Advances in Global Innovation & Technology

Application of the PER model in the *Valmor de Souza* – Jundiaí-*SP*

Aplicação do modelo PER no Jardim Botânico Valmor de Souza – Jundiaí-SP

Aplicación del modelo PER en el Jardín Botánico Valmor de Souza – Jundiaí- SP

Barbara Modesto Simões[1]
barbara.simoes@fatec.sp.gov.br

Beatriz Mamedes de Amorim[1]
beatriz.amorim@fatec.sp.gov.br

Claudinete da Conceição Nilo[1]
claudinete.nilo@fatec.sp.gov.br

Tânia Rita Gritti Ferraretto[1]
tania.ferraretto@fatec.sp.gov.br

1 – Fatec Jundiai

Recebido
Received
Recibido
Jun. 2024

Aceito
Accepted
Aceptado
Nov. 2024

Publicado
Published
Publicado
Jan./Mar. 2025
Ene./Mar. 2025

https://**git.fateczl.edu.br**

e_ISSN
2965-3339

DOI
10.29327/2384439.3.2-4

São Paulo
v. 3 | n. 2
v. 3 | i. 2
e32460
Janeiro-Março
January-March
Enero-Marzo
2025

Abstract :

The *Jardim Botânico de Jundiaí Valmor de Souza* - JBJ - located in the city of Jundiaí - SP, occupies an area of 150,000 m², once abandoned, taken over by exotic grasses, waste and rubble, the result of decades of degradation by anthropogenic actions. Inaugurated in 2004, the site, intended initially as a garden for the public's leisure, has become a *Jardim Botânico* with various attractions, including themed gardens paying homage to different ethnic groups, walking and cycling trails, as well as conservation and preservation activities for some species, environmental research and education, and genetic conservation of regional flora. The aim of this study was to identify the impacts that existed before the construction of the Jundiaí *Jardim Botânico* and how they were resolved and/or reversed after its installation. The methodology adopted was exploratory research with a bibliographic survey of websites and articles on the subject, complemented by a case study (in loco) applying the Pressure-State-Response Model (PER) at the JBL. It was found that, by using environmental rehabilitation and conservation measures, the JBJ has not only reversed environmental decline but has become an inspiring example of ecological reconstruction and public awareness, highlighting the fundamental role of *Jardim Botânico* in promoting the conservation and preservation of biodiversity in urban environments, and meeting 3 of the sustainable development goals of the 2030 agenda: "Sustainable cities and communities", "Action against global climate change" and "Life on land", which are important in helping to tackle the problems of development and environmental degradation found not only in Brazil but throughout the world.

Keywords: *Pressure-State-Response; Sustainable Development Goals; Environmental Monitoring.*

Resumo:

O Jardim Botânico de Jundiaí Valmor de Souza – JBJ – localizado na cidade de Jundiaí-SP, ocupa uma área de 150.000 m², outrora abandonada, tomada por gramíneas exóticas, resíduos e entulhos, resultado de décadas de degradação por ações antropogênicas. Inaugurado no ano de 2004, o local, originalmente pensado como um jardim para lazer da população, tornou-se um Jardim Botânico, com diversas atrações, incluindo jardins temáticos homenageando diferentes etnias, trilhas para

DOI: https://doi.org/10.29327/2384439.3.2-4

caminhada e bicicleta (ciclovia), além de atividades de conservação e preservação de algumas espécies, pesquisa e educação ambiental, conservação genética da flora regional. O presente trabalho objetivou identificar os impactos existentes antes da construção do Jardim Botânico de Jundiaí, e como foram solucionados e/ou revertidos após a sua instalação. A metodologia adotada foi a pesquisa exploratória com levantamento bibliográfico em sites e artigos que versam sobre o tema complementada pela realização de um estudo de caso (in loco) com a aplicação do Modelo Pressão-Estado-Resposta (PER) no JBL. Verificou-se que, ao utilizar medidas de reabilitação e conservação ambiental, o JBJ não só reverteu o declínio ambiental, mas tornou-se um exemplo inspirador de reconstrução ecológica e conscientização pública, realçando o papel fundamental dos Jardins Botânicos na promoção da conservação e preservação da biodiversidade em ambientes urbanos, e atendendo a 3 dos objetivos de desenvolvimento sustentável da agenda 2030: "Cidades e comunidades sustentáveis", "Ação contra a mudança global do clima" e "Vida terrestre", importantes no auxílio ao enfrentamento dos problemas de desenvolvimento e degradação ambiental encontrados não só no Brasil, mas em todo o mundo.

Palavras-chave: Pressão-Estado-Resposta; Objetivo de desenvolvimento Sustentável; Monitoramento Ambiental.

Resumen:

El Jardín Botánico de Jundiaí Valmor de Souza – JBJ – ubicado en la ciudad de Jundiaí-SP, ocupa un área de 150.000 m², una vez abandonado, invadido por pastos exóticos, desechos y escombros, resultado de décadas de degradación por acciones antropogénicas. Inaugurado en 2004, el lugar, originalmente concebido como un jardín para el esparcimiento de la población, se ha convertido en un Jardín Botánico, con varias atracciones, entre ellas jardines temáticos que honran a diferentes etnias, senderos para caminar y andar en bicicleta (ciclovía), así como actividades de conservación y preservación de algunas especies, investigación y educación ambiental, conservación genética de la flora regional. El presente trabajo tuvo como objetivo identificar los impactos que existían antes de la construcción del Jardín Botánico de Jundiaí, y cómo se resolvieron y/o revirtieron después de su instalación. La metodología adoptada fue una investigación exploratoria con un relevamiento bibliográfico en sitios web y artículos que tratan el tema, complementado con un estudio de caso (in loco) con la aplicación del Modelo Presión-Estado-Respuesta (PER) en JBL. Se descubrió que mediante el uso de medidas de rehabilitación y conservación ambiental, JBJ no solo revirtió el deterioro ambiental, sino que se convirtió en un ejemplo inspirador de reconstrucción ecológica y conciencia pública, destacando el papel clave de los Jardines Botánicos en la promoción de la conservación y preservación de la biodiversidad en entornos urbanos, y cumpliendo 3 de los objetivos de desarrollo sostenible de la agenda 2030: "Ciudades y comunidades sostenibles", "Acción contra el cambio climático global" y "Vida de ecosistemas terrestres", importantes para ayudar a enfrentar los problemas de desarrollo y degradación ambiental que se encuentran no solo en Brasil, sino en todo el mundo.

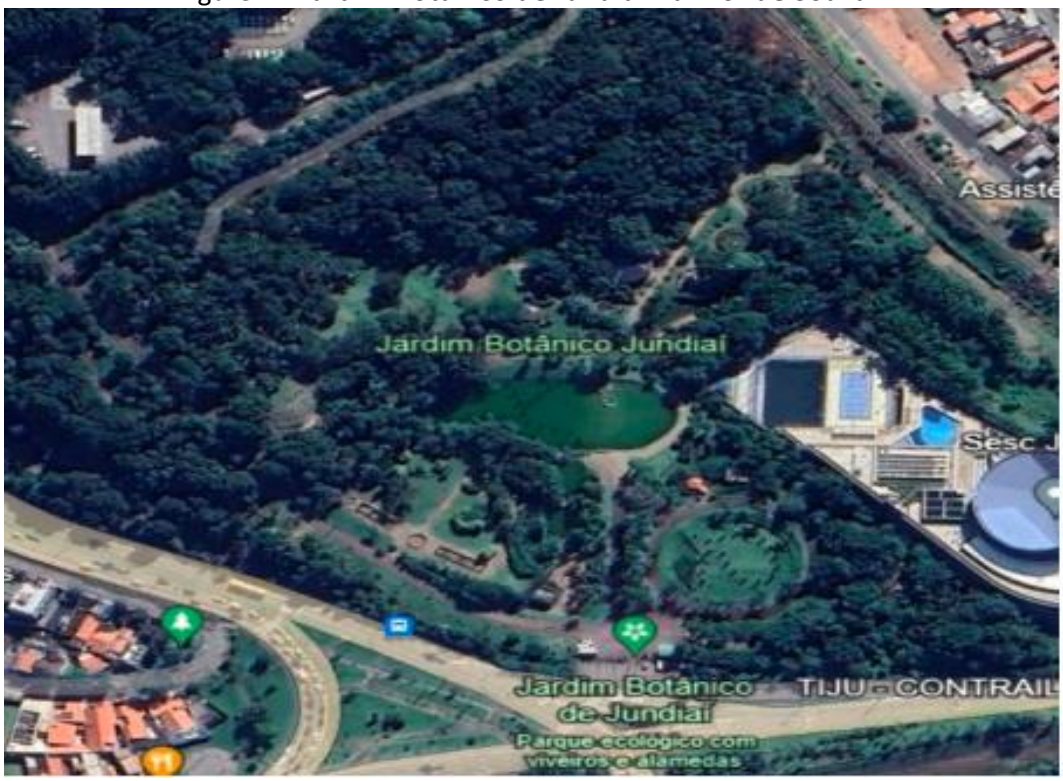
Palabras clave: *presión-estado-respuesta; Objetivo de Desarrollo Sostenible; Vigilancia ambiental.*

DOI: https://doi.org/10.29327/2384439.3.2-4

1. INTRODUCTION

The *Jardim Botânico de Jundiaí Valmor de Souza* – JBJ – is located in the city of Jundiaí-SP, occupying an area of 150,000 m² (Figure 1). Inaugurated on December 29, 2004, "it emerged as a proposal to recover a public area with a long history of degradation" (Jardim Botânico de Jundiaí, N/D, our translation).

Figure 1 – *Jardim Botânico de Jundiaí Valmor de Souza*



Source: Google Earth, 2023

The previously abandoned site was overgrown with exotic grasses, waste and debris, resulting from decades of degradation caused by anthropogenic actions such as mineral extraction activities, improper disposal of domestic and industrial waste and recurrent fires that altered the original vegetation, causing damage to the remaining flora. To recover the area in question, the initial proposal aimed to "establish a large garden to enrich and rehabilitate the space, providing a new green leisure area for the city of Jundiaí". However, after technical discussions, the municipal administration approved the proposal to build a *Jardim Botânico* (Jardim Botânico de Jundiaí, N/D, our translation).

In 2012, following CONAMA Resolution No. 339/2003, which governs the guidelines for *Jardim Botânico* throughout Brazil, the management of the *Jardim Botânico* began several activities provided for in the aforementioned resolution: the creation of a team with the skills and technical knowledge to carry out conservation, environmental education and research activities, as well as seedling breeding and seed collection. On July 9, 2015, the National Commission of *Jardim Botânico* granted the *Jardim Botânico* the registration and classification in Category "B". In 2016, the preparation of the *Jardim Botânico* Policy for Living

DOI: https://doi.org/10.29327/2384439.3.2-4

Plant Collections began. This document aims to serve as a practical instrument to support the management and management of collections, presenting the main guidelines for decision-making, purposes and objectives when managing a collection of living plants. Its purpose is to promote the genetic preservation of flora groups that are native to the two main biomes of the municipality of Jundiaí: Cerrado and Atlantic Forest (Jardim Botânico de Jundiaí, N/D).

Given the above, the main objective of this study was to identify the impacts that existed before the construction of the *Jardim Botânico* and how they were resolved and/or reversed after its installation. Furthermore, specific objectives were to understand the history of the area before and after the creation of the JBJ and to measure and compare, through on-site analysis, the changes that occurred at the site. This is a significant fact that needs to be addressed due to the growing demand for environmental issues and the restoration of degraded areas.

To this end, the methodology adopted was exploratory research, with a bibliographic survey of websites and articles dealing with the subject. A case study (in loco) was also carried out with the application of the Pressure-State-Response Model (PER) at JBL, and information was collected from employees and interns at the site.

2. Theoretical Basis

2.1 The PER Model – Pressure-State-Response

The Pressure-State-Response (PER) model developed by the OECD (Organization for Economic Cooperation and Development) allows us to distinguish indicators of pressures on the environment, indicators of environmental conditions and indicators of society's responses.

Environmental **pressure indicators** describe the pressures exerted by human activities on the environment and natural resources. "Pressures" are implicit or indirect and immediate or direct pressures. Environmental indicators are closely linked to production and consumption methods and often reflect emission intensities or resource use and their trends and developments over a given period.

Indicators **of environmental conditions, or status,** refer to the quality of the environment and the quality and quantity of natural resources. They thus reflect the ultimate goal of environmental policies and aim to provide an overview of the state of the environment and its evolution over time.

Response indicators show the extent to which society responds to environmental issues. They refer to individual and collective actions and reactions aimed at reducing or avoiding the negative effects of human activities on the environment, limiting or remedying the degradation already inflicted on the environment, and conserving and protecting nature and natural resources (OECD, 2002).

DOI: https://doi.org/10.29327/2384439.3.2-4

2.2 Sustainable Development Goals

As a form of plea for environmental protection and climate issues, to end social problems such as hunger and extreme poverty and to ensure that individuals in all locations can enjoy prosperity and peace, the Sustainable Development Goals are part of the 2030 agenda of the United Nations in Brazil. These consist of 17 challenging and interconnected goals governed by 169 global action objectives to be achieved by 2030. These goals aim to solve the main development problems affecting the population in Brazil and globally (United Nations Brazil, 2024).

Numbered from 1 to 17, their themes are: Poverty eradication; Zero hunger and sustainable agriculture; Health and well-being; Quality education; Gender equality; Clean water and sanitation; Affordable and clean energy; Decent work and economic growth; Industry, innovation and infrastructure; Reducing inequalities; Sustainable cities and communities; Responsible consumption and production; Action against global climate change; Life below water; Life on land; Peace, justice and effective institutions and Partnerships for the means of implementation (Scabin, 2024).

Monitoring and evaluating progress on the 2030 Agenda are crucial to its implementation and needs to be done at all global, regional and national levels. The High-Level Political Forum on the Sustainable Development Goals oversees global progress and is overseen by the UN General Assembly and the Economic and Social Council. Implementation of the Agenda is guided by Goal 17 and several other targets from other goals, requiring collaboration, solidarity and engagement between governments, the private sector, civil society and the United Nations (Scabin, 2024).

3. METHOD

The present study aimed to evaluate the impact of the installation of the *Jardim Botânico de Jundiaí* -JBJ- in an area previously degraded by anthropogenic actions (Figure 2) with a view to the site's environmental recovery.

To this end, the methodology used was exploratory research, with a bibliographic survey of websites and articles dealing with the subject. A case study (in loco) was also carried out with the application of the Pressure-State-Response Model (PER) at JBL, and information was collected from employees and interns at the site.

Eight anthropogenic pressure indicators (existing before the installation of JBL), eight state indicators (consequences of anthropogenic pressures on the environment) and eight response indicators (solutions resulting from the installation of JBL) were raised.

So that we could quantify the scale of importance of each item, pressure, state and response, a table was created with two columns for assigning scores to the indicators (given by the researchers, with the help of JBJ employees, to generate greater credibility due to the guidance of professionals in the area).

DOI: https://doi.org/10.29327/2384439.3.2-4

Figure 2 – Photo of the area where the *Jardim Botânico de Jundiaí* was built – SP

Source: *Jardim Botânico de Jundiaí* (2023)

Pressure is considered an adverse anthropic action that causes damage to the chosen location/environment and the state as a consequence of these actions, meaning degradation or harm to the environment. Therefore, negative scores are given to both indicators. As for the responses, positive scores were given to nullify the conditions of the degraded area for beneficial actions carried out during the construction of the JBJ.

Table 1 shows the values assigned to the indicators (pressure, state and response): pressure item (4 different scales, with 0 being the lowest impact score and 3 the highest); "State" item (values also vary from 3 to 0, with 0 being the best score and 3 the worst); "Response" item (values are between 0, 3, 6 and 9, with 0 being an unsatisfactory situation concerning the recovery of the degraded area, and 9 being an excellent situation to the detriment of the same relationship).

Table 1- Linked notes following the PER model

Pressure (-)	**State (-)**	**Answer (+)**
3- High Pressure	3- Very Negative	9- Excellent
2- Strong Pressure	2- Negative	6- Good
1- Weak Pressure	1- Slightly Negative	3- Weak
0- No Pressure	0- Positive	0- Unsatisfactory

In accordance with the linked notes, a formula was developed to calculate the

DOI: https://doi.org/10.29327/2384439.3.2-4

current environmental condition of the *Jardim Botânico*:

Current Environmental Condition = Response + (- Pressure + (- State))

4. Results and Discussion

We created a spreadsheet using the Windows Excel tool to visualize and analyze the data obtained better. Table 2 shows the indicators found through literature and employee perspectives collected from descriptive and bibliographic research. The responses obtained about the former degraded area reflect the construction of the *Jardim Botânico* on the site.

Table 2 - Linked notes and related values for current condition by indicator

Indicators	Pressure (-)	State (-)	Answer (+)
Exotic Grasses	-2	-1	6
Isolated trees	-1	-1	9
Mineral extraction	-3	-3	9
Deposition of industrial debris/waste	-2	-3	9
Disposal of waste/waste from the local population	-2	-2	9
Successive fires	-3	-3	9
Visual pollution	-1	-1	9
Use of land for circus attractions	-1	-1	9

Source: Prepared by the authors (2023)

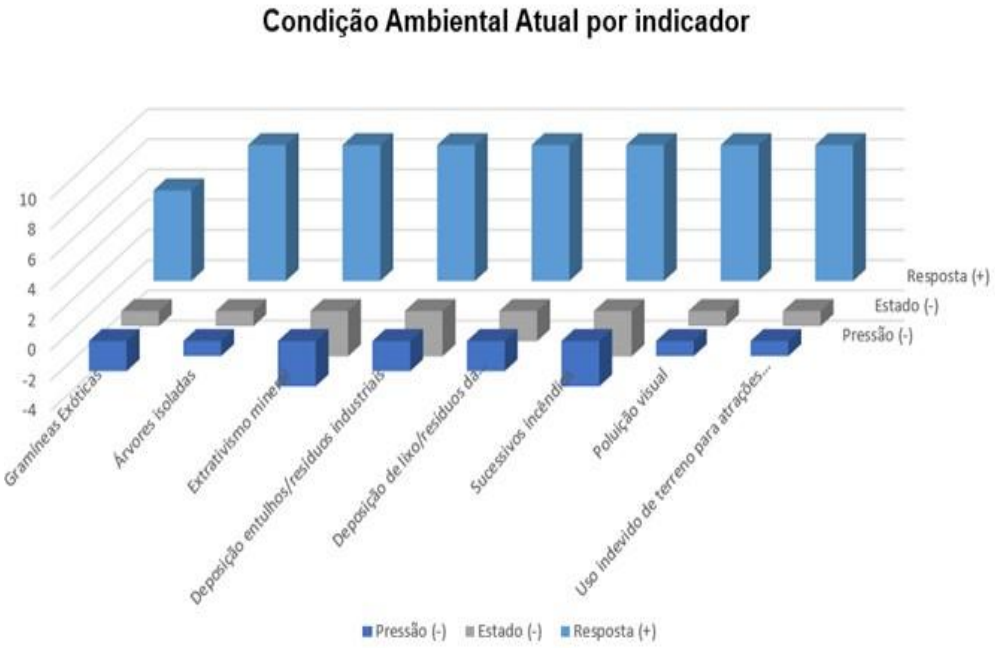
After filling in the table of indicators raised according to the PER model and assigning the appropriate scores to each pressure indicator, state of the degraded area and response (construction of the JBJ), we calculate the current Environmental Condition of each indicator based on the formula developed in equation 1.

Most of the values linked to the responses are 9, which is excellent (referring to the recovery of the degraded area).

This fact can be explained by the fact that all the problems, except for the exotic grasses, were 100% solved from the moment the *Jardim Botânico* (answer, according to the PER Model) was built. The isolated trees no longer exist since space has extensive afforestation, with numerous species important to our history, such as *Pau-Brasil*, and possessing scientific rigor, not just something for visual purposes.

Figure 3 – Graph of the results of the current Environmental Condition of the indicators applied in the PER method

DOI: https://doi.org/10.29327/2384439.3.2-4



Source: Prepared by the authors (2023)

Mineral extraction has been eliminated, and its impacts are no longer visible, as the JBJ has recovered soil full of life. Whether domestic or industrial, waste disposal no longer occurs, as the area is not abandoned, and trash cans are scattered throughout the garden, making it easy to dispose of trash brought by visitors to the site. There are no frequent fires at the JBJ, as it is a preservation and conservation area, and to prevent citizens from setting fires for some vile reason, there are guards constantly patrolling the area. Using the land to set up circuses is no longer possible due to its construction.

The researchers believe that visual pollution is a better-solved problem since the visual transformation of the place is significant: a degraded and lifeless area transformed into a space with plants, animals, and spaces for leisure, research, and environmental education, certainly contributing to the quality of life of the residents and the scientific community.

The only indicator that did not receive a score of 9 was exotic grass because, unfortunately, a large number of brachiarias are still competing for space with native grasses, an impact that needs to be controlled by JBJ employees. In short, we did not receive any negative responses or recovery.

5. Conclusion

From the analysis of the results obtained with the application of the Pressure-State-Response model in the *Jardim Botânico de Jundiaí*, we can observe a significant evolution and recovery of the area that was previously degraded and today transformed into a space for the protection of natural resources and environmental research, becoming an example of a model for future attitudes of preservation and recovery of the environment, promoting ecological awareness in the region.

DOI: https://doi.org/10.29327/2384439.3.2-4

The transformation of this degenerated area into an active *Jardim Botânico* demonstrates a significant effort to transform the environmental damage caused by human actions in the past.

The application of the PER model in the studied area allowed a more direct assessment of the impacts of the construction of the JBJ, highlighting the adverse actions that were offset by positive and beneficial responses, resulting in visible improvements in environmental quality and local biodiversity, demonstrating a continuous commitment to sustainability and the preservation of local species, in conjunction with conservation and research guidelines, aligned with the standards of the National Environmental Council in 2016.

By using environmental rehabilitation and conservation measures, the *Jardim Botânico* has not only reversed environmental decline but has also become an inspiring example of ecological reconstruction and public awareness, reinforcing the importance of continuous monitoring and assessment of environmental impacts, highlighting the fundamental role of *Jardim Botânico* in promoting the conservation and preservation of biodiversity in urban environments.

Finally, it is concluded that the construction of the JBJ meets 3 of the sustainable development goals of the 2030 agenda, numbers 11, 13 and 15, respectively, the goals of "Sustainable cities and communities", "Action against global climate change" and "Life on land", important in helping to face the development problems found not only in Brazil but throughout the world, building a community more accessible to green spaces, developing environmental education and implementing policies that contribute to sustainability and mitigation of climate impacts, supporting the preservation of plant species, native and exotic, important for the maintenance of the ecosystem and the prosperity of life on the planet.

REFERENCES

ECONÔMICOS, OCDE - **Organização de Cooperação e Desenvolvimento. Rumo a um Desenvolvimento Sustentável**: indicadores ambientais. 2002. Tradução - Ana Maria S. F. Teles. Disponível em: https://www.oecd.org/env/indicators-modellingoutlooks/2345364.pdf. Acesso em: 13 out. 2023.

JBJ. JARDIM BOTÂNICO DE JUNDIAÍ. **Histórico**. 2023. Disponível em: https://jardimbotanico.jundiai.sp.gov.br/institucional/historico/. Acesso em: 09 out. 2023.

ONU. ORGANIZAÇÃO DAS NAÇÕES UNIDAS. **Sobre o nosso trabalho para alcançar os Objetivos de Desenvolvimento Sustentável no Brasil**. 2024. Disponível em: https://brasil.un.org/pt-br/sdgs. Acesso em: 15 abr. 2023.

DOI: https://doi.org/10.29327/2384439.3.2-4

SCABIN, Denise. **O QUE SÃO OS ODS E O QUE VOCÊ TEM A VER COM ISSO?** 2024. Disponível em: https://semil.sp.gov.br/educacaoambiental/2023/09/o-que-sao-os-ods-e-o-que-voce-tem-a-ver-com-isso/#:~:text=Os%20Objetivos%20de%20Desenvolvimento%20Sustent%C3%A1vel%20(ODS)%20s%C3%A3o%2017%20objetivos%20ambiciosos,no%20Brasil%20e%20no%20mundo. Acesso em: 10 abr. 2024.