

# Methodological criteria in delimiting areas of influence: instruments for urban and environmental impact analysis and assessment

*Critérios metodológicos na delimitação das áreas de influência: instrumentos de análise e avaliação de impactos urbanos e ambientais*

*Criterios metodológicos en la delimitación de áreas de influencia: instrumentos de análisis y evaluación de impactos urbanos y ambientales*

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## CRediT

**Author contributions:** Conception; Data curation; Analysis; Data collection; Methodology; Software; Supervision; Validation; Visualisation; Writing – original draft; Writing – review and editing: INGUAGGIATO, F. F. Conception; Data curation; Analysis; Data collection; Methodology; Software; Supervision; Validation; Visualisation; Writing – original draft; Writing – review and editing: STANGANINI, F. N.

**Conflicts of interest:** The authors certify that there are no conflicts of interest.

**Funding:** Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES) – Funding Code 001.

**Ethical approval:** The authors certify that there was no need for Ethics Committee approval.

**Use of AI:** DeepL Translator tool was used in the process of translating the accepted work in Portuguese (original) to English. The Editor-in-Chief and the authors reviewed and edited the content as needed and assume full responsibility for the content of the published article.

**Editors:** Daniel Sant'Ana (Editor-in-Chief); Luciana Saboia F. Cruz (Associate Editor); Leandro S. Cruz (Associate Editor); Paola C. F. Martins (Associate Editor); Rodrigues de Medeiros (Editorial Assistant).

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## Abstract

The process of land use and occupation, resulting from anthropogenic actions in urban and environmental areas, has historically led to impacts associated with socioeconomic inequalities, environmental susceptibility, and other factors. In Brazil, throughout the second half of the 20th century and the early 21st century, numerous urban and environmental instruments, established in different pieces of legislation, have sought to mitigate these impacts. However, a frequent issue regarding these instruments is the delimitation of methodological criteria in the delimitation of the area of influence of the projects that need them for implementation. The aim of this article is to conduct a bibliographical, methodological, and legislative survey regarding the presence of these criteria in legal processes and their instruments, as well as some propositions and reflections on the subject. To this end, the methodology used includes stages of data collection, investigation and analysis of the state of the art of the subject. The study concludes that, in the national scenario, although several legislations propose studies of urban and environmental impacts, none of them make reference any methodological criteria for delimitation of areas of influence of these projects, which denotes a large gap to be explored and studied in future scenarios.

**Keywords:** Legislation; Urban Planning; Environmental Planning; Method.

## Resumo

O processo de uso e ocupação do solo, fruto de ações antrópicas em áreas urbanas e ambientais, historicamente remete a impactos relacionados a desigualdades socioeconômicas, suscetibilidade ambiental, entre outros. No Brasil, ao longo da segunda metade do século XX e início do século XXI, inúmeros instrumentos urbanos e ambientais, em diferentes legislações, visam mitigar esses impactos. Todavia, uma problemática frequente em relação a esses instrumentos é a definição de critérios metodológicos para a delimitação da área de influência dos empreendimentos que deles necessitam. O objetivo deste artigo é realizar um levantamento bibliográfico, metodológico e legislativo referente à presença desses critérios em seus processos legais e instrumentos, bem como algumas proposições e reflexões sobre a temática. Para isso, a metodologia utilizada inclui etapas de levantamento, investigação e análise do estado da arte sobre o tema. Conclui-se que, embora existam no cenário nacional diversas legislações que propõem estudos de impactos urbanos e ambientais, nenhuma faz menção a critérios metodológicos para a delimitação das áreas de influência desses empreendimentos, o que denota uma grande lacuna a ser explorada e estudada em cenários futuros.

**Palavras-Chave:** Legislação; Planejamento Urbano; Planejamento Ambiental; Método.

## Resumen

El proceso de uso y ocupación del suelo, resultado de acciones antrópicas en áreas urbanas y ambientales, históricamente remite a impactos relacionados con las desigualdades socioeconómicas, la susceptibilidad ambiental, entre otros. En Brasil, a lo largo de la segunda mitad del siglo XX y el inicio del siglo XXI, numerosos instrumentos urbanos y ambientales, establecidos en diferentes legislaciones, buscan mitigar estos impactos. Sin embargo, un problema frecuente relacionado con estos instrumentos es la definición de criterios metodológicos para la delimitación del área de influencia de los emprendimientos que los requieren. El objetivo de este artículo es realizar un levantamiento bibliográfico, metodológico y legislativo sobre la presencia de estos criterios en sus procesos legales e instrumentos, así como algunas propuestas y reflexiones sobre la temática. Para ello, la metodología utilizada incluye etapas de recopilación, investigación y análisis del estado del arte sobre el tema. Se concluye que, aunque en el escenario nacional existen diversas legislaciones que proponen estudios de impactos urbanos y ambientales, ninguna hace referencia a criterios metodológicos para la delimitación de las áreas de influencia de estos emprendimientos, lo que evidencia una gran laguna que debe ser explorada y estudiada en escenarios futuros.

**Palabras clave:** Legislación; Planificación Urbana; Planificación Ambiental; Método.

## 1 Introduction

The Brazilian urbanisation process has consolidated in an accelerated, uneven manner, deeply linked to the dynamics of capital, shaping an urban space that is functional to market demands but dysfunctional to the social and environmental needs of the majority of the population (Villaça, 1999; Maricato, 2000; Rolnik, 2004). This process has led to fragmented and exclusionary land occupation, marked by stark socio-spatial inequalities and patterns of urban expansion that are disconnected from pre-existing ecological systems. In this context, structural challenges to urban and environmental governance have emerged, particularly with regards to managing the impacts of large-scale development projects.

The persistent dissociation between the spheres of urban planning and environmental management is criticised by several authors. Maricato (2000) and Rocco (2009) argue that the lack of coordination between urban policy, land use and environmental regulation compromises the effectiveness of public policies. On the environmental side, Sánchez (2020), Lopes (2019) and Inguaggiato (2020; 2024) recognise the advances in the field of Environmental Impact Assessment (EIA), but point to significant methodological limitations, especially in the stage of defining the area to the scope of a project's impacts. This definition, which is essential for guiding mitigation, compensation and monitoring measures, still lacks consolidated technical parameters, as pointed out by Glasson and Therivel (2013), Geneletti (2006) and Canter (1996).

In this context, The New Urban Agenda (NUA) (UN, 2017) offers an international normative framework that guides integrated, participatory and multiscale urban planning. In discussing the fragmentation between urban planning and environmental management, the NUA highlights the need to overcome sectoral approaches and promote institutional coordination and an integrated territorial vision – principles intrinsically related to the methodological gap that exists in the delimitation of areas of influence. Thus, the absence of clear technical criteria for this delimitation weakens Brazil's commitments under the NUA, which aims to build more sustainable, inclusive and resilient cities. This reference, together with Agenda 2030 and the Sendai Framework, reinforces the current and international relevance of the issue addressed, strengthening the analytical framework of this study.

The 2030 Agenda for Sustainable Development (UN, 2015a) and the Sendai Framework for Disaster Risk Reduction (UN, 2015b) reinforce the need for integrated public policies. The 2030 Agenda establishes 17 Sustainable Development Goals (SDGs), among which SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action), which require urban and environmental planning strategies aligned with risk reduction and the promotion of socio-environmental resilience. In turn, the Sendai Framework emphasises the importance of territorial risk assessment, cumulative impact management and the participation of multiple actors in disaster prevention and mitigation. The integration of these international benchmarks shows that the clear definition of areas of influence is not only a methodological issue, but also a requirement for the fulfilment of global commitments to sustainability, resilience, and socio-environmental justice, strengthening the relevance of the topic addressed in this study.

In addition to international instruments, the National Civil Protection and Defence Policy (Law No. 12,608/2012) provide normative parameters that can support the delimitation of

areas of influence based on the analysis of vulnerabilities and risks. By articulating urban planning, environmental management and civil defence policies, this law complements the existing regulatory framework, providing support for more integrated and preventive strategies.

Although articulated at national and international levels, this gap becomes even more critical when considering that the impacts of projects extend beyond the immediate boundaries of the areas of intervention, reaching peripheral territories and broader social, urban and environmental dynamics. The specialised literature has shown that the delimitation of so-called areas of influence – whether direct, indirect, cumulative or synergistic – remains a weak point in both environmental and urban management instruments (Raymond et al., 2017; Sánchez, 2023; Olivatto; Inguaggiato; Lollo, 2025). This technical and methodological challenge directly impacts policy formulation and compromises the effectiveness of instruments such as the Neighbourhood Impact Study (EIV) and the Environmental Impact Study (EIA) itself.

It is important to note that this regulatory weakness is not merely a theoretical abstraction, but translates into concrete technical practices that compromise diagnoses and interventions. For example, recent studies in municipalities in São Paulo (Inguaggiato; Stanganini; Melanda, 2021; Abreu; Peres, 2024; Peres; Cassiano, 2017) show that the absence of clear technical criteria for preparing NIAs has led to superficial assessments that fail to capture the complexity of the real impacts suffered by local populations.

Furthermore, regulatory and institutional fragmentation between urban and environmental policies contributes to overlapping, omission, or conflict of competences. The literature on urban planning instruments points out that the EIV, even though it is provided for in the City Statute (Law No. 10,257/2001), still lacks clear guidelines and objective territorial parameters for defining affected areas (Peres; Schenk, 2021; Inguaggiato, 2024; Freire, 2015). At the same time, the Technical Notebook on Regulation and Implementation of City Statute Instruments (CTRIIEC) clarifies that the area of influence must be designated in the legislation referring to the EIV, and it also pre-establishes the responsibility for this delimitation to the municipal authority – in accordance with Art. 36 of Law No. 10,257/2001. Because of this, it is emphasised that municipal legislation often does not provide the method that the delimitation of the EIV's area of influence should follow, thus creating uncertainties regarding its use to mitigate socio-spatial inequalities.

On the environmental side, despite the technical robustness accumulated around the EIA, as demonstrated by the IBAMA (2004) manuals and the works of Sánchez (2008; 2020) and Fonseca (2015), it is observed that, in practice, the territorial definition of impacts is still treated on a case-by-case basis, often without proper integration with urban planning. Olivatto, Inguaggiato and Lollo (2025) bring up this discussion when presenting the EIA related to mining activities in the municipality of Maceió and its implications and congruencies with the parameters and impacts on the municipality.

Conceptually, “enterprise” based on IBAMA (2004) is understood as any planned activity, whether public or private, with the potential to interfere with socio-environmental systems, regardless of its scale. The “area of influence,” in turn, refers to the territorial delimitation of the direct and indirect effects of this intervention, defined by both spatial variables and socioeconomic and ecological factors (Grando, 1986; Geneletti, 2006). The impacts resulting from these interventions, as discussed by Krafta (1997), reconfigure patterns of

land use and occupation, affect urban infrastructure and alter the functioning of ecosystems, thus requiring integrated planning responses.

Thus, despite the multiplicity of existing regulations, what we observe is a generalised methodological weakness in the definition of these areas in regulatory instruments, which has a direct impact on the formulation of effective measures for mitigation, compensation and impact management. This gap highlights the need to build bridges between the fields of urban planning and environmental assessment, promoting methodological approaches that simultaneously consider territorial, ecological and social factors. Issues such as interdisciplinary integration between environmental, social, urban and technological sciences for the development of methodologies that encompass the multiple dimensions of impacts and territorial management, as explained by Negev et al. (2013), are crucial for assessment and planning instruments to reflect the complexity of contemporary urban territories and their environmental challenges.

Given this scenario, this article aims to conduct a documentary and legislative survey of the main urban and environmental instruments that refer to the delimitation of areas of influence of developments. The proposal consists of identifying the normative criteria adopted, the presence (or absence) of methodologies, and the possibility of integration between the different instruments. The methodological approach is exploratory and based on the analysis of legal texts, technical guidelines, and reference documents.

This study is justified by the scarcity of integrated approaches in the literature and in technical-institutional practice, which compromises the quality of diagnoses and, consequently, socio-environmental justice in the affected territories. By mapping and critically analysing the legal provisions that deal with this delimitation, this work aims to contribute to the academic and technical debate on the integration between urban planning and environmental management, providing analytical support for the formulation of more effective and socially sensitive public policies. This methodological contribution is essential to overcome the fragmented and uncoordinated nature of current practice, offering a path for the improvement of territorial management instruments.

## 2 Environmental and urban management instruments

The installation of developments in Brazilian territory, especially medium and large ones, has a series of environmental and urban impacts that transcend the physical boundaries of the plot or land directly occupied. These impacts manifest themselves in direct, indirect, cumulative and synergistic ways, affecting ecosystems, urban systems, populations and existing infrastructure. However, the precise definition of the areas of influence of these impacts is still one of the main gaps in the processes of territorial assessment and regulation, both in the environmental and urban spheres.

In the environmental field, Environmental Impact Assessment (EIA) is recognised as a central instrument of the National Environmental Policy (PNMA), established by Law No. 6,938/1981. EIA was standardised in Brazil through CONAMA Resolution No. 01/1986, which established the legal basis for the Environmental Impact Study (EIS) and the Environmental Impact Report (EIR). The EIA is conceived as a technical and participatory process designed to anticipate and assess the environmental impacts of projects and human activities prior to their implementation. As Sánchez (2020; 2023) states, it is a dynamic instrument with the potential to articulate ecological, social, and economic

variables, supporting more sustainable public decisions. One of its central moments is the scope definition phase, a stage in which the area of influence to be studied is established. However, although the legislation recognises the importance of delimiting these areas, there are no clearly established normative methodological parameters.

Furthermore, the absence of these standardised technical criteria opens the door to fragmented decisions, subject to local interests and diverse interpretations, which hinders the replicability of studies and the comparison between cases (Geneletti, 2006; Silva; Lollo, 2013; Inguaggiato, 2024).

CONAMA Resolution No. 01/86 recommends that the area of influence consider the hydrographic basin in which the project is located, but this guidance is generic, without technical details or requirements for standardised methods. In practice, the definition of the area of influence falls to the contracted technical team or the licensing agency, which leads to differing interpretations, undermining the consistency of the diagnoses (Fonseca, 2015; Lopes, 2019). This methodological gap compromises the effectiveness of the EIA and, consequently, the environmental licensing process as a whole. According to authors such as Geneletti (2006), Sánchez (2020), and Almeida et al. (2017), this lack of definition reflects one of the main weaknesses of the current environmental assessment model in Brazil.

Environmental licensing, in turn, should be understood as an administrative act resulting from technical analysis based on environmental studies. Although it is a procedure and not an analytical instrument in itself, licences such as the Preliminary Licence (LP), Installation Licence (LI) and Operating Licence (LO) indicate different stages in the implementation of a project, but do not define the areas of influence. However, although the delimitation of these areas should occur during the preparation of the required technical studies (EIA, RIMA or simplified studies), which are part of the licensing process, none of the stages suggest the incorporation of areas of influence in these studies. The conceptual confusion between licence and technical study compromises methodological clarity and, at times, the institutional referrals of impactful projects themselves.

Other instruments associated with licensing, such as the Preliminary Environmental Report (RAP), the Simplified Environmental Report (RAS) and the Simplified Environmental Study (EAS), also do not establish specific guidelines for delimiting areas of influence, although they require general descriptions of the affected area. CONAMA Resolution No. 279/2001, for example, stipulates that the RAP should contain information about the surrounding area, but does not detail how this delimitation should be carried out. The same is true of CONAMA Resolution No. 237/1997, which broadened the scope of activities subject to licensing and promoted advances by systematising procedures, but remained silent on technical criteria for territorial measurement of impacts.

Although legislation such as Law No. 9,795/1999, which establishes the National Environmental Education Policy (PNEA), and Law No. 9,605/1998, which provides for criminal and administrative penalties for conduct and activities harmful to the environment (Environmental Crimes Law), have no relation to the definition of areas of influence in the context of environmental management instruments, the former aims to regulate environmental education actions in formal and informal settings, promoting environmental awareness and citizenship, while the latter defines criminal offences and administrative violations, establishing punitive mechanisms. Although both may be present in programmes derived from environmental studies – such as compensation,

mitigation or recovery actions – they do not deal with the technical delimitation of areas affected by developments.

In the field of urban planning, the debate surrounding the delimitation of areas affected by developments advanced with the enactment of the City Statute (Law No. 10,257/2001), which introduced a new generation of urban policy instruments. Among these, the Neighbourhood Impact Study (EIV) stands out, provided for in Articles 36 to 38, designed to assess the positive and negative effects of certain projects on the neighbourhood. The EIV considers impacts such as population density, traffic generation, property values, changes to the landscape, among other aspects. However, the Statute itself delegates the regulation of the EIV to municipalities, which has resulted in very heterogeneous practices, with methodological gaps similar to those observed in the environmental field.

In the Technical Notebook on Regulation and Implementation of Instruments of the City Statute, regulation relating to the EIV is commonly carried out in relation to two specificities: type and size, listing some examples of developments subject to the study. The first, relating to types of development, is presented as follows (Schvarsberg et al., 2016):

1. Shopping centres, supermarkets and similar establishments;
2. Cargo centres or terminals or supply centres;
3. Transport terminals, especially road, rail and air terminals, and heliports;
4. Treatment plants, landfills and solid waste recycling plants;
5. Amusement centres, racetracks, horse tracks and sports stadiums;
6. Concert halls, regardless of the area used for the activity;
7. Convention centres, regardless of the area used for the activity;
8. Party and event venues with an area of more than 360 m<sup>2</sup>;
9. Interventions in consolidated urban areas, including significant geometric modifications to vehicle traffic routes;
10. Cemeteries and mortuaries;
11. Slaughterhouses and abattoirs;
12. Prisons;
13. Barracks and fire stations;
14. Zoos or botanical gardens;
15. Schools of any kind, colleges, universities, and religious temples on land larger than 1,000 m<sup>2</sup>.

The second, relating to developments subject to EIV due to their size, is presented as follows:

1. Developments located in large areas, between 15,000 m<sup>2</sup> and 25,000 m<sup>2</sup>;
2. Developments with a large built area – on average, areas greater than 10,000 m<sup>2</sup>;
3. Non-residential buildings with a large built area – on average, greater than 3,000 m<sup>2</sup>;
4. Non-residential buildings with a vehicle parking area exceeding 8,000 m<sup>2</sup> or with more than 400 parking spaces;
5. Buildings intended for mixed use and with a built area intended for non-residential use greater than 5,000 m<sup>2</sup>;
6. Mixed-use developments with a built area greater than 20,000 m<sup>2</sup>;
7. Developments that, due to their nature or conditions, require specific analysis or treatment by the municipal government, as provided for in the land use and occupation legislation;

8. Developments resulting from the subdivision of areas larger than 15,000 m<sup>2</sup>, regardless of the activity implemented and the built area;
9. Land subdivisions linked to the figure of subdivision, which result in lots with an area greater than 10,000 m<sup>2</sup> or blocks with a side length greater than 200 m
10. Developments resulting from the subdivision of real estate areas in environmental preservation areas, regardless of the activity implemented and the built area;
11. Developments intended for residential use and with more than 120 units in some municipalities, reaching 300 units in others.

Overall, EIVs lack rigorous spatial delimitations or even technical justifications for defining areas of urban influence. As pointed out by Silva and Lollo (2013), Hoshino et al. (2019) and Inguaggiato (2024), the absence of unified methodological references for the EIV weakens its application as an instrument of control and territorial planning, reducing its effectiveness in urban planning. Despite operating at the municipal level and having a more restricted scope than the EIA, the EIV faces similar difficulties with regard to systematic territorial analysis, especially when the impacts go beyond the local scale or affect multiple dimensions of urban space, although, in the environmental field, Sánchez (2023) makes a similar criticism when discussing the cumulative impacts of developments on the natural environment.

The Master Plan, considered the main instrument of municipal urban policy, as defined in Article 182 of the Federal Constitution (Brazil, 1988) and regulated by the City Statute itself (Brazil, 2001), is also indirectly related to the issue of areas of influence. Article 41 of the Statute stipulates that the Master Plan is mandatory for municipalities with more than 20,000 inhabitants, or those located in metropolitan areas and tourist resorts. However, neither the Constitution nor infra-constitutional legislation establish technical criteria for identifying or delimiting areas of influence in any of the instrument's present in the Master Plan. Thus, the recognition of the existence of areas of influence in the legal text is not accompanied by normative provisions that guide their measurement, leaving this definition, once again, to municipal or state entities, which contributes to the absence of technical standardisation.

Thus, there has been constant evolution in the environmental and urban planning instruments of national legislation, especially with regards to the delimitation and classification of projects subject to studies, licences and concessions. However, although these issues have progressed positively, the definition of methodological criteria for the delimitation of areas of influence in these instruments still lacks greater precision, both in the environmental and urban spheres. This normative and dialogical evolution with the presence of technical criteria for the delimitation of areas of influence in urban and environmental instruments is presented in Figure 1.

**Figure 1:** Environmental instruments and methodological criteria for delimiting areas of influence.

	INSTRUMENT	IMPACT CLASSIFICATION	AREA OF INFLUENCE	CRITERIA FOR AI
1981 Decree No. 88,351	RIMA	Applications for licensing of projects that may have an environmental impact become mandatory.	NONE	NONE
1986 CONAMA No. 01	AIA	It specifies which projects are eligible for evaluation.	"In all cases, consider the river basin in which it is located."	NONE
	EIA	"to conduct a systematic examination of the environmental impacts resulting from a proposed action, where its results should be stipulated in a way that is accessible to civil society."		
	RIMA	"A description of a project and its technological and locational alternatives, specifying for each of them, in the construction and operation phases of the area of influence, the raw materials, labor, energy sources, operational processes and techniques, probable effluents, emissions, waste and energy loss, and the direct and indirect jobs to be generated."		
1997 CONAMA No. 237	EIA RIMA	"Description of activities subject to environmental licensing, totaling 116 categories"	"It is any and all environmental impact that directly affects (the project's direct area of influence), in whole or in part."	NONE
1997 Law No. 9,605		"It mentions the need to request the signing of the commitment agreement regarding the installation of the project."	NONE	NONE
1999 Law No. 9,795		NONE	NONE	NONE
2001 CONAMA No. 237	RAP	YES	NONE	NONE
	EAS	"Environmental impact assessment resulting from the installation of low-impact projects"	NONE	NONE
	RAS	"Environmental diagnosis of the project, its identification and characterization, as well as mitigating and compensatory measures."	"Project description, its location alternatives, specifying the area of influence"	NONE
2001 Law No. 10,257	Master Plan	"The creation of a PD (Planning Development) is necessary when the municipality is within the area of operation of a project."	NONE	NONE
	EIV	"It addresses 7 scales of impact in the urban environment"	NONE	NONE

Source: Brazil (1981; 1998; 1999; 2001); Conama (1986; 1997; 2001).

Information such as that presented in Figure 1 corroborates this statement, because although urban and environmental instruments gained prominence in the last decades of the 20th century, methodologies for measuring and delimiting areas of influence are addressed subjectively or not at all.

In practice, this gap in environmental and urban legislation can be observed in the Neighbourhood Impact Study (EIV) itself. Inguaggiato, Stanganini and Melanda (2021) and Abreu and Peres (2022) analysed medium-sized municipalities in the state of São Paulo, highlighting those that include or do not include the EIV in their respective Master Plans. Inguaggiato and Olivatto (2021) present a similar discussion when they relate the EIV to methodological issues and models for measuring sustainability indicators in capitals in southeastern Brazil and find that many municipalities simply reproduce the normative content of the City Statute, without technical descriptions or their own methodological criteria. This clearly illustrates the absence of a clear delimitation of areas of influence in the urban field, reinforcing the central argument of this study. As a result, these elements generate difficulties in the effective application of the EIV, compromising local urban management and social participation.

Similarly, authors such as Sánchez (2020), Formiga and Martini (2023), López (2019) and Olivatto, Inguaggiato and Lollo (2025) also highlight problems in the delimitation of these areas and in the definition of technical criteria, especially in environmental instruments. The first two discuss the legal and institutional obstacles present in current legislation, while the third analyses the relationship between the legislative process and environmental licensing, drawing attention to the lack of definition of methodological parameters. The latter reflect on how this lack of technical criteria leads, in a practical analysis, to urban and environmental impacts. In convergence, these authors recognise that, even after decades of improvement in public policies and environmental standards, there remains a conceptual and technical vacuum surrounding the delimitation and operational methods of these instruments, which is in line with the lack of parameterisation, for example, of the delimitation of areas of influence in these instruments.

Thus, it is essential to highlight the importance of promoting debates and discussions on this topic, seeking not only to understand and classify the different technical and legal instruments, but also to improve and develop practical and applicable criteria that establish effective methodologies for delimiting these areas. Regulatory and institutional fragmentation, by hindering coordination between environmental and urban planning licensing, reduces the effectiveness of public policies, which requires efforts towards integration and regulatory harmonisation to strengthen territorial governance.

### **3 Methodology**

This research adopts a qualitative and exploratory approach, focusing on the documentary and legislative analysis of environmental and urban management instruments related to the delimitation of areas of influence of developments. This approach aims to understand how legal and regulatory provisions address – or fail to address – the technical, conceptual, and territorial criteria for this delimitation, both in the environmental and urban spheres.

Legal documents, guidelines, and manuals published between 1980 and 2024 were included, selected based on their relevance to the assessment of urban and

environmental impacts and the definition of areas of influence. Documents without practical application or that did not specifically address territorial delimitation were excluded.

Federal legal documents, including laws, decrees, resolutions, and technical guidelines that underpin the main instruments for impact assessment and territorial planning in Brazil, were selected as primary sources of analysis. Among the environmental instruments analysed, the following stand out: the Environmental Impact Assessment (EIA), the Environmental Impact Study (EIS), the Environmental Impact Report (EIR), the Preliminary Environmental Report (PER), the Simplified Environmental Study (SES), the Simplified Environmental Report (SER), in addition to Preliminary, Installation and Operating Licences. In the field of urban planning, the instruments investigated include the Master Plan and the Neighbourhood Impact Study (EIV), as established by the City Statute (Law No. 10,257/2001).

The analysis followed stages of systematic reading, categorisation by instrument, identification of methodological gaps, and construction of comparative matrices. The categories of analysis considered: the presence of technical criteria, spatial delimitation, institutional responsibility, and integration between urban and environmental instruments.

The document analysis was guided by a reading script that identified in the documents: (i) the presence or absence of mention of the need to delimit the area of influence; (ii) the existence (or non-existence) of objective technical criteria for this delimitation; (iii) the institutional mechanisms responsible for this definition; and (iv) the consistency between the instrument's objective and its practical applicability.

In the bibliographic field, reference works by national and international authors on impact assessment, urban planning, and environmental management were consulted. These works provided the theoretical and analytical support necessary to interpret the legal mechanisms in light of the most recent academic debates on the subject.

The content analysis was performed manually, with the support of summary matrices that allowed for the systematisation of the presence or absence of methodological criteria in the instruments analysed. The information was then organised into comparative tables, allowing for the visualisation of convergences and normative gaps between environmental and urban instruments.

It should be noted that, although no specific content analysis software was used, the study follows the principles of methodological rigour in qualitative document analysis, as proposed by Bardin (2011), and incorporates aspects of triangulation between legal sources, academic literature and empirical evidence extracted from municipal Master Plans.

This methodology therefore sheds light on normative and conceptual shortcomings in the treatment of areas of influence, in addition to providing insights for critical reflections on the improvement of territorial management instruments in Brazil.

## 4 Results and discussions

The analysis of the available management plans and EIVs revealed that, despite the existence of normative instruments that regulate their preparation, there are significant gaps in the operationalisation of these studies in the municipalities investigated. It is

observed that the standardisation of NIAs is still limited, which compromises the comparability between studies and makes it difficult to measure social and environmental impacts consistently. These findings corroborate previous studies that point to similar challenges in urban contexts with different institutional capacities.

The analysis of management plans and Neighbourhood Impact Studies (NIS) in the municipalities investigated revealed that, although the regulatory instruments are formally established, there are significant gaps in their implementation. It is observed that the standardisation of NIAs is still limited, which compromises the comparability between studies and hinders the consistent measurement of social and environmental impacts. These findings indicate that, despite the regulatory advances provided for in the City Statute and master plans, the practical application of these instruments still faces institutional and technical challenges.

Furthermore, the results indicate that the effectiveness of EIVs depends heavily on the technical capacity of municipal teams and coordination between different public agencies. The mere preparation of an EIV does not guarantee the effective mitigation of impacts or the integration of recommendations into urban planning, highlighting the need for complementary monitoring and evaluation mechanisms. This aspect reinforces the argument that the EIV should be considered a dynamic instrument, whose potential is limited if isolated from broader urban governance strategies.

The environmental and urban planning licensing process in Brazil involves a complexity that goes beyond the simplification often observed in technical literature. In the case of environmental licensing, it is structured in interdependent phases ranging from the Terms of Reference, environmental diagnosis, prognosis, analysis of location alternatives, identification and assessment of impacts, proposal of mitigation measures, to monitoring and follow-up after the licence is issued.

Documentary analysis reveals the absence of consolidated methodologies for spatial delimitation in the main instruments, opening the door to arbitrary decisions and weakening impact management. Thus, from a legislative point of view, the analysis revealed that few instruments formally use the expression "area of influence" in their texts, and when they do, the term is used vaguely. Although the concept appears in regulations such as CONAMA Resolutions No. 01/86 and No. 237/97, as well as in the City Statute itself (Law No. 10,257/2001), its definition remains generic and its operationalisation absent. Law No. 9,795/1999 (National Environmental Education Policy) and Law No. 9,605/1998 (Environmental Crimes Law), although mentioned in some debates, do not deal with the definition of areas of influence, as their functions are distinct, focused, respectively, on critical environmental education and liability for damages, not on the spatial delimitation of impacts.

In this sense, the results show a regulatory vacuum that compromises the effectiveness of studies and licensing, especially with regard to the relationship between predicted impacts and affected areas. The absence of Terms of Reference with well-defined, y criteria, especially in the scope delimitation stage of environmental and urban impact assessment instruments, compromises the technical robustness of the studies from the outset. The literature points out that the lack of standardisation in the preparation of these terms favours ad hoc interpretations, allowing similar projects to be assessed in different ways, depending on the jurisdiction or local political pressure (Geneletti, 2006; Inguaggiato, 2024).

Authors such as Sánchez (2008; 2020), Abreu (2023) and Abreu and Peres (2021) detail these stages and emphasise the importance of the scope definition phase, at which point, as discussed throughout this essay, the criteria for delimiting areas of influence could be established. However, although this moment is fundamental for delimiting areas of influence, after the analyses and investigations carried out, it was found that the instruments lack clear and standardised criteria, which compromises the technical quality of the studies and favours inconsistent approaches, as found in documentary analyses carried out in several practical cases, as presented by Abreu (2023) and Olivatto, Inguaggiato and Lollo (2025).

In the context of urban licensing, even more fragmented institutional dynamics can be observed. This type of licensing involves not only the approval of projects based on land use and occupation criteria, but also the analysis of compliance with specific urban legislation, such as Master Plans, building and land subdivision codes, accessibility standards, zoning laws, and specific laws for cultural or environmental protection areas. Documents such as land use certificates, building and operating permits, project approval records, among others, are part of this process. However, in many Brazilian cities, conflicts between environmental and urban licensing are notorious, either due to overlapping competences between agencies or the lack of regulatory and technical integration between the instruments used. As pointed out by Araújo and Costa (2019) and Araújo (2021), this fragmentation hinders the coordinated application of public policies and compromises the effectiveness of territorial management.

Additionally, it is recommended to expand the analysis of the national regulatory framework, incorporating the National Policy for Protection and Civil Defence (Law No. 12,608/2012) as a complementary instrument for the identification and management of risk and influence areas. This law makes it possible to articulate aspects of socio-environmental vulnerability, geotechnical susceptibility, and disaster risk, reinforcing the need for an integrated approach with existing urban and environmental instruments (Brazil, 2012). In this context, the use of georeferenced technical bases, such as the susceptibility cartography of the Geological Service of Brazil (SGB), data from the National Centre for Natural Disaster Monitoring and Alerts (CEMADEN) and information from the Brazilian Institute of Geography and Statistics (IBGE), provides solid methodological support for the spatial delimitation of areas of influence, allowing EIVs and other legal instruments to reflect territorial complexity and actual risk conditions. Recent studies show that the integration of spatial data with technical and socio-environmental criteria significantly increases the robustness and applicability of planning and licensing instruments, contributing to more efficient and fair governance (Geneletti, 2006; Inguaggiato, 2024; Formiga; Martini, 2023; Sánchez, 2020). Thus, the articulation between regulations, technical information, and geospatial methodologies is a strategic path to overcoming existing gaps in the definition of areas of influence, promoting more consistent, transparent, and evidence-based decisions.

In addition to the regulatory gaps identified, the absence of clear criteria for delimiting areas of influence also impacts the achievement of global sustainability goals. According to the Sustainable Development Goals (SDGs), SDG 11 (Sustainable Cities and Communities) highlights the need for more accurate and inclusive urban instruments; SDG 13 (Climate Action) and SDG 15 (Life on Land) highlight the importance of delimiting areas of influence to prevent environmental degradation and reduce vulnerabilities to extreme weather events; and SDGs 16 and 17 reinforce the need to strengthen governance and

cooperation between administrative spheres. In addition, the Sendai Framework (2015-2030) emphasises prevention and territorial resilience, reinforcing that robust methodological criteria in defining areas of influence contribute to the adaptation and socio-environmental security of cities.

Throughout the documentary analysis, it was found that, although environmental instruments such as the Environmental Impact Assessment (EIA), the Environmental Impact Report (RIMA), the Simplified Environmental Study (EAS) and the Simplified Environmental Report (RAS) mention the need to delimit an area of influence, there are no clear guidelines on how this delimitation should be carried out. For example, CONAMA Resolution No. 01/86 suggests considering the hydrographic basin as a reference unit, but does not offer technical parameters to guide the operationalisation of this definition. As Formiga and Martini (2023) reinforce, the absence of objective criteria leaves room for arbitrary or technically fragile decisions, reducing the capacity for accurate diagnosis of impacts.

The same deficiency is identified in urban planning instruments, particularly in the Neighbourhood Impact Study (EIV). Although the EIV aims to analyse the impacts of the implementation of developments on the immediate neighbourhood, considering aspects such as population density, traffic, mobility, urban infrastructure and property values, its regulation, generally at the municipal level, rarely specifies methodologies or technical criteria for delimiting the area of influence. Studies such as those by Inguaggiato, Stanganini and Melanda (2021) and Abreu and Peres (2022) show that many municipalities simply reproduce the text of the City Statute in their Master Plans, without any operational details of the EIV, which makes its consistent application unfeasible. In a practical sense, this issue is presented by Inguaggiato and Stanganini (2022), when they identify these gaps in a specific case of an EIV in a municipality in the interior of the state of São Paulo.

It is important to note that the methodology used, based on document analysis, a survey of management plans and a literature review, allowed for the identification of general patterns and regulatory gaps but did not enable a comprehensive assessment of the practical implementation of EIVs or their concrete effects on urban management. This limitation points to the need for complementary studies that include interviews with managers and field monitoring, providing a deeper understanding of the degree to which EIV recommendations are incorporated into municipal decisions.

Compared to international experiences, Brazilian municipalities still face difficulties in integrating EIVs into urban planning in a systematic and transparent manner. In countries such as the United States, where the National Environmental Policy Act (NEPA) established clear parameters for impact assessment in 1970, or Canada, whose Impact Assessment Act (2019) reinforced the need for descriptive and legally binding analyses, there is greater institutionalisation of assessment processes. Similarly, instruments such as New Zealand's Resource Management Act (1991) and the European guidelines consolidated by Directive 2011/92/EU and its 2014 update demonstrate the importance of standardised methodologies, structured social participation and objective criteria for decision-making. The analysis shows that the adoption of clear assessment criteria, greater technical capacity, and effective social participation are fundamental elements for maximising the results of these instruments. Thus, the data analysed indicate that, although the Brazilian regulatory framework is robust, its practical effectiveness depends on institutional and governance conditions that still require improvement.

To this end, some issues may promote – or at least assist – the representation and measurement of areas of influence in the proposed instruments. Firstly, it should be noted that pre-establishing criteria and epistemologically conceptualising the points of analysis of these instruments can contribute to a parameterised analysis with greater technical rigour, such as the construction of impact matrices for projects subject to EIV (Lollo; Rohm, 2005). Inguaggiato (2024) brings this approach by proposing analytical scales for each of the items presented in EIV. For example, the criterion of population density can be assessed by analysing variations in demographic density before and after the implementation of the project, by census sectors, offered free of charge on national portals, such as the Brazilian Institute of Geography and Statistics (IBGE). The criterion of property valuation can be measured by the Reference Market Value (VVF) or the Property Tax (IPTU) on lots in the region, also available free of charge on municipal portals. In another example, when analysing the impact on traffic and demand for public transport, the same author points out that the analysis can be carried out through studies of traffic-generating hubs, which estimate the number of trips originating from certain land uses, allowing predictive mobility scenarios to be drawn up.

In turn, in a second-order analysis, the use of tools such as Geographic Information Systems (GIS) can fill another gap in the proposed problem, regarding the lack of criteria and tools for delimiting areas of influence, assisting in territorial analysis, planning, and management. Santos (2004), Souza (2020), Rolnik (2022) and Sánchez (2020) highlight the use of these tools as an element of utmost importance for territorial reading, in addition to corroborating the development of environmental and urban assessment instruments.

Inguaggiato (2024) used GIS to first delimit the criteria for the development of EIV in a municipality in São Paulo and then cross-referenced this georeferenced data, constructing a matrix that enables the identification of areas of influence for this instrument, overcoming exclusively descriptive or generic approaches. Thus, the combination of geospatial techniques, socio-environmental and empirical knowledge is essential for legal and technical instruments to reflect the complexity of territories and ensure socio-environmental justice, elements that must be incorporated into the revision of regulatory frameworks. In turn, Peres and Cassiano (2017), Faria and Silva (2017), and Souza (2020) reinforce that participatory and horizontal decision-making processes contribute to the greater effectiveness of these instruments.

Finally, it is important to highlight that the instruments analysed – EIA, RIMA, RAP, EAS, RAS, EIV and others – share a common structure consisting of diagnosis, impact analysis and management proposal. However, none of them has a consolidated methodology for delimiting the area of influence. This finding reinforces the need to develop specific national technical guidelines for this purpose, as well as to create minimum parameters to be observed in the Terms of Reference issued by licensing bodies. Only through a rigorous delimitation of these areas will it be possible to ensure that mitigation and compensatory measures are correctly targeted, covering the territory that is effectively affected.

With regards to social participation, it is recommended to integrate participatory methodologies for defining areas of influence, such as community mapping, territorial workshops, collaborative digital platforms, and local monitoring committees. Such practices are in line with the New Urban Agenda and reinforce the principles of SDG 16, in addition to dialoguing with the Sendai Framework, promoting inclusive, democratic, and resilient urban planning.

These findings demonstrate the importance of reviewing, harmonising and deepening the legal and technical frameworks of environmental and urban management instruments. By gathering and critically analysing the applicable regulatory provisions and technical criteria, this study contributes to filling this methodological gap, offering support for the improvement of planning, assessment and licensing practices in Brazil. It also highlights the need to incorporate interdisciplinary analyses and combine technical, social and environmental knowledge as essential for improving impact assessment and defining areas of influence, ensuring that territorial planning is capable of considering multiple dimensions and actors.

Thus, the integration of national regulatory instruments, international frameworks such as the Sendai Framework, and geospatial tools allows not only for accurate technical assessment, but also for an approach that contributes to the SDGs, promoting more sustainable, resilient and inclusive cities.

## 5 Conclusions

Based on the critical analysis developed in this study, it is evident that, despite the significant regulatory progress made since the 1970s with the creation of various legal instruments, both environmental and urban, substantial gaps remain that compromise their full effectiveness. Among these, the absence of consistent technical criteria for delimiting the areas of influence of the projects analysed stands out repeatedly, compromising the quality of assessments and weakening decision-making processes in the field of territorial planning and management.

Instruments such as Master Plans, Neighbourhood Impact Studies (EIV), Environmental Impact Studies (EIA), Environmental Impact Assessments (AIA), Environmental Impact Reports (RIMA), Simplified Environmental Reports (RAS), and Preliminary Environmental Reports (RAP) mostly present gaps and methodological or generic approaches that do not provide accuracy in the spatial delimitation of socio-environmental impacts. The superficiality of the guidelines found in these documents prevents rigorous diagnosis and informed decision-making, making it difficult to measure the extent, intensity, and persistence of the impacts generated by different types of projects.

Given this scenario, this article proposed, as a preliminary solution, the conceptual and technical definition of the evaluative variables present in these instruments (such as population density, real estate valuation, changes in urban mobility, among others) so that, based on them, reflective paths and scenarios can be established that lead to the construction of replicable methodologies for delimiting areas of influence. This approach allows, for example, the association of spatial and temporal factors with the diagnosed impacts, promoting an integrated reading between socio-environmental dynamics and land use planning.

A methodological contribution was also presented by systematising evaluation variables and proposing the use of integrated tools, such as GIS, for a more accurate and transparent delimitation of these areas, which can serve as a basis for future technical guidelines.

The bibliographic and legislative survey carried out reinforces the need for methodological alignment between the various instruments and regulatory spheres (federal, state and municipal), with a view to standardising practices, increasing legal certainty and overcoming fragmentation between environmental and urban planning licensing. The

strengthening of clear methodological guidelines for the delimitation of areas of influence can, therefore, contribute to the reduction of institutional conflicts, to greater effectiveness in mitigating negative impacts, and to the promotion of a more equitable analysis of the territorial benefits generated by the projects.

Another noteworthy aspect is the importance of promoting an interdisciplinary approach that combines knowledge from the environmental, human, social, and technological sciences in the formulation of more robust assessment tools. This integration of knowledge promotes a broader understanding of the impacts generated on territories and contributes to the improvement of public policies associated with urban and environmental sustainability.

Furthermore, strengthening social participation in licensing processes, especially in defining scopes and evaluation criteria, proves to be strategic. Citizens, who experience the effects of projects on their territories on a daily basis, play a fundamental role in developing methodologies that are more sensitive to local realities and in legitimising legal and technical instruments. The institutionalisation of permanent channels for listening and deliberation can improve public decisions and increase the transparency of processes.

In analytical terms, the results obtained prove that the methodological gap in the delimitation of areas of influence is not only a formal deficiency but impacts directly on the effectiveness of urban and environmental management instruments, compromising the achievement of sustainable planning goals. The research shows that, without standardised technical criteria and replicable methodologies, assessments are subject to ad hoc interpretations and fragmented decisions, reinforcing the need for clear and applicable national guidelines.

Among the limitations of this study, we highlight the restriction to documentary analysis and the absence of empirical application of methodological proposals in practical cases, which prevents the complete validation of the proposed instruments. It is recommended that future research explore comparative methodologies between municipalities, test the practical applicability of the proposals in case studies, and contribute to the development of standardised national technical guidelines.

Additionally, it is appropriate to link these conclusions to international benchmarks, demonstrating the relevance of the proposed methodological improvement for the consolidation of fairer and more resilient cities. The study dialogues with the New Urban Agenda, the Sustainable Development Goals (SDGs) and the Sendai Framework, reinforcing that consistent methodologies for impact assessment and delimitation of areas of influence are strategic instruments for promoting sustainable urbanisation, territorial resilience and reduction of socio-environmental risks.

Based on the analyses and proposals presented, it is concluded that the debate on the delimitation of areas of influence in urban and environmental management instruments requires a thorough regulatory review, anchored in technical, methodological and participatory criteria. This study seeks to contribute to this debate by identifying existing gaps, systematising critiques already consolidated in the literature and proposing possible ways to improve existing instruments.

The practical relevance of the proposals in this work is evidenced by documentary analyses that demonstrate the consequences of the lack of definition of areas of influence

for governance and territorial justice. Not only that, but the alignment of the study with contemporary debates on urban governance, interdisciplinarity, and innovative methodologies reinforces its potential for academic and technical impact.

It is hoped that this work will serve as a resource for both future academic research and institutional initiatives aimed at promoting fairer, more resilient and sustainable territories. Finally, the need for regulatory, methodological, and participatory improvements is reinforced so that the delimitation of areas of influence can effectively contribute to the promotion of fairer, more resilient, and sustainable territories. Finally, it is emphasised that, by explaining limitations, proposing methodological guidelines and linking results to international benchmarks, the research contributes to the consolidation of more robust, integrated practices geared towards urban and socio-environmental sustainability.

Therefore, the standardisation and integration of criteria for delimiting areas of influence, combined with inter-institutional cooperation, social participation and technological innovation, are essential conditions for Brazil to effectively fulfil the commitments made in the New Urban Agenda, the 2030 Agenda and the Sendai Framework. Only in this way will it be possible to ensure that environmental and urban management instruments promote sustainable, resilient and inclusive urbanisation, consolidating robust regulatory, methodological and participatory practices that are aligned with international territorial planning guidelines.

## Acknowledgements

This work was carried out with the support of the Coordination for the Improvement of Higher Education Personnel – Brazil (CAPES) – Funding Code 001.

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