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Urban Afforestation: challenges and instruments for integrated planning with urban expansion and social dynamics

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Arborização Urbana: desafios e instrumentos para o planejamento integrado com a expansão urbana e as dinâmicas sociais.

RESUMO

Objetivo - Identificar instrumentos integrados de planejamento para resolver conflitos relacionados à arborização urbana, com foco nas interfaces com a expansão urbana e as dinâmicas sociais.

Metodologia - Estudo teórico com base em revisão bibliográfica, utilizando as etapas de síntese temática (análise por subtemas) e síntese dimensional (integração das problemáticas).

Originalidade/relevância - Preenche lacuna teórica ao tratar a arborização de forma integrada, multidimensional e articulada aos agentes urbanos, com enfoque em conflitos e estratégias de gestão.

Resultados - Identificação de três agentes-chave (técnicos, gestores e sociedade civil) e estratégias que favorecem uma arborização urbana mais integrada e eficiente.

Contribuições teóricas/metodológicas - Proposição de um método analítico (síntese temática e dimensional) e ampliação do entendimento da arborização como elemento estruturador do espaço urbano.

Contribuições sociais e ambientais - Fortalecimento da participação cidadã e da gestão ambiental urbana, com benefícios à qualidade de vida, ao microclima e à sustentabilidade das cidades.

PALAVRAS-CHAVE: Arborização Urbana. Vegetação. Planejamento Urbano. Planejamento Integrado. Síntese Temática.

Urban Afforestation: challenges and instruments for integrated planning with urban expansion and social dynamics.

ABSTRACT

Objective – Identify integrated planning instruments to resolve conflicts related to urban tree plantations, focusing on the interfaces with urban expansion and social dynamics.

Methodology – Theoretical study based on a bibliographic review, using the stages of thematic synthesis (analysis by subtopics) and dimensional synthesis (integration of problems).

Originality/Relevance – Attend to lacuna theory of arborization in an integrated, multidimensional and articulated way to the urban agents, with a focus on conflicts and management strategies.

Results – Identification of three key agents (technicians, managers and civil society) and strategies that favor a more integrated and efficient urban tree plantation.

Theoretical/Methodological Contributions – Proposal of an analytical method (synthetically and dimensionally) and expansion of the understanding of trees as a structuring element of urban space.

Social and Environmental Contributions – Strengthening city participation and urban environmental management, with benefits to the quality of life, the microclimate and the sustainability of cities.

KEYWORDS: Urban Arborization. Vegetation. Urban Planning. Integrated Planning. Synthesize Theme.

Forestación Urbana: desafíos e instrumentos para la planificación integrada con la expansión urbana y la dinámica social.

RESUMEN

Objetivo – Identificar instrumentos integrados de planificación para resolver conflictos relacionados con la arborización urbana, con foco en las interfaces con la expansión urbana y con las dinámicas sociales.

Metodología – Estudio teórico com base em revisión bibliográfica, utilizando como etapas de síntese temática (análisis por subtemas) y síntese dimensional (integração das problemáticas).

Originalidad/Relevancia – Preenche laguna teórica ao tratar a arborização de forma integrada, multidimensional e articulada aos agentes urbanos, com enfoque em conflictos e estrategias de gestión.

Resultados – Identificación de tres agentes chave (técnicos, gestores y sociedad civil) y estrategias que favorecen una arborización urbana más integrada y eficiente.

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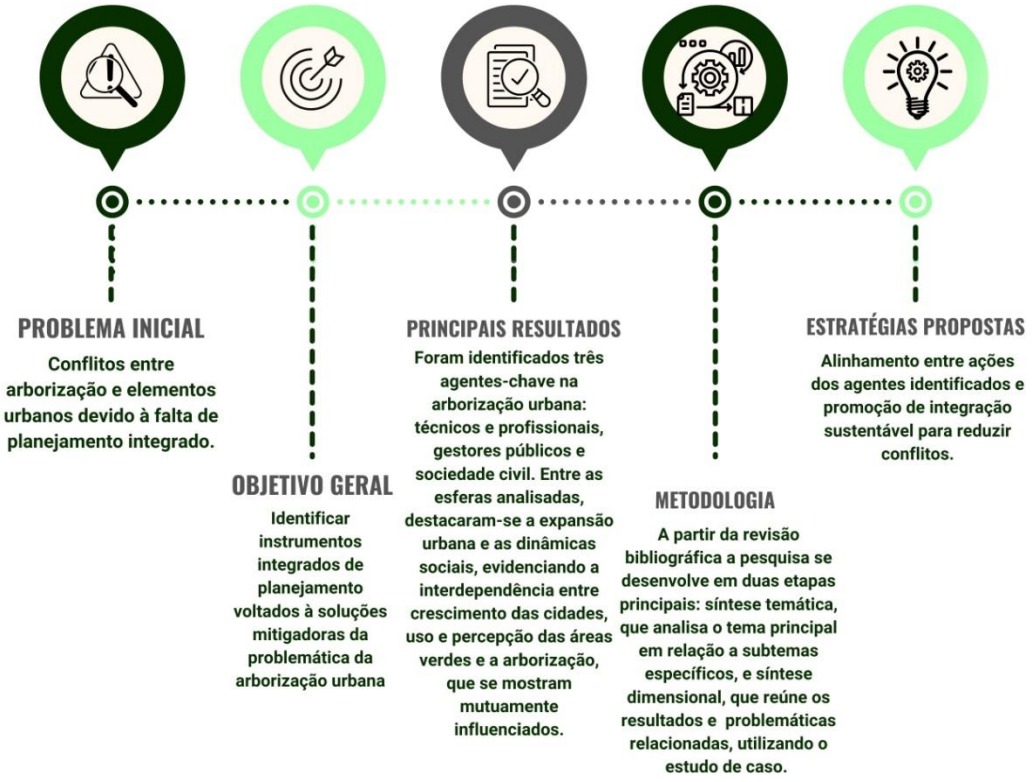
Contribuciones Teóricas/Metodológicas – Proposición de un método analítico (síntesis temática y dimensional) y ampliación del entendimiento de la arborización como elemento estructurador del espacio urbano.
Contribuciones Sociales y Ambientales – Fortalecimiento de la participación en la ciudad y de la gestión ambiental urbana, con beneficios para la calidad de vida, el microclima y la sustentabilidad de las ciudades.

PALABRAS CLAVE: Arborização Urbana. Vegetación. Plano Urbano. Planeamiento Integrado. Síntesis Temática.

GRAPHIC SUMMARY



INITIAL PROBLEM
Conflicts between afforestation and urban elements due to a lack of integrated planning.

GENERAL OBJECTIVE
Identify integrated planning instruments aimed at solutions to mitigate the problem of urban afforestation.

MAIN RESULTS
Three key agents in urban afforestation were identified: technicians and professionals, public managers, and civil society. Among the spheres analyzed, urban expansion and social dynamics stood out, highlighting the interdependence among city growth, use, and perception of green areas and afforestation, which are mutually influenced.

METHODOLOGY
Based on the bibliographic review, the research is developed in two main stages: thematic synthesis, which analyzes the main theme in relation to specific subthemes, and dimensional synthesis, which brings together the results and related issues, using the case study.

PROPOSED STRATEGIES
Alignment between the actions of identified agents and the promotion of sustainable integration to reduce conflicts.

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1 INTRODUCTION

Considering the diversity of agents that make it up and the dynamism of its places, the city cannot be entirely seen by planners as a matter of human action, a purely physical space, but as a social universe in constant transformation.

Lewis Mumford (1937), when considering the essence of the city, put forward the notion of the city as a social institution: a collection of diverse groups, arranged through social and economic organizations within a specific spatial area. As such, the urban is based on physical means, represented by the site that encompasses the natural elements and resources, and the shelters and durable structures built by human beings, and social means, corresponding to the cultural and economic processes of the society that inhabits it.

Thus, the construction of the city occurs through conflict, divergence, or cooperation among the most diverse individuals, groups, and elements within the urban space. Understanding and intervening in the functioning of urban spaces, therefore, implies the duty to carefully observe the dynamics of everyday life and each element in this system of collective construction and propose solutions aimed at the well-being of all those involved in this process.

Urban arborization is one of the essential elements in the dynamics of cities, promoting quality of life and acting as a potential component for organizing urban space (Araújo, 2020, p. 23). In addition to its role as a structuring element of the city, a systematic analysis by Wolf et al. (2020) reveals the necessity of investing in planning strategies to ensure the effectiveness and substantial benefits of urban arborization, both economic and social.

Urban afforestation is understood to be vegetation of different sizes and origins incorporated into different locations in the city, as explained by Mello Filho (1985) and Miller (1997). Among these spaces, afforestation predominates in three different spheres of use and responsibility: along roads; in open areas for public and potentially collective use; and on privately-owned plots (EMBRAPA, 2000 apud Ribeiro, 2009).

Urban vegetation is responsible for a series of social benefits, such as enhancing the use of public spaces through shading and the consequent physical and psychological well-being provided to users, and environmental benefits, such as the stability of the urban microclimate, guaranteeing air quality in cities, and controlling and absorbing rainwater. However, there is also a sequence of conflicts and damage to urban infrastructure due to inadequate afforestation: deterioration or making public sidewalks unfeasible, and conflicts with electricity and sewage networks. This highlights the importance of planning and the adoption of appropriate solutions by those responsible for its implementation to ensure the benefits generated by the presence of vegetation.

Regarding responsibility for urban afforestation, Bononi (2006 apud Ribeiro, 2009) points out that this falls to the municipal administration, but it is not exclusive, since vegetation can also permeate the private domain and, in these spaces, the primary responsibility is delegated to the owner. Ermínia Maricato (2011) adds that in Brazil, there are documents and legislation formulated for the planning and management of urban afforestation and the sustainable city. Examples include participatory municipal master plans, local sanitation plans, solid waste plans, environmental and water resources policies, among other instruments and resources.

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Some Brazilian cities have already adopted their respective Tree Master Plans, with measures that focus on the planning, implementation, and management of urban vegetation. Thus, planning and implementation become linked to a collaborative process that requires engagement between the management spheres and society, which makes use of vegetation in everyday life.

However, the reality is very different from this assumption. As Ribeiro (2009) points out, the role of providing guidance to civil society when afforestation takes place on private property is hardly ever fulfilled. Without proper guidance and technical knowledge, property owners determine the species, increasing the risk of various conflicts with the urban environment. This occurs by the selection of inappropriate species.

In summary, since planning is directly linked to management and conservation, as well as the multifaceted nature of the subject and the complexity of the challenges - which involve everything from conceptual issues to everyday practice - it is essential to problematize the issue and thus understand the interrelationships between afforestation, expansion and urban social dynamics. Thus, urban green management is necessary to maximize the benefits provided by vegetation and promote well-being in cities. This process can be carried out through quantitative analysis, such as the innovative technologies created by the MIT Senseable City Lab, which contribute to the efficient management of afforestation, as well as qualitative analysis, which considers the interfaces of vegetation in the urban context (Silveira, Lima, and Oliveira, 2020). To this end, the processes of thematic decomposition have proved to be propitious in allowing the evaluation of interfaces between diverse natures and, thus, better assimilating complex themes.

This work is part of a larger study that covers eight urban interfaces, in addition to the two explored in this study. The method first consists of the thematic synthesis stage: the isolated contrast and analysis of the main theme against each sub-theme identified. Subsequently, when the problems specific to each interface have been identified, the dimensional synthesis is carried out, which consists of bringing together the points verified in the previous stage and explaining, by superimposing the information found, the problems surrounding the main theme. The Thematic Synthesis and Dimensional Synthesis of eight main spheres interconnected and interdependent with urban afforestation: Social dynamics; Property interests; Trade and services; Housing; Urban transportation; Urban infrastructure; Urban expansion and the Legal sphere.

In 2015, the 193 member countries of the United Nations (UN) approved the 2030 Agenda for Sustainable Development, which establishes 17 Sustainable Development Goals (SDGs) and 169 targets. This agenda includes global partnerships, application and formulation of public policies, monitoring and review of targets to achieve social inclusion, sustainable development, and democratic governance. These commitments must be fulfilled by 2030. Of the 17 SDGs identified, urban forestry interferes in at least 6 of them, directly among the others where important relationships are established, such as SDG 7 - Affordable and Clean Energy; SDG 11 - Sustainable Cities and Communities; SDG 12 - Responsible Consumption and Production; SDG 13 - Combating Climate Change; SDG 14 - Life Under Water and SDG 15 - Life on Land.

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This research will be carried out in two stages: thematic synthesis and dimensional synthesis, which will analyze urban vegetation in relation to urban expansion and social dynamics, pointing out the main conflicts and scenarios at the end of each thematic synthesis, as well as the prospects for resolving these issues, condensed into analytical tables. The second stage will indicate theoretical and practical planning measures that can guarantee the resolution of the conflicts identified.

2 THEMATIC OVERVIEW: PROBLEMATIZING URBAN AFFORESTATION

Once the notion of urban vegetation as one of the various foundations for the proper functioning and quality of urban spaces is established, as well as the perception that its planning depends entirely on understanding the complex dynamics between it and the other elements of the city's spaces, and adopting instruments and actions aimed at integration and harmony between them, it becomes clear that it is essential to evaluate it using a method that takes into account the various interfaces of this dynamic and the complexity of the subject itself.

Figure 1 – Infographic demonstrating the method applied – Thematic Synthesis and Dimensional Synthesis.

Source: (Lacerda et al., 2021, adapted by the authors,2025)

Síntese temática – THEMATIC SYNTHESIS; Esfera Jurídica – LEGAL SPHERE; Dinâmica social – SOCIAL DYNAMICS; Interesse patrimonial – HERITAGE INTEREST; Comércio e serviços – COMMERCE AND SERVICES; Habitação – HOUSING; Transporte urbano – URBAN TRANSPORT; Infraestrutura urbana – URBAN INFRASTRUCTURE; Expansão urbana – URBAN EXPANSION
Somatório das sínteses temáticas = Síntese dimensional = SUM OF THEMATIC SYNTHESES = DIMENSIONAL SYNTHESIS

The proposed analysis here consists of breaking down a multifaceted theme. Urban afforestation, in the light of the various aspects identified through a literature review, both in the specific literature on urban vegetation and in the literature covering other urban themes in

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which urban afforestation is mentioned as part of the subject. The aim of the complete research was to cover as many interfaces as possible (thematic syntheses) and, consequently, to generate a global overview of the problem of urban vegetation (dimensional synthesis), as shown in **Figure 1.**

Therefore, the interfaces were identified in terms of: Responsibility and Legal Nature (I); Urban Expansion (II); Urban Infrastructure (III); Transportation Systems (IV); Housing and Social Interest Zones (V); Trade and Services Zones (VI); Heritage Interest Zones (VII) and Social Dynamics (VIII). For this investigation, as part of a more complex analysis and extensive literature review, the Urban Expansion and Social Dynamics interfaces were selected. The themes identified and to be explored in sequence serve both as a basis for defining the problem and as a signpost, to the extent that at the end of each analysis the main conflicts and the prospects for resolving them will be identified, as well as the management instruments that contemplate and act in the practical resolution of the conflicts pointed out.

2.1 Theme 1: Urban expansion processes

Regarding the expansion of urban centers and the relationship between this phenomenon and the existing vegetation mass, the various approaches allude to two intrinsic aspects defended by Rolim, Carvalho and Silveira (2023), which have a direct influence on urban vegetation: the power dynamics and influence of the market on the occupation of the city; and the clash between development, represented by the need to occupy more and more spaces, while the environment is represented by spaces set aside for environmental preservation.

As agglomerations consolidate and the urban core begins to grow, vegetation tends to concentrate either in defined spaces between the built-up masses, when they are of environmental significance to the immediate surroundings, or in the peripheral areas of the city, signaling, in both cases, the limits between the area occupied by the urban environment and the important remnants of natural resources. However, due to the desire for horizontal expansion and the dynamics of land valuation by the real estate market, this vegetation is being curtailed and the pressure is intensifying on it to make way for new buildings, either due to the lack of integration of the vegetation areas into the urban environment, or because it constitutes a direct obstacle to the expansion of the urbanized area.

This creates the stigma of obsolete, residual green spaces that generate relative comfort and urban quality. However, the sacrifice of these spaces for the sake of development underpins all the supposed prosperity of the urban fabric (Carvalho et al., 2023a). This reveals a problem whose core lies in the understanding of vegetation's role in the urban context. Regarding the widespread idea of the value of vegetation and its relationship with the urban environment, Oliveira (1996) noted that the assessment of afforestation quality in a given city is usually based on two ratios: the ratio of the area occupied by vegetation to the total municipal area or the ratio of the area covered by vegetation to the number of inhabitants.

Consequently, these ratios disseminate a superficial notion of the quality and role of vegetation in the urban sphere, defining it as a quantifiable component whose value is entirely reflected by measuring the areas occupied by plant species. This disconnects vegetation from

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the multitude of social indicators that comprise any analysis of the quality of spaces in everyday city life.

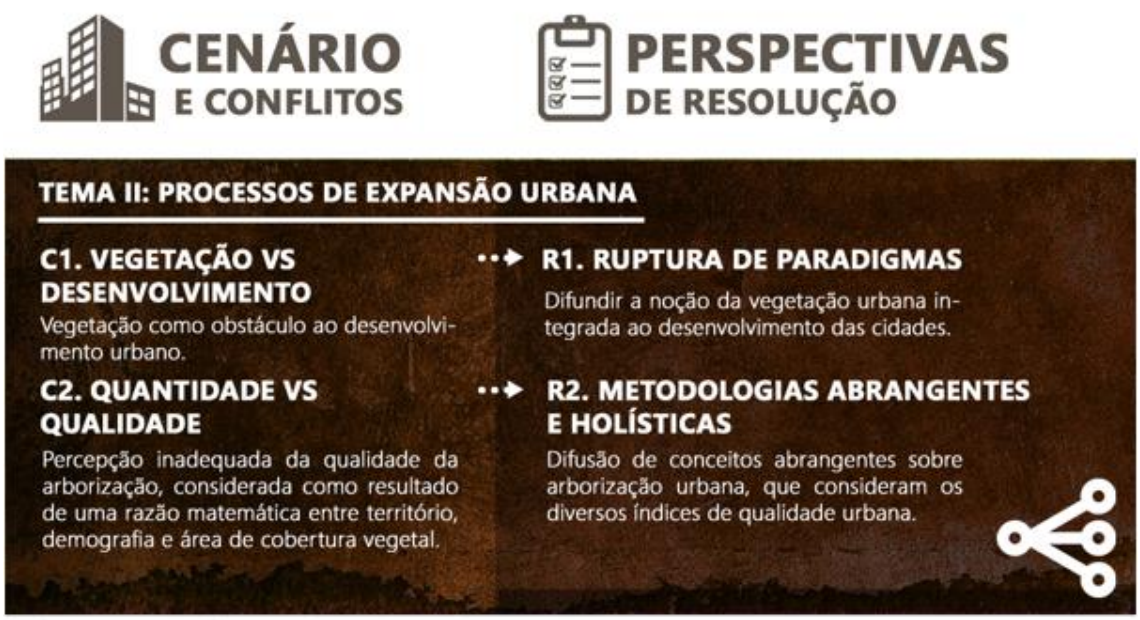
Considering what has been said about the concept and method usually used to assess the quality of vegetation, it is clear that they lack depth, since the discussions are based on quantitative reasons and do not cover the interfaces between vegetation and the urban context. And this is reflected in the illusory nature of the results, since spaces with a smaller occupied area, but with generous and isolated environmental reserves, would be among the spaces with good afforestation, without this afforestation necessarily bringing all the benefits of its presence to the urban community.

If not from this point of view, what would quality wooded spaces and vegetation correspond to, and what aspects should be considered in a qualitative measurement?

Lima (1994) and Llardent (1982 apud Loboda; De Angelis, 2005) confirm that terminologies such as zones, spaces, and green areas refer beyond what is understood by vegetation cover. Instead of spaces where species are concentrated, well demarcated and preservation is an absolute priority, they correspond to places endowed with tree vegetation and permeable soil, and incorporated into the functions and needs of free spaces - those opposed to built space and destined for the individual for rest, leisure, recreation, and entertainment.

Figure 2 - Analytical Framework and Thematic Synthesis: Scenarios, Conflicts and Prospects for Resolution seized in the Thematic Synthesis process - Theme I.

Source: (Lacerda et al., 2021, adapted by the authors, 2025)



CENÁRIOS E CONFLITOS – SCENARIOS AND CONFLICTS; PERSPECTIVAS DE RESOLUÇÃO – RESOLUTION PROSPECTS; TEMA II: PROCESSO DE EXPANSÃO URBANA – THEME II: URBAN EXPANSION PROCESS;
C1. VEGETAÇÃO VS DESENVOLVIMENTO – C1. VEGETATION VS DEVELOPMENT; Vegetação como obstáculo ao desenvolvimento urbano. – Vegetation as an obstacle to urban development.; C2. QUANTIDADE VS QUALIDADE – C2. QUANTITY VS QUALITY Percepção inadequada da qualidade da arborização, considerada como resultado de uma razão matemática entre território, demografia e área de cobertura vegetal.

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Inadequate perception of the quality of afforestation, considered as the result of a mathematical ratio among territory, demography, and area of vegetation cover.
R1. RUPTURA DE PARADIGMAS – R1. RUPTURE OF PARADIGMS: Difundir a noção da vegetação urbana integrada ao desenvolvimento das cidades. Spread the notion of urban vegetation integrated into the development of cities.
R2. METODOLOGIAS ABRANGENTES E HOLÍSTICAS: Difusão de conceitos abrangentes sobre arborização urbana, que consideram os diversos índices de qualidade urbana - R2. COMPREHENSIVE AND HOLISTIC METHODOLOGIES Dissemination of comprehensive concepts about urban afforestation, which consider the various urban quality indices

Urban vegetation must be thought of in an integrated way within the context of cities, considering a multidisciplinary approach that goes beyond quantification. As stated by Coelho, Fernandes and Nagano (2021), "it is necessary to understand afforestation as a global structure, in which small parts of local actions articulated form its totality".

The analysis of urban expansion processes, as pointed out by Lacerda et al. (2021) and detailed in figure 3, presents two fundamental points: **the discrepancy (C2) between the methodology applied** (quantitative analysis) **and the results obtained through it** (quantitative data, but disseminated as the quality of afforestation); and the **interpretation (C1) given to it**. To address this problem effectively, the authors propose breaking paradigms (R1) about development and the environment, seeking to disseminate holistic concepts and methods (R2), which recognize urban vegetation as something beyond agglomerations with plant species, highlighting it as an essential resource in the urban environment. In addition, it must transcend the limitations imposed by market logic. Thus, the authors claim that, through this approach, it will be possible to achieve more integrated and sustainable urban progress.

2.2 Theme 2: Social dynamics and urbanity

As Melo and Romanini (2008, p.57) point out, cities "enchant with their variety, events, possibilities and intense stimulation that many individuals consider a desirable setting for their lives, [thus providing an infinity] of options that no other social arrangement allows".

A diverse, multifaceted environment that depends entirely on the dynamics of how individuals use spaces, the urban environment is a direct reflection of the appropriations and interfaces between the various agents that are linked to it. From this perspective, the city "is configured, in its daily life, as a scenario and place of representation of its users in a space and time of its own where the context of thinking, feeling, and acting are collectivized" (ROLIM FILHO, 2013, p.106).

From this perspective, approaches such as Lachapelle's (2004) portray the public space as the generator of subjective urban dynamics and, thus, as the place where emotions and the essence of what makes up everyday life in cities can best be seen, due to the multiplicity of cultures, social classes and characters that live together in the same place.

Intervening in these spaces thus implies observing their primary function, which, according to Wall and Waterman (2010), is to foster interactions between users and between users and the physical space that surrounds them, carefully observing the movements, uses, and sensations to be provided by planning decisions. Along the same lines are discussions about quality of life and urbanity, where the subjectivity and identity of users and their relationships with urban elements must be observed to ensure the full functioning of city spaces.

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In this respect, the environment becomes the setting for social dynamics, on which it exerts a direct influence. In studies carried out in the field of social psychology by Miana (2010 apud MARUYAMA, SIMÕES, 2014), and alluded to by Gomes and Soares (2003), the ability of tree planting to influence the mood of human beings living in urban areas is highlighted, where they are more friendly, cooperative, less depressed and affected by the stress characteristic of large cities, as well as being much more inclined to socializing, physical exercise and leisure activities.

For this reason, urban vegetation has been incorporated into discussions about public spaces as more than just a landscape feature and urban aesthetic, but as a tool to ensure that the population enjoys these spaces, attracted by the environmental conditions provided and the emotions that urban greenery brings.

However, this condition has not always been adopted in the planning of public spaces. In recent years, public spaces have increasingly been configured as "systems of increasingly artificial objects, populated by systems of actions equally imbued with artificiality and increasingly tending towards ends foreign to the place and its inhabitants" (Santos, 2006, p.39). These spaces have embraced more and more functions, especially those geared towards artistic and cultural events, and have often abandoned the typical configuration of public space intended for leisure and recreational activities. In this specific use, planning involves different concerns: thinking of spaces for events or seasonal activities means designing a place for use at specific times of the day, especially at night, and making the most of free and uncovered areas to install equipment; often forming a place whose operation is tied to planned activities, rather than the spontaneity of public spaces.

Illustrating these transformations, Dimenstein and Scocuglia (2015) allude to an emblematic example in the city of João Pessoa: Praça Vidal de Negreiros (also known as Ponto de Cem Réis), which after a series of renovations and successive changes in its conformation, gained in its last intervention in 2009, the appearance of a large square designed to host large events, as opposed to the previous configuration which had a viaduct cutting through the space, as well as planters and water mirrors, as shown in **Figures 3 and 4**.

During the intervention, changes were made to the floor, with the replacement of the hydraulic tiles with concrete slabs; to the furniture, now replaced by concrete benches without backrests; and to the lighting and landscaping equipment, with the removal of some of the previously existing trees and the planting of new saplings next to the furniture on the edges of the square (Dimenstein, Scocuglia, 2015).

However, Dimenstein and Scocuglia (2015) reveal that these interventions have had consequences for the predominant use dynamics, in addition to the physical space: the predominance of empty spaces without protection from the sun, the dryness, the lack of comfort of the concrete furniture and the absence of trees have ended up making it difficult to stay or even the flow of people at times of higher heat load.

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Figure 3 - Configuration of Praça Vidal de Negreiros, before the intervention in 2009, highlighting the vegetation on the edges of the square.

Source: Scocuglia (2006).

Figure 4 - Configuration of Vidal de Negreiros Square, after the most recent renovation.

Fonte: Prefeitura Municipal de João Pessoa, 2010. Source: João Pessoa City Hall, 2010.

This ended up harming, above all, a public whose presence characterized the dynamics of occupation of the space: the elderly. The elderly, who are more fragile due to direct exposure to the sun, difficulties in getting around, and patterns of occupying the space that are different

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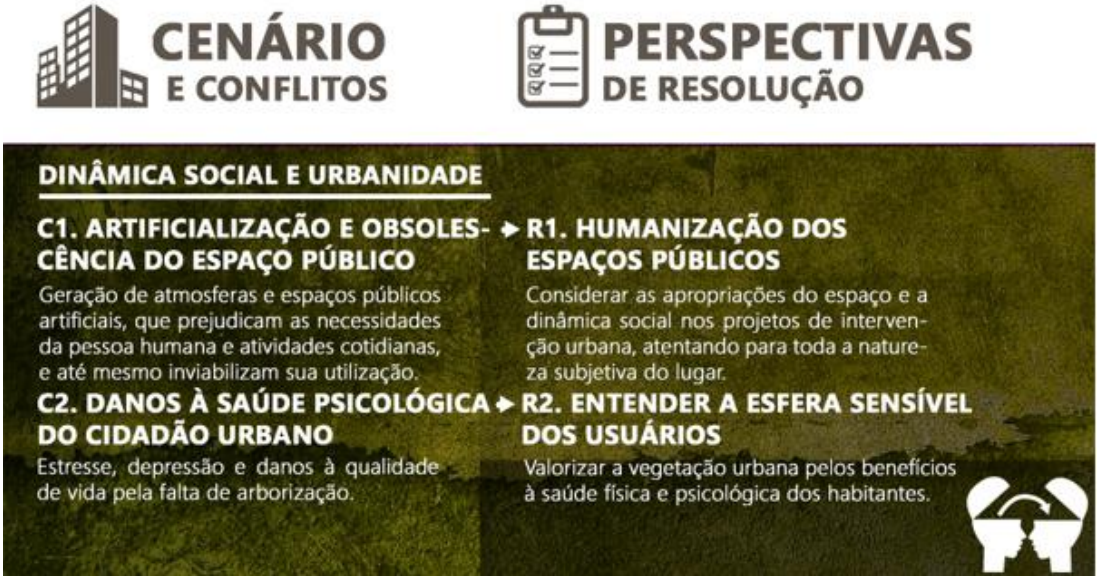
from what was intended in the renovation, end up having their enjoyment of the place compromised, especially by the environmental conditions that are now typical of the place. Also, insofar as they had already occupied it long before the renovations, they reveal the inadvertence of the site's characteristics and dynamics to the project's conception.

Figure 5 - Analytical Framework - Thematic Synthesis: Scenarios, Conflicts and Prospects for Resolution seized in the Thematic Synthesis process - Theme II.



Source: Elaborated by the authors, 2025.

DINÂMICA SOCIAL E URBANIDADE - SOCIAL DYNAMICS AND URBANITY
C1. ARTIFICIALIZAÇÃO E OBSOLESCÊNCIA DO ESPAÇO PÚBLICO - C1. ARTIFICIALIZATION AND OBSOLESCENCE OF PUBLIC SPACE
Geração de atmosferas e espaços púbicos artificais, que prejudicam as necessidades da pessoas humana e atividades cotidianas, e até mesmo inviabilizam sua utilização. - Generation of artificial atmospheres and public spaces, which hinder human needs and daily activities, and even make them impossible to use.
C2. DANOS À SAÚDE PSICOLÓGICA DO CIDADÃO URBANO - C2. DAMAGE TO THE PSYCHOLOGICAL HEALTH OF THE URBAN CITIZEN
Estresse, depressão e danos à qualidade de vida pela falta de arborização. - Stress, depression and damage to quality of life due to the lack of trees.
R1. HUMANIZAÇÃO DOS ESPAÇOS PÚBLICOS - R1. HUMANIZATION OF PUBLIC SPACES
Considerar as apropriações do espaço e a dinâmica social nos projetos de intervenção urbana, atentando para toda a natureza subjetiva do lugar. - Consider the appropriation of space and social dynamics in urban intervention projects, paying attention to the whole subjective nature of the place.
R2. ENTENDER A ESFERA SENSÍVEL DOS USUÁRIOS - R2. UNDERSTANDING THE SENSITIVE SPHERE OF USERS
Valorizar a vegetação urbana pelos benefícios à saúde física e psicológica dos habitantes. - Valuing urban vegetation for its benefits to the physical and psychological health of inhabitants.

Through this example and the one shown in this analysis **(Figure 5),** it is possible to see a series of consequences for urban life generated by the presence (or absence) of vegetation in public spaces. In addition to the consequences of **generating artificialized atmospheres (C1)** and without adequate landscape treatment, they can interfere with the characteristics of the space in its materiality, and **directly damage the subjective nature of those who use it (C2),** hindering or even making impossible the functioning of the space and all the dynamics of daily life that take place in it.

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It is therefore necessary **to understand the interface between design decisions and human behavior (R1)**, using urban vegetation as a means of designing **integrated, inviting spaces that enhance human relationships (R2),** functions that are fundamental to public spaces.

2.3 Dimensional synthesis

Atentando para o constatado nos quadros analíticos apresentadas anteriormente, fica ilustrada a natureza complexa das relações da arborização para com o espaço urbano, uma vez que esta exerce influência sobre diversas esferas da vida urbana que não somente a ambiental, o que confirma o enunciado adotado na pesquisa: é imprescindível adotar uma abordagem integrada e plural para melhor compreender a extensão de uma problemática complexa.

The analytical frameworks presented above illustrate the complex nature of the relationship between tree planting and urban space, since it influences several spheres of urban life other than just the environment, which confirms the statement adopted in the research: it is essential to adopt an integrated and plural approach in order to better understand the extent of a complex problem.

Concerning the conflicts identified, one aspect stands out: they indicate not only a problem within the planning policy and the praxis adopted in the projects, but also in the very concept of afforestation. Reflections on the instruments to be adopted must therefore be based on theoretical and practical aspects, in order to guarantee a full resolution of the problems of urban afforestation.

3 MANAGEMENT TOOLS: WHICH APPROACH TO ADOPT?

As has been seen in other studies, three main players and their respective perspectives were involved: technical professionals, environmental researchers, and civil society, as well as the management responsible for implementing the policies. These actors interact with vegetation in public and private spaces in cities (Lacerda et al., 2021).

In the second part of the approach, the integrated action of these agents is taken as the generator of these scenarios, which implies the indication of practical management instruments that have a direct impact on these fields; in order to remedy, through a comprehensive urban afforestation policy, the issues directly linked to the actors at the heart of this problem.

The following are reflections on the resources and management initiatives for each of these areas, as set out by Lacerda et al. (2021): (I) resources of a technical nature, aimed at professionals working in city planning; (II) of a political-administrative nature, for those who carry out activities in urban policy management; and (III) of a civil and educational nature, for citizens who are a fundamental part of the construction of urban space, with the construction of a concept of urban afforestation specific to each field and the discussion of practical measures applied to the issue.

3.1 Resources of a technical nature

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In this field, the understanding of vegetation as an urban element that contributes to the formation of a sense of local identity, contributing to a deeper connection with the urban environment, must predominate (Deng *et al.*, 2017; Carvalho *et al.*, 2023b). Furthermore, green Spaces can contribute to spatial appropriation, which will depend on some visible and/or invisible factors in complex interactions, which must be considered through planning in a web of connections. Afforestation, when used appropriately in urban Spaces, in addition to promoting the revaluation of these spaces, contributes to reducing levels of air and noise pollution, structuring roads, and creating spaces of identity in the city (Bonametti, 2020; Carvalho et al., 2023b). This strategy, which uses vegetation, provides greater urbanity to public Spaces, whether in larger spaces, such as squares and parks, or small and residual Spaces, with the creation of so-called pocket squares, pocket parks (NEW YORK CITY DEPARTMENT OF PARKS & RECREATION, 2010).

Furthermore, the formation of an environmental awareness in the technical staff working in urban areas can be closely linked to the training of these professionals, ensuring that in this process, they have access to the disciplines. Awareness materials and reflections are responsible for thinking about the urban environment, as already regulated in the National Curricular Guidelines: Resolutions CNE/CES nº 11, of March 11, 2002, and CNE/CES nº 2, of June 17, 2010, for Civil Engineers and Architects and Urban Planners, respectively.

Through these initiatives, it becomes possible to guarantee what constitutes the very essence of these professionals' work: conceiving and executing actions and projects aimed entirely at guaranteeing quality of life for the Community that they also form part of.

3.2. Resources of a political-administrative nature

In the political-administrative sphere, the notion of urban vegetation as a shared responsibility must prevail, that is, neither exclusive to public administration nor civil Society, but resulting from a collaborative process of conception, execution, and preservation. Urban afforestation, therefore, requires the effective participation of the population in decision-making processes and assistance and encouragement to their participation by the responsible planning bodies.

To this end, administrative initiatives can be adopted to engage the population in environmental preservation, such as tax incentives and tax discounts, such as the initiative called Crédito Verde, by the Municipality of Curitiba and regulated by the Forest Code of Curitiba (Complementary Law nº 0,806, of July 4, 1994), which established discounts on Urban Property and Territorial Tax (IPTU) according to the percentagem of wooded area within the lot in question, collaborating so that vegetation is absorbed not only by the urban context, but by Spaces for private use.

Furthermore, indices, methods and concepts for evaluating vegetation cover and requirements for urban projects in municipal legislation cna be established and complied with, as a condition for approval, guaranteeing, by legal instrumentation and strategic action plans, the consolidation of integrated urban improvements, governed by the principles of Sustainability, such as that adopted in the urban improvement plan proposed for San Francisco (USA) in 2011, called Better Streets.

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Therefore, through a Public Power that recognizes its responsibilities and technical capabilities and acts to raise awareness and participation of professionals and Society in its actions, the functioning of the State is ensured beyond the institutionalize d machine, but rather the Entity that primarily cares for the well-being of everyone who needs it.

3.3 Civil and educational resources

As for civil society, it is essential to establish an understanding of vegetation as an element integrated into the daily lives of cities, whose presence in Spaces directly affects their daily flow activities and enjoyment of Spaces and therefore demands a collective effort for its preservation.

In practical terms, the solidification of this concept can occur through environmental awareness and education initiatives, carried out by civil society organizations, such as social movements and non-governmental organizations (NGOs) in partnership with planning and enivornmental preservation bodies: campaigns, booklets and theoretical and practical actions, such as lectures and activities to plant seedlings and restore degraded ecosystems, especially those activities carried out in primary and secondary Education institutions.

In discussions about urban enironmental education, this has been highlighted as "a possible response to the challenge of a harmonious relationship among city, Society and nature, seeing to build a city from a socio-environmental point of view" (CARVALHO, 2014, p.1); even more so when applied to children, as highlighted by research in the Fields of psychology and pedagogy, since having premature contact with these discussions:

> It will allow these children to become multipliers in the near future and, in a more distant time, into conscious and competent adults to seek methods and models of life that guarantee the sustainability of their homes and their cities. Exercising their power of pressure and decision-making over companies and the Society in which they live (SOUZA, 2008 apud SILVA et al, 2011, p.3).

This way, through the valorization of urban vegetation and the active participation of society in safeguarding it, a city will be created that embraces the plurality of individuals and that, therefore, is conducive to human coexistence in its fullness and in Harmony with the environment.

4 FINAL CONSIDERATIONS

Through this study, it was possible to compose an overview of the problem of afforestation, encompassing the complexity of the subject and urban issues in general, and outlining different paths to be considered and explored in the search for a resolution to these conflicts.

In the first stage of this analysis, the thematic synthesis procedure proved to be effective in exposing the interfaces between vegetation and the various fields of the urban environment,

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indicating that the problems observed and discussed in the practice of afforestation do not arise exclusively from environmental issues, but also from those of a social and economic nature. Delving deeper into two of the eight spheres made it possible to elucidate and correlate the characteristics of urban expansion and social dynamics with urban afforestation, explaining the interdependence of these urban factors.

Additionally, the scenarios identified reveal that the problem lies not only in the practice and implementation of planning policies, but has a much deeper core: in the very understanding of what afforestation is and its representativeness in the urban context. Based on this, the second stage of this approach sought to indicate instruments and actions, in the fields of theory and practice, that work to dissolve these conflicts, with a view to harmonious and sustainable urban development through a collaborative process between the main players: technicians and planning professionals, managers and civil society.

In short, it can be seen that afforestation is responsible for incalculable benefits to the urban environment, which is why it requires in-depth studies and the adoption of holistic methodologies in its planning. This is the only way to ensure that the issue is dealt with in its entirety and that everyone can work together towards a single goal: urban quality, guaranteed by the search for a harmonious environment for all those who make up the city.

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CONTRIBUTION OF EACH AUTHOR

- **Leandro Ismael de Azevedo Lacerda**: Conception and design of the study, data curation, formal analysis, research, methodology, and writing of the initial draft.
- **José Augusto Ribeiro da Silveira:** Conception and design of the study, data curation, methodology, writing - critical review, review and final editing, and supervision.
- **Gabriel Lincoln Lopes Carvalho:** Writing - critical review, revision, and final editing.
- **Larissa Ellen Oliveira de Lima:** Writing - critical review, proofreading, and final editing.
- **Edson Leite Ribeiro:** Writing - critical review
- **Juliana Xavier Andrade de Oliveira:** Writing - critical review, proofreading, and final editing.

DECLARATION OF CONFLICTS OF INTEREST

I/We, **Leandro Ismael de Azevedo Lacerda, José Augusto Ribeiro da Silveira, Gabriel Lincoln Lopes Carvalho, Larissa Ellen Oliveira de Lima, Edson Leite Ribeiro, Juliana Xavier Andrade de Oliveira,** declare that the manuscript entitled **"Urban Afforestation: challenges and instruments for Integrated Planning with urban expansion and social dynamics":**

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