.

With a population of 19.7 million people, the São Paulo Metropolitan Region (SPMR) is not only the largest region in Brazil but also one of the largest urban conglomerates in the world. Of this population, 11 million people reside in the city of São Paulo. This region is

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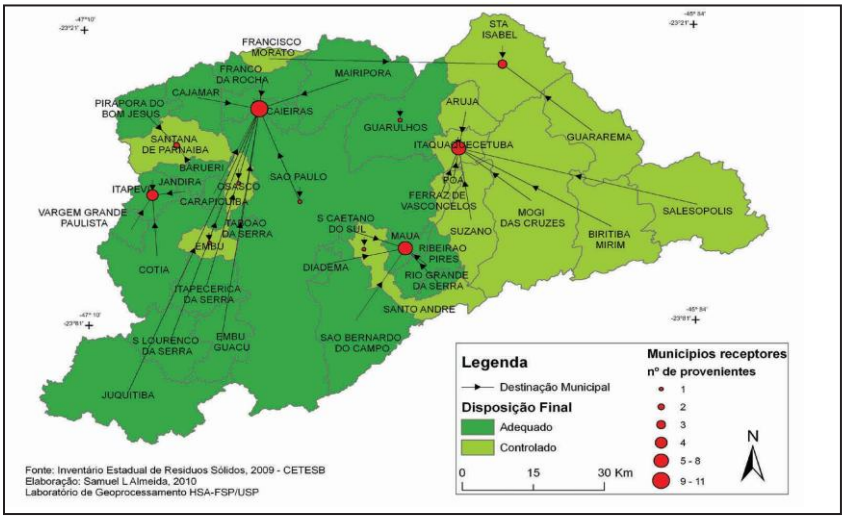
composed of 39 municipalities, including the state capital and 38 neighboring communities. The São Paulo Metropolitan Region is responsible for the estimated production of 16,233 tons of solid waste per day, or nearly six million tons of waste annually. This amount is equivalent to approximately 10% of the waste collected nationwide. The city of São Paulo produces 62.5% of this waste (Jacobi; Besen, 2011).

In more than half of the metropolitan region, approximately 54%, there are environmental limitations that hinder the installation of equipment for waste treatment or disposal. These limitations are located in areas that protect water sources. As a consequence, municipalities are required to transport waste to more distant locations, thereby incurring higher costs. According to Jacobi and Besen (2011), ten of the 39 municipalities in the SPMR have more than 75% of their territorial area inserted in Watershed Protection Areas. Additionally, six of these municipalities have more than half of their territorial area within these areas.

The average estimated amount of household waste generated per person per day in the SPMR is 0.8 kg, while in the city of São Paulo it is around 1 kg (Besen, 2011). In comparison to other countries, the average production of urban solid waste per person per day varies significantly; for example, in the United States, the average production is about 2.58 kg per person per day, while in some European countries like Germany, the average production is approximately 0.77 kg per person per day. In developing countries like India, the average production may be significantly lower, around 0.5 kg per person per day. These differences reflect variations in consumption patterns, waste management practices, and recycling infrastructure in each country (Szigethy; Antenor, 2021).

ABRELPE (2009) reports that in the SPMR, eight private landfills receive approximately 13.5 thousand tons of urban solid waste daily. This represents 57.5% of all waste destined for private landfills in Brazil. A notable distinction of the SPMR compared to other entities is its commitment to eliminating the practice of waste disposal in landfills (Jacobi; Besen, 2011). This distinction is clearly illustrated in the map represented in Figure 2.

Figure 2 - Map of the SPMR with the destination and condition of final disposal of household solid waste 2009.



Source: CETESB (2010)

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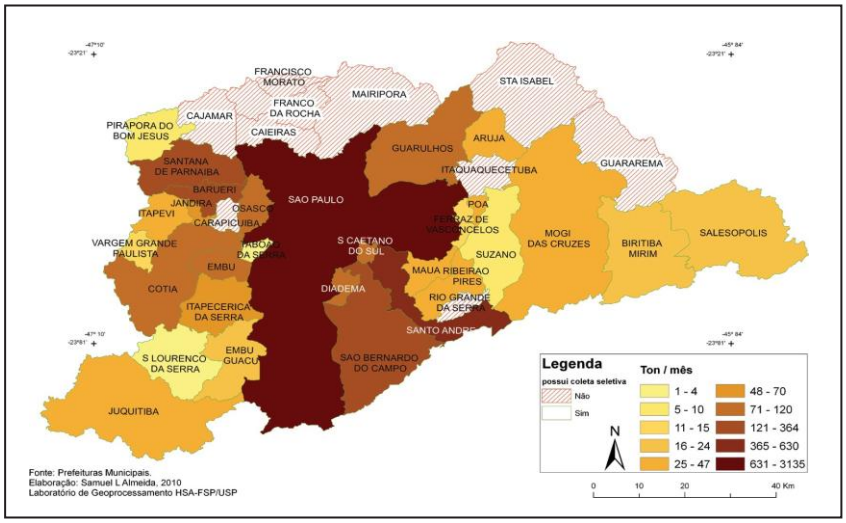
According to Figure 3, in the year 2010, it was found that out of the municipalities belonging to the SPMR, 29 of them, corresponding to 74.4% of the total, had selective collection services. However, only in seven of these municipalities did the selective collection system cover the entire urban area. Additionally, 23 out of the 39 municipalities surveyed in the SPMR dispose of their waste in neighboring municipalities.

Figure 3 – Map of selective collection in the São Paulo Metropolitan Region in March 2010



Source: CETESB (2010)

Considering the importance of universal access and equity in service provision, it is evident that there is a deficit in the availability of selective collection in several cities, as illustrated in Figure 3, which shows the map of selective collection in the São Paulo Metropolitan Region in March 2010. Even in municipalities that have been providing this service for some time, only a small portion of the population benefits from it.

3. METHODOLOGICAL PROCEDURES

The present article aims to analyze the impacts of implementing recycling points in the city of Itaquaquecetuba/SP, both in environmental awareness and in reducing the irregular disposal of waste. To achieve this, a qualitative research approach was conducted, including a literature review and document analysis. The choice of this methodology was driven by the need to understand the current situation of waste management in the municipality of Itaquaquecetuba and the installation of recycling points, as well as municipal public policies focused on environmental education.

For data collection, official documents provided by the Municipal Government of Itaquaquecetuba were analyzed, such as management reports, municipal solid waste management plans, bills, and decrees. Additionally, news articles published in local and regional media outlets covering the topic were consulted.

According to Evangelista (2012, p. 52), these materials originate "from the State apparatus, multilateral organizations, and agencies and intellectuals that circulate within its

sphere." The author also catalogs a variety of documents that are typical in educational policy. These include laws, official and unofficial documents, statistical data, school documents, correspondence, registration books, regulations, reports, books, texts, and related items.

Following Cellard's considerations (2008, p. 297), a document is defined to encompass any form of historical record. This may include photos, music, artwork, interviews, testimonies, newspaper publications, films, among others. In agreement with Evangelista (2012, p. 52), it is emphasized that these documents serve as empirical basis for research in educational policies as they are related to the dissemination of policy guidelines for education, often analyzed as primary sources.

Data analysis was conducted through content analysis. According to Bardin (1991), content analysis is a technique for analyzing qualitative data that allows for the inference of knowledge related to the conditions of production/reception of messages.

4. RESULTS

4.1 The transformation of Itaquaquecetuba through Environmental Education

The municipal administration of Itaquaquecetuba has instituted a series of measures aimed at improving the city's environmental situation. One of these actions was the creation of the Municipal Environmental Guard, whose objective is to protect and oversee environmental preservation areas and water sources, preventing and addressing predatory actions (Itaquaquecetuba, 2023a). The Environmental Guard also collaborates with the Civil Defense and the Department of the Environment, issuing fines and citations for improper waste disposal and forest clearing, as well as addressing issues related to local fauna and flora.

Itaquaquecetuba is one of the 645 municipalities in the state of São Paulo, located in the Southeast region of the country. The municipality has 379,082 inhabitants, all located in urban areas, with none in rural areas. Its area is 82.62 km² and the population density is 4,588.15 inhabitants/km², while the state average is 187.94 inhabitants/km². The municipality is part of the Atlantic Forest biome and the Paraná Hydrographic Region (IBGE, 2022).

Improper waste disposal is a significant problem in Itaquaquecetuba. There are several documented cases of improper disposal in the city (G1, 2023). As a response, an initiative carried out by the local government is the construction, by the year 2023, of 12 recycling points in different neighborhoods and Voluntary Delivery Points (PEVs) in public facilities for the collection of recyclables. Figure 4 illustrates the situation on Vitórino Street, No. 254, located in the Arizona neighborhood in mid-2018, regarding the inappropriate disposal of debris in an unsanctioned storage location.

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Figure 4 – Ilegal Dumping Site – Vitórino Street – Neighborhood: Arizona

Source: Google Street View (2018)

Amidst the challenge of combating illegal dumping in the municipality, the City Hall of Itaquaquecetuba established, in January 2021, the Municipal Environmental Civil Guard with the purpose of safeguarding and restoring the city's environmental preservation areas and water sources (Itaquaquecetuba, 2023a).

With a sustainability-focused vision, the Municipal Government inaugurated recycling points in various neighborhoods, achieving significant progress in solid waste management through the installation of these collection points. Recycling points are designated locations for the collection, storage, handling, and transportation of solid waste that cannot be discarded in regular trash bins (Itaquaquecetuba, 2023b).

Additionally, the Secretariat of Environment, Infrastructure, and Logistics of the State of São Paulo promoted three accessible initiatives for Municipalities. These include the SIGOR Recycling program, the Solid Waste Management Index (SWM), and the Solid Waste Index of the Environmental ICMS (IRS). The conception of the Solid Waste Management Platform aimed to support solid waste management administration in the State of São Paulo and, consequently, facilitate the implementation of the State Solid Waste Plan (SIGAM, 2021).

In the state of São Paulo, an evaluation involving 645 cities was conducted by the Secretariat of State for the Environment, Infrastructure, and Logistics with the aim of analyzing the effectiveness of their solid waste management policies. The city of Itaquaquecetuba stood out due to its remarkable performance in this area (CONDEMAT, 2023). In the Alto Tietê region, the municipality achieved the third position among the evaluated cities and received the efficiency management seal by the Solid Waste Management Index (IGR) for the year 2022. This recognition is the result of the effective implementation of strategies and projects focused on waste management (Itaquaquecetuba, 2023c).

In the assessment, municipalities in the region were classified on a scale of 0 to 10. With a score of 7.8965, the municipality in focus reached the third place in the region, behind only Salesópolis and Suzano, and surpassing Guarulhos and Poá. Among the remaining seven municipalities, the average score was obtained, while two were classified as inefficient (CONDEMAT, 2023).

The transformation of Itaquaquecetuba through environmental education and the

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installation of recycling points is a notable example of how local awareness and action can have a significant impact on waste management. Recycling points play a crucial role in promoting effective solid waste management, as stated by the Brazilian Association of Public Cleaning Companies and Special Waste (ABRELPE, 2009).

According to information provided by the Municipal Government of Itaquaquecetuba, the four newly inaugurated recycling points (Vila São Carlos, Marengo, Piratininga, and Vila Arizona) collected 115 tons of waste in just the months of March and April 2023. This suggests that residents are consistently using these locations for proper waste disposal, instead of opting for improper disposal practices. Figure 5 shows the recent installation of the recycling point in the Vila Arizona neighborhood, as part of measures to combat illegal dumping in the city. The site is equipped with four dumpsters designated for the collection of dismantled furniture, wood, recyclable materials, and construction waste. Additionally, there is a specific space for collecting broken light bulbs (Itaquaquecetuba, 2023e).

Figure 5 – Installation of the recycling point Vila Arizona – Located on Vitórino Street

Source: Google Earth (2023)

The implementation of recycling points in the metropolis has had notable repercussions on the management of irregular waste disposal. Prior to the establishment of these collection sites, the city faced significant challenges regarding improper disposal of materials, particularly solid waste (Itaquaquecetuba, 2023e).

During rainy periods, waste collection plays a crucial role in facilitating proper water drainage into water bodies, making it essential to operate the 15 recycling points established by the Municipality of Itaquaquecetuba, with the prospect of opening five more units by the end of this year (Itaquaquecetuba, 2023b).

During the first semester of 2022, the Municipal Environmental Civil Guard intensified its actions to combat irregular disposal of inert materials in Itaquaquecetuba. The data from Figure 6 reveal a significant reduction in the number of reported occurrences, demonstrating the effectiveness of the implemented measures (Itaquaquecetuba, 2023c).

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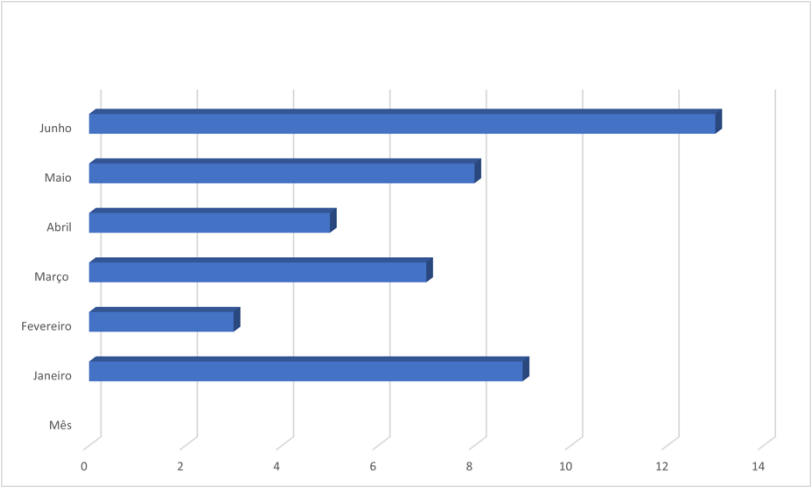
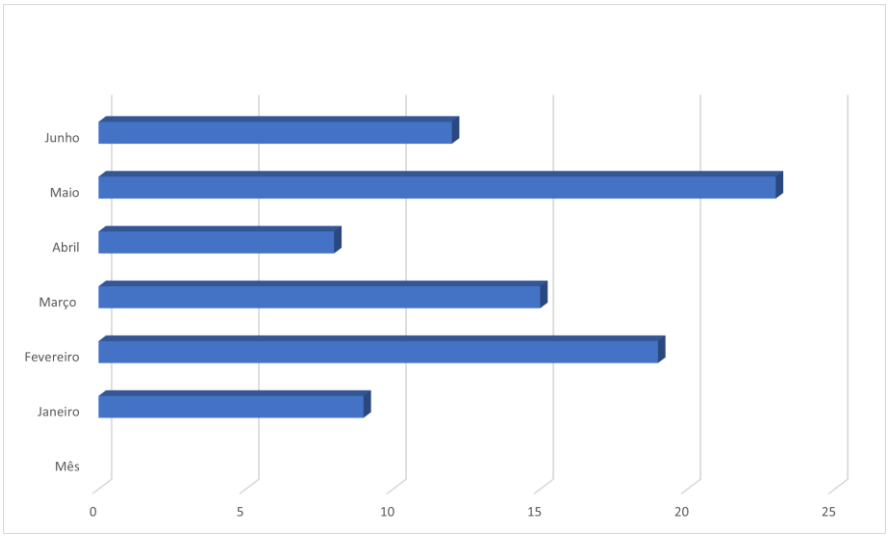
Figure 6 - Data on Irregular Disposal of Inert Materials - January to June/2022 (occurrence records)



Source: Itaquaquecetuba Municipal Department of Environment and Sanitation (2024)

Annually, approximately 3,000 dumpsters are removed from the facilities to prevent improper disposal. The recycling points are available to receive construction waste, tires, disassembled furniture, recyclable materials, appliances, electronics, and light bulbs, from Monday to Saturday, from 8 am to 5 pm (Itaquaquecetuba, 2024).

Figure 7 – Data on Irregular Disposal of Inert Materials - January to June/2023 (incident records)



Source: Itaquaquecetuba Municipal Department of Environment and Sanitation (2024)

Figure 7 reveals a concerning increase in the irregular disposal of inert materials, highlighting the urgency of actions to curb this harmful practice to the environment. The installation of the 15 recycling points so far aims to deter this behavior, aiming at raising awareness among the population and preserving natural resources. Additionally, the imposition of sanctions serves as a deterrent for those who disregard environmental regulations,

reinforcing the importance of compliance with laws and care for the local ecosystem.

Peralta Ambiental is the entity responsible for managing these facilities. All debris collected at these sites is transported to the CDR Pedreira landfill, located in Guarulhos. This fact signals a waste management strategy that includes proper collection and transportation to appropriate disposal facilities (Itaquaquecetuba, 2023f).

5. CONCLUSIONS

The recycling points have proven to be an effective tool for engaging the community in environmental management, fostering shared responsibility between the government and citizens. They have been a catalyst for the reuse of recyclable materials, which are transformed into new products or processes, generating social and economic benefits for the city. In essence, the recycling points are a tangible testimony of how urban development can harmonize with environmental conservation, thereby contributing to the improvement of the population's quality of life.

Looking to the future, there is potential for Itaquaquecetuba to become a model for other Brazilian cities in terms of waste management. The expansion of the recycling points network, together with increased public awareness about their importance, can result in greater citizen adherence to sustainable waste disposal practices.

Furthermore, as technology advances and new recycling strategies emerge, recycling bins have the potential to become centers of innovation in waste management. This could include incorporating advanced technologies to increase collection and recycling efficiency, as well as exploring new ways to transform waste into valuable resources.

In this way, Itaquaquecetuba has the opportunity to stand out as a leading city in sustainability and innovation in waste management. This study suggests that efforts to implement and expand recycling points should be maintained, considering their proven effectiveness in engaging the community and promoting adequate waste disposal. Furthermore, the importance of recycling points as an effective strategy in urban waste management stands out. However, for them to continue to be an efficient and sustainable solution in the future, it is essential that research and innovation in this area remain continuous, always seeking to maximize their potential.

As limitations of this study, it is important to highlight that the analysis of ecopoints in Itaquaquecetuba was restricted to official documents and local news, which may not reflect the full complexity of social and environmental interactions related to waste management. For future studies, it is suggested to conduct interviews or surveys with the local population to gain a deeper understanding of the community's perception of the recycling points and their effectiveness. Additionally, comparing the implementation of recycling points in Itaquaquecetuba with other cities of similar size would be beneficial to identify best practices and common challenges in urban waste management.

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- **Data Curation:** Paulo Roberto Moreira
- **Formal Analysis:** Paulo Roberto Moreira
- **Funding Acquisition:** Heidy Rodriguez Ramos
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- **Supervision:** Heidy Rodriguez Ramos and Jorge Gallego

CONFLICT OF INTEREST DECLARATION

We, **Paulo Roberto Moreira, Heidy Rodriguez Ramos and Jorge Gallego**, declare that the manuscript entitled "**Environmental Education and Sustainability in the Installation of Recycling Points in the city of Itaquaquecetuba/SP**":

1. **Financial Ties:** No financial ties that could influence the results or interpretation of the work. This study was supported in Brazil by and CNPQ - National Council for Scientific and Technological Development, Research Productivity Scholarship.
2. **Professional Relationships:** No professional relationships exist that could affect the analysis, interpretation, or presentation of the results.
3. **Personal Conflicts:** No personal conflicts of interest related to the content of the manuscript.