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Proposals for the redevelopment of deactivated landfill areas

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ABSTRACT

Large amounts of the most diverse waste are produced in urban environments, being the landfill one of the most common forms of disposal of these wastes. The need for research on the redevelopment of landfill areas lies in the dynamism and externalities of urban spaces, which generates the need to rebuild degraded areas to promote economic, social, and environmental benefits. In Brazil, there is an expectation that open and controlled dumpsites will be replaced by sanitary landfills. In this sense, the present study seeks to identify alternatives to re-urbanization for areas of deactivated landfills as a way to increase the sustainability of cities, presenting solutions already adopted in Brazil and international trends. To this end, a bibliometric analysis and an extensive bibliographic review were conducted. The main alternatives found were: open spaces (parks, sports and leisure centers), use for agriculture, woods and reforestation areas, intensive use for commercial purposes, housing and energy generation. The main contribution of this article is to open the discussion about what will be the use of these new landfills in the post-closure phase of waste disposal, having in mind an adequate planning of these new landfills, allowing them not to become environmental liabilities when they are deactivated.

KEYWORDS: Bibliometrics. Redevelopment. Sanitary landfill. Scientometrics. Urban solid waste.

1. INTRODUCTION

Since the industrial revolution, a huge amount of the most diverse waste has been produced and currently one of the most common forms of disposal of this waste is the landfill. Landfills are places where the waste generated by the population of a city is deposited, with technical processes that allow contamination reduction when compared to open air dumps and controlled landfills. However, this mode of final waste disposal has several implications for the environmental, economic and social levels (DASKALOPOULOS *et al*., 1997; NOCHIAN *et al*., 2016). Older landfills generally lack the technological elements to make adequate environmental treatments, which turns them into possible sources of contamination due to processes such as leaching of hazardous substances (FLYHAMMAR, 1997).

A pertinent question in the context of this study is about the end of the life cycle of a landfill. As a rule, projects consider the construction, filling, and closing of the site, with the last stage referring to the completion or end of the operation, which in a practical way means saying that the actions of waste transfer and disposal ended (COLOMBO, 2019). However, the processes of solid waste decomposition continue and, therefore, so does the management of these processes. For example, gas and leachate management, surface water management, erosion control, and environmental monitoring. Some serious environmental impacts, such as gas and leachate, can continue for almost 30 years or more. Another challenge that can arise is the use of these sites after decommissioning, since many of the landfills are located in or near urban areas, and can pose both an environmental hazard and restrict the development and expansion of cities. Closure and aftercare are the most important stages of the redevelopment process because most of the technical issues for reusing the site begin at this stage (BUI *et al*., 2019; NOCHIAN *et al*., 2016; ZHANG; KLENOSKY, 2016; ZHAO *et al*., 2007).

The need for research on redevelopment in landfill areas is justified in the constant change in the urban space of cities, the decrease of green areas for future development and the increasing urban population, thus generating the need to rebuild degraded areas and promote benefits for the economy, society and the environment. In developed countries these processes

are more consolidated, because the topic has already been discussed both in academia and in government spheres, but in developing countries the process is still incipient and for this reason it is essential to evaluate the process of landfill decommissioning, as well as the techniques of use change and policy measures adopted (BUI *et al*., 2019; ZHANG; KLENOSKY, 2016).

The Brazilian solid waste final disposal scenario is delicate and complex. From 2010 to 2019, the percentage of tons/year destined in landfills increased from 56.8% to 59.5%. There are also about 17.5% of waste generated in Brazil deposited in dumpsites and 23% in controlled landfills (ABRELPE, 2020) and there are about 2,500 active dumpsites and controlled landfills in the country (OBSERVATÓRIO DOS LIXÕES, 2021). There is an expectation that dumpsites and controlled landfills will be replaced by sanitary landfills and this study seeks, therefore, to present alternatives and solutions for use after the deactivation of sanitary landfills, so that the planning for the elimination of dumpsites also considers this phase of the life cycle. Thus, it is expected that the notes presented here will serve to open a discussion that will avoid that the current dumps become landfills with environmental liabilities when they close their activities and that their urban reinsertion will be facilitated.

2. OBJECTIVES

The aim of this study is to identify redevelopment alternatives for deactivated landfill areas as a way to increase the sustainability of cities and to present solutions already adopted in Brazil.

3. METHODOLOGY

The methodology of this work is composed of three stages: i) bibliographic data collection and bibliometric analysis of the results; ii) proposals for urban reinsertion of landfill areas to increase urban sustainability; and iii) survey of landfill areas redevelopment initiatives in Brazil.

Identifying within the research process the lines and their connections, based on the information present in the databases, is fundamental to understanding the knowledge structure. Bibliometrics and scientometrics allowed the identification of the scientific production in the research area analyzed, in order to measure and analyze the indicators of this field of knowledge. Scientific writing indexed in databases allows for the automatic processing of the various information units found in bibliographic records such as authors, citations, keywords, title terms, and abstracts. The processing of these units uses bibliometrics to identify patterns that show structure, evolution, development and new trends in the knowledge area (FERREIRA *et al*., 2017; GÓMEZ, *et al*., 2016; SOARES *et al*., 2016).

In stage 1, a bibliometric review was performed with data obtained in a search in the Scopus database, which, according to Elsevier, is the largest database of abstracts and citations of the literature reviewed by experts: scientific journals, books and conference proceedings. The procedures were performed on August 05, 2021, with the search in English, using the following clause: ("landfill" AND "redevelopment"). The only refinement applied to the search was

language, and only publications in English were retained. The results were downloaded in .csv format and treated in Excel® and VOSViewer, the latter being a tool for building and viewing bibliometric networks.

In stage 2, the main publications returned in the search were individually analyzed in order to list proposals for redevelopment and urban reinsertion of landfill areas. Finally, in stage 3, a new search was conducted in national databases to survey projects for redevelopment of deactivated landfills in Brazil.

4. RESULTS

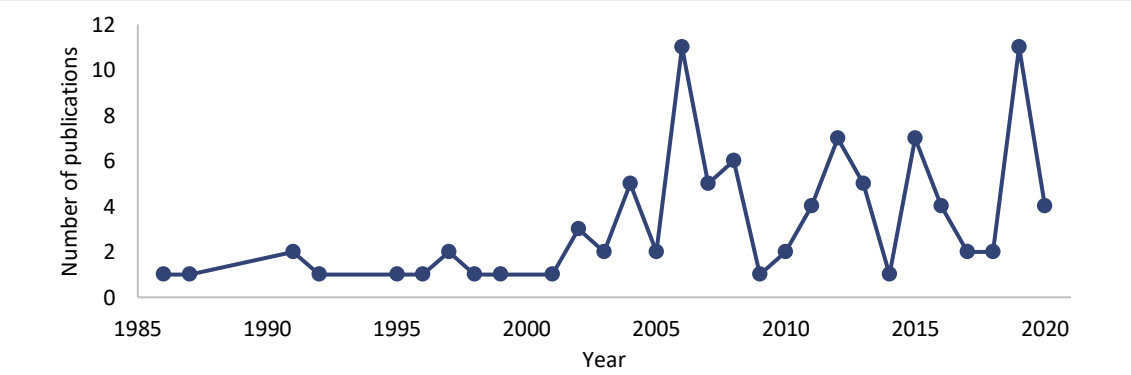
4.1 Bibliographic data collection and bibliometric analysis

The search with the terms "landfill" and "redevelopment" returned 96 publications in journals, conferences, and books. Next, the results are presented in the following structure: i) historical evolution; ii) publications by country; and iii) keyword map.

4.1.1.Historical Evolution

Publications from 1986 onwards were returned, revealing that the theme is not a novelty in terms of scientific publications. However, the historical evolution presented in Figure 1 shows that the annual number of publications is not very high and oscillates greatly over time, with periods of growth often followed by sharp drops in the number of publications. Despite the oscillations, the last 20 years concentrate about 88.5% of the publications, with the peaks occurring in the years 2006 and 2019, with 11 publications.

Figure 1 - Historical evolution of publications indexed in the Scopus database.



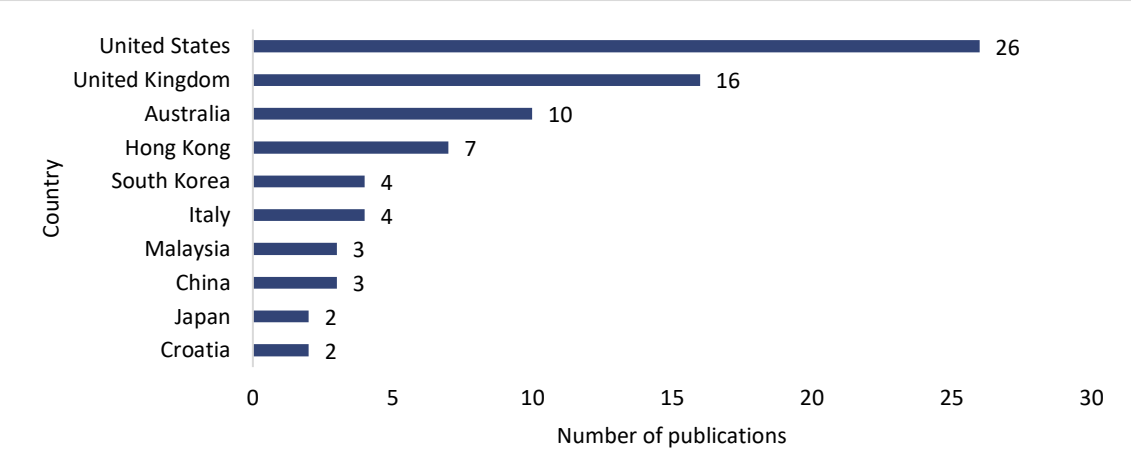
Source: Created by the authors, 2021.

4.1.2.Geographical division of the publications

Of the 96 publications returned in the search, 16 have an undefined country of origin. Figure 2 shows the rankings of the 10 countries with the largest number of publications, whose main origins are the United States, the United Kingdom, Australia, Hong Kong, and South Korea.

These countries concentrated about 66% of the results. The remaining publications are mostly concentrated in European countries, and no publications from Brazil or other Latin American countries were found.

Figure 2 - Publications by country indexed in the Scopus database.

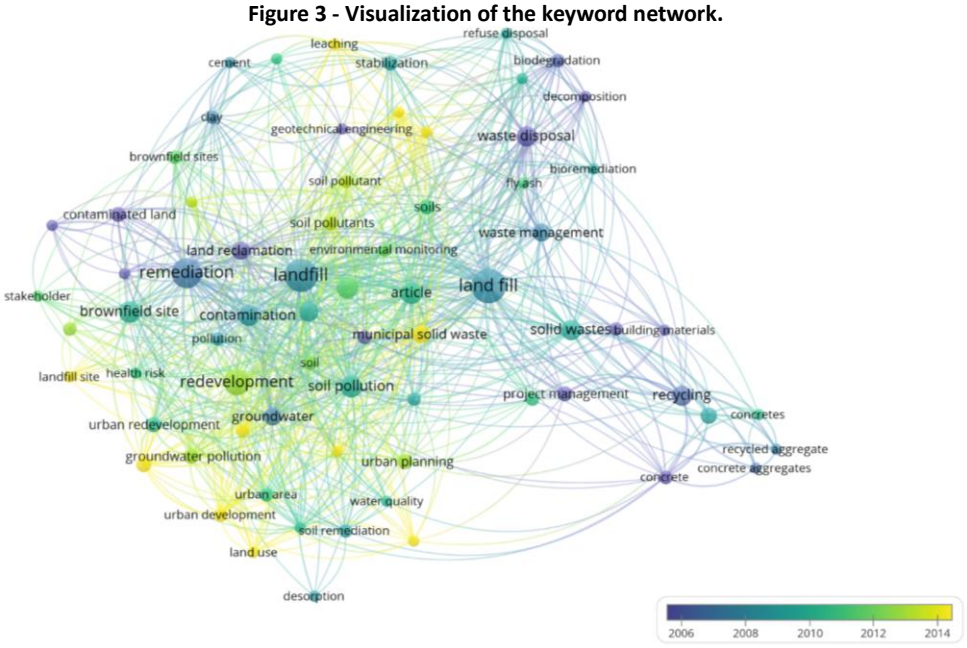


Source: Created by the authors, 2021.

4.1.3.Keyword analysis

Figure 3 presents the keyword network for the search with the terms "landfill" and "redevelopment" by year of publication. Notably, until 2010, the main related terms were linked to the landfill operation itself, or else they linked the landfill to solid waste disposal, as can be seen in the rightmost cluster containing the terms waste/refuse disposal, decomposition, biodegradation, waste management, and solid wastes.

Figure 3 - Visualization of the keyword network.



Source: Created by the authors, 2021.

Terms related to redevelopment, such as land use, urban development, and urban planning, start appearing as of 2012 and become more frequent in the 2014 cluster. This pattern shows that the theme of the urban insertion of landfills was not a focus of attention until recently and that it may gain prominence due to the growing concern about climate change and environmental disasters.

4.2 Proposals for urban reinsertion in landfill areas

The application of purely technical solutions for the redevelopment of landfill areas does not guarantee the success of such initiatives, as the sustainability of the solution under environmental, economic and social aspects must be considered. The main environmental challenges are related to the technical feasibility of the post-decommissioning project, making use of engineering solutions to ensure that the closed landfill is a useful and safe environment. Key economic challenges involve the life-cycle costs of redevelopment and the economic benefits generated, as well as the financial risks and incentives. Key social challenges include the public image of the project, since landfills are perceived as sites of contamination and danger. Therefore, projects that foresee community use post-closure may offer greater resistance to acceptance by the population. Importantly, a successful landfill redevelopment project brings an interesting and beneficial post-use back to the site, promoting public trust (NOCHIAN *et al*., 2016).

The possible benefits that landfill redevelopment can bring can also be divided according to sustainability aspects. Environmental benefits can include the creation of ecological habitats, the improvement of soil and groundwater quality, the possibility of flood control, as well as aesthetic aspects such as improvement of the local landscape. Economic benefits include the economic revitalization of neighborhoods and the economic stimulation of the surrounding areas. The social benefits consist of increased areas for public recreation and leisure, preservation of historically significant sites and the environmental restoration itself that promotes improvements in health and well-being of the population (DE SOUSA, 2003, 2004, 2006). Next, the main alternatives of projects for post-decommissioning landfills are presented.

The creation of open spaces is one of the most recommended options for landfill redevelopment, as this option decreases the risk of environmental failures and disasters (NOCHIAN *et al*., 2016). Open space options include parks, ecological zones, gardens, recreational areas, and sports centers (BUI *et al*., 2019). In a perception study on landfill redevelopment in Malaysia, Simis and Awang (2015) point out that this type of use is considered a priority by the population.

Chart 1 shows examples of open space applications as a use in the period after decommissioning on landfills.

Chart 1 - Deactivated landfills with open spaces as post-use.

Project name	Location	Year of Development or Completion	After-Use Option
Croos State Site	Florida, US	1976	Public Park
Hachiada	Fukuoka, Japan	1981	Park → Primary School → Sports Arena → Community Hall
Cesar Chavez Park	Berkeley, US	1991	Public Park
Imazu Sport Park	Fukuoka, Japan	1992	Park → Urban Farm → Sewage Treatment Facility → Welfare School → Community Hall
Dyer Boulevard Landfill	Florida, US	1993	Multi-Facetted Sports and Recreational Facility
Sanlando Landfill	Florida, US	1994	Softball Complex
Shichimpu	Kaohsiung, Taiwan	1996	Park → Art Gallery → Sports Arena → Power Plant → Sites for temporal waste storage
Milennium park	Massachusetts, US	1997	Public Park
Fudeken Landfill	Taipei, Taiwan	2004	Park → Power Plant → Sites for temporal waste storage
Hirya Landfill	Tel Aviv, Israel	2004	Public Park
Moerenuma Landfill	Sapporo, Japan	2005	Park → Art Gallery → Winter Sports Arena → Community Hall

Source: Adapted from NOCHIAN *et al*., 2016.

Another possible use is transformation into agricultural areas. Bui *et al*. (2019) points out rice cultivation and the planting of pasture and grass for cattle as examples. It is an easy option for redevelopment of these areas and requires low maintenance, but it is necessary that a large area is available for planting and that the topology is suitable. It is also necessary to control leachate and soil and water contamination. As an example of this type of application, the Imazu Sport Park landfill in Fukuoka in Japan had an urban farm as one of its previous uses (BUI *et al*., 2019; NOCHIAN *et al*., 2016).

The creation of woodlands or reforestation areas is also a possibility, although the composition of the waste received in the landfill can configure an implantation restriction, *i.e.*, if the landfill received toxic waste, plants can be affected and this use becomes not recommended. This restriction occurs mainly in this use due to the depth of the roots (BUI *et al*., 2019; COLOMBO, 2019; NOCHIAN *et al*., 2016). Examples of application of this use are presented in Chart 2.

Chart 2 - Deactivated landfills with woodlands as post-use.

Project name	Location	Year of Development or Completion	After-Use Option
Childwall Woods	Liverpool, UK	1960	Woodlands
Key Largo Landfill	Florida Keys	1992	Woodlands
Vizzolo Predabissi Landfill	Vizzolo Predabissi, Italy	2003	Woodlands

Source: Adapted from COLOMBO, 2019 and NOCHIAN *et al*., 2016.

One alternative with greater market appeal is the construction of buildings, for residential and commercial use or for services. This option involves several necessary precautions, among them a more careful technical analysis for the building foundation projects, if the land is suitable for the proposed typology and if after the environmental recovery the water and soil contamination levels are safe. In addition, the flammability of the residues must

be observed, if there is the possibility of explosions and if there are toxic emissions, such as hydrogen sulfide (H_2S) and carbon dioxide (CO_2). In observance of area's safety criteria, the construction of parking lots, public transportation stations, residential condominiums, commercial and service buildings, gymnasiums, museums, waste processing and recycling plants, warehouses, among others can be included in this use (BUI *et al*., 2019; NOCHIAN *et al*., 2016; WILEY; ASSADI, 2002). Some examples are presented in Chart 3.

Chart 3 - Deactivated landfills with constructions as post-use.

Project name	Location	Year of Development or Completion	After-Use Option
Colma Landfill	California, US	1993	Commercial area
Jersey Garden Mall	New Jersey, US	1999	Mall, Hotels, Commercial, Ferry Service
Seabord Point Resort	New Jersey, US	2002	Residential Condominiums
Borgata Casino	Atlantic City, US	2003	Hotel, casino and spa
Lakeside	Atlanta, US	2006	Shopping center
Bayonne Golf Course	Bayonne, US	-	Golf Course
Passaic county Community College	Wanaque, US	-	Community College
Ashbrook Farm	Edison, US	-	Residential
Federal Business Center	Woodbridge, US	-	Office / warehouse development

Source: Adapted from NOCHIAN *et al*., 2016 and WILEY and ASSADI, 2002.

Finally, the last use to be presented in this study is energy generation, either through the collection of gas from the landfill itself, or through implementing solar panels and wind power plants. Power generation at the landfill can provide some benefits to the local community, including offsetting some or all of the electricity needed for the region. Collecting gases generated at the landfill can also present additional environmental benefits, such as decreasing potential nuisance emissions and reduction in greenhouse gas emissions (BUI *et al*., 2019; NOCHIAN *et al*., 2016). Chart 4 presents applications of this use.

Chart 4 - Deactivated landfills with energy generation as post-use.

Project name	Location	Year of Development or Completion	After-Use Option
Los Alamos Country Landfill	Florida, US	2012	Solar Energy Harvesting
Undefined	Florida, US	2012	Solar Energy Harvesting
Undefined	Florida, US	2012	Solar Energy Harvesting
Undefined	Florida, US	2012	Solar Energy Harvesting

Source: Adapted from NOCHIAN *et al*., 2016.

4.3 Brazilian scenario

Brazil faces a peculiar condition regarding final waste disposal and post-decommissioning landfill use. On one hand, there is an expected increase in creating new sanitary landfills as a result of an effort to end open air dumpsites and controlled landfills - 2,518 are still operating in the country (OBSERVATÓRIO DOS LIXÕES, 2021). On the other hand, there is the deactivation of some already saturated landfills. Experiences with deactivations can serve as a planning horizon for the new landfills that will need to be built.

The few Brazilian landfills that have already been deactivated with a redevelopment strategy are mainly located in the city of São Paulo, but bibliographic references were also found

for one case in Salvador and another in Curitiba. The post-use scenarios are diverse, with the city of São Paulo presenting sites with completely inadequate post-use, such as the Jardim Damasceno and Vila São Francisco landfills, sites classified as contaminated areas and that have irregular occupations (BARROS, 2011). More successful cases are discussed in the following.

The Raposo Tavares Park, in the city of São Paulo, was the first park built on landfill in Latin America. The landfill was in operation from 1967 to 1979 and the park was built starting in 1981. The park's current infrastructure includes a running track, playground, multi-sports courts, soccer field, seating areas, and walking trails. Within the park area there is also a plant for sorting recyclable materials (BARROS, 2011; SÃO PAULO, 2021b). Also, in the city of São Paulo, the Sapopemba Landfill Park was built on the landfill that remained active from 1979 to 1986. Installed in the park are sports courts, soccer fields, a central square, seating areas and gym equipment (BARROS, 2011; SÃO PAULO, 2021a).

In Salvador, in a former dumpsite area that was in operation from 1974 to 1997, the Canabrava Socio-Environmental Park was implemented. The area was urbanized and has spaces for sports and other equipment, besides having a complex for generating energy from biogas, a waste sorting plant and a composting unit for the production of fertilizers (STUERMER *et al*., 2011). Reforestation actions have also been carried out at the site, planting seedlings of native species of the Atlantic Forest (SALVADOR, 2015). The Master Plan of the municipality foresees the implementation of management programs for environmental and landscape recovery and recomposition of the areas derived from the landfill, contemplating activities aimed at promotion and social inclusion of the surrounding population (SALVADOR, 2016).

Another case is the landfill of Caximba in Curitiba, in operation from 1989 to 2010, whose closure plan anticipates that the future use of the area should be compatible with the other activities of the landfill that would continue to be performed - treatment of liquid effluents, stabilization of the generation or use of biogas, geotechnical and differential settlements stabilization, and also environmental monitoring activities - these activities should be restricted to research, environmental education and use of biogas. The closure plan also provided for the isolation of the area in a natural way, with the composition of a tree curtain of native species surrounding the entire site (CURITIBA, 2009). Currently, an additional project is underway that foresees energy harvesting through the installation of photovoltaic panels on the deactivated landfill (CURITIBA, 2020).

5. CONCLUSION

This article presented an overview of scientific publications on redevelopment in landfill areas after the deactivation of these spaces, as well as alternatives for urban reinsertion and projects already executed in Brazil. The search conducted in the Scopus database resulted in 96 indexed publications between the years 1986 and 2020. As presented in the results of this study, publications on the subject are incipient, but there is an increase from the 2000s onward. Also, until 2010, the keywords were related to the landfill operation itself, or linked the landfill to solid waste disposal; terms related to redevelopment such as "land use", "urban planning"

and "urban development" started to be indexed only in the last decade, possibly because of the growing concern with environmental protection and conservation for the next generations.

The urban redevelopment and reinsertion projects found in the literature appeared from 1960s onwards, and the following possible uses were observed after the deactivation of landfills: open spaces (parks, sports and leisure centers), use for agriculture, woods and reforestation areas, intensive use for commercial and housing purposes, and energy generation. The Brazilian redevelopment projects presented in this study are located in the city of São Paulo, in Salvador and in Curitiba, and the main use is for open space and leisure, parks and reforestation areas. At the deactivated landfill in Curitiba, a project is being developed to harvest solar energy.

The solid waste disposal situation in Brazil is very complex and is still in a stage of elimination of dumpsites and controlled landfills. It is therefore a time of planning and implementation of new landfills, and the post-closure stage of receiving waste should be incorporated as a phase of the life cycle of the landfill during its construction project. The contribution of this article is precisely to open the discussion about what will be the use of these new landfills in the post-closure stage of waste disposal, and an adequate planning of these new landfills will allow them not to become environmental liabilities when they are deactivated. It is emphasized that because of the controversies surrounding the theme, as well as the significant impacts resulting from both the implementation and the urban reinsertion of these areas, the local population must be consulted, and their opinions must be taken into consideration for the projects planned for these areas.

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REFERENCES

ABRELPE. **Panorama dos Resíduos Sólidos no Brasil**. São Paulo: Abrelpe, 2020. Disponível em: https://abrelpe.org.br/panorama/. Acesso em: 06 ago. 2021.

BARROS, L. H. S. **Requalificação dos aterros desativados (brownfields) no Município de São Paulo: Parques (greenfields) Raposo Tavares e Jardim Primavera**. 2011. Tese de Doutorado. Universidade de São Paulo.

BUI, T. H. H.; HOANG, A. D.; KIM, Y. T. An application of full analytic hierarchy process to identify the best use of Dong Ngo closed-landfill site in Bac Ninh city, Vietnam. **Environmental Progress & Sustainable Energy**, v. 38, n. 6, p. e13273, 2019.

COLOMBO, S. M. The naturalistic recovery of an old landfill: the case of Vizzolo Predabissi, Milan, Italy. **Detritus**, Volume 07 - September 2019(0), 1. doi:10.31025/2611-4135/2019.13848.

CURITIBA. PREFEITURA MUNICIPAL. **Plano de encerramento do aterro sanitário de Curitiba**. Prefeitura Municipal de Curitiba, Secretaria Municipal do Meio Ambiente, 2009. Disponível em: https://mid.curitiba.pr.gov.br/2020/00299234.pdf. Acesso em: 06 ago. 2021.

CURITIBA. PREFEITURA MUNICIPAL. **Avança projeto de instalação de painéis solares no antigo aterro do Caximba**. Prefeitura Municipal de Curitiba, 2020. Disponível em: https://www.curitiba.pr.gov.br/noticias/avanca-projeto-de-instalacao-de-paineis-solares-no-antigo-aterro-do-caximba/56390. Acesso em: 06 ago. 2021.

DASKALOPOULOS, E.; BADR, O.; PROBERT, S. D. Economic and environmental evaluations of waste treatment and disposal technologies for municipal solid waste. **Applied Energy**, v. 58, n. 4, p. 209-255, 1997.

DE SOUSA, C. A. Turning brownfields into green space in the City of Toronto. **Landscape and urban planning**, v. 62, n. 4, p. 181-198, 2003.

DE SOUSA, C. A. The greening of brownfields in American cities. **Journal of Environmental Planning and Management**, v. 47, n. 4, p. 579-600, 2004.

DE SOUSA, C. A. Unearthing the benefits of brownfield to green space projects: An examination of project use and quality of life impacts. **Local Environment**, v. 11, n. 5, p. 577-600, 2006.

ELSEVIER. SCOPUS. Editora Elsevier, 2021. Disponível em: <https://www.scopus.com/home>. Acesso em: 05 ago. 2021.

FERREIRA, V. G. F.; WILMERS, J. T.; FERNANDES, R. A.; HOFFMANN, W. A. Análise bibliométrica na área de pesquisa em cidades inteligentes a partir das características de governança e governabilidade. In: **XVIII ENCONTRO NACIONAL DE PESQUISA EM CIÊNCIA DA INFORMAÇÃO (XVIII ENANCIB**). 2017.

FLYHAMMAR, P. Estimation of heavy metal transformations in municipal solid waste. **Science of the total environment**, v. 198, n. 2, p. 123-133, 1997.

GÓMEZ, M. C. A.; GOÑI, J. O. Análisis bibliométrico y de contenido. Dos metodologias complementarias para el análisis de la revista colombiana Educación y Cultura. **Revista de Investigaciones· UCM**, v. 14, n. 23, p. 14-31, 2016.

NOCHIAN, A.; TAHIR, O. M.; MAULAN, S.; MIKAEILI, A. R. A review of systematic approach for sustainable redevelopment of a closed landfill site. **Jurnal Teknologi**, v. 78, n. 5, 2016.

OBSERVATÓRIO DOS LIXÕES. Confederação Nacional de Municípios (CNM), 2021. Disponível em: http://www.lixoes.cnm.org.br/pagina/interna/o-que-e-observatorio. Acesso em: 06 ago. 2021.

SALVADOR. PREFEITURA MUNICIPAL. **"Vem Me Regar" dá início a reflorestamento do Parque Socioambiental de Canabrava.** Prefeitura municipal de Salvador, 22 setembro 2015. Disponível em: http://www.comunicacao.salvador.ba.gov.br/index.php/todas-as-noticias-4/46964-vem-me-regar-da-inicio-a-reflorestamento-do-parque-socioambiental-de-canabrava. Acesso em: 06 ago. 2021.

SALVADOR. PREFEITURA MUNICIPAL. **Lei nº 9.069 de 30 de junho de 2016**. Dispõe sobre o Plano Diretor de Desenvolvimento Urbano do Município de Salvador - PDDU 2016 e dá outras providências. Disponível em: http://www.sucom.ba.gov.br/wp-content/uploads/2016/07/LEI-n.-9.069-PDDU-2016.pdf Acesso em: 06 ago. 2021.

SÃO PAULO. PREFEITURA MUNICIPAL. **Aterro Sapopemba.** Prefeitura Municipal de São Paulo, 2021a. Disponível em: https://www.prefeitura.sp.gov.br/cidade/secretarias/meio_ambiente/parques/regiao_leste/index.php?p=142855. Acesso em: 06 ago. 2021.

SÃO PAULO. PREFEITURA MUNICIPAL. **Raposo Tavares.** Prefeitura Municipal de São Paulo, 2021b. Disponível em: https://www.prefeitura.sp.gov.br/cidade/secretarias/meio_ambiente/parques/regiao_centrooeste/index.php?p=5764. Acesso em: 06 ago. 2021.

SIMIS, M.; AWANG, A. Planning for ex-landfill redevelopment: Assessing what community have in mind. **Asian Social Science**, v. 11, n. 15, p. 136, 2015.

SOARES, P. B.; CARNEIRO, T. C. J.; CALMON, J. L.; CASTRO, L. O. D. C. D. Análise bibliométrica da produção científica brasileira sobre Tecnologia de Construção e Edificações na base de dados Web of Science. **Ambiente Construído**, v. 16, n. 1, p. 175-185, 2016.

STUERMER, M. M.; BROCANELI, P. F.; VIEIRA, M. E. M. Os aterros sanitários desativados e o sistema de áreas verdes da Cidade de São Paulo: possibilidade de integração. **Revista LABVERDE**, n. 2, p. 11-29, 2011.

VOSVIEWER para Windows, versão 1.6.11. Desenvolvido por Nees Jan van Eck e Ludo Waltman no Centro de Ciência e Estudos de Tecnologia da Universidade de Leiden. Leiden University, The Netherlands, 2019. Disponível em <https://www.vosviewer.com/>. Acesso em 15 jun. 2019.

WILEY, J. B.; ASSADI, B. Redevelopment potential of landfills. A case study of six New Jersey projects. **WIT Transactions on Ecology and the Environment**, v. 55, 2002.

ZHANG, L.; KLENOSKY, D. B. Residents' perceptions and attitudes toward waste treatment facility sites and their possible conversion: A literature review. **Urban forestry & urban greening**, v. 20, p. 32-42, 2016.

ZHAO, Y.; SONG, L.; HUANG, R.; SONG, L.; LI, X. Recycling of aged refuse from a closed landfill. **Waste Management & Research**, v. 25, n. 2, p. 130-138, 2007.