REVISTA
INTERDISCIPLINAR DE
DESENVOLVIMENTO SUSTENTÁVEL
ISSN 3086-7401

RIDES

MUNICIPAL NURSERIES AS A STRATEGIC TOOL FOR PUBLIC MANAGEMENT AND ENVIRONMENTAL CONSERVATION: A CASE STUDY IN SOUTHWESTERN PARANÁ

Viveiros municipais como ferramenta estratégica de gestão pública e conservação ambiental: estudo de caso no Sudoeste do Paraná

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How to cite: SILVA, Newton José de Jesus. VIVEIROS MUNICIPAIS COMO FERRAMENTA ESTRATÉGICA DE GESTÃO PÚBLICA E CONSERVAÇÃO AMBIENTAL: ESTUDO DE CASO NO SUDOESTE DO PARANÁ. **Revista Interdisciplinar de Desenvolvimento Sustentável**, [S. l.], [s.d.]. DOI: 10.48075/x38gpd78. Disponível em: https://e-revista.unioeste.br/index.php/rides/article/view/38012. Acesso em: 29 ago. 2026.

Abstract: Municipal nurseries constitute fundamental technical units for public environmental management, especially in regions subject to intense agricultural and livestock pressure, such as Southwest Paraná. This study presents an account of the experience of the Municipal Nursery in Santo Antônio do Sudoeste, Paraná, analyzing its history, infrastructure, and the production and distribution of seedlings from June 2023 to June 2026. A qualitative-quantitative approach was adopted, involving a document review, technical visits, and regulatory analysis. During the analyzed period, 9,080 seedlings were produced, with 49.06% being native species and 50.94% exotic species; regarding distribution, 74.83% went to rural areas and 25.17% to urban areas. The results demonstrate that the municipal nursery's role extends beyond seedling production, as it fosters administrative autonomy, contributes to compliance with environmental legislation, enhances public spaces, and aids in achieving the Sustainable Development Goals (SDGs). It is concluded that strengthening the unit depends on maintaining institutional partnerships and continuous capacity-building initiatives, which are essential to ensuring its sustainability and expanding its contribution to municipal environmental management.

Keywords: Seedling production; Public administration; Ecological restoration; Urban afforestation; Sustainable Development Goals.

Resumo: *Viveiros municipais constituem unidades técnicas fundamentais para a gestão ambiental pública, especialmente em regiões submetidas à intensa pressão agropecuária, como o Sudoeste do Paraná. Este estudo apresenta um relato da experiência do Viveiro Municipal de Santo Antônio do Sudoeste, Paraná, analisando seu histórico, sua infraestrutura, a produção e a destinação de mudas no período de junho de 2023 a junho de 2026. Adotou-se uma abordagem quali-quantitativa, mediante levantamento documental, visitas técnicas e análise normativa. No período analisado, foram produzidas 9.080 mudas, das quais 49,06% correspondem a espécies nativas e 50,94% a espécies exóticas; quanto à destinação, 74,83% foram direcionadas à zona rural e 25,17% à área urbana. Os resultados demonstram que a atuação do viveiro municipal ultrapassa a produção de mudas, uma vez que promove autonomia administrativa, contribui para o cumprimento da legislação ambiental, favorece a qualificação dos espaços públicos e auxilia no alcance dos Objetivos de Desenvolvimento Sustentável (ODS). Conclui-se que o fortalecimento da unidade depende da manutenção de parcerias institucionais e de ações contínuas de capacitação, fundamentais para assegurar sua sustentabilidade e ampliar sua contribuição para a gestão ambiental municipal.*

Palavras-chave: *Produção de mudas; Administração pública; Restauração ecológica; Arborização urbana; Objetivos de Desenvolvimento Sustentável.*

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INTRODUCTION

A forest or seedling nursery is a technical facility structured to produce, maintain, and provide plant specimens with genetic, phytosanitary, and physiological quality suitable for field planting (Galhardo et al., 2020; Carvalho Filho et al., 2018). More than simply a space dedicated to plant cultivation, it constitutes a strategic tool for public management, particularly in regions subject to anthropogenic pressures, where ecosystem conservation and restoration depend on the availability of suitable plant material that is adapted to local conditions and accessible to the population (Joly et al., 2018).

In addition to ecological restoration, municipal nurseries play an important role in urban forestry and the enhancement of public spaces, contributing to the mitigation of urban heat island effects, improved air quality, and the promotion of population well-being.

Municipal seedling production provides local governments with greater autonomy, enabling them to establish priorities, select species suited to local conditions, and reduce risks associated with urban infrastructure and the introduction of potentially invasive species (Wisser et al., 2024). In this regard, appropriate floristic composition in urban forestry is essential to maximize environmental benefits and promote biodiversity conservation in cities (Almeida et al., 2024).

The activities carried out by municipal nurseries are also aligned with the Sustainable Development Goals (SDGs) of the 2030 Agenda, particularly:

- **SDG 6 – Clean Water and Sanitation**, through actions aimed at protecting springs and riparian forests;
- **SDG 11 – Sustainable Cities and Communities**, through urban forestry and the enhancement of public spaces;
- **SDG 13 – Climate Action**, by promoting increased vegetation cover and contributing to carbon sequestration; and
- **SDG 15 – Life on Land**, through actions aimed at biodiversity conservation and the restoration of degraded ecosystems (United Nations, 2015).

In Brazil, Law No. 12,651/2012 establishes general provisions for the protection of native vegetation and regulates, among other aspects, Permanent Preservation Areas (Áreas de Preservação Permanente – APPs), which perform environmental functions related to the preservation of water resources, landscapes, geological stability, and biodiversity, as well as soil protection and the well-being of human populations (Brazil, 2012).

In Southwestern Paraná, a region characterized by significant agricultural and livestock activities, changes in land use and occupation can place pressure on natural resources and increase the risk of environmental degradation (Arrien et al., 2025; Silva et al., 2026). In this context, municipal nurseries can serve as important instruments for supporting environmental restoration initiatives, facilitating compliance with environmental legislation, disseminating good practices, and contributing to the

achievement of sustainability-related goals (Silva et al., 2016; Balzan et al., 2022).

Against this background, this study aimed to report on the experience of the Municipal Nursery of Santo Antônio do Sudoeste, Paraná, Brazil, and to analyze its contribution to public environmental management and local sustainable development, considering its history, infrastructure, seedling production, and seedling allocation during the period analyzed.

METHODOLOGY

This study consists of a descriptive experience report using a mixed-methods approach and was conducted at the Municipal Nursery of Santo Antônio do Sudoeste, Paraná, Brazil, located within the Arnaldo Busatto Exhibition Park, at the geographic coordinates 26°04'27.52" S and 53°42'54.03" W, covering an area of approximately 2,000 m². The study covered the period from June 2023 to June 2026 and was conducted through documentary research, technical visits, *in loco* observations, and technical and regulatory analysis.

Research Procedures

Documentary research: Administrative records, production forms, and internal reports from the Municipal Nursery covering the period from June 2023 to June 2026 were examined. These documents were analyzed to obtain data on the number of seedlings produced, species classification, and seedling allocation.

Technical visits and field observations: *In loco* observations were conducted to characterize the nursery infrastructure, growing conditions, management system, and different stages of seedling development, accompanied by photographic records. Additionally, inspections were conducted at seedling destination sites in both rural and urban areas to observe seedling adaptation and survival after planting.

Technical and regulatory analysis: The species produced were analyzed in terms of their suitability for the region's edaphoclimatic conditions (Costa, 2011; Viana, 2022), as well as their compliance with environmental legislation and guidelines applicable to the conservation and restoration of native vegetation (Brazil, 2012). The presence of non-native species was also considered, particularly regarding their invasive potential, based on specialized technical references (Instituto Hórus, 2022). In addition, the activities carried out by the nursery were examined in relation to the Sustainable Development Goals (SDGs) of the 2030 Agenda, particularly SDGs 6, 11, 13, and 15 (United Nations, 2015).

Data Organization and Analysis

Quantitative data obtained from institutional records were organized in

electronic spreadsheets and subjected to descriptive statistical analysis using absolute and relative frequencies. The results were organized into tables and analyzed according to total seedling production, species classification, and allocation to rural and urban areas.

Qualitative data obtained from documents, field observations, and technical records were analyzed descriptively and interpretively, considering aspects related to infrastructure, management practices, species suitability, environmental legislation, and the contributions of nursery activities to municipal environmental management and the Sustainable Development Goals.

Ethical Considerations

The study used administrative institutional records and data derived from technical observations conducted at the Municipal Nursery and at seedling destination sites. No interviews or questionnaires were conducted, and the study involved no interventions or collection of individuals' personal data. Likewise, no animals were used for experimental purposes. Therefore, considering the nature and procedures adopted in this study, the research was not submitted to the Brazilian Research Ethics Committee/National Research Ethics Commission System (CEP/Conep).

RESULTS AND DISCUSSION

History and Infrastructure

The Municipal Nursery of Santo Antônio do Sudoeste was established in 1995 and, throughout its history, its infrastructure has been strengthened through institutional partnerships and investments by the municipal government. Among the institutions that have contributed to its development are state environmental agencies and the Paraná Sanitation Company (Companhia de Saneamento do Paraná – Sanepar).

Initially, the nursery had three shade-house structures covered with shade cloth and an estimated production capacity of up to 100,000 seedlings per year. Over the years, the facility underwent renovations and improvements, including the addition of a reception area, restrooms, a kitchen, an input storage area, and dedicated spaces for seedling production, management, and development. The physical infrastructure and cultivation areas are presented in Figure 1.

Figure 1 – Physical infrastructure and cultivation area of the Municipal Nursery of Santo Antônio do Sudoeste, Paraná, Brazil: aerial view of the nursery area (A); greenhouses and cultivation structures (B); seedling production beds (C); and facilities used for management activities and input storage (D).

Source: Photographic records of the research (2026).

Figure 2 presents the different stages related to the planting and development of seedlings used in activities carried out by the Municipal Nursery, illustrating the process from site preparation for planting to the establishment of the specimens at their destination sites.

Figure 2 – Stages of seedling planting and development: soil preparation and seedling ready for planting (A); seedlings after planting, during the development process (B); and an overall view of the area showing the specimens distributed throughout the site (C).

Source: Photographic records of the research (2026).

Regarding human resources, the nursery staff, initially composed of three professionals, currently consists of a coordinator and one staff member responsible for operational activities. Despite the reduction in personnel, the facility has maintained its activities on a continuous basis, which is particularly relevant to the planning and implementation of medium- and long-term environmental initiatives. The continuity of nursery operations is an important factor in maintaining seedling production and supporting the development of environmental restoration and conservation initiatives (Galhardo *et al.,* 2020).

Species Production and Classification

From June 2023 to June 2026, the Municipal Nursery produced a total of 9,080 seedlings. According to the institutional records analyzed, 4,455 seedlings (49.06%) were classified as belonging to native species, while 4,625 (50.94%) were classified as belonging to non-native species. Production varied throughout the study period, increasing from 522 seedlings during the period analyzed in 2023 to 2,721 in 2024 and 3,763 in 2025. By June 2026, a total of 2,074 seedlings had been produced.

The diversity of species produced reflects the different purposes served by the nursery, including environmental restoration, urban forestry, landscaping, and meeting demands from rural areas. In this context, species selection should consider not only their intended use but also their origin, ecological characteristics, and suitability for the destination environment.

The presence of non-native species in nursery production requires particular attention regarding their ecological behavior and their potential to establish and spread in natural environments. Invasive non-native species can alter ecosystem composition and functioning by competing with native species and compromising biodiversity conservation efforts. Therefore, species with documented invasive behavior or recognized invasive potential should be carefully evaluated before use, particularly when seedlings are intended for conservation areas, Permanent Preservation Areas (Áreas de Preservação Permanente – APPs), or ecological restoration projects (Instituto Hórus, 2022).

Table 1 – Classification and identification of species produced at the Santo Antônio do Sudoeste Municipal Nursery

Classificação	Nome científico	Nome popular
Native	*Ocotea catharinensis* Mez	*Louro-preto*
Native	*Handroanthus serratifolius* (Vahl) S.O.Grose	*Ipê-amarelo*
Native	*Handroanthus impetiginosus* (Mart. ex DC.) Mattos	*Ipê-rosa*
Native	*Eugenia uniflora* L.	*Pitanga*
Native	*Campomanesia xanthocarpa* (Mart.) O.Berg	*Cerejeira-do-mato*
Native	*Eugenia pyriformis* Cambess.	*Uvaia*
Native	*Myrcianthes pungens* (O.Berg) D.Legrand	*Guabijú*
Native	*Psidium guajava* L.	*Goiabeira*
Native	*Plinia cauliflora* (Mart.) Kausel	*Jaboticabeira*
Native	*Anadenanthera colubrina* (Vell.) Brenan	*Angico*
Native	*Syagrus romanzoffiana* (Cham.) Glassman	*Jerivá*
Native	*Campomanesia guazumifolia* (Cambess.) O.Berg	*Guavirova*
Native	*Miconia sellowiana* Naudin	*Sete-capotes*
Native	*Psidium cattleianum* Sabine	*Araçá*
Native	*Cedrela fissilis* Vell.	*Cedro-rosa*
Native	*Peltophorum dubium* (Spreng.) Taub.	*Canafístula*
Native	*Vitex megapotamica* (Spreng.) Moldenke	*Tarumã*
Native	*Sebastiania commersoniana* (Baill.) L.B.Sm. & Downs	*Tucaneiro*
Native	*Poincianella pluviosa* (DC.) L.P.Queiroz	*Sibipiruna*
Native	*Bauhinia forficata* Link	*Pata-de-vaca*
Native	*Lantana camara* L.	*Lantana*
Non-native	*Cinnamomum verum* J.Presl	*Canela*
Non-native	*Magnolia grandiflora* L.	*Magnólia*
Non-native	*Sesbania punicea* (Cav.) Benth.	*Brinco-de-índio*
Non-native	*Ligustrum lucidum* W.T.Aiton	*Ligustro*
Non-native	*Koelreuteria paniculata* Laxm.	*Coleutéria*
Non-native	*Tipuana tipu* (Benth.) Kuntze	*Tipuana*
Non-native	*Hibiscus rosa-sinensis* L.	*Hibisco*
Non-native	*Phoenix canariensis* Chabaud	*Palmeira-fênix*
Non-native	*Dypsis lutescens* (H.Wendl.) Beentje & J.Dransf.	*Palmeira-areca*

Source: Institutional research data, prepared by the author (2026).

The floristic composition recorded at the Municipal Nursery demonstrates a diversity of species intended for different environmental and landscaping purposes. A total of 30 plant species were identified, of which 21 were classified in the records analyzed as native and nine as non-native. Among the native species are specimens of

particular importance for environmental restoration, urban forestry, and regional biodiversity conservation, including Ocotea catharinensis, Handroanthus serratifolius, Eugenia uniflora, Cedrela fissilis, and Peltophorum dubium. Non-native species, in turn, are primarily associated with urban forestry and landscaping needs. Although they represent lower diversity in terms of the number of species, non-native species accounted for 50.94% of the seedlings produced during the study period, highlighting the importance of production planning and careful assessment of the species used, particularly regarding their invasive potential and suitability for their intended destination.

Table 2 – Summary of seedling production and allocation (2023-2026)

Indicator	2023[1]	2024	2025	2026[2]	Total	%
Native species	265	1.102	1.902	1.186	**4.455**	**49,06**
Non-native species	257	1.619	1.861	888	**4.625**	**50,94**
Total seedlings produced	**522**	**2.721**	**3.763**	**2.074**	**9.080**	**100,00**
Rural areas	431	2.202	3.150	1.012	**6.795**	**74,83**
Urban areas	91	519	613	1.062	**2.285**	**25,17**
Total seedlings allocated	**522**	**2.721**	**3.763**	**2.074**	**9.080**	**100,00**

Fonte: Survey data (2026).

Regarding production, a total of 9,080 seedlings were recorded between June 2023 and June 2026, of which 4,455 (49.06%) were classified as native species and 4,625 (50.94%) as non-native species. Production increased from the partial period analyzed in 2023, with 522 seedlings, to 2,721 in 2024 and 3,763 in 2025, with 2025 representing the highest annual production recorded. By June 2026, a total of 2,074 seedlings had been produced; however, this figure should not be directly compared with the previous full-year totals because it corresponds only to the first half of the year. Regarding allocation, rural areas accounted for the largest share, receiving 6,795 seedlings (74.83%), while 2,285 seedlings (25.17%) were allocated to urban areas. These results highlight the importance of the nursery in meeting environmental needs in rural areas, while also demonstrating its contribution to urban forestry and the environmental enhancement of urban spaces.

The results therefore demonstrate the importance of planning nursery production according to the intended use of the seedlings, prioritizing native species in ecosystem restoration initiatives and applying appropriate technical criteria when using non-native species in landscaping and urban forestry activities.

Seedling Allocation and Contribution to Public Management

Of the 9,080 seedlings produced during the study period, 6,795 (74.83%) were allocated to rural areas, while 2,285 (25.17%) were directed to urban areas. The predominance of allocation to rural areas demonstrates the relevance of the Municipal Nursery in meeting environmental needs on rural properties and within rural communities in Santo Antônio do Sudoeste, particularly in a territory characterized by significant agricultural and livestock activities.

In rural areas, the seedlings were primarily used in vegetation restoration initiatives, including riparian forests, areas surrounding springs, and environmentally

protected areas. These interventions are related to the provisions of Law No. 12,651/2012, which establishes standards for the protection of native vegetation and regulates, among other aspects, Permanent Preservation Areas (Áreas de Preservação Permanente – APPs) (Brazil, 2012). Restoring vegetation cover along watercourses and around springs performs important environmental functions, contributing to the protection of water resources, soil conservation, the reduction of erosion processes, and the maintenance of biodiversity (Souza et al., 2019).

From the perspective of the 2030 Agenda, these initiatives are directly related to SDG 6 – Clean Water and Sanitation, particularly regarding the protection and restoration of water-related ecosystems. They are also aligned with SDG 15 – Life on Land, considering the importance of restoring degraded ecosystems, conserving biodiversity, and protecting terrestrial environments (United Nations, 2015). In this regard, the nursery serves as a local mechanism capable of supporting the implementation of environmental commitments established at different levels.

In urban areas, 2,285 seedlings were allocated, corresponding to 25.17% of the total production recorded. The seedlings were planted along streets, in public squares, schools, and other public spaces, contributing to the expansion of urban tree cover and the environmental and landscape enhancement of these areas. Vegetation in urban environments can provide benefits related to thermal comfort, environmental quality, biodiversity, and human well-being, reinforcing the importance of urban forestry planning as a component of municipal environmental management.

Activities carried out in urban areas are also related to SDG 11 – Sustainable Cities and Communities, particularly through the promotion of environmentally enhanced public spaces, and SDG 13 – Climate Action, considering the contribution of increased vegetation cover to local strategies for climate change adaptation and mitigation (United Nations, 2015). The nursery's activities therefore provide a means of linking environmental initiatives implemented at the municipal level with the broader objectives established by the 2030 Agenda.

The allocation of seedlings between rural and urban areas demonstrates that the Municipal Nursery performs functions that extend beyond the production of plant material. By providing seedlings for environmental restoration, water resource protection, urban forestry, and the enhancement of public spaces, the nursery supports the implementation of policies and initiatives related to municipal environmental management. Maintaining a municipal nursery can also provide greater administrative autonomy in production planning and in meeting local demands, allowing priorities to be established according to the environmental needs identified within the municipality.

In addition to seedling production and distribution, the nursery has the potential to serve as a space for environmental education, public awareness, and the dissemination of knowledge related to biodiversity conservation and the appropriate use of plant species. This dimension broadens its socio-environmental role and facilitates closer interaction among public authorities, rural producers, educational institutions, and the community, thereby fostering the development of integrated environmental conservation and restoration initiatives.

In this context, the continuity of the Municipal Nursery's activities depends not only on maintaining its physical infrastructure but also on production planning,

appropriate species selection, professional training, and the strengthening of institutional partnerships. These elements are important for enhancing the effectiveness of the activities undertaken and consolidating the nursery as a permanent instrument of municipal environmental policy and a means of promoting local sustainable development.

Figure 3 presents examples of the destination sites of seedlings produced by the Municipal Nursery, including both urban forestry initiatives and interventions aimed at environmental restoration.

Figure 3 – Destination sites of seedlings produced by the Municipal Nursery of Santo Antônio do Sudoeste, Paraná, Brazil: urban forestry and environmental restoration initiatives.

Source: Photographic records of the research (2026).

The records presented in Figure 3 illustrate the different ways in which seedlings produced by the Municipal Nursery are used, encompassing both urban forestry and the environmental enhancement of urban spaces, as well as environmental restoration initiatives. The diversity of areas served demonstrates that the nursery's activities are not limited to seedling production and distribution but are integrated into different municipal environmental management strategies. In this regard, the allocation of species to urban and rural areas reinforces the importance of maintaining a permanent public facility capable of addressing local needs related to urban forestry, vegetation restoration, and the protection of natural resources.

The experience analyzed also demonstrates that the effectiveness of these initiatives depends on continued technical monitoring following seedling distribution and planting. The selection of species suited to the characteristics of each environment, combined with monitoring of their establishment and development, can contribute to

improving the outcomes of the interventions implemented. Therefore, strengthening planning, institutional partnerships, and environmental education initiatives represents an important strategy for consolidating the Municipal Nursery as an instrument of environmental management and local sustainable development.

CONCLUSIONS

The analysis of the experience of the Municipal Nursery of Santo Antônio do Sudoeste, Paraná, Brazil, highlights its relevance as an instrument of local public environmental management, with activities extending beyond seedling production and distribution. Between June 2023 and June 2026, a total of 9,080 seedlings were produced, of which 49.06% were classified as native species and 50.94% as non-native species. Regarding allocation, 74.83% of the seedlings were directed to rural areas and 25.17% to urban areas, demonstrating the nursery's capacity to address different environmental needs within the municipality.

The results indicate that the nursery contributes to vegetation restoration, water resource protection, urban forestry, and the environmental enhancement of public spaces. These activities are also aligned with the Sustainable Development Goals (SDGs) of the 2030 Agenda, particularly SDG 6 – Clean Water and Sanitation, SDG 11 – Sustainable Cities and Communities, SDG 13 – Climate Action, and SDG 15 – Life on Land (United Nations, 2015). In this regard, the experience analyzed demonstrates how initiatives implemented at the municipal level can contribute to the local implementation of goals related to environmental conservation and sustainable development.

Maintaining a municipal facility dedicated to seedling production also enhances the autonomy of the local government in planning and implementing environmental initiatives. However, the results highlight aspects that could be improved, particularly regarding the composition and planning of seedling production. The proportion of non-native species, which accounted for 50.94% of the seedlings produced during the study period, reinforces the need for continuous technical assessment of the species used and for the gradual prioritization of native species, particularly when seedlings are intended for the restoration of Permanent Preservation Areas (Áreas de Preservação Permanente – APPs), riparian forests, and other environments of importance for biodiversity conservation.

To strengthen and ensure the continuity of the Municipal Nursery's activities, it is recommended that partnerships with educational, research, and extension institutions be expanded; continuous staff training be promoted; technical criteria for species selection and allocation be improved; records related to seedling production, distribution, and planting be standardized and digitized; and outreach efforts regarding the activities carried out by the nursery be expanded within the community. It is also recommended that systematic mechanisms be implemented to monitor seedlings after planting, allowing the assessment of indicators such as survival, development, and the effectiveness of the interventions undertaken.

Regarding the limitations of this study, the analysis relied predominantly on

institutional administrative records and field observations, without systematic monitoring of all seedlings after their allocation. Therefore, although the results allow for the characterization of seedling production and distribution by the nursery, they do not enable a comprehensive assessment of the environmental impacts resulting from planting, such as survival rates, increases in vegetation cover, carbon sequestration, or improvements in water resource conditions. Future studies could incorporate these indicators, as well as economic analyses of the costs and benefits of municipal seedling production and long-term assessments of the areas served.

In conclusion, the Municipal Nursery of Santo Antônio do Sudoeste constitutes an important component of local environmental policy and has the potential to strengthen ongoing conservation, environmental restoration, and urban forestry initiatives. Its continued improvement, combined with technical planning, monitoring of outcomes, and collaboration among public authorities, educational and research institutions, and the community, can further enhance its contribution to environmental management and the municipality's sustainable development.

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Submission date: July 13, 2026
Acceptance date: August 28, 2026
Publication date: August 29, 2026