

## Social components and the use of target images for the Piraquara River restoration in Realengo (RJ)

### Os componentes sociais e as imagens-alvo na requalificação fluvial do Rio Piraquara, Realengo (RJ)

### Componentes sociales e imágenes objetivo en la rehabilitación fluvial del río Piraquara, Realengo (RJ)

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## Abstract

This work addresses the challenge of balancing natural and urban objectives amidst the erasure of water bodies and disastrous floods by sensitizing social agents involved in transforming territories. Specifically, the focus is on the reinsertion of rivers in cities, emphasizing recovering memory and perception of river landscapes and their impact on urban river restoration projects. The proposed solution is a conceptual structure that includes social components in prospective images, called target images. This structure was developed through a five-step process, including a general diagnosis, compartmentalization of the territory, historical research, qualitative interviews, and application of the conceptual structure. The case study used is the Piraquara River Sub-Basin in Rio de Janeiro, resulting in a new conceptual structure for reflecting on possible narratives and cultural repertoires of social agents involved in urban fluvial restoration projects.

**Keywords:** River Restoration; Social Components; Target Images; Piraquara River.

## Resumo

Este trabalho aborda o desafio de equilibrar objetivos naturais e urbanos em meio ao apagamento de corpos d'água e inundações desastrosas, sensibilizando agentes sociais envolvidos na transformação de territórios. O foco é a reinsertão dos rios nas cidades, com ênfase no resgate da memória e da percepção das paisagens fluviais e seu impacto em projetos de requalificação de rios urbanos. A solução proposta é uma estrutura conceitual que inclui componentes sociais em imagens prospectivas, denominadas imagens-alvo. Essa estrutura foi desenvolvida por meio de um processo de cinco etapas, incluindo diagnóstico geral, compartimentalização do território, pesquisa histórica, entrevistas qualitativas e aplicação da estrutura conceitual. O estudo de caso utilizado é a Sub-bacia do Rio Piraquara, no Rio de Janeiro, resultando em uma nova estrutura conceitual para refletir sobre possíveis narrativas e repertórios culturais de agentes sociais envolvidos em projetos de requalificação fluvial urbana.

**Palavras-chave:** Requalificação fluvial; Componentes sociais; Imagens-alvo; Rio Piraquara.

## Resumen

Este trabajo aborda el desafío de equilibrar los objetivos naturales y urbanos en medio del borrado de cuerpos de agua e inundaciones desastrosas, sensibilizando a los agentes sociales involucrados en la transformación de los territorios. El foco está en la reinsertión de los ríos en las ciudades, con énfasis en la recuperación de la memoria y la percepción de los paisajes fluviales y su impacto en los proyectos de restauración de ríos urbanos. La solución propuesta es un marco conceptual que incluye componentes sociales en imágenes prospectivas, denominadas imágenes objetivo. Este marco fue desarrollado a través de un proceso de cinco pasos, incluyendo diagnóstico general, compartimentación del territorio, investigación histórica, entrevistas cualitativas y



aplicación del marco conceptual. El estudio de caso utilizado es la subcuenca del río Piraquara, en Río de Janeiro, resultando en una nueva estructura conceptual para reflexionar sobre posibles narrativas y repertorios culturales de los agentes sociales involucrados en proyectos de rehabilitación de ríos urbanos.

**Palabras clave:** Rehabilitación fluvial. Componentes sociales. Imágenes objetivo. Río Piraquara.

## INTRODUCTION

Despite the historical background of occupation and the various public policies for planning and managing the territory, urban rivers have significant historical and environmental value. However, they often suffer degradation and disappearance, being reduced to drainage systems due to urban expansion, disregarding their characteristics. These bodies of water often become garbage and pollutant dumps, with the risk of occupation on their banks, marginalizing them from the city itself. In this context, river restoration initiatives emerge as an alternative to balance the natural dynamics of water in urban areas, seeking integrated and sustainable solutions to reduce flood risks and restore environmental quality (Veról *et al.*, 2020; CIRF, 2006). However, the modified urban environment represents a considerable challenge for the restoration process, which must consider the cultural perspectives of communities and meet social, cultural, and historical demands, aiming at a more effective result (Burch *et al.*, 2020).

This article starts from the premise that the support and acceptance of the different social agents involved in the processes of transformation of the territory favor the actions of river restoration. Although sensitizing them is challenging, the hypothesis is defended that these agents' environmental perception and memory are fundamental for projects to restore urban rivers, supporting decision-making. In this sense, the work's main objective is to build a conceptual structure that encompasses the insertion of the representative social component in prospective images, called target images, to support design decision-making, aiming at constructing adequate and sustainable solutions for river restoration. The Piraquara River sub-basin, located about Realengo in Rio de Janeiro (RJ), is used as a case study.

## River restoration and the balance between natural and social demands

According to Veról *et al.* (2018), river restoration projects require balancing ecological restoration and social and economic factors. For them to be viable projects, the authors highlight four main pillars: improvement of river ecosystems, improvement of water quality, reduction of hydraulic risk, and geomorphological



recovery, in addition to dividing river restoration practices into structural and non-structural actions, involving the development of social awareness about the value of watercourses, participatory planning, accessibility to information, among others. However, He *et al.* (2019) point out no endpoint exists for restoration actions due to regional differences. Kondolf and Pinto (2017) add that the restoration of the original characteristics of a river may not be the best solution, especially in urban rivers, which have social and cultural functions incorporated into their system.

Success assessments of river restoration projects proposed by Palmer *et al.* (2005) and Nardini and Conte (2021) converge by emphasizing the importance of establishing a target image incorporating stakeholders' perspectives. Palmer *et al.* (2005) emphasize the need for social involvement and shared responsibility to achieve a common image despite political and cultural constraints. Nardini and Conte (2021), in turn, advocate using similarity criteria, scientific knowledge, and river history, including collecting historical data to develop a comprehensive interpretive theory. Furthermore, Kondolf and Pinto (2017) highlight the importance of social connectivity in river restoration efforts and emphasize the need for public involvement before final decisions are taken. The Framework Directive for Water in Europe (European Union, 2000) confirms the importance of social and cultural connections in river restoration efforts, while Brazil still lacks a specific law on restoring urban rivers.

### **Construction of a new conceptual structure of social components for river restoration**

Many of the above considerations contribute to understanding the dynamism and interdependence of the fluvial regime and socioeconomic variables. In the context of research on more resilient cities, "knowledge emancipation" (Santos, 2002) is beneficial, considering the social components of restoring degraded urban rivers.

Guattari's (2001) concept of singularity and production of subjectivity is also relevant in constructing a creative proposal that considers the subjective and territorial complexity involved in restoring urban waterscapes. Reflecting on innovative practices to reframe current models, Ginzburg (2012) argues that analyzing literary works instead of historical documents can reveal uncontrolled voices in a conditioned narrative, recognizing that frames of social memory shape the construction of the landscape. Similarly, Freire and Pereira (2002) identify microhistory as a method of "unique effectiveness" due to the close connection between identity and memory, which is responsible for developing two forms of memory: the document and remembrance. The technique contributes to a fairer reconstruction of the past, making the investigation a "creative and cooperative" process.

The rescue of memory is linked to the term environmental perception, where Kevin Lynch (1960), Yi-Fu Tuan and Okamoto (1999) recognize the importance of considering sociocultural, economic, educational, and belief aspects when



proposing projects and identifying the cognitive and affective aspects of the human being in the built space. Therefore, environmental perception is understanding the outside world from each individual's memories, inner baggage, and experiences identifiable in the landscape.

### **Environmental perception and satisfaction of social agents as part of the success of river restoration**

Protection against floods has been the central issue of river management in the last two decades (Junker; Buchecker; Müller-Böcker, 2007) and, as it is a global disaster, floods are read as totalizing events that affect all aspects of human life. Therefore, it is inevitable that they contribute to collective memory (Ullberg, 2013). History and local memory can influence the perceptions of social agents more than measurable records in a project context (Bell; Graham; White, 2020). As mentioned earlier, it is understood that memory is internal and is linked to the perception of external factors, such as how we relate to the environment. In general, water in urban spaces can be perceived today as a necessary resource and a danger to life and property, assuming opposite meanings. According to Bunschoten (1998 apud Corner, 2011), this urban spatial conformation is dynamic and composed of the interaction between different "actors" and "agents," which can be represented by environmental groups, landowners, and even the local public in general, including frequently excluded groups (Junker; Buchecker; Müller-Böcker, 2007).

Considering a participatory approach to river restoration, the target image should serve both as a means of communication and adaptation of proposals according to the collective's desires, expectations, and needs, as a bridge for the active participation of actors in the project's development. However, due to the disparity in understanding and receptivity to environmental issues, it is necessary to understand the social context and interpret collective and individual desires, expectations, and needs before educating and adapting to technical solutions. Nardini and Miguez (2016) highlight the positive impact of changing the local community's perception of river restoration solutions before the project's participatory development process. Using tools such as meetings with government agents, distribution of illustrated explanatory leaflets, and behavioral studies of those involved led to a rapprochement between social agents.

### **The concept of landscape is related to memory and collective and individual perception**

Several authors (Mcharg, 1971; Raaphorst *et al.*, 2020; Rees; Cosgrove, 1986; Steiner, 2008) understand that landscapes are complex entities encompassing natural and social components. On the other hand, cultural representations refer to the collective knowledge, opinions, and images that shape social expressions, which implies that landscapes result from cultural interpretation and the



accumulation of representational sediments over time (Corner, 1992). These definitions highlight landscapes' dynamic and diverse nature, which a single narrative cannot fully define.

Considering that the experiences of memory and collective and individual perceptions of social agents interfere in the landscape, it is common to start the design process from a diagnosis that considers these narratives that will subsidize the project. Thus, it can be said that the diagnostic narrative is an intentional cut, and the project resulting from this stage is not a final product but a creative process represented through different media (Raaphorst *et al.*, 2020). By associating the Actor-Network Theory (TAR) of sociology with the design process in architecture, Costa, Azevedo, and Pedro (2017) propose to understand the architect as an "author network" due to his ability to translate and associate the elements involved with the collective context, human and non-human. In this sense, the authors understand that "for the project, 'translating' is communicating the message so that it becomes understandable, interesting, and important to others – there is a built-in work of persuasion" (Costa; Azevedo; Pedro, 2017, p. 108). Therefore, what these consumers and agents say about their places is very relevant: it constitutes a set of memories and perceptions that help to understand the patterns of social life, to know their specificities, and to provide their future evaluation. Therefore, the conceptual discussion is woven as a proposal for better guidance in understanding the landscape, the cast of social agents, and their possible benefits in realizing a project to restore the degraded river landscape.

In a creative process, drawings, images, and mappings can be potential catalysts of a desired future state and not just representations of existence (Corner, 2011; Raaphorst *et al.*, 2020). They have the potential to articulate time and space to build a new future and, therefore, make new impressions on narrative consumers. Thus, the interest in the communication approach through target images is to positively impact the population, as it is both the target consumer and the agent of the constructed narrative. Based on the understanding of memory and perception of social agents, it is proposed a conceptual structure divided into two main stages:

- I. **Historical Research**, diagnosing the landscape's transformation by identifying "roughness" and "haze":
  - a. **Roughness**: they represent the intersection of time and space, and their identification can reveal cause-consequence relationships that provide valuable information about landscape transformations (Lewis, 1979; Santos, 1999);
  - b. **Fog**: represents the overlapping layers of information that landscapes carry, as Lewis (1979) and Santos (1999) discussed, looking behind the form to understand the content. Identifying these structural layers in isolation helps to reveal situations that are initially invisible or not apparent.



**II. The Qualitative Study** aims to retrieve memories and identify perceptions about the landscape by reading existing cultural representations to identify micro-history (undocumented memory) and localities.

- **micro-history:** This lens reveals hidden information but focuses on subjective data that rescue memory.
- **locality:** Local knowledge and specificities also help to identify hidden subjectivities. In the same way as the collection of micro-stories, the identification of locations is done on an approximate scale with social agents, however, in correlation with the physical space and the existing dynamics in the composition of the territory.

Therefore, river restoration, initially located at the core of environmental management, has two axes of action: structural and non-structural. The latter directly involves the social components related to environmental management and applied social sciences. The first step in the proposed new conceptual framework is a historical survey of landscape transformation, which requires understanding perceptions as a product of social components using representative tools such as roughness and fog.

The second stage involves the qualitative study of landscape representations, focusing on microhistory and localities, with the understanding that landscapes result from cultural interpretation and representational sediments over time. The investigation is interactive with the subjects; hence, the target image tool refers to individual and collective perception catalysts of a purposeful desired future state. Together with the image tool, there is a semi-structured interview at this stage. In this type of interview, there is flexibility that helps to collect unforeseen information. Despite using a question guide, it was possible to include new questions and even record free association thoughts mentioned by respondents during the process.

Before the fieldwork, the social agents influencing the production of the space under study were identified. Respondents were then selected based on three groups: 1. beneficiaries of ecosystem services (residents), 2. visitors (business or leisure), and 3. people with technical knowledge or proactivity with the environment. At least two individuals from each of the six points in the study area were selected for group 1. In comparison, groups 2 and 3 had at least two individuals interviewed at any point and fifteen people at the end of the process. The interviews lasted from September 17 to October 29, 2022, from twenty to thirty minutes each.

The interview questions were divided into objective and subjective categories. Objective questions were used to characterize the interviewees. On the other hand, subjective questions were designed to understand the interviewee's relationship with the environment, exploring their memories, opinions, and origins. These questions aimed to reveal micro-stories and locations related to the space under study; therefore, they will be the focus of this work.





Figure 1 presents a summary flowchart with the new methodological conceptual structure proposal that inserts the social components in river restoration projects using target images.

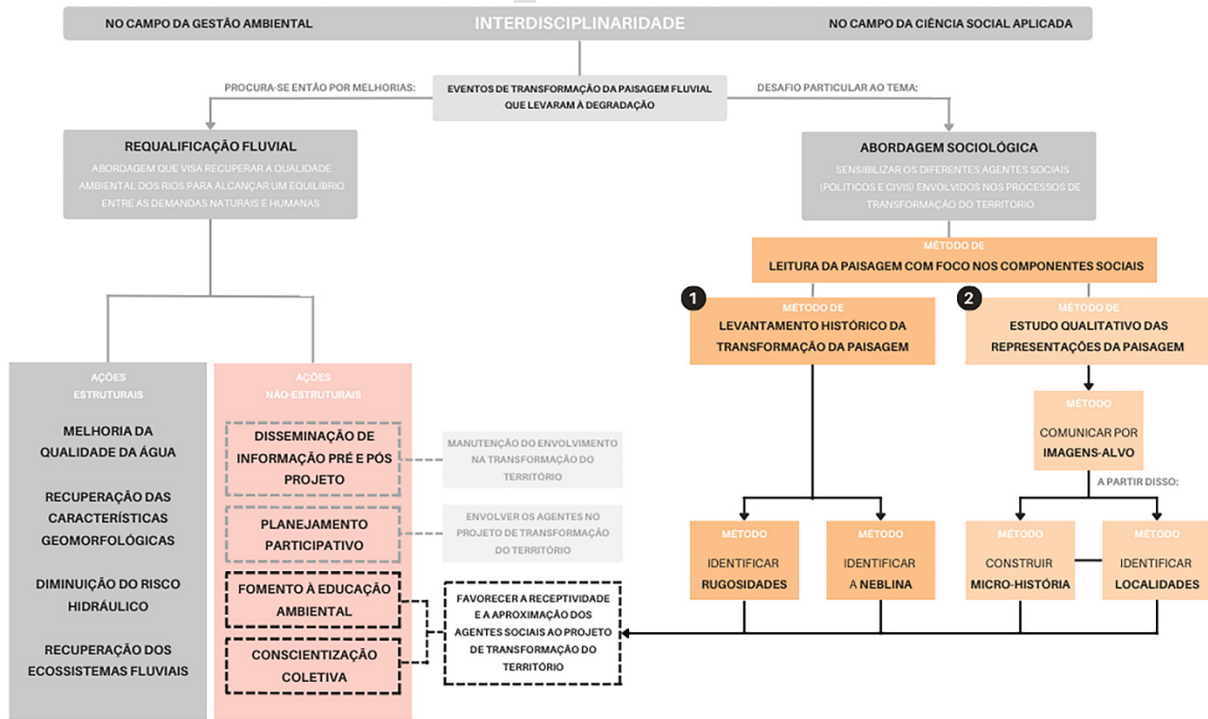


Figure 1: Flowchart of the conceptual structure for inserting social components in river restoration projects. The fields of environmental management and applied social science do not always coexist in practice, but they are necessarily related in the proposed structure. In the technocratic field of environmental management focused on river restoration, there are two axes of action: structural and non-structural actions. The latter speaks directly to the method of insertion of social components proposed in the research. The method comes along with two other steps: a historical survey and a qualitative study. Firstly, the survey is taken to investigate the transformation of the landscape. In order to understand the landscape – an entity difficult to delineate, and in constant transformation – we must look beyond the physical elements. Hence the need to understand perceptions as a product of social components, which in turn, encompass a set of common memories, knowledge, opinions and images. The second step involves the qualitative study of landscape representations. With the understanding that landscapes are “the result of cultural interpretation and the accumulation of representational sediments over time” (CORNER, 1992, p. 243), we propose the investigation of historical and subjective representations using four representative tools “roughness”, “fog”, “micro-history” and “localities”. This investigation ends up being interactive with the subjects investigated, hence the use of a fifth tool: the target image that refers to the individual and collective perception that catalyzes a purposeful desired future state. Source: Elaborated by the authors (2022).

### Piraquara River in Realengo, Rio de Janeiro

The Piraquara River was chosen as a case study due to its confinement by dense urban conditions, degraded state entering the urban fabric, and recurrent overflow events affecting human and material conditions. The river rises within the Pedra Branca State Park (PEPB), an essential landmark in the landscape and the main public leisure space in the basin, drains the urbanized area of Realengo



(Ilha *et al.*, 2013). Piraquara is a tributary of the Acari River, whose watershed (Oliveira, 2018) covers 31 neighborhoods. It cuts through the neighborhood of Realengo for approximately 6km until it meets the Rio Marinho at the level of Avenida Brasil, and together, they form the Marangá River. Figure 2 shows its location to the Acari River Basin.

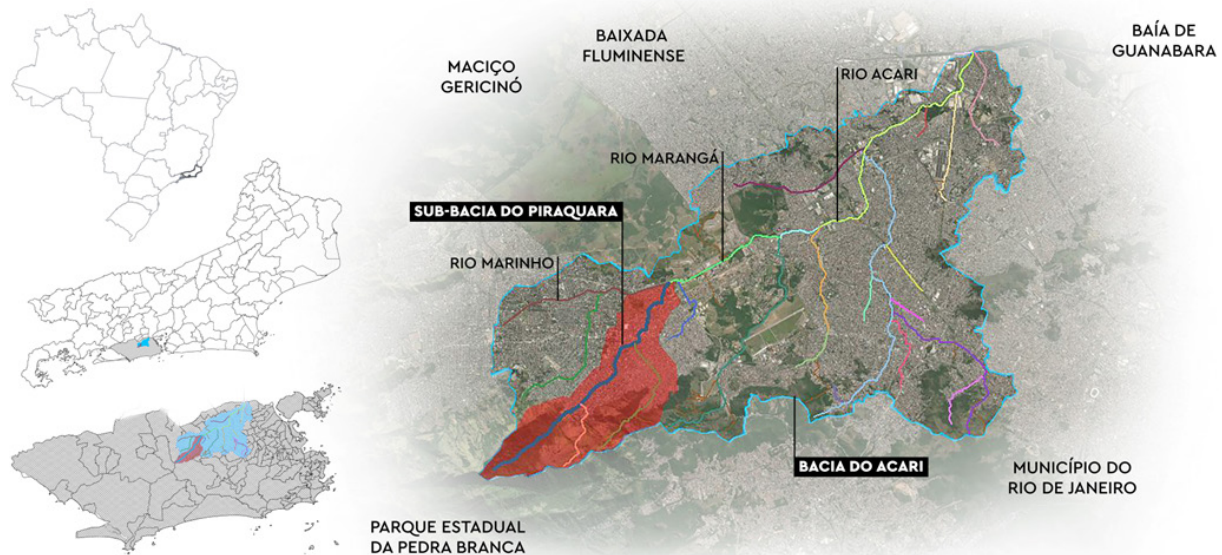


Figure 2: Location of the Piraquara River Sub-Basin. Source: Elaborated by the authors (2022) based on IBGE data apud MPRJ (2010 and Martins, Azevedo and Figueiredo (2017).

### Landscape units and qualitative field research

In this article, qualitative research is the focus, as it contextualizes the material produced in the field. To carry out this step, it was necessary to understand the territory and its structure. In common sense, space compartmentalization occurs in the political-administrative bias. However, this delimitation sometimes is not enough to adequately understand the space, making it necessary to compartmentalize it into Landscape Units (LU). LUs are defined based on the four defining elements of the landscape, such as physical support, structure/ drainage pattern, vegetation cover, and urban area (Veról *et al.*, 2020). The territory under study was categorized into seven Landscape Units, shown in Figure 3.



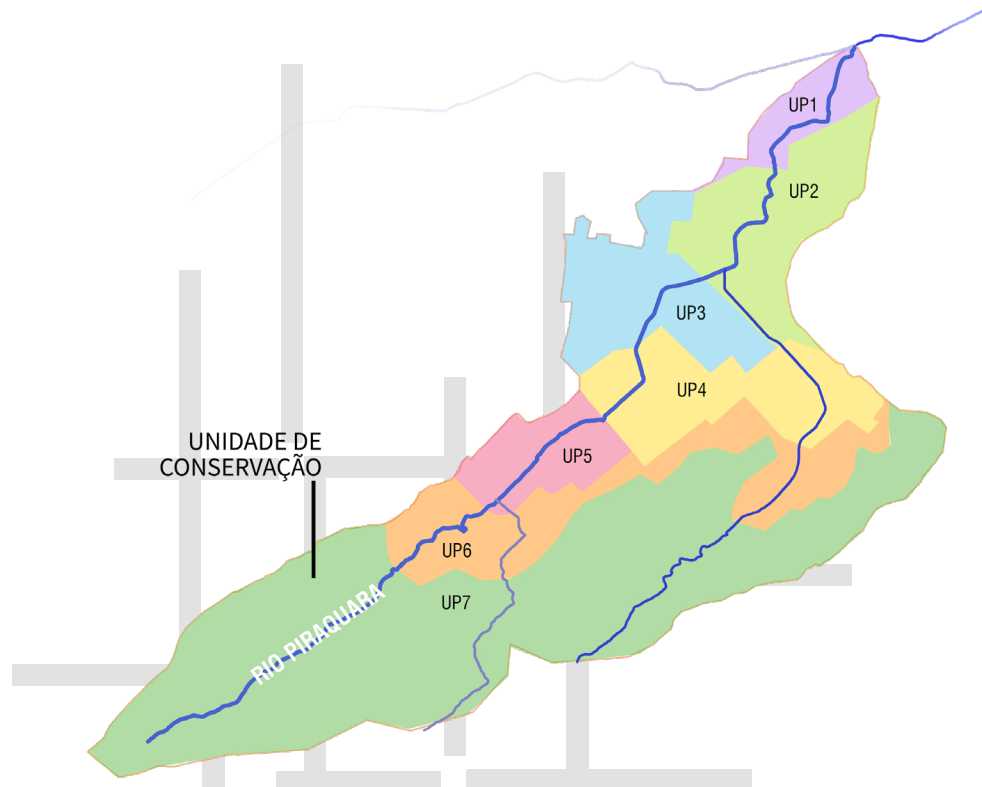


Figure 3: Landscape Units (LU) in the Piraquara River sub-basin. Source: Elaborated by the authors (2022).

The LU7 is not detailed in the research, as it is an area free of urban occupation, which corresponds to the PEPB.

In this research, it was essential to understand the river restoration proposals and their problems and to elaborate on target images for communication in the semi-structured interview. This method allowed the interviewee to structure his thinking around the object of study, focusing on hidden data (Ruquoy, 1997). In general, the proposals consider integrating with the urban project, the distribution of measures throughout the hydrographic basin, and using free spaces for multifunctional solutions (Veról *et al.*, 2020). Based on these proposals and the definition of the Planning Units, it was possible to summarize the proposals in seven concepts that, when integrated, had as their objective the restoration of the Piraquara River. Figure 4 presents these seven concepts with the associated techniques and the prediction of their location along the study basin.

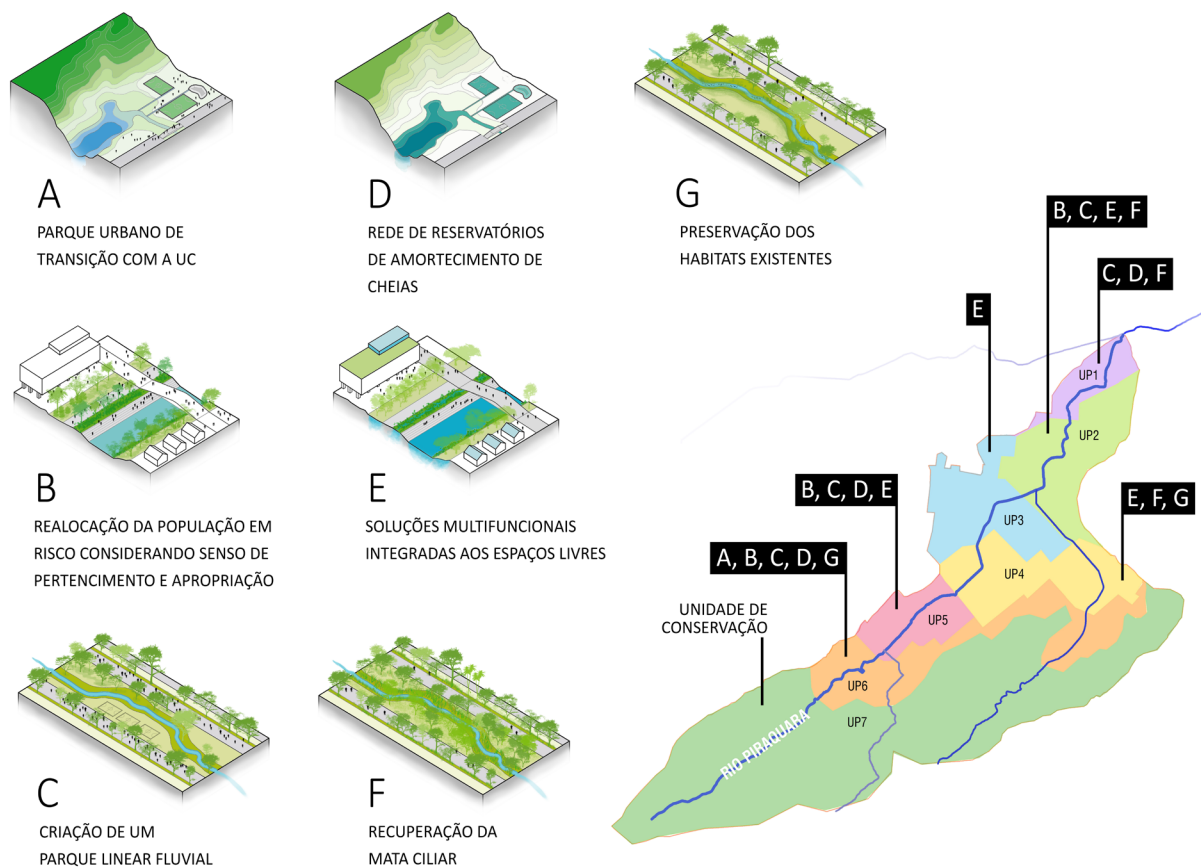


Figure 4: Concepts and techniques for river restoration and their use in Landscape Units considering diagnosis and existing proposals. **CONCEPT A:** to create a transitional urban park with the Conservation Unit (UC); **CONCEPT B:** relocation of the population at risk, considering a sense of belonging and appropriation of the territory - the relocation of houses in risk areas to the same location, but with a new construction typology on pilotis, which follows Corbusian precepts that define the pilotis occupied with leisure, but which also allows systemic continuity (flow of water, vegetation and animals); **CONCEPT C:** to create a linear river park, not only as a means of bringing the population closer to natural resources (in an ideal post-project situation in which water quality makes this approach possible) through spaces intended for leisure and contemplation and of use for economic purposes: possibility of kiosks and native plant nurseries; **CONCEPT D:** to create a network of flood damping reservoirs – in this case, it focuses on urban multifunctional elements. In times of drought, squares and football fields are used for leisure, contemplation and sports, but in times of river flooding, these same urban facilities can serve the macro-drainage system, as a detention basin; **CONCEPT E:** of multifunctional solutions integrated into the open space system – such as considering the gardens of the landscape design as elements of infiltration and flood dampening; **CONCEPT F:** restoration of riparian forest – the presence of vegetation along the banks, in addition to contributing to the condition of water balance, protecting the soil against leaching and erosion, is also capable of relieving drainage systems, as increased soil permeability offers new opportunities for infiltration during rains; **CONCEPT G:** preservation of existing habitats, where there are less artificial characteristics and space for intervention. Source: Elaborated by the authors (2022).

With the compartmentalization of the landscape and the structuring of the concepts, according to their demands established in the diagnostic items of the historical survey and proposals developed in previous research, the target images were constructed in each representative point of the LUs (see Figure 5).



The target images are, therefore, photomontages, as graphic representations of the seven concepts on photos taken on field visits, which always had the river in evidence and the pedestrian's view as a priority. The entire development of this stage is authorial and aimed at building communication tools.

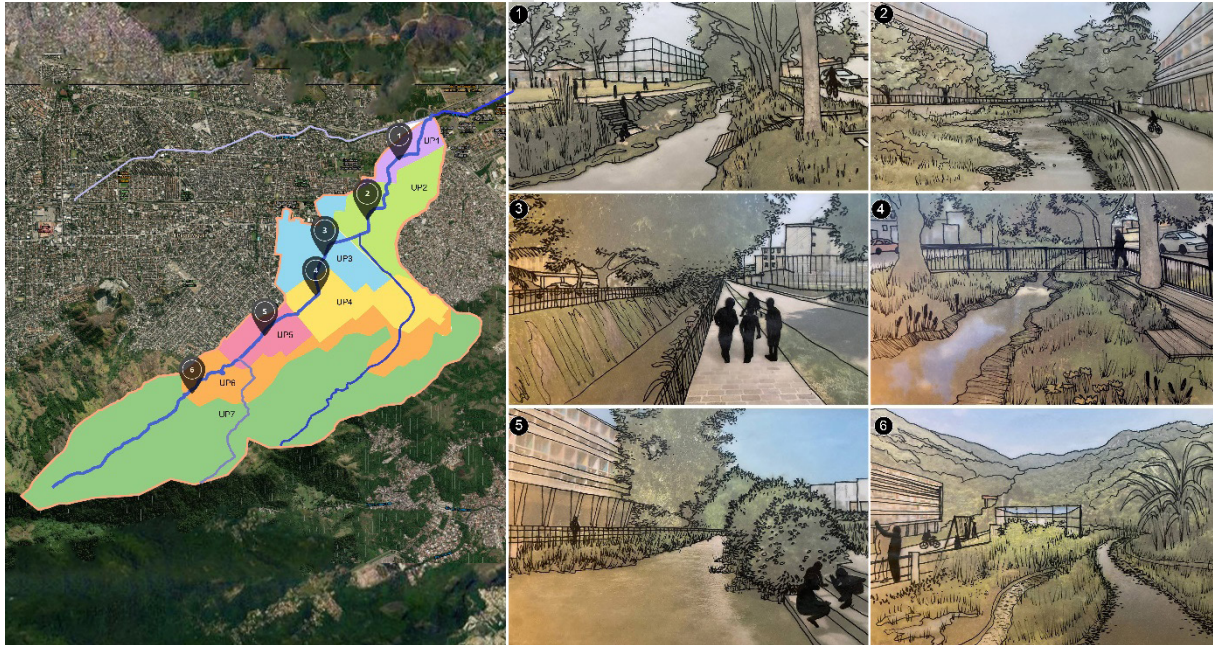


Figure 5: Target images from points 1 to 6 correspond to the six Landscape Units (LU) in the Piraquara River sub-basin. Source: Elaborated by the authors (2022).

### Target images in local perception: methodology, results, and discussions

As a research tool for this stage, there is a semi-structured interview, which aims to give voice to the experiences, sensations, and relationships of the interviewees with the surroundings of the Piraquara River in their daily experience.

To spatialize the local perception, the terms most used by the interviewees were associated with the 6 points where the interviews took place, in the form of a map, identifying the results before and after target images concerning the points and in relation to groups of social agents. Figure 6 shows the desire for the pre-target image location, and Figure 7 shows the reaction of the post-target image respondents.

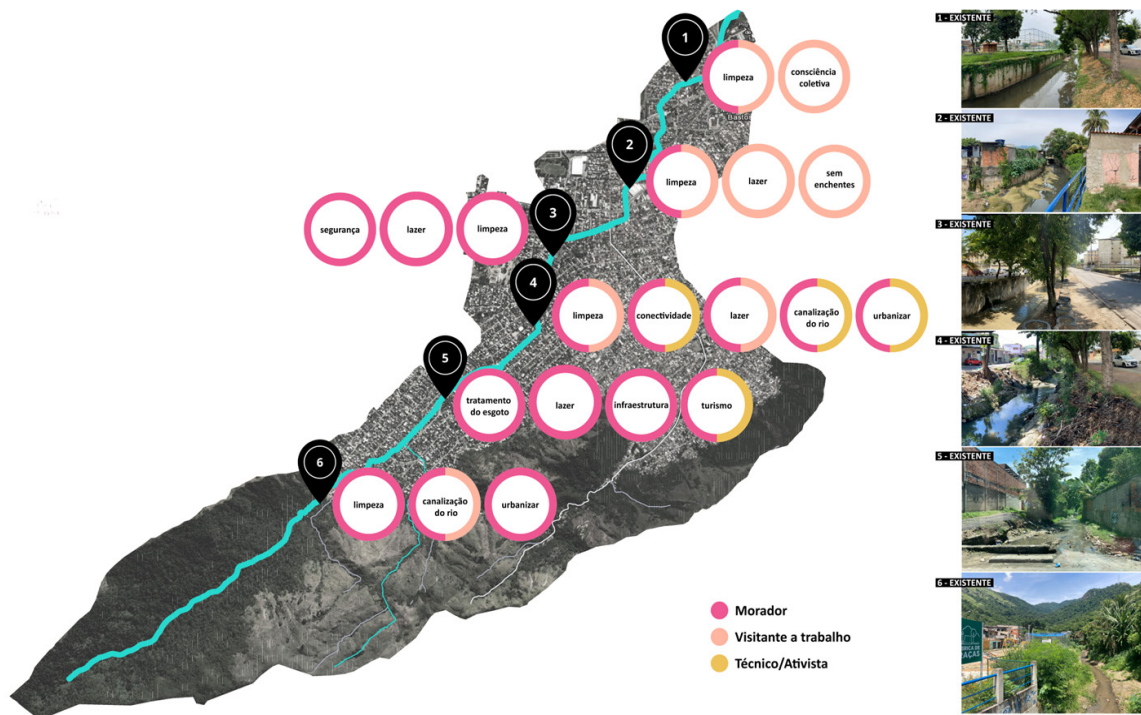


Figure 6: Desire of respondents from the pre-target images locality. The bright pink represents the desire of the locals; the light pink represents the desire of the working visitors; the yellow represents the desire of the experts and activists for the environmental cause. Source: Elaborated by the authors (2022).

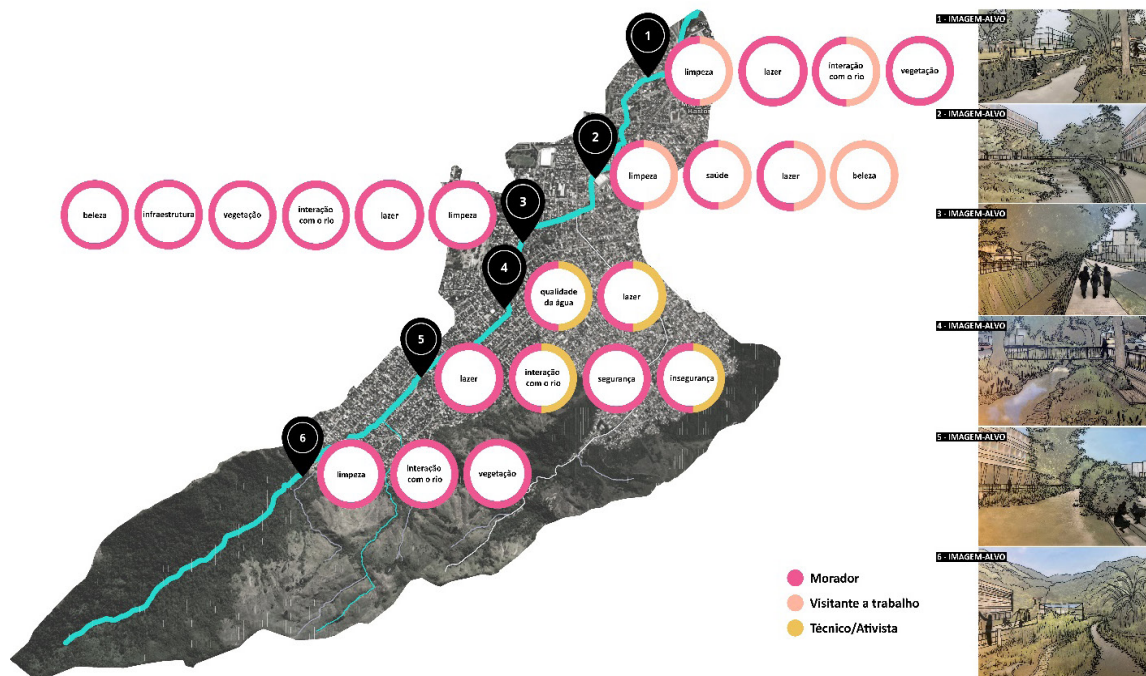


Figure 7: Respondents' reactions from the post-target image location. The bright pink represents the reaction of the locals to the target-images; the light pink represents the reaction of the working visitors to the target-images; the yellow represents the reaction of the experts and activists for the environmental cause to the target-images. Source: Elaborated by the authors (2022).



The lack of cleanliness and flooding are common problems among all points and groups of respondents, as seen in Figure 6. The activists interviewed focused on urbanization and the appearance of the urban landscape, but their solutions may not meet the needs of the river ecosystem. At all points, respondents want cleaner spaces suitable for leisure, but with differences in details. Figure 7 shows that "interaction with the river" and "vegetation" are new expressions that emerged after exposure to the target images. In general, there was a greater appreciation of the expansion of "vegetation" and a shift from the desire for "urbanization" to "interaction with the river." Comparing the pre- and post-contact responses was essential for the interviewees' opinions on the images and for presenting a new repertoire of solutions for social agents.

The survey of micro-histories and locations shows valuable information about local leisure activities and nostalgia for an environment that no longer exists, which would hardly be collected in a geostatistical analysis using satellite images (although this is also essential for pre-project diagnosis). Thus, surveying roughness, fog, micro-stories, locations, and perception using images that involve and approximate their social and cultural dimensions tends to favor communication and collective appropriation to validate belonging to the place.

## CONCLUSIONS

The present work sought to demonstrate the importance of the contribution of cultural values, which influence and are influenced by the memory and collective and individual perception of the different social agents that produce the space, to make the restoration of the river landscape successful. In this sense, a new conceptual structure was built that encompasses the social components of the river restoration project that is part of the axis of non-structural actions. For this, the memories and perceptions of social agents about river landscapes were investigated. The investigation process was as significant as its results because, despite some communication obstacles, the study facilitated the sharing of interactive and reflective knowledge among social agents, aided using target images and the subsequent analysis of data from the interviews. Thus, lessons learned included the importance of presenting technical data in a way that is accessible to all and establishing credibility and trust in the transmission of knowledge. Therefore, the qualitative study achieved two objectives: sensitizing social agents to the theme and understanding their perceptions of the place and its potential. The most significant development of the research was identified as making social agents active participants in the development of proposals beyond the communication phase, using the conceptual map presented in Figure 3 as a starting point to negotiate project solutions with laypeople, activists, and technical professionals.

The Piraquara River case study helped to understand the importance of data collected in loco, the sense of community, and the activism of social agents for the proposed methodological structure. The survey also revealed the lack



of infrastructure in the region and how different social agents adapt to socio-environmental vulnerabilities. The difficulty in accepting and implementing alternatives is usually due to societal reception rather than economic or political challenges. The study demonstrates the flexibility and variability of collective knowledge and the need for environmental education, especially for social agents.

Finally, this work is expected to have contributed to technical knowledge and local actions in the fight in favor of the environmental restoration of the territory and, mainly, to improving conditions on the Piraquara River, with the exchange of knowledge between groups and fields of expertise. The aim was, above all, to reinforce the importance of the relationships between cities and their rivers and, through this, to give visibility to the reconciliations between agents that produce space in its cultural and social variety in restoring the river landscape.

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