Reconecta RMC: green infrastructure as a regional landscape planning tool

Reconecta RMC: infraestrutura verde como uma ferramenta de planejamento de paisagem regional

Reconecta RMC: infraestructura verde como herramienta de planificación paisajística regional

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ABSTRACT
The progressive emergence of the negative socio-environmental effects of urban expansion has fostered, on the part of technical professionals and administrators at various scales, the search for new ways of enjoying natural resources and spaces so that such effects are reduced or even, ideally, eradicated in the long term. Among them, there are the so-called Nature-based Solutions (NbS), one of which is Green Infrastructure (GI), whose concept can still be subjected to different interpretations and application methodologies in land use and occupation plans at different scales, generating diffuse results that are difficult to assess. By associating the need to improve the theoretical and practical understanding of GIs with the urgency of including actions to promote the
recovery and conservation of the biodiversity of the local fauna and flora, the Reconecta RMC Program was chosen, in the metropolitan area of Campinas (SP), as an object of analysis, aiming to discuss the use of green infrastructure as a landscape planning tool. The analysis was carried out by comparing the program procedures and a landscape planning methodology composed of steps (Reading, Mapping, Analysis, Scenario, Implementation, and Monitoring) defined by Sant’Anna (2020), according to the most relevant principles of GI. The program, represented by descriptive documents, presented a high potential for contributing to the insertion of green infrastructure in landscape planning at the integrated urban development plan of RMC, up to the stage that it can be analyzed, and may also be reflected in the Master Plans of the municipalities from the metropolitan area.

**Keywords:** metropolitan area, regional planning, land use and occupation plans.

**RESUMO**
O surgimento progressivo dos efeitos socioambientais negativos da expansão urbana tem fomentado, por parte de profissionais técnicos e administradores de diversas escalas, a busca por novas formas de usufruir dos recursos e espaços naturais para que tais efeitos sejam reduzidos ou mesmo, idealmente, erradicados a longo prazo. Dentre elas, estão as chamadas Soluções Baseadas na Natureza (SbN), e uma delas é a Infraestrutura Verde (IV), cujo conceito ainda pode ser submetido a diferentes interpretações e metodologias de aplicação em planos de uso e ocupação do solo em diferentes escalas, gerando resultados difusos e difíceis de avaliar. Ao associar a necessidade de melhorar a compreensão teórica e prática das IVs com a urgência de incluir ações que promovam a recuperação e conservação da biodiversidade, da fauna e da flora locais, foi escolhido o Programa Reconecta RMC, na região metropolitana de Campinas (SP), como objeto de análise, visando discutir o uso da infraestrutura verde como ferramenta de planejamento paisagístico. A análise foi realizada comparando os procedimentos do programa e uma metodologia de planejamento paisagístico composta por etapas (Leitura, Mapeamento, Análise, Cenário, Implementação e Monitoramento) definidas por Sant’Anna (2020), de acordo com os princípios mais relevantes da IV. O programa, representado por documentos descritivos, apresentou elevado potencial de contribuição para a inserção da infraestrutura verde no planejamento paisagístico do plano integrado de desenvolvimento urbano da RMC, até a fase em que pode ser analisado, podendo também ser refletido nos Planos Diretores dos municípios da região metropolitana.

**Palavras-chave:** região metropolitana, planejamento regional, planos de uso e ocupação do solo.

**RESUMEN**
La progresiva emergencia de los efectos socioambientales negativos de la expansión urbana ha propiciado, por parte de los profesionales técnicos y administrativos a diversas escalas, la búsqueda de nuevas formas de disfrutar de los recursos naturales y de los espacios para que tales efectos se reduzcan
o incluso, idealmente, se erradiquen a largo plazo. Entre ellas, están las llamadas Soluciones Basadas en la Naturaleza (NbS), una de las cuales es la Infraestructura Verde (GI), cuyo concepto aún puede ser sometido a diferentes interpretaciones y metodologías de aplicación en planes de uso y ocupación del suelo a diferentes escalas, generando resultados difusos que son difíciles de evaluar. Al asociar la necesidad de mejorar la comprensión teórica y práctica de las IG con la urgencia de incluir acciones para promover la recuperación y conservación de la biodiversidad de la fauna y flora local, se eligió el Programa Reconecta RMC, en el área metropolitana de Campinas (SP), como objeto de análisis, con el objetivo de discutir el uso de infraestructura verde como herramienta de planificación paisajística. El análisis se llevó a cabo comparando los procedimientos del programa y una metodología de planificación paisajística compuesta por etapas (lectura, cartografía, análisis, escenario, ejecución y seguimiento) definidas por Sant’Anna (2020), de acuerdo con los principios más relevantes de la IG. El programa, representado por documentos descriptivos, presentó un alto potencial para contribuir a la inserción de infraestructura verde en la planificación paisajística en el plan de desarrollo urbano integrado de RMC, hasta la etapa en que pueda ser analizado, y también puede reflejarse en los Planes Maestros de los municipios del área metropolitana.

Palabras clave: área metropolitana, planificación regional, planes de ocupación y uso del suelo.

1 INTRODUCTION

According to a report organized by the United Nations (UN) in 2020, Brazil is among the countries that most suffer from climate catastrophes worldwide, and a large part of the events that occur annually are related to rainwater drainage problems, such as floods (UN-OCHA, 2020). The report states that, since 2000, Brazil is the Latin American country considered the most prone to flooding, having suffered until 2019 about 70 episodes of major flooding, affecting almost 70 million people. At the same time, Brazil faces a serious problem of water scarcity, and crises in the water supply system have been a constant issue, affecting different sectors.

These and other common problems in the country (droughts, heat islands, loss of biodiversity, increase in temperature, etc.) are directly associated with the continuous and growing process of urbanization, which, in turn, results in soil sealing, inappropriate occupations near water bodies, removal of native
vegetation, terrain modification, and soil compaction (Rotemund, 2012), among other impacts, including alteration of the landscape.

Traditionally, the mitigating measures applied in situations resulting from these events tend to aggravate the problem, precisely because they consist of building, adding, and further modifying the remaining natural attributes of the already affected space, using materials and techniques, as well as monofunctional solutions and traditional engineering, incompatible with the natural particularities of each region.

In this context, the concept of Nature-based Solutions (NbS) emerges, defined by the International Union for Conservation of Nature as “actions aimed at protecting, managing, and recovering natural or modified ecosystems, addressing challenges in an effective and adapted manner, while ensuring human well-being and biodiversity benefits” (IUCN, 2020). The term brings together a range of approaches at multiple scales, from global to local, engaged in the ecosystemic perspective, especially referring to the renaturalization of cities.

Green Infrastructure (GI) stands out among the available approaches. Although the concept of NbS is recent, the debate on the application of green infrastructure in cities predates it and has been discussed since the 1990s. It was initiated from an attempt to think about environmental conservation actions in line with urban development, within the proposal “Green infrastructure: Smart conservation for the 21st century” for the states of Florida and Maryland (Benedict & McMahon, 2002). According to Benedict and McMahon (2002, p. 10), GI solutions seek on the one hand, “[...] linking parks and other green spaces for the benefit of people, and, on the other, preserving and linking natural areas to benefit biodiversity and counter habitat fragmentation.”

Green infrastructure strategies are still being consolidated and there is no consensus among academics, professionals, and governments about their role; the fact is that planning and design with green infrastructure has expanded to a holistic and multifunctional approach (Sant’Anna, 2020) that helps promoting ecosystem services in the territory landscape.
In this context, this study aims to discuss the use of green infrastructure as a landscape planning tool, linked to regional and urban land use and occupation plans, taking the Reconecta RMC program as a case study.

1.1 GREEN INFRASTRUCTURE: DEFINITIONS AND PRINCIPLES

There is still a plurality of positions seeking to associate solutions for green infrastructure that are not only ecological but also sociocultural. The initial discussion of green infrastructure is further substantiated by Benedict and McMahon in the book “Green Infrastructure: Linking Landscapes and Communities,” which presented a first attempt to organize the principles that support the concept. Taking into account these principles, Sant’Anna (2020), in turn, seeks to define the principles that guide green infrastructure approaches based on a review of the main authors that address the topic, highlighting the following principles: multiscalarity, interdisciplinarity, multifunctionality, connectivity, integration, and social participation (Table 1).

<table>
<thead>
<tr>
<th>PRINCIPLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiscalarity</td>
<td>The principle of multiscalarity concerns the need to think and plan green infrastructure considering its context and scale of action, as well as the ability of its elements to dialogue with other scales. Effective planning must consider the ease of transition between the global, regional, and local scales of what is proposed as a green infrastructure solution.</td>
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<tr>
<td>Interdisciplinarity</td>
<td>This principle highlights the importance of combining different disciplines in building a green infrastructure implementation strategy, so that each one contributes with its respective perspective, whether theoretical or practical, to the identification of problems and the proposal of solutions.</td>
</tr>
<tr>
<td>Multifunctionality</td>
<td>As one of the most recurrent and, therefore, crucial principles to be observed in green infrastructures, multifunctionality refers to the ability of a given resource to integrate different natural processes and to “perform multiple functions” in the environment and scale in which it is inserted, in a way that maximizes the offering of benefits to the user, as ecosystem services.</td>
</tr>
<tr>
<td>Connectivity</td>
<td>Connectivity is, perhaps, the most visible principle of a green infrastructure, since it is mainly present in the way of structuring and designing the spatial distribution of the adopted elements. This principle requires the creation of a network of elements that enable the flow of species, the performance of ecological functions, and the integrity of the ecosystem.</td>
</tr>
</tbody>
</table>
This principle refers to the integration of green infrastructure elements with gray infrastructure elements found in the established landscape, so that both can complement each other rather than competing for functions and contributions to the environment and/or society.

Social participation comes as an often-neglected principle, but of extreme importance for the success of adequate planning and for the long-term sustainable implementation of green infrastructures. From the acceptance to the maintenance of green elements introduced as part of the incorporation of green infrastructures in the space, the involvement of the different parts of a community proves to be a key point in achieving the objectives of plans and projects aimed at conserving the environment.

Based on these principles, in the context of this study, green infrastructure is understood as:

a multifaceted tool to think about landscape planning and design, proposing the creation of a network composed of green and blue systems in the territory, which allow the expression of the landscape structure, in its broadest sense, involving: (i) human action in harmony with natural processes (cycles of air, water, materials, plants, production) and their characteristics (vegetation, water bodies, soil characteristics, fauna, and flora) and; (ii) meaning and perception, of aesthetic, cultural, and patrimonial use (Sant’Anna, 2020, p. 101, free translation).

When thinking about landscape planning as a possible inducer of green infrastructure strategy, however, it is noteworthy that there are no institutionalized landscape plans in the country that bring the landscape agenda in its broad sense, as occurs, for example, in Germany (Santos, Soriano, Bernardo, & Silva Netto, 2010).

Concerning the GIs strategy implementation, although they are not yet widely disseminated in Brazil, they have been applied in specific and diversified practices. Moreover, they also have concomitantly been gaining notoriety for their potential to contribute to the resolution of contemporary urban emergencies, reinforcing the need to create public policies directed to this topic in Brazil. Thus, GI still faces challenges for its wide use, associated with landscape, especially regarding the opportunity of its institutionalization and inclusion of its design in plans in a more strategic way.
1.2 GREEN INFRASTRUCTURE AND LANDSCAPE: THE BRAZILIAN URBAN DEVELOPMENT PLANS

As the European Commission (EC, 2013) puts it, green infrastructure corresponds to a strategically planned network and, in this sense, we reinforce the opportunity and significance of linking the design of green infrastructures to the landscape as strategically interconnected networks, along with land use and occupation plans, especially the Municipal Master Plan (MMP), at the municipal scale, and the Integrated Urban Development Plans (IUDP), at the regional scale, specific to metropolitan areas, especially in the Brazilian context, where no landscape plans are drawn up, as mentioned above.

The MMP, according to the City Statute, Law No. 10.257/01, must express the guidelines and rules for territorial organization, to ensure the needs of citizens regarding quality of life, social justice, and economic development, essentially starting from the fulfillment of the social function of the property.

The MMP is mandatory for municipalities with more than 20 thousand inhabitants, members of metropolitan areas, or cities of tourist interest, among other specific situations; also, it must cover the entire municipal territory, and must contain, among others: parameters for subdivision, use, and occupation of the land; identification and guidelines for the preservation and occupation of municipal green areas, when applicable, with a view to reducing the waterproofing of cities.

The IUDP, in accordance with the Metropolis Statute, Law No. 13.089/15, corresponds to the planning instrument that establishes the guidelines for the strategic territorial development and structuring projects of a metropolitan area. It must consider the set of municipalities that compose the metropolitan area in question and must be compatible with the MMP of each of the municipalities involved, and as well as include, among other points listed in Art. 12 of the referred Statute: “V – the delimitation of areas with restrictions on urbanization aimed at protecting environmental or cultural heritage, as well as areas subject to special control due to the risk of natural disasters” (free translation).

Considering the minimum contents that must be presented by the plans, we highlight here the evident relationship that they start to establish not only with
the guidelines and restrictions of land use for urban development purposes, but recognizing the necessary attention to issues of drainage, reduction of disaster risk, and preservation of green areas, roles that are easily linked to nature-based solutions, with an evident emphasis on green infrastructure and, more broadly, on the landscape. In this sense, identifying relevant areas for the mentioned themes favors the design of a large, interconnected network of green infrastructure elements, as recommended in its essential principle, and offers to these plans the opportunity to play a role in landscape planning.

Moreover, when working with complementary scales, making the MMPs compatible with the IUDPs offers a valid opportunity to integrate broader visions and strategies, designed at the regional scale, to be expanded/detailed at the municipal scale, establishing guidelines closer to those of project guidelines. This is in line with what Sant'Anna (2020, p.114) argues, that “the regional scale emerges as the basis for planning and designing with the landscape and infrastructure, as it enables mediation between the other scales”.

1.3 PLANNING LANDSCAPE ON THE CAMPINAS REGIONAL SCALE: THE RECONECTA RMC PROGRAM

The Metropolitan Area of Campinas (Região Metropolitana de Campinas–RMC), located in the state of São Paulo, was created in 2000, consisting of 20 municipalities: Americana, Arthur Nogueira, Campinas, Cosmópolis, Engenheiro Coelho, Holambra, Hortolândia, Indaiatuba, Itatiba, Jaguariúna, Monte Mor, Morungaba, Nova Odessa, Paulínia, Pedreira, Santa Bárbara d’Oeste, Santo Antônio de Posse, Sumaré, Valinhos, and Vinhedo, with Campinas as the central city.

With an area of approximately 3800 km² and a population of around 3,225,000 inhabitants, the Metropolitan Area of Campinas has vegetation characteristic of the Atlantic Forest and Cerrado biomes, with a vegetation cover currently corresponding to about 15% of the territory, being found in a sparse and fragmented way, a consequence of an intensive urbanization process. As a result, it was identified as a critical area regarding the loss of native vegetation and, therefore, it encouraged the creation of the Reconecta RMC Program.
In this context, the Reconnecta RMC Program was developed with the goal of structuring regional strategies for the preservation of local fauna and flora, aiming, among other things, at the provision of ecosystem services. The program was made official in 2017 by a Technical Cooperation Agreement that was signed by the mayors of the 20 municipalities that compose the RMC, committing to offer cooperation in the different biodiversity conservation actions necessary for the implementation of the program. Physical and ecological connectivity is the basis of planning, comprising the so-called Connectivity Area, proposed according to a joint diagnosis of the particularities and needs of the municipalities included in the RMC.

Figure 1 shows the Connectivity Area proposed by the Program, elaborated considering hydrography, highways, spring areas, areas of environmental interest, conservation units of the RMC, among others.

Figure 1 – Connectivity Area proposed for the RMC.

Source: retrieved from the document prepared within the scope of the Reconnecta RMC Program and the Interact-Bio Project. PREFEITURA MUNICIPAL DE CAMPINAS et al. (2018).
For the implementation of this Connectivity Area, an action plan was foreseen to organize the necessary activities and those responsible for each of them, based on six implementation pillars: urban afforestation; linear parks; ecological corridors; wild fauna; regulation, supervision, and compensation; articulation and communication.

Considering this context, the deepening and understanding of the Reconecta RMC Program from the perspective of green infrastructure as a tool for landscape planning proved to be quite opportune. Thus, an analysis of the Reconecta RMC Program was carried out based on an integrated landscape planning methodology, having green infrastructure as a tool developed by Sant’Anna (2020).

2 MATERIAL AND METHODS

This study corresponds to an exploratory qualitative study, based on bibliographic and documental review, addressing the following themes: green infrastructure, landscape planning, and land use and occupation. Seeking to bring theory closer to practical reality, a case study was carried out with the Reconecta RMC Program, to which the methodology developed by Sant’Anna (2020) was applied.

Regarding the Reconecta RMC Program, the following documents were initially selected: Technical Cooperation Agreement, Work Plan, and the Connectivity Area Proposal of this program, which are the most relevant sources of information collected and of considerations made by the bodies and entities involved in the program. The preliminary analysis of these documents showed the need to include Report 1, referring to the activities developed in the 1st Workshop of the program, as it is a document whose results were widely used in the preparation of the other documents.

For this study, at first, the documents were analyzed from the perspective of GI principles, to detect the document that would be the target of the evaluation based on the steps foreseen by Sant’Anna (2020). Then, it was found that the Connectivity Area Proposal comprised the largest number of principles in its content, and its evaluation started by the detection of points that meet, at each
stage, the topics highlighted by the methodology, as needed throughout the landscape planning process using green infrastructure.

2.1 METHODOLOGICAL STRATEGY FOR LANDSCAPE PLANNING WITH GREEN INFRASTRUCTURE

Sant’Anna (2020) elaborates practical steps that compose a complete landscape planning and design process associated with green infrastructure elements. As the insertion and adoption of green infrastructures in an adequate manner and in order to produce significant results requires an almost total change from the traditional approach to urban and landscape planning, the author used the principles listed above (Table 1) as a subsidy for this new way of thinking and designing the landscape (Sant’Anna, 2020).

Sant’Anna (2020) establishes the methodological steps for the development of the following stages of landscape planning with Green Infrastructure: reading, mapping, analysis, scenario, implementation, and monitoring.

Table 2 presents a description of each stage that will be used as a tool for analysis and evaluation of the Reconecta RMC Program.

Table 2 – Landscape planning stages using green infrastructure as a tool.

<table>
<thead>
<tr>
<th>STAGE</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>READING</td>
<td>The first stage consists of collecting materials and various information regarding the study region as a first contact with the place. Mainly in this, but also in future stages, it is greatly important to obtain data related to the physical, ecological, social/human, economic, political, and cultural context of the territory, as well as survey the existing policies and plans in the scope of the use of green infrastructures.</td>
</tr>
<tr>
<td>MAPPING</td>
<td>In this phase, the information collected is interpreted from the point of view of the purpose defined for the project, so that a more in-depth diagnosis of the region is obtained regarding needs, potentialities, and challenges. As its name implies, this stage aims at producing maps and other materials—preferably visual—which will be the basis for discussing the appropriate distribution of green infrastructure elements in the studied area, as well as the expected function and possible integration with other existing or planned urban elements.</td>
</tr>
<tr>
<td>ANALYSIS</td>
<td>Based on the visual material synthesized in previous stages, the analysis of this content allows for a grounded identification of what actually needs to be planned for the region, what is the expected performance, the</td>
</tr>
</tbody>
</table>
format and function of the elements considered, including the challenges and potentialities identified throughout the territory mapped in the previous stage. The product of this stage is the structuring of the green infrastructure in the form of a design that allows for its broad visualization in conjunction with other elements relevant to the planning process.

**SCENARIO**

The stage of construction stage brings the information synthesized so far, and the analysis of the necessary structure, closer to the practical context of interest. In short, the scenarios are prepared by proposals for action and application of green infrastructure according to the objectives defined in the Reading stage, with the scales relevant to the project in question, with the period of time included in the planning, seeking to establish the best relationship of land use and occupation that optimizes the use of the planned space, whether in environmental or social and economic terms.

**IMPLEMENTATION**

The implementation stage brings the planning conclusions to the physical space or political sphere, such as projects, programs, plans, or public policies, to achieve the objectives defined at the beginning in all the scales considered, including the entire implementation structure necessary to achieve the expected results.

**MONITORING**

In the monitoring stage, a recurring point of any planning, the author suggests the creation of a Green Infrastructure Observatory, whose function would be to monitor the progress of the green infrastructure in meeting its objectives, as well as its performance and integration with its context over time, at different scales.

Source: adapted from Sant’Anna (2020).

### 3 RESULTS AND DISCUSSION

The reading of each document with the objective of comprehensively identifying each green infrastructure principle resulted in Table 3 and acted as a starting point for the subsequent comprehensive analysis of the program according to Sant’Anna’s methodology.
Table 3 – Summary of the preliminary analysis of the documents, based on the principles of GI.

<table>
<thead>
<tr>
<th>PRINCIPLE</th>
<th>Document</th>
<th>Work Plan</th>
<th>Annex I (Work Plan)</th>
<th>Proposal of the Area of Connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MULTISCALARITY</td>
<td>Term of Technical Cooperation: Provides integration with ongoing local actions</td>
<td>Proposal for intermunicipal partnerships</td>
<td>Integrates local-scale actions into regional environmental planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annex I (Work Plan): Adoption of the regional sphere</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTERDISCIPLINARITY</td>
<td>Participants from public and private bodies to exchange information</td>
<td>Participation of politicians and technicians in the environmental area</td>
<td>Participation of politicians and technicians in the environmental area</td>
<td></td>
</tr>
<tr>
<td>MULTIFUNCTIONALITY</td>
<td>Themes cover different ecosystem services</td>
<td></td>
<td>Identification and mapping of priority ecosystem services</td>
<td></td>
</tr>
<tr>
<td>CONNECTIVITY</td>
<td>Strengthening/creation of hubs and websites, as well as proposing green corridors as links</td>
<td>Focus of the Program: to promote connectivity and dialogue between nature and social/economic development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCIAL PARTICIPATION</td>
<td>Proposal for environmental education activities and popular participation to strengthen PPAs and create new Protected Areas</td>
<td>Different social actors contributed to raising local environmental issues and exchanging Experiences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTEGRATION</td>
<td>Survey of questions regarding the urban expansion of some municipalities</td>
<td>Layout of the Connectivity Area from “green” and “gray” characteristics; preliminary area adjustment with insertion of devices already existing/planned</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: prepared by the authors based on Prefeitura Municipal de Campinas (2017); Prefeitura Municipal de Campinas et al. (2017); Prefeitura Municipal de Campinas (2018); Prefeitura Municipal de Campinas et al. (2018).
This individualization made it possible to recognize the Connectivity Area Proposal as a primary source of information on the program development process, followed by Report 1. As the main document selected here, the Proposal (Prefeitura Municipal De Campinas et al., 2018) acted as a dossier of the Reconecta RMC Program and was submitted to evaluation according to the criteria of Sant’Anna (2020). Next, the stages identified in the documents are discussed.

3.1 READING

The Reading stage, in the landscape planning process, stood out with some ease in the analyzed material. As a first stage, it comprises virtually any survey that makes it possible to understand the physical, political, and social situation of the studied region, as well as the definition of the involved parties, objectives of the initiative, scales of action, and several parameters that will guide the subsequent stages.

In 2010, based on the Forest Inventory of Native Vegetation of the State of São Paulo (Prefeitura Municipal de Campinas et al., 2018), the Metropolitan Area of Campinas was identified as a “very high” priority region for the restoration and conservation of native vegetation; thus, this area became a critical point of attention in the elaboration of the Municipal Green Plan, which was initially thought only for the municipality of Campinas.

This municipal plan, then, detected the need to expand its field of action to the RMC and start, from the beginning, from a regional scale of operation of the programs foreseen to achieve the aforementioned recovery and conservation objectives. The justification provided in the Connectivity Area Proposal for choosing the regional scale is that the successful implementation of management, connectivity, recovery, and conservation actions is closely linked to the integration of efforts from the local spheres (territories and public bodies), since the ecological and biological processes involved in this issue transcend geographic and administrative boundaries (Prefeitura Municipal de Campinas et al., 2018).
Then, it was considered that the first item addressed by Sant’Anna (2020) at this stage, within the principle of multiscalarity, was accepted by the program at this starting point with the choice of scale.

Based on this presupposition, the outline of the program presented to the Metropolitan Agency of Campinas (AGEMCAMP) and to the Municipal Mayors made it possible to propose the creation of the aforementioned Technical Cooperation Agreement. The acceptance of this proposal by the Municipal Mayors led to the organization of the 1st Workshop Reconecta RMC, which had representatives from 13 of the municipalities involved and participants from entities such as AGEMCAMP, Pontifical Catholic University of Campinas (PUC-Campinas), Local Governments for Sustainability (ICLEI), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and the International Union for Conservation of Nature (IUCN) (Prefeitura Municipal de Campinas et al., 2017).

The 2nd Workshop “Biodiversity, Ecosystem Services, and Metropolitan Management,” organized by ICLEI as part of the establishment of the INTERACT-Bio partnership project, in turn, had the participation of other institutions such as ICMBio, UNICAMP, and guests from public agencies of the states of Paraná and Minas Gerais.

Based on the activities listed in the 1st Workshop for each defined theme, the 2nd Workshop worked on the survey and selection, by each municipality, of the most relevant ecosystem services that require greater attention in their respective territories. As a way of prioritizing services whose promotion or maintenance are most urgent, this exercise reflected Sant’Anna’s (2020) item aimed at the “definition of the main public benefits sought.”

Regarding social participation, both Workshops mobilized a total of 80 participants and acted in the composition of the technical and leadership team of the program. As part of the methodology under discussion, it was found that the requirements aimed at “establishing a cross-sectional master group with leadership and representation of the main stakeholders and the community, supported by appropriate specialists” and “identification of the specialists involved” (Sant’Anna, 2020) were met.
As the last topic addressed in accordance with the principle of social participation, the question of “defining the methodology of participatory work” was present in the methodology used in the 2nd Workshop, the participatory evaluation, which allowed the conduction of a series of exercises aimed at identifying priority ecosystem services for each municipality in the RMC and action strategies for their promotion or conservation.

The principle of integration in the reading stage was identified in the collection of information on the existence of a Master Plan, Laws for Land Use and Occupation, and other Municipal Plans focused on the environment, housing, sanitation, and water resource areas, by the diagnostic questionnaire coming, again, from the 2nd Workshop. According to the Proposal, 15 municipalities responded to the questionnaire, and it was possible to identify a diversity of disciplines, presence, and competence of the teams that make up the environmental agencies of each municipality.

This diversity translates into the difficulty of identifying and including, in the program, representatives of key departments in the environmental area, since each municipality has a variety of devices for waste management, urban afforestation, and fauna and park management, for example (Prefeitura Municipal de Campinas et al., 2018).

At this stage, the topics scored for the principle of multifunctionality were not clearly identified in the Proposal or in complementary documents of Reconecta RMC. On the other hand, the last principle, interdisciplinarity, was included throughout most of the case study, mainly in the Workshops.

3.2 MAPPING

In the stage of mapping the territory studied for the implementation of the Connectivity Area, the construction of the design was based on the combination of territorial information provided by each municipality, in response to a diagnostic questionnaire made available to representatives at the 2nd Workshop.

In addition to specific information on the municipalities, with a view to a more local scale, the program used maps: of the hydrography, highways, and springs of the RMC, therefore, applying a regional scale. Moreover, the
construction of maps at the regional level had complementary information at the local level, thus defining the “scale of approach to maps” suggested for the principle of multiscalarity.

The mapping of existing urban and green infrastructure; the identification of “local issues, challenges, risks, and community needs”; and the definition of “how to make the population aware of their territory” were points identified throughout the aforementioned documents (the reports on the Workshops and the diagnostic questionnaire).

As part of the principle of social participation, the Mapping and Reading stages are mixed by using the activities carried out during the 1st and 2nd Workshops with the technical representatives to identify the main needs of the region, as well as the priority ecosystem services of each municipality. The awareness of the population, in turn, was not defined in a practical way, only mentioned as a need or suggestion for activities within the 4 themes.

Concerning the principle of integration, the establishment of a relationship between the planned green infrastructure and the existing gray infrastructure was identified only in the provision of information, in response to the diagnostic questionnaire, on the composition of territories in terms of urban and rural areas and the road map used as a basis of knowledge of the RMC territory.

The requirements that make up the principle of multifunctionality at this stage were met, to a large extent, by meetings held between technicians from the Municipal Secretary for Green, Environment and Sustainable Development (Secretaria do Verde, Meio Ambiente e Desenvolvimento Sustentável – SVDS) and from municipalities to identify pressures and points of interest in the region, as a way of “understanding the place.” The mapping of landscape elements, ecosystem services, areas of urban expansion, and urban renewal projects was also done by the mentioned maps, trying to map the principle of connectivity.

3.3 ANALYSIS

The Analysis stage, despite showing a significant amount of unattended points, constitutes the core of the case study of the Reconecta RMC Program. This is because the design and delimitation of the Connectivity Area are
effectively produced from the overlapping of maps and materials collected in the previous stages.

The analysis of the maps used and the relationship between them, for the construction of the Connectivity Area, was not specified or detailed beyond the provision of maps associated with satellite images. Even so, it was considered that the analysis requirements were met, since the methodology does not provide a specific reference for conducting this analysis.

As part of “inclusion strategies of the population,” the program only mentions the need for environmental education activities for mobilization of the population, but does not develop or specify strategies or actions to do so. In addition, there was no discussion about the inclusion of the population in the analysis of maps, since their development took place exclusively in the technical scope of the entities involved.

From the preliminary version of the Connectivity Area, a joint analysis of the maps printed by each municipality was carried out, highlighting issues not addressed in previous stages to the design of this version.

Regarding to the multifunctionality, the items “identification of the existing green infrastructure and its ecosystem performance”; “definition of areas of environmental risk (landscape)”; and “identification of areas of loss of ecosystem function” were considered met after the intervention of the technical representatives in the first version of the Connectivity Area, by the introduction of relevant items such as: Linear Parks (existing or planned) and Ecological Corridors (existing or planned).

This intervention enabled the refinement of the Connectivity Area and the design of its final version for approval, in line with other green infrastructure devices that can interact with what is proposed by the Reconecta RMC Program.

From the establishment and location of the Connectivity Area, the Analysis stage also identified, within the delimited area and by the crossing of data obtained from the 2nd Workshop referring to ecosystem services, the relationship between the area of implementation of green infrastructure, the supply of the main ecosystem services chosen by the participants, and the categories of Land Use and Occupation.
With the map produced, it was possible to meet the requirement of “identification of the areas of loss of ecosystem function” from the overview of the current interaction between the ecological elements of the region.

The construction of this and other thematic maps in the context of the Connectivity Area made it possible to achieve the principle of interdisciplinarity in the form of “readings that promote the connection between the different approaches” (Sant'Anna, 2020). Among the 9 thematic maps constructed (available as annexes to the Proposal), three are highlighted, showing the potential for articulating different disciplines throughout the implementation.

3.4 SCENARIO, IMPLEMENTATION AND MONITORING

The last three steps outlined in Sant’Anna’s (2020) methodological strategy are practical and more advanced than the scope of the Reconecta RMC Program, according to the documents and material available for analysis.

The Connectivity Area Proposal brings, in addition to the map containing the area itself, a set of general guidelines to ensure that the use of the constructed graph respects the connectivity proposal of the study. Therefore, these guidelines were interpreted as part of the construction stage of Scenarios proposed by Sant’Anna (2020)

The case study of the program highlights the importance of basing future “recovery projects on scientific and popular data, [...] which enable the reestablishment of interactions” (Prefeitura Municipal de Campinas et al., 2018, p. 32) necessary for connectivity. This guideline dialogues with the question of including the “population and main agents in the development of proposals” (Sant'Anna, 2020), showing the relevance of including different views and approaches in future stages of application of the Connectivity Area in projects and proposals of execution.

The guidelines also mention the joint work between municipalities for the implementation of green infrastructure elements (linear parks and ecological corridors, for example) using joint legislation, as well as the recurring consultation of state databases and revisiting the evaluation of ecosystem services for constant updating of the Connectivity Area, according to the evolution of its
implementation in the form of green infrastructure (Prefeitura Municipal de Campinas et al., 2018).

These notions bring the essence of what Sant’Anna (2020) proposes as methods of “defining new proposals for green infrastructure” and “evaluating and, when possible, quantifying the current and potential benefits of existing and proposed GI ecosystem services” (Sant’Anna, 2020), demonstrating the principles of integration and multifunctionality of the Scenario stage.

We then move towards the Implementation and Monitoring stages, of which it was not possible to identify elements in the case study. Considering the nature of the analyzed document, the lack of information regarding these steps was already expected.

Some points should be highlighted, starting with the need to, in addition to guaranteeing the expected ecological connectivity and the consequent promotion of biodiversity and the provision of ecosystem services, promote broad public participation, from the beginning of the development of the proposal until its effective implementation and monitoring.

This Proposal, prepared in 2018, was submitted to the Empresa Paulista de Planejamento Metropolitano SA (Emplasa) for consideration of the inclusion of the Connectivity Area, along with its guidelines, in the Integrated Urban Development Plan (IUDP) of the RMC (Prefeitura Municipal de Campinas et al., 2018, p. 35). This important initiative and the expected adequacy of the Municipal Master Plan of each of the municipalities in the RMC to the IUDP, as well as the possibility of including guidelines, rules, and restrictions for land use and occupation in these plans, favor the implementation of the planned green network and the guarantee of its ecological performance.

4 CONCLUSIONS

The use of such a broad and highly complex methodology to establish a parallel with the structure originally followed by the Reconecta RMC allowed the analysis of the latter regarding the general scenario of landscape planning delimited by the steps elaborated by the author of the methodological strategy. It was found that the Program has a high potential for contributing to the
incorporation of green infrastructure elements into urban and landscape planning in the city of Campinas and other cities in its metropolitan area.

In this context, the general analysis of the documents, from the perspective of the stages, allowed the characterization of several items described in the program within the scope of each stage and indicated a positive trend of approximation of the program’s approach to the proposed planning model. However, as presented in the discussion of the results, the stages of scenario construction should still be better developed, which still do not make it clear how the plans jointly established by the municipalities translate spatially into projects, as well as how they will be implemented and monitored, since monitoring has a direct relationship with previous studies that are not usually developed in the Brazilian context. This intrinsic role of impact assessment, for example, is only fulfilled in the case of projects with the potential to cause negative impacts, thus failing to ensure learning and monitoring of the consequences of implementing new proposals, even using known low-impact solutions in favor of promoting biodiversity.

We reiterate here the need to expand public participation, both in the definition of objectives and in the monitoring of the implementation of the proposal, highlighting that the latter, despite its great focus on promoting biodiversity, addresses the provision of ecosystem services, which have the potential for bringing several benefits to the well-being of this population.

It is also important to emphasize the importance of stimulating the dissemination of this Reconecta RMC proposal to the most varied audiences, as well as promoting dialogues with experiences that have been developed in other places in Brazil, together with the Interact-BIO Project, such as with the metropolitan area of Londrina and Belo Horizonte. Such initiatives are essential for green infrastructure to be effectively incorporated as a tool for the construction of the Landscape Design of Brazilian Cities and Metropolitan regions, so that we can review the current paradigm and incorporate Landscape into planning practices.
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