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Environmental Analysis of the Sanitary Landfill Complex of Feira de Santana, Bahia

Nájila Sena da Silva
State University of Feira de Santana (UEFS), Brazil
najilasil@gmail.com
ORCID iD https://orcid.org/0000-0003-1651-4113

Edson Eyji Sano
Brazilian Agricultural Research Corporation (Embrapa Cerrados), Brazil
edson.sano@embrapa.br
ORCID iD https://orcid.org/0000-0001-5760-556X

Joselisa Maria Chaves
State University of Feira de Santana (UEFS), Brazil
joselisa@uefs.br
ORCID iD https://orcid.org/0000-0003-3627-8074

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Análise Ambiental Do Complexo De Aterro Sanitário De Feira De Santana-Bahia

RESUMO

Objetivo -Analisar a dinâmica ambiental do complexo de aterro sanitário de Feira de Santana, Bahia, identificando os impactos ambientais e as transformações no uso e cobertura do solo ao longo do tempo.

Metodologia - O estudo foi desenvolvido por meio de análise multitemporal com imagens de satélite Landsat 5 e 8 (1993, 2008, 2014 e 2019) e imagens de alta resolução do Google Earth. Os dados foram processados em ambiente SIG, com aplicação de índices de vegetação (NDVI) e classificação de uso e cobertura do solo, subsidiados por análises geológicas, hidrológicas e geomorfológicas da área de estudo.

Originalidade/relevância - O estudo preenche uma lacuna teórica e aplicada sobre o monitoramento ambiental de aterros sanitários em áreas urbanas de médio porte no Nordeste do Brasil, contribuindo para o debate sobre a gestão integrada de resíduos sólidos e o uso do sensoriamento remoto como ferramenta de gestão ambiental municipal.

Resultados - Observou-se redução significativa da vegetação perenifólia e semidecídua, aumento das áreas de solo exposto e expansão das células dos aterros. Foram identificados indícios de contaminação de aquíferos fissurais e a proximidade das unidades de disposição final com áreas de proteção permanente.

Contribuições teóricas/metodológicas - O estudo demonstra a aplicabilidade do sensoriamento remoto e dos sistemas de informações geográficas no diagnóstico ambiental de aterros sanitários, propondo metodologia de análise integrada que pode ser replicada em outros contextos urbanos.

Contribuições sociais e ambientais - Os resultados subsidiam políticas públicas voltadas à recuperação de áreas degradadas, controle da contaminação e planejamento ambiental urbano, reforçando a importância da economia circular e do monitoramento contínuo dos impactos ambientais de aterros sanitários.

PALAVRAS-CHAVE: Aterro Sanitário. Sensoriamento Remoto. Impacto Ambiental. Gestão de Resíduos.

Environmental Analysis of the Sanitary Landfill Complex of Feira de Santana, Bahia

ABSTRACT

Objective – To analyze the environmental dynamics of the landfill complex in Feira de Santana, Bahia, identifying environmental impacts and land use and land cover changes over time.

Methodology – The study applied a multitemporal analysis using Landsat 5 and 8 satellite images (1993, 2008, 2014, and 2019) and high-resolution Google Earth images. Data were processed in a GIS environment with NDVI application and land use/cover classification, supported by geological, hydrological, and geomorphological analyses of the study area.

Originality/Relevance – The research fills a theoretical and applied gap on environmental monitoring of landfills in medium-sized urban areas in Northeastern Brazil, contributing to discussions on integrated solid waste management and the use of remote sensing as a municipal environmental management tool.

Results – The results revealed a significant reduction in perennial and semideciduous vegetation, an increase in exposed soil areas, and the expansion of landfill cells. Signs of contamination of fissural aquifers and proximity to permanent preservation areas were also detected.

Theoretical/Methodological Contributions – The study demonstrates the applicability of remote sensing and GIS tools for environmental diagnosis of landfills, proposing an integrated analytical methodology that can be replicated in other urban contexts.

Social and Environmental Contributions – The findings support public policies aimed at the recovery of degraded areas, contamination control, and urban environmental planning, emphasizing the role of circular economy and continuous monitoring of landfill impacts.

KEYWORDS: Landfill. Remote Sensing. Environmental Impact. Waste Management.

Análisis Ambiental del Complejo de Relleno Sanitario de Feira de Santana, Bahía

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RESUMEN

Objetivo – Analizar la dinámica ambiental del complejo de relleno sanitario de Feira de Santana, Bahía, identificando los impactos ambientales y los cambios en el uso y la cobertura del suelo a lo largo del tiempo.

Metodología – El estudio se desarrolló mediante análisis multitemporal utilizando imágenes satelitales Landsat 5 y 8 (1993, 2008, 2014 y 2019) e imágenes de alta resolución de Google Earth. Los datos fueron procesados en un entorno SIG, aplicando el índice de vegetación NDVI y la clasificación del uso y cobertura del suelo, junto con análisis geokógicos, hidrológicos y geomorfológicos del área de estúdio.

Originalidad/Relevancia – La investigación llena un vacío teórico y aplicado sobre el monitoreo ambiental de rellenos sanitarios en áreas urbanas de tamaño medio en el Nordeste de Brasil, aportando al debate sobre la gestión integrada de residuos sólidos y el uso del teledetección como herramienta de gestión ambiental municipal.

Resultados – Se observó una reducción significativa de la vegetación perennifolia y semidecidua, aumento de las áreas de suelo expuesto y expansión de las celdas de los rellenos. También se identificaron indicios de contaminación de acuíferos fisurales y proximidad a áreas de preservación permanente.

Contribuciones Teóricas/Metodológicas – El estudio demuestra la aplicabilidad de la teledetección y de los sistemas de información geográfica en el diagnóstico ambiente al de rellenos sanitarios, proponiendo una metodología de análisis integrada replicable en otros contextos urbanos.

Contribuciones Sociales y Ambientales – Los resultados apoyan políticas públicas orientadas a la recuperación de áreas degradadas, control de la contaminación y planificación ambiental urbana, destacando la importancia de la economía circular y del monitoreo continuo de los impactos ambientales de los rellenos sanitarios.

PALABRAS CLAVE: Relleno Sanitario. Teledetección. Impacto Ambiental. Gestión de Residuos.

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1 INTRODUCTION

The management of municipal solid waste represents one of the greatest environmental and social challenges of the 21st century, especially in developing countries, where accelerated urban expansion and increasing consumption significantly intensify waste generation (Nanda; Berruti, 2021). Inadequate management of this waste, through disposal in open dumps or landfills without technical control, causes direct impacts on soil, water bodies, air quality because of the emission of greenhouse gases, and the degradation of ecosystems (Machado *et al.,* 2010; King; Gutberlet, 2013; Galdino *et al.*, 2015).

Sanitary landfills remain the main form of final disposal of solid waste in Brazil, as established by the NBR 13896/1997 technical standard (ABNT, 1997), which defines criteria for their design, implementation, and operation. The National Solid Waste Policy (Law No. 12,305/2010) (Brasil, 2010) proposes the closure of open dumps in the country, supported by reverse logistics, selective collection, and recycling. However, the Brazilian reality still reflects inequalities in the implementation of these regulations, with many municipalities still operating open-air dumps, in violation of the principles of sustainability and environmental justice (Costa *et al.,* 2019; Cruz *et al.*, 2025).

The discussion on the role of sanitary landfills is directly related to the Sustainable Development Goals (SDGs), particularly SDG 6 (Clean Water and Sanitation), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). Achieving these goals requires innovative solutions that reconcile economic growth, social inclusion, and environmental preservation (United Nations, 2015; Silva *et al.,* 2024).

In this context, the use of remote sensing and geographic information systems (GIS) emerges as an essential tool for the monitoring and environmental management of areas designated for the final disposal of waste. These technologies enable the assessment of temporal changes in land use and land cover, the identification of environmental impacts, and support sustainable urban planning with lower costs and greater accuracy (Souza, 2010a; Azimov *et al*,2020; Li *et al.*, 2022).

Several international studies have employed remote sensing to diagnose and monitor sanitary landfills, highlighting changes in vegetation, expansion of disposal cells, and groundwater contamination. Studies such as those by Yin et al. (2016) and Sener et al. (2011) demonstrate the potential of satellite images for site selection and the detection of geotechnical instabilities in landfills. In turn, Rahman et al. (2021) and Li et al. (2022) emphasized the role of spectral indices (e.g., Normalized Difference Vegetation Index – NDVI and Normalized Difference Water Index - NDWI) in identifying risk zones and environmental degradation.

In the Brazilian context, the municipality of Feira de Santana (Bahia State) presents a representative scenario: it hosts a complex comprising two sanitary landfills and a deactivated former open dump, reflecting the transition from inadequate disposal practices toward more sustainable waste management models. Located in an area of high hydrogeological sensitivity and within an expanding urban context, the municipality faces challenges related to soil sealing, leachate contamination, and fragmentation of native vegetation (PMGIS, 2016; Oliveira, 2018). Within this context, the general objective of this study is to analyze the environmental dynamics

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of the sanitary landfill complex of Feira de Santana (BA), identifying environmental impacts associated with the expansion of disposal areas and land use and land cover (LULC) changes. This research aims to contribute to scientific advances in the environmental monitoring of sanitary landfills and to strengthen the interface between geotechnologies, solid waste management, and public policies aligned with the SDGs.

2 MATERIALS AND METHODS

2.1 STUDY AREA

This study was conducted in the municipality of Feira de Santana, Bahia State, located at the coordinates 12°16′00″ S (latitude) and 38°58′00″ W (longitude). Among the environmental characteristics, the Atlantic Forest biome predominates, with native forest formations, along with the Caatinga biome, whose vegetation consists of woody, herbaceous, cactus, and bromeliad species.

The average annual precipitation ranges from 300 mm to 500 mm (Franco-Rocha *et al.,* 2007). According to Santos et al. (2018), Feira de Santana presents a C1w2A′a′ climate type, characterized as dry subhumid with a prolonged summer period, megathermal conditions, and summer potential evapotranspiration of 31%, according to the Köppen climate classification. Rainfall is relatively well distributed throughout the year, with averages of 26% in summer, 30% in autumn, 24% in winter, and 20% in spring (Brandão *et al*., 2010).

The city of Feira de Santana is located on a sedimentary plateau formed by Tertiary–Quaternary sediments overlying a Precambrian crystalline basement (Correia Neto *et al.,* 2005). Due to the influence of this sedimentary tablelands, urban expansion in the north–south direction is influenced by the presence of 52 lagoons and the headwaters of several rivers of regional importance, such as the Subaé, Pojuca, and Jacuípe rivers (Lobão; Machado, 2005). Under this geographical influence, the former open dump and two sanitary landfills are located within the urban area of the Nova Esperança neighborhood.

2.2 METHODOLOGICAL APPROACH

To carry out the environmental diagnosis of the sanitary landfills in Feira de Santana, high spatial resolution satellite images available on the Google Earth platform were used for the years 1993, 2008, 2014, and 2019, along with images from the following satellites: Landsat 5 Thematic Mapper ™ (path/row: 216/068; overpasses of 10 December 1993 and 3 February 2008; and spatial resolution of 30 m) and Landsat 8 Operational Land Imager (OLI), Tier 1 (overpasses of 10 May 2014 and 2 December 2019). Landsat is a series of multispectral Earth observation satellites launched by NASA in 1972, comprising nine sensor generations that provide global coverage of the Earth's surface (Souza, 2010a). The image quality and data diversity allow Landsat imagery to be applied in a wide range of environmental studies, as well as to monitor the historical evolution of specific targets on the Earth's surface.

Image selection was based on radiometric quality and cloud cover below 10%. Satellite images were acquired from the United States Geological Survey (USGS) website and processed

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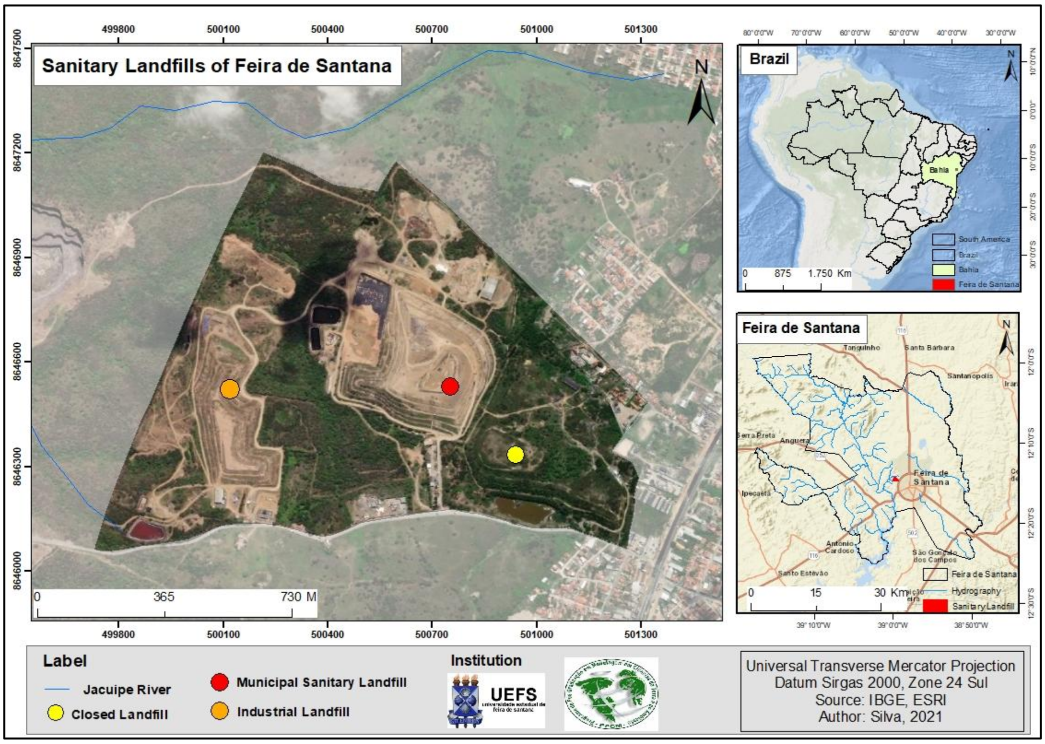
using a geographic information system (GIS), including geographic coordinate projection, false-color composition, image clipping, and LULC classification. To enhance the delineation of vegetation and landfill areas, the red and near-infrared bands were used, and the NDVI was calculated using the equation: NDVI = (NIR − RED) / (NIR + RED), enabling the discrimination between vegetated and non-vegetated areas. For land use analysis, the images were reclassified into four categories: evergreen vegetation, semideciduous vegetation, bare soil, and sanitary landfill. To support the analysis, thematic maps of municipal boundaries, elevation, slope, geology, and hydrography were produced. High-resolution Google Earth imagery supported the historical assessment of solid waste disposal sites.

3 RESULTS AND DISCUSSION

The environmental analysis of solid waste disposal sites constitutes a fundamental step for compliance with federal and municipal legislation related to environmental preservation, ecosystem quality, and monitoring, which are considered obligations of the managers and companies responsible for these activities.

Figure 1 – Location of the study area in the municipality of Feira de Santana, Bahia State



Source: The Authors (2021).

In the municipality of Feira de Santana, municipal solid waste (MSW) disposal sites are concentrated within the same area of influence located in the Nova Esperança neighborhood, near the ring road that connects several neighborhoods to the city center. In this area, a municipal open dump was operated until 2004. The operation of the municipal sanitary landfill began in 2005, and in 2014 a privately operated sanitary landfill was implemented. Thus, the site is referred to as a complex, as it is characterized by environmental constraints and urban pressure (Figure 1).

In the mid-1980s, the operation of the municipal open dump began in a deactivated mining area, specifically an abandoned quarry pit in the Nova Esperança neighborhood, approximately 4 km from the city center (PMGIS, 2016). At that time, neither the NBR 13896/1997 regulation nor the municipal environmental code had yet been approved; therefore, no soil contamination prevention techniques or leachate treatment systems were applied. The open dump operated until 2004 under conditions of severe environmental impact due to the open-air exposure of waste, combined with serious social and public health problems, as it was common to find waste pickers living in precarious and improvised housing.

The open dump area covers 218,000 m² and includes two leachate ponds totaling 9,000 m². The larger pond lacks an impermeable lining, whereas the second pond was constructed with a geomembrane. In 2004, the site exhibited extensive exposed soil and waste disposed of without inert material cover (Figure 2). The open dump activities were terminated in the same year, followed by the initiation of remediation measures involving surface cover and partial leachate drainage.

Figure 2 – Temporal evolution of the Feira de Santana open dump

Source: Google Earth (2021).

During the period from 2014 to 2020, the presence of vegetation was identified at both the base and the top of the disposal cells, along with a reduction in the leachate pond area. Climatic action, combined with high evapotranspiration rates, contributed to a decrease in leachate volume. Part of this liquid effluent is treated; however, landfill gases are not collected or drained (PMGIS, 2016). Considering that the open dump operated for approximately 20 years without environmental and social safety criteria, a Degraded Area Recovery Plan (PRAD) was developed. Its objectives include restoring the area with native vegetation, treating leachate to dry the ponds, and implementing landscape transformations aimed at establishing an urban park (PMGIS, 2016).

In 2004, in response to the socio-environmental impacts resulting from solid waste disposal in an open dump, the first sanitary landfill in the municipality was established, this time in compliance with technical standards and environmental licensing requirements. This landfill is currently in operation and receives household waste.

The municipal sanitary landfill covers an area of 520,000 m² and includes two leachate ponds with a total area of 6,573 m². Between 2014 and 2020, an expansion of disposal cells was

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observed (Figure 3), associated with population growth, increased consumption, and higher waste generation. The landfill was constructed above the original ground level, with waste layers covered by inert material and compacted above the natural terrain. By 2021, the disposal cells had reached an approximate height of 40 m of accumulated waste and inert material.

Figure 3 – Temporal evolution of the municipal solid waste sanitary landfill of Feira de Santana, Bahia State

Source: Google Earth (2021)

Data provided by the company Sustentare Saneamento indicate that in 2020, out of a total of 380,000 liters of leachate generated, 50,000 liters were treated at the landfill itself, while the remaining 330,000 liters were sent to Cetrel, in Salvador, for treatment. Of the treated leachate, 10% is processed using reverse osmosis technology. Sustentare Saneamento operates by receiving municipal solid waste from the municipality of Feira de Santana and neighboring municipalities, including São Gonçalo do Campos, Conceição do Jacuípe, and Amélia Rodrigues. In 2021, a new unit of household waste disposal cells entered into operation. The facility is also equipped with an autoclave for the incineration of healthcare (hospital) waste.

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Figure 4 – Temporal evolution of the industrial waste sanitary landfill

Source: Google Earth (2021)

In response to the population and economic growth of the municipality, the operation of a second sanitary landfill began in 2015. This privately owned landfill was constructed to receive industrial waste and other materials not collected by the municipal public cleaning service. The industrial waste sanitary landfill occupies an area of 389,000 m² and includes four leachate ponds totaling 5,745 m². Figure 4 illustrates the expansion of landfill activities in proximity to a water body, a spring, evergreen vegetation, and a Permanent Preservation Area (PPA).

Over the years, the sanitary landfill complex has been investigated by several authors. Santos (2004), in a physicochemical analysis of groundwater within the area of influence of the open dump, identified high concentrations of sodium, calcium, magnesium, iron, manganese, HCO_3^-, Cl^-, SO_4^{2-}, and NH_4^+, lower values of potassium and NO_3^-, and elevated levels of biochemical oxygen demand (BOD), chemical oxygen demand (COD), and total solids in samples from landfill monitoring wells. Groundwater in the municipal landfill area showed altered composition due to the leaching of compounds originating from the disposed waste.

Souza (2010b), when analyzing the composition of leachate from the municipal landfill in accordance with CONAMA Resolution No. 357/2005 (Brasil, 2005), observed that the concentrations of cadmium, plumber, copper, and chromium found in the samples did not comply with the maximum permissible limits for discharge into receiving water bodies. Oliveira (2018) identified leachate leakage points in both the North and South lagoons of the open dump, even 15 years after the closure of the Nova Esperança dump. Physicochemical analysis of water samples revealed values exceeding the limits established by the Brazilian Ministry of Health Ordinance No. 2,914/2011 for drinking water standards, particularly in terms of alkalinity, electrical conductivity, BOD, total solids, total coliforms, and chloride. Lower concentrations of heavy metals (cadmium, lead, copper, chromium, and mercury), nitrate, nitrite, and sulfate were

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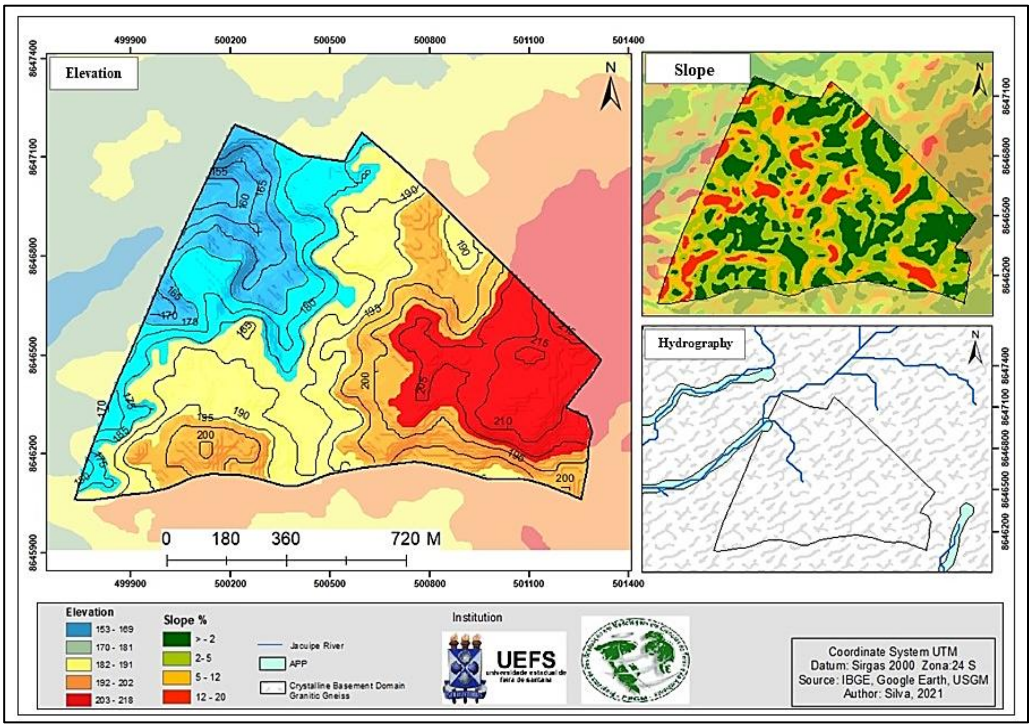
also observed. When compared with the results reported by Santos (2004), it was noted that the time factor contributed to the attenuation of certain elements in the leachate ponds due to natural geological processes involved in the depuration of some chemical constituents.

The landfill complex is located at elevations ranging from 160 m to 200 m and on slopes between 3% and 19%. The lithological units are predominantly composed of granulitic gneiss rocks (Figure 5).

Figure 5 – Elevation, slope, and hydrography of the landfill complex of Feira de Santana, Bahia State



Source: The Authors (2021).

The hydrology of the area is characterized by shallow, weakly incised intermittent streams with small fluvial terraces (Santos, 2004). The main direction of regional groundwater flow is northeast–southwest, toward the Jacuípe River (Oliveira, 2018). According to Santos (2004), groundwater is influenced by a fractured aquifer within the crystalline basement. The rocks exhibit fractures that allow the circulation of water and leachate, increasing infiltration rates and facilitating the transport of contaminants. The predominant soil type in the landfill area is Planosols, characterized by shallow depth, weathering, and low permeability (EMBRAPA, 2006). The composition of both rocks and soils favors surface runoff and infiltration of water and leachate. When there is no impermeabilization at the base, the retention of leachate in treatment ponds derived from waste decomposition becomes a significant source of aquifer contamination.

To assess the influence of landfill activities on vegetation, Landsat 5 and Landsat 8 satellite images from the years 1993, 2008, 2014, and 2019 were processed to identify LULC changes over time (Figure 6).

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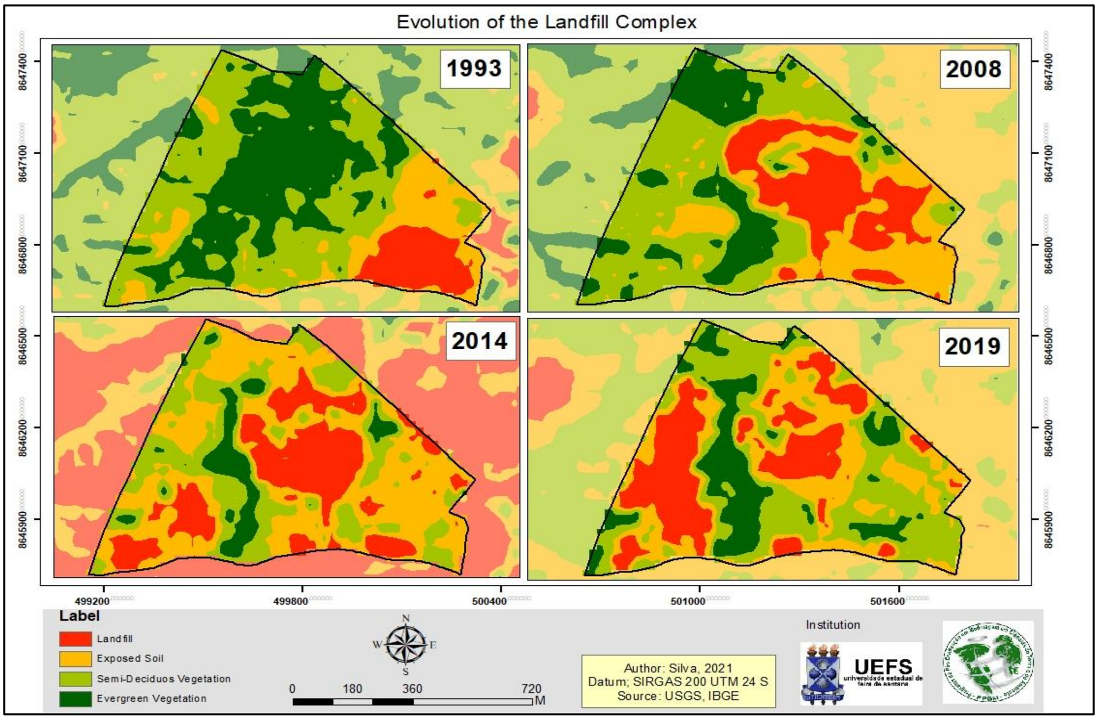
Figure 6 – Temporal evolution of land use in the landfill complex



Source: The authors (2021)

Semideciduous vegetation is characterized by shrub Caatinga species, whereas evergreen arboreal vegetation is influenced by the Jacuípe River. The 1993 land use map shows the presence of open dumps as the only waste disposal site toward the southeast. Regarding natural vegetation, there is a concentration of evergreen vegetation and evidence of intermittent watercourses around the riparian forest.

In 2008, the presence of the municipal sanitary landfill, implemented in 2005, can be observed in conjunction with the open dump, which had its activities terminated in 2004 in compliance with environmental regulations. Evergreen vegetation shows a reduction due to the installation of the new landfill activity. Analysis of the 2014 map reveals changes in vegetation vigor resulting from the expansion of the municipal sanitary landfill and the presence of a new sanitary landfill intended for industrial waste, which began operations in the same year.

The 2019 map indicates partial recovery of vegetation cover in the closed open dump areas, as well as increased vigor and density of evergreen vegetation near the industrial landfill. In contrast, landfill activities and exposed soil areas increased over the years. Vegetation cover was directly influenced by land use changes associated with the implementation and operation of waste disposal facilities.

The industrial landfill was installed near the Environmental Protection Area of the Jacuípe River. Land use and the expansion of disposal cells and landfill areas suppressed vegetation adjacent to a watercourse that may be affected by leachate percolation, potentially resulting in local soil and water contamination. Vegetation in landfill areas tends to be unstable in terms of species composition, as fragmentation and the presence of invasive plants are common; therefore, continuous monitoring is required (Vaverková *et al.,* 2019).

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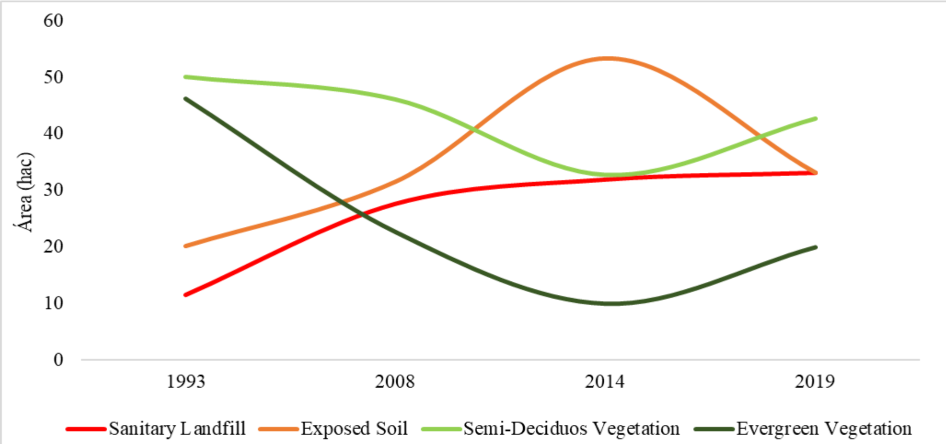
Figure 7 presents the evolution of land use classes between 1993 and 2019 for a total area of 128 hectares. The sanitary landfill area increased from 11.5 ha in 1993 to 33.2 ha in 2019, while bare soil increased from 20.2 ha in 1993 to 33.2 ha in 2019. In 2019, sanitary landfill and bare soil occupied equal areas, indicating that bare soil corresponds mainly to areas of cell expansion in operating landfills and recently disposed waste. Semideciduous vegetation decreased from 50.2 ha in 1993 to 42.8 ha in 2019, while evergreen vegetation declined from 46.3 ha in 1993 to 20.0 ha in 2019, representing a reduction of approximately 50% of native vegetation following landfill implementation.

Figure 7 – Evolution of land use classes from 1993 to 2019



Source: The authors (2021).

An inverse relationship is observed between the bare soil and evergreen vegetation, indicating that the expansion of landfill cells resulted in vegetation fragmentation. By 2019, we identified the beginning of recovery of semideciduous vegetation cover, increasing from 32.8 ha in 2014 to 42.8 ha in 2019 in the open dump that was closed. Evergreen vegetation also showed recovery, increasing from 10 ha in 2014 to 20 ha in 2019 within the zone of influence of the Environmental Protection Area (EPA) near the industrial landfill.

According to NBR 13896/1997 technical standard for the implementation of sanitary landfills, slope and urban distance factors are within the established limits. However, regarding watercourses, the sanitary landfills are located at distances of less than 50 meters, within Permanent Preservation Areas (PPAs). Given these environmental constraints, the landfill complex was implemented in an environmentally fragile area due to the influence of a fractured aquifer, permeable soils, the presence of surface hydrology, and protected areas. Over the years, this has resulted in aquifer contamination by leachate and fragmentation of native Caatinga species.

As an alternative, it is recommended that requalification and ecosystem restoration measures be adopted, since the closure of landfill activities may generate additional environmental impacts, in addition to the high financial costs involved. The implementation of technologies based on the circular economy represents a viable alternative that can contribute to environmental recovery and extend the operational lifespan of the landfill beyond the 30 years originally projected.

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4 CONCLUSIONS

Based on the discussions presented, there has been a significant advancement in environmental legislation and regulations related to solid waste management and sanitary landfill design in Brazil. However, the effectiveness of these public policies still depends on integrated, continuous, and evidence-based implementation, guided by the principles of sustainable development and aligned with the Sustainable Development Goals (SDGs).

The use of remote sensing technologies and GIS in decision-making processes constitutes an indispensable tool for environmental management. Considering the heterogeneity of geographic space, these resources enable continuous monitoring, spatial analysis, and territorial management in a more precise and efficient manner. This technological integration strengthens environmental governance and supports the formulation of sustainable public policies, directly contributing to SDGs 6 (Clean Water and Sanitation), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), 13 (Climate Action), and 15 (Life on Land).

The temporal analysis of landfill areas in the municipality of Feira de Santana revealed processes of vegetation suppression, installation in proximity to water resources, and occupation of permanent preservation areas. Even 16 years after the deactivation of the former open dump, exposed leachate ponds are still observed, highlighting the need for effective environmental policies and projects aimed at the recovery of degraded areas, such as reforestation initiatives or the establishment of an urban green park.

Pollution generated by landfills and open dumps poses significant environmental and public health risks, requiring the implementation of efficient systems for waste treatment and final disposal. The adoption of circular economy-based practices, such as selective collection programs, recycling, composting, and energy recovery, is essential to extend landfill lifespan, reduce pressure on ecosystems, and promote the sustainable use of natural resources.

Therefore, aligning solid waste management with the SDG targets is essential to consolidate a sustainable and smart urban development model that integrates environmental, social, and economic dimensions. Such an approach not only contributes to mitigating environmental impacts but also enhances population quality of life and ensures the preservation of natural resources.

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DECLARATIONS

AUTHORS CONTRIBUTIONS

Nájila Sena da Silva:
Funding acquisition: Secured a master's research scholarship from FAPESB (Bahia State Research Support Foundation), which enabled the execution of the study.
Investigation: Conducted the research and data collection.
Data curation: Organized and validated the data to ensure quality.
Formal analysis: Performed data analyses by applying the defined methods.
Writing – original draft: Wrote the initial version of the manuscript.

Edson Eyji Sano:
Conceptualization and study design: Contributed to the definition of the study objectives and methodology.
Methodology: Assisted in the development and refinement of the methodologies applied in the study.
Writing – review and editing: Performed critical revision of the manuscript, contributing to its clarity and coherence.
Supervision: Coordinated the progress of the work and ensured the overall quality of the research.
Final review and editing: Participated in the final revision to ensure that the manuscript complied with the required standards.

Joselisa Maria Chaves:
Conceptualization and study design: Contributed to the conception of the study and the definition of its objectives.
Methodology: Contributed to the development and refinement of the methods used.
Writing – review and editing: Conducted critical review of the content, improving the structure and argumentation of the article.
Supervision: Coordinated the development of the study and ensured the quality of the work.
Final review and editing: Participated in the review and editing of the final version of the manuscript.

DECLARATION OF CONFLICTS OF INTEREST

We, **Nájila Sena da Silva, Edson Eyji Sano,** and **Joselisa Maria Chaves,** declare that the manuscript entitled **Environmental Analysis of the Feira de Santana Sanitary Landfill Complex, Bahia, Brazil** had:

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