



# Social Cartography as a Participatory Strategy for Community Ownership of environmental health

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## Abstract

Social cartography has emerged as a participatory strategy that strengthens community involvement in the understanding and transformation of environmental health conditions. **Objective:** To analyze the role of social cartography as a strategy for community ownership of environmental health in rural and peri-urban territories of the department of Cauca, Colombia. **Methodology:** A qualitative study was conducted using a Participatory Action Research approach, applying social cartography and stakeholder mapping to explore water management and environmental health from a community-based perspective. **Results:** The findings reveal marked differences between rural and peri-urban contexts in terms of water management, social organization, and perceptions of environmental health. Social cartography facilitated collective diagnoses, strengthened dialogue among actors, and supported the formulation of context-specific community action agendas. **Conclusions:** The integration of social cartography with principles of social appropriation of knowledge enhances community participation, makes territorial inequalities visible, and contributes to the development of participatory strategies of environmental health.

## Keywords

Social Cartography; Participatory Research; Community; Water resources; Environmental Health

## Registration

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## La cartografía social como estrategia participativa para la apropiación comunitaria de la salud ambiental

## Resumen

La cartografía social se consolida como un mecanismo para la transformación colectiva al promover la comprensión crítica de la realidad local y la formulación de estrategias de acción construidas desde la comunidad. **Objetivo:** Analizar el papel de la cartografía social como estrategia para la apropiación comunitaria de la salud ambiental en contextos rurales y periurbanos en el departamento del Cauca, Colombia. **Metodología:** Se realizó una investigación cualitativa utilizando un enfoque de investigación-acción participativa, empleando la cartografía social y el mapeo de actores para comprender el territorio desde una perspectiva participativa, con un enfoque en los recursos hídricos y la salud ambiental. **Resultados:** La aplicación de los principios de apropiación social del conocimiento permitió identificar diferencias entre las zonas rurales y periurbanas, especialmente en relación con la gestión del agua, la salud ambiental y la articulación institucional. La cartografía social facilitó los diagnósticos colectivos y la formulación de agendas comunitarias adaptadas a cada territorio. **Conclusiones:** La cartografía social, integrada con la apropiación social del conocimiento, fortalece la participación comunitaria y visibiliza las desigualdades estructurales, lo que la convierte en una herramienta eficaz para generar comprensión crítica y transformación en los territorios.

## Palabras clave

Cartografía social; investigación participativa; comunidad; recursos hídricos; salud ambiental.

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## 1. Introduction

Environmental health, understood as a complex interaction between environmental, social, and biological factors that modulate human well-being, constitutes an essential pillar for sustainable development, particularly in rural and peri-urban communities. These populations often face unique challenges arising from limited health infrastructure, lower institutional capacity, and multifaceted issues related to natural resource management. They also face greater vulnerability to exposure to environmental risks specific to their territories, where phenomena such as climate change and variability exacerbate their situation ([WHO, 2025](#)). Globally, according to the World Health Organization (WHO), it estimates that approximately 24% of the global burden of disease is directly attributable to environmental factors, disproportionately affecting the most vulnerable populations, including those settled in rural and peri-urban areas ([Neira and Prüss-Ustün, 2016](#)).

In this context, environmental health transcends its conception as a mere scientific discipline to become a strategic component intrinsic to the design of inclusive and equitable public policies for these geographic areas. The 2030 Agenda for Sustainable Development makes explicit its relevance in fundamental goals such as SDG 3 (health and well-being) and SDG 6 (clean water and sanitation). It emphasizes the imperative need for comprehensive and participatory approaches that actively involve communities in the identification of their challenges and the construction of contextualized solutions ([Naciones Unidas, 2015](#)).

Within these participatory approaches, grounded in the tradition of Participatory Action Research (PAR) that emphasizes the active participation of communities in knowledge production and social transformation ([Cornish et al., 2023](#)), social cartography emerges as a methodological strategy for community empowerment. This tool facilitates the identification and spatial visibility of the conditions in which a community develops. Thus, it is possible to capture, among others, perceived and real environmental risks; this technique can facilitate a process of social appropriation of integral knowledge about the political, cultural, and social dimensions intrinsic to the community experience in specific territories. Thus, one hypothesis is that social cartography is a mechanism for collective transformation by fostering a critical understanding of local reality and the formulation of action strategies built from the community itself.

In this context, participatory approaches grounded in Participatory Action Research offer relevant methodological alternatives for addressing environmental health challenges in a territorial and inclusive manner. Among these, social cartography enables communities to collectively interpret their environment, identify socio-environmental risks, and construct shared strategies for action. Therefore, this study aims to analyze the role of social cartography as a strategy for community appropriation of environmental health in rural and peri-urban territories of the department of Cauca, Colombia, focusing on water management as a key determinant of environmental health.

## 2. Theoretical background

### 2.1. Context of Environmental Health

Environmental health is understood as the result of complex interactions between ecological, social, and biological systems that directly influence human well-being and quality of life ([WHO, 2025](#); [Folke et al., 2021](#)). The historical separation between human development and nature, reinforced by anthropocentric models of growth, has generated significant ecosystem degradation, resulting in water contamination, loss of biodiversity, food insecurity, and increased exposure to environmental risks ([Aron and Patz, 2002](#)). These impacts are more pronounced in rural and peri-urban communities, where structural inequalities and limited access to basic services exacerbate health vulnerabilities ([Neira and Prüss-Ustün, 2016](#)).

From a holistic perspective, health cannot be reduced to the absence of disease but must be understood as a harmonious relationship between populations and environmental resources ([Lebel, 2003](#)). In Colombia, environmental health has been incorporated into public health policies aimed at disease promotion and

prevention. In this framework, the Ministry of Health has developed the Subdirectorate of Environmental Health and the Territorial Environmental Health Councils (COTSA), which seek to address specific environmental health challenges in the territories, including rural and urban areas of the country. They are responsible for the implementation of the Comprehensive Environmental Health Policy (PISA) in the municipalities ([Minsalud, 2011](#)). This policy constitutes a strategic framework to articulate intersectoral actions aimed at improving outdoor and indoor air quality, water supply, basic sanitation and hygiene ([CONPES, 2008](#)), and their impact on human health. It is based on principles of equity, sustainability, and community participation and establishes key objectives such as reducing environmental risk factors in communities; promoting environmental health research and surveillance; and strengthening institutional and community capacity for risk management. However, progress in the territorial management of environmental health still presents significant gaps, such as the lack of intersectoral coordination and limitations in the application of environmental regulations. This is especially true in rural and peri-urban areas where the precariousness of environmental conditions directly impacts the quality of life of the populations. This is especially true in the context of climate change ([World Bank, 2019](#)).

In the rural context of Cauca, human interventions have generated negative impacts, such as the construction of housing in water reserve areas and the expansion of the agricultural frontier ([Gobernación del Cauca, 2024](#)). These problems require the implementation of sustainable processes that promote the protection of resources such as water, the soils, and biodiversity within a framework of equitable territorial development ([Cortés, Burgos, Adaros, Lucero and Quirós-Alcalá, 2021](#)). The conception of a differentiated rurality, which recognizes the diversity of urban and rural communities, their traditional knowledge, and their self-management capacities, is necessary to facilitate the sustainability of environmental health processes in the territories. Understanding these dynamics would allow the design of participatory territorial appropriation and management strategies, where tools such as social cartography can play a crucial role.

## *2.2. Principles of the Social Appropriation of Knowledge for Environmental Health*

Social Appropriation of Knowledge (ASC) is conceived as a dynamic and progressive process through which communities not only access information but also critically internalize, reinterpret, and mobilize scientific and local knowledge to address social and environmental challenges ([Berkes, Mahon, Mcconney, Pollnac and Pomeroy, 2001](#)). Although research is widely recognized as a driver of social and economic development ([PNUD, 2016](#); [BID, 2025](#)), its impact depends on the extent to which knowledge is socially embedded and used in everyday decision-making processes ([PNUD, 2022](#)).

In Colombia, this perspective is institutionalized through the Social Appropriation of Knowledge Policy, which promotes inclusive, equitable, and trust-based environments for the production, circulation, and application of knowledge ([Minciencias, 2021](#)). In the field of environmental health, ASC provides a conceptual framework that enables communities to actively engage in understanding environmental risks, strengthening local governance, and promoting collective action beyond the mere implementation of technical solutions. The guiding principles of ASC: context recognition, participation, dialogue of knowledge, transformation, and critical reflection support participatory territorial processes by fostering intercultural exchange, collective learning, and socially relevant interventions aimed at improving quality of life and sustainability.

## *2.3 Social Cartography*

Social cartography emerges as a technique for the collective representation of the territory, differentiating itself from traditional cartography by prioritizing the dialogic construction of knowledge and the valuation of local experiences and knowledge in the elaboration of maps ([Herlihy and Knapp, 2003](#)). Its roots are found in critical geography, which analyzes the power relations inscribed in space; popular education ([Quintar et al., 2018](#)), which emphasizes collective knowledge as a tool for conscientization; and Participatory Action Research (PAR) ([Cornish et al., 2023](#)), which promotes community participation for social transformation. In essence, social cartography constitutes a collective strategy aimed at making visible the ways in which

communities experience and understand their environment, generating spatial representations that reflect their priorities, and laying the groundwork for equitable social and environmental action.

Its methodological application enables the spatially referenced identification of socio- environmental problems and the visualization of available resources from a community perspective, thus promoting inclusive and evidence-based decision-making. This participatory perspective not only reinforces social cohesion by involving key stakeholders in the construction of territorial knowledge but also facilitates greater community ownership of environmental health intervention strategies. Research has consistently shown that active participation in the identification and analysis of environmental difficulties strengthens the internalization of the solutions implemented, increasing their effectiveness and long-term sustainability ([Chambers, 1994](#); [Corbett and Keller, 2004](#)).

In rural contexts through Latin America, social cartography has been used to reveal inequities in access to essential resources such as drinking water, sanitation, and exposure to environmental pollutants, supporting the design of public policies aimed at mitigating environmental risks and promoting healthy environments ([Sullivan-Wiley, Short and Casellas, 2019](#)). Its application in environmental health strategies is particularly relevant in culturally and ethnically diverse territories, such as the department of Cauca, where social cartography enables the recognition of territorial differences and supports the construction of context-specific community action agendas.

According to the World Health Organization, diarrheal diseases remain the second leading cause of death among children under five worldwide, accounting for approximately 525,000 deaths annually. In Cauca, despite a relatively low mortality rate (2.67), significant inequalities persist between urban and rural areas in access to drinking water and sanitation services ([Gobernación del Cauca, 2024](#)). While urban aqueduct coverage exceeds 75%, rural coverage often remains below 45%, and sewerage coverage is generally under 30%, contributing to increased incidence of waterborne diseases and hygiene-related health problems, particularly child population ([Minvivienda, 2021](#)).

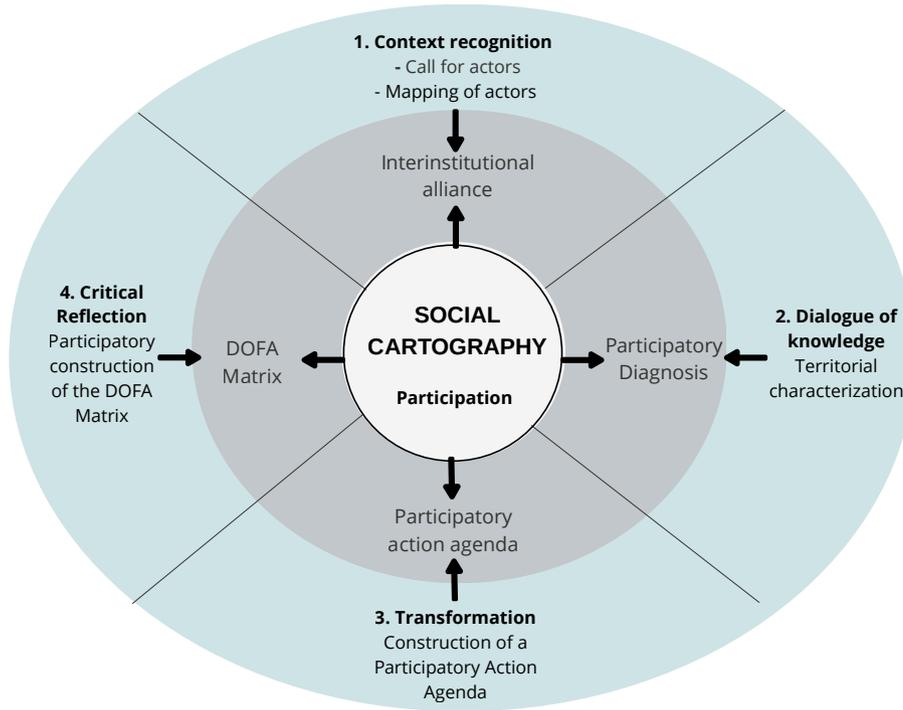
From this theoretical perspective, environmental health, social appropriation of knowledge, and social cartography converge as complementary dimensions of a participatory territorial approach. Environmental health provides the substantive field of analysis; social appropriation of knowledge frames the processes through which communities internalize, reinterpret, and mobilize knowledge; and social cartography operates as a methodological device that articulates both dimensions through collective representation and dialogue. This articulation enables communities not only to identify environmental health problems but also to construct shared meaning.

### 3. Methodology

The [Figure 1](#) summarizes analytical proposal of the relationship of social cartography and principles of social appropriation. The methodological approach for conducting the research.

The research was developed under a qualitative approach, using the methodology of Participatory Action Research ([Cornish et al., 2023](#)). It used social cartography and stakeholder mapping as fundamental dialogical tools to know and understand the territory from a participatory and transformative perspective around water resources and health in rural and peri-urban contexts.

To achieve the construction of knowledge around understanding the complexity of the relationship between health and the environment and to generate actions for transformation, phases were designed based on the principles of the CSA: recognition of the context, dialogue of knowledge, participation, transformation, and critical reflection. The design was oriented to the actors related to environmental health in the territory.



**Figure 1.** Analytical proposal of the relationship of social cartography and principles of social appropriation.

**Note:** Own elaboration.

**Context recognition and knowledge dialogue phase**

To understand the needs, interests, and knowledge of the stakeholders involved, a community and institutional convening strategy was carried out (Table 1), agreed upon under the thematic axis “Water and health.” As a component of the social cartography, a mapping of stakeholders was carried out to identify their level of interest and recognition of their role in the territory regarding water resource management and its implications for collective well-being. This work had two moments. The first was an exercise in which each actor identified their level of interest and the actions of intervention in the territory. In the second moment, in a plenary session, the different stakeholders presented the first exercise and received contributions and observations.

**Table 1.**

Actors involved in the process

Social sector / Actors	Rural area	Peri-urban area
Service company	Public services administrative board.	Public services provider company.
Community leaders	Environmental collectives, boards of community action, local administrative boards.	Environmental collectives, boards of community action, local administrative boards.
Institutions	Planning, agriculture, environmental authority, health.	Planning, agriculture, environmental authority, health.
Academy	Universities in the region.	Universities in the region, High school institutions.

**Note:** Own elaboration.

Subsequently, social cartography was carried out under a participatory diagnostic approach. For this purpose, focus groups were formed with the participation of the stakeholders. In this way, the exchange of knowledge between institutional and community actors was encouraged, i.e., a dialogue of knowledge. In this dynamic, the guidance and intervention of the project's research team ensured the fluidity of the groups' work. The research team designed a guide to questions, [Table 2](#), arranged in three categories: 1. Water resource management, 2. Community organization and participation and 3. Health and environment.

**Table 2.**  
Guiding questions guide

Categories	Guiding questions
Water resource management	What happens to the water in your territory when there are rainy periods? Are there any problems? Are there periods of water scarcity? When do they occur, and how do they affect the community? How is water managed in the community? How is the community involved in the management and protection of water resources? Which sectors (agricultural, industrial, domestic) consume the most water in the region? How is water stored in households? Do they use household water purification methods? Sources of supply How efficient is the existing infrastructure for water supply and sanitation? Is there enough water available to meet the needs of the local population? Sources of contamination What is the current water quality in the main water sources in the community? Do you think the water you consume is safe to drink? What is the status of local aquatic ecosystems, such as rivers, lagoons, and wetlands? What actions are being taken to protect and restore these ecosystems? Are there areas recognized as environmental conservation areas by the State?
Community organization and participation	Are there educational programs on water use and conservation? What significant changes has the community experienced in recent decades? Are there any private, intercultural, or public conflicts in the community?
Health and environment	What diseases are common in your territory? What are the water-related diseases that occur in your territory? In what seasons are there higher rates of diseases in the population? Do you consider that aqueducts have contributed to reducing the recurrence of diseases in the population?

**Note:** Own elaboration.

Subsequently, in plenary session, each group presented the results obtained and presented them to the other groups for their consideration. The information collected through social cartography was validated in the field by the research team through field inspections and interviews with administrators and operators of the supply system as well as with members of the community. Subsequently, this information was systematized according to the categories previously defined in the study.

Transformation and critical reflection phase: to achieve an approach to these two phases, the information obtained was completed with observations and conversations, then systematized and organized. Data processing was carried out based on critical analysis, which made it possible to transform the data collected into graphic representations useful for understanding and acting on the territory. The synthesis of the diagnosed problems was achieved through a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis carried out by the research team. This analysis was presented to the participating actors so that through dialogue and collective reflection mediated by the research team, an action agenda was built around water and health that would contribute to the well-being of the community.

Methodological triangulation was employed to enhance the rigor and validity of the qualitative analysis. Information obtained through social cartography was contrasted with field observations, interviews with

system operators, and sanitary inspections, allowing the verification and enrichment of the collective diagnoses. Additionally, the SWOT analysis was used as a participatory analytical tool to synthesize the identified strengths, weaknesses, opportunities, and threats, facilitating critical reflection and the collective construction of action agendas oriented toward environmental health improvement.

The project's research group is multidisciplinary and is composed of a physician, 6 engineers, 3 biologists, 1 sociologist, and 1 anthropologist, who led the design and execution of the research. This study obtained ethical approval from the Ethics Committee of the Universidad del Cauca, in accordance with Resolution No. 00843, which establishes the scientific, technical, and administrative norms for health research in Colombia.

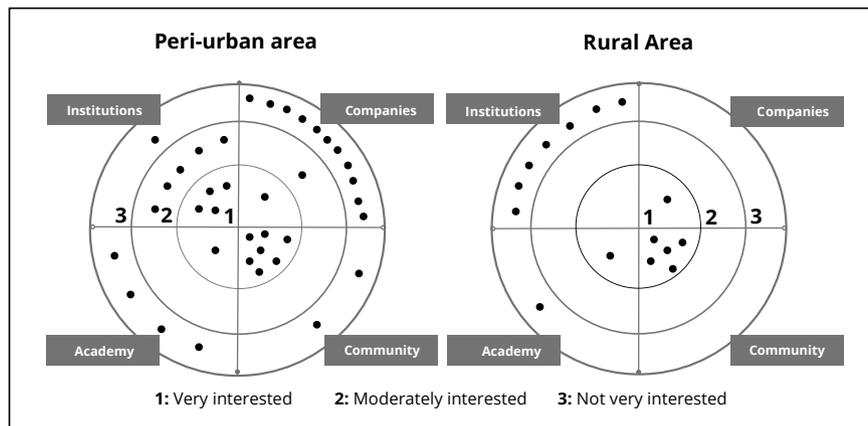
### 3. Results

#### 4.1. Study area

The study area is made up of two communities located in the central zone of the department of Cauca, corresponding to different territorial contexts: a peri-urban zone and a rural zone. The peri-urban zone has a population of 14,917 inhabitants and has an aqueduct system operated by a conventional treatment plant with an operating flow of 45 L/s, which guarantees 83.2% coverage through intra-domiciliary connections in more than 4,600 homes. The rural area is home to approximately 13,000 inhabitants and has an aqueduct system managed by a multistage filtration plant (FIME) with an operating flow of 15 L/s, which achieves 83% coverage and provides service through household connections to 1,667 subscribers ([Yama, 2024](#)).

#### 4.2. Recognition of the context and dialogue of knowledge

The initial phase of context recognition focused on identifying the territorial (geographic and environmental), sociocultural, economic, and political-institutional dynamics that influence the reality of the communities supplied by the aqueduct in the peri-urban and rural areas studied. The call facilitated the active and diverse participation of stakeholders and interest groups linked to both water resource management and health promotion. The participating stakeholders were categorized into four main groups for analysis: public sector, business sector, organized community, and academia. [Figure 2](#) illustrates a comparison of the results obtained between peri-urban and rural areas, showing significant contrasts and similarities in the level of stakeholder involvement in water management processes and perceived health conditions. During the plenary session it was necessary to adjust the mappings, as there were incompatibilities between what was expressed by each sectoral working group and the rest of the groups. Thus, the resulting mapping was the result of discussions and dialogues among the different actors; conflicts regarding the subject were systematically addressed with critical and reflective attitudes, showing the ability to reach agreements and consensus.



**Figure 2.** Stakeholder participation according to level of interest.

**Note:** Own elaboration.

In the peri-urban zone, the institutional presence was mainly characterized by the participation of municipal public entities with competencies in agriculture, environment, and territorial development. The stakeholder analysis, as shown in Figure 2, revealed that these institutions are perceived as having a high level of interest and active involvement in local water management and environmental health processes. Additionally, a moderate interest was identified on the part of some regional entities, suggesting a continuous institutional presence, although not a leading role, with potential for future articulations. In contrast, the rural zone presented significantly limited institutional participation, with most of the municipal and regional entities located at low levels of interest, despite having functional competencies and potentially strategic resources for strengthening the local water supply system. This marked institutional disconnection is identified as an opportunity to work towards environmental and participatory governance in the rural territory.

The service provider sector showed a scarce articulation with territorial dynamics in both zones. In the peri-urban zone, despite the identification of a greater number of business actors, most of them showed a low level of interest, according to the stakeholder analysis. Only one company directly linked to water resource management showed a high level of interest, while other stakeholders showed a moderate level of involvement. This limited integration of the productive sector in institutional and community agendas restricts its potential contribution to sustainability and corporate social responsibility processes. In the rural zone, this disconnection was even more pronounced, which significantly limits the possibilities of multisectoral articulation and co-management of water resources in the rural territory.

With respect to the academic sector, relevant contrasts were observed in the dynamics of participation between the two zones. In the peri-urban area, academic participation was incipient, with only one secondary education institution classified as fascinating, while universities and technical centers showed a low level of involvement (Figure 2). This scenario reveals a significant gap between the higher education sector and the environmental and health issues identified in the peri-urban territory. On the contrary, in the rural context, the active involvement of the departmental public university is highlighted, evidenced in applied research projects that respond directly to the needs of the territory. However, other local educational institutions presented limited participation, which suggests a weak articulation of pedagogical processes with the approaches of sustainability, territorial rooting, and environmental citizenship training from the basic and middle educational levels.

In terms of community participation, contrasting dynamics were observed between the peri-urban and rural zones. In the peri-urban zone, participation is significantly more structured, with the community emerging as the group with the highest number of actors classified as having a high level of interest (Figure 2). Community action boards and various local grassroots organizations play an active and visible role in processes related to water management and public health, suggesting a strong territorial ownership. However, certain relevant actors, such as community mothers and local environmental groups, showed a low level of interest. In rural areas, although community participation was less representative and less structured, its role remains fundamental as a key pillar for strengthening more inclusive, participatory, and sustainable governance, particularly in contexts where articulation with other sectors is limited.

### *4.3. Implementation of Social Cartography and Validation of Results*

Figures 3 and 4 present the results of the social cartography carried out in the field. Table 3 presents the results of the guiding questions.

Social cartography as a participatory technique proved to be useful for integrating local knowledge and technical expertise in the analysis of the socio-environmental dynamics of the territory. The active and committed participation of local stakeholders, previously prepared with stakeholder mapping, facilitated the construction of a collective diagnosis that made visible structural problems, community perceptions, and significant daily practices related to water, the environment, and health.



The validation of the results obtained through the social cartography was carried out through triangulation with field visits and direct inspection, contrasting with the elaboration of thematic maps, as can be seen in [Figure 3](#), and [Figure 4](#). Through the analysis of the thematic categories represented by the communities, significant differences and similarities in water management, social organization, and perception of environmental health were evidenced.

The mapping encouraged the participation of various social sectors, which expressed differences in economic interests, development dynamics, power relations, and demands aimed at improving living conditions and the environment.

The research team continuously and in parallel to the social cartography exercise carried out a sanitary inspection of the systems and interviewed system operators and users. These visits and interviews became an element of information triangulation, which allowed validating the problems identified in the previous stage.

#### 4.4. Transformation and critical reflection phase

Based on a critical reflection analysis of the information obtained, weaknesses and opportunities were identified, constructed through the SWOT matrix ([Table 4](#)).

**Table 4.**

SWOT Matrix (Strengths, Weaknesses, Opportunities, Threats)

Peri-urban zone		Rural Zone	
Weaknesses	Opportunities	Weaknesses	Opportunities
- Limited participation	- Water training	- Deficient infrastructure	- Natural conservation
- Agrochemical contamination	- Conservation potential	- Water scarcity	- Community education and management
- Absent protocols	- Educational leadership	- Domestic treatment	- Water modernization
- Ineffective communication	- Health partnerships	- Insufficient filtration	
- Poor education	- Community reforestation	- Unstable service	
- Restricted conservation	- Environmental education	- Incomplete sewerage	
- Disjointed management		- Multiple contamination	
		- Conflictive urbanization	
Strengths	Threats	Strengths	Threats
- Various water sources	- Rainfall risk	- Organized actors	- Reduced availability
- Community initiatives	- Land degradation	- Active participation	- Sanitary risk
- Home storage	- Anthropogenic pollution	- Strong social Structure	- Water overload
- Active organizations	- Water overload	- Favorable perception of water quality	- Territorial disputes
- Community work			

**Note:** Own elaboration

The integrated analysis of socio-environmental conditions in rural and peri-urban areas revealed a complex panorama that, while presenting significant contrasts in water management structure, social cohesion, and level of institutional intervention. It shares critical environmental threats such as contamination of water sources, deforestation, and vulnerability to the effects of climate change. This convergence of challenges, despite contextual differences, underscores the need for adaptive and participatory management strategies to move towards greater justice and sustainability in water resource management and the promotion of environmental health.

In the rural zone, relatively consolidated community water management was identified, characterized by the implementation of technical advances at the local level and a higher degree of organizational cohesion compared to the peri-urban zone. This social and technical structure represents an important capital for the construction of adaptation processes to environmental challenges and the implementation of improvements in water resource management. However, this zone also faces critical challenges such as unplanned population growth, the proliferation of illegal connections to aqueduct systems, and threats to water ecosystems.

In the peri-urban zone, despite having a more formally established institutional structure through the municipal utility company, it evidenced less cohesive and more fragmented community participation. This situation is exacerbated by the presence of pre-existing social conflicts, the circulation of misinformation, and a climate of distrust towards the managing entities. The perception of health problems directly associated with water quality and inadequate domestic practices significantly raises the level of health risk, especially in the most socioeconomically vulnerable sectors of the population.

#### *4.5. Community Action Agendas: Differentiated and Complementary Strategies*

Faced with this dual scenario, the information gathered through the participatory methodologies constituted an analytical tool for the formulation of a community action agenda aimed at addressing the particularities of each area and complementary to promote synergies and mutual learning. This agenda sought not only to respond to the environmental and health problems identified at present but also to strengthen the endogenous capacities of the communities. It also aimed to promote the creation of strategic alliances with key actors and facilitate shared decision-making based on local knowledge. The results of the phases of recognition of the context and dialogue of knowledge and transformation and critical reflection were the basis for the collective construction exercise that followed.

In the peri-urban zone, priority was given to an action agenda aimed at protecting water resources and improving environmental health at the municipal level. The key actions proposed included the development of awareness campaigns aimed at preventing the dumping of solid waste into water sources and raising the awareness of the inhabitants of the surrounding areas about the impacts of pollution. Community empowerment initiatives were generated, and environmental education was integrated into the school curriculum, promoting water care practices from an early age. In addition, specific training will be provided on the risks associated with the consumption of contaminated water and its relationship with the incidence of diseases such as gastric cancer and dengue fever. The agenda also contemplated the implementation of reforestation campaigns in strategic areas for water protection and periodic analysis of water quality in the rivers and streams of the municipality. Finally, it was suggested the adoption of safe water treatment and disinfection practices at the domestic level by means of accessible home methods, seeking to improve household health.

The rural community defined an action agenda focused on optimizing local water management and promoting environmental health. This agenda began with a participatory contextualization process on the current state of the community water systems, with the objective of informing and empowering the population for action. Awareness campaigns were included to prevent the dumping of solid waste into water sources, with awareness-raising actions organized by geographic zones and villages to ensure greater community outreach and commitment. At the same time, it was proposed to strengthen environmental education in educational institutions and to carry out training on the risks associated with the consumption of untreated water. The agenda would also promote reforestation campaigns in strategic areas for the protection of water sources and the provision of training in domestic water disinfection methods, encouraging safe practices at the family level.

Finally, based on the results obtained, social cartography is consolidated as a key pillar in applied research with a territorial and participatory approach by facilitating the articulation of social and institutional actors in the construction of collective diagnoses and agendas. It also integrates the principles of social appropriation of knowledge.

## 5. Discussion

The research carried out shows the importance of social cartography and community participation in water management and environmental health in rural and peri-urban areas of the department of Cauca. The research falls within the theoretical and methodological frameworks of the Social Appropriation of Knowledge (ASC), sharing epistemological foundations with Participatory Action Research (PAR). As pointed out by [Berkes et al. \(2001\)](#), the active participation of communities in the construction of knowledge about their own realities is a fundamental principle of PRA and a central axis of CSA. Its objective is to democratize knowledge and link it to processes of social transformation ([Minciencias, 2021](#); [Ortega and Marín, 2019](#)).

In this context, social cartography is revealed as a key methodological tool, allowing the collective representation of the territory from local experiences, wisdom, and knowledge ([Barragán, 2019](#)). Far from being just a spatial representation technique, it constitutes a process of critical and collective reflection on the territory ([López, 2018](#)). This, as stated by [Gallardo Milanés et al. \(2020\)](#), enables the exploration of territorial perceptions from the voices of the communities themselves. This approach promotes a horizontal dialogue of knowledge between researchers and community actors ([Pérez, Muñoz-Duque, and Betancur, 2022](#)), recognizing the value of situated knowledge as a basis for understanding socio-environmental dynamics and identifying common agendas for action ([Braceras and Etxebarria, 2012](#)).

The findings of the study are presented and discussed below, considering the principles underpinning the Social Appropriation of Knowledge, highlighting its potential to bring about significant transformations in the territories.

### *5.1. Recognition of the context and dialogue of wisdom: an intercultural approach to knowledge*

Stakeholder mapping and classification by levels of interest is a key tool not only for diagnosis but also for strategic and collaborative action. This methodology allows the identification of gaps, synergies, and different dynamics between rural and peri-urban areas, reinforcing the call for differential and context-sensitive territorial policies. In particular, the contrasts observed in water management, organizational structure, and perception of environmental health underline the need for strategies adapted to each local reality.

These findings are in line with [Rojas and Rincón \(2021\)](#), who emphasize that stakeholder mapping drives participation from the diagnostic phases and strengthens the fabric between government, civil society, and local stakeholders. Likewise, [Mendoza et al. \(2021\)](#) show that the rural aqueducts have their own forms of governance and community organization, which require specific skills in conflict resolution to maintain service provision.

More recent research extends this perspective. For example, [Ricart et al. \(2023\)](#) propose a hydro-social cycle approach that fosters interdependence among actors in urban agroecosystems, which is particularly relevant for understanding water as a socio-technical phenomenon ([Ricart et al., 2023](#)). Likewise, [Ortiz \(2019\)](#) highlight that the sociocultural valuation of ecosystem services in rural contexts reflects local priorities, places water in a web of symbolic and political meanings, and intercultural political demands adapted to the environment. This evidence supports the perspective of dialogue of knowledge and an intercultural approach to knowledge, where the crossover between technical, scientific, and ancestral knowledge enriches the diagnostic process and allows the construction of more relevant and sustainable solutions ([Escobar, 2014](#); [Silva, 2020](#)). In rural and peri-urban contexts such as those of the present study, it is recognized that the goals of territorial social innovation require an inclusive epistemological approach, capable of valuing the diversity of local worldviews.

In a complementary vein, [Figari and Pereira \(2020\)](#) underline the value of mapping as an instrument of collective self-knowledge, showing how its application surprised the participants themselves by revealing the existence of multiple institutions operating in the same thematic field. However, their presence was

unknown to the collective. In line with these findings, in our study the mapping exercise provoked internal reflection processes among local actors, broadening their understanding of the institutional ecosystem and revealing opportunities for collaboration that had not been explored until then. It also promoted a re-reading of the territory from participatory and multi-stakeholder logic.

This type of dynamic reinforces the epistemic and political character of stakeholder mapping as a tool for the democratization of knowledge, which allows the re-signification of local knowledge in dialogue with technical and scientific knowledge. More than a neutral technique, mapping becomes a space for intercultural mediation, in which tensions, alliances, and diverse narratives on water, health, and territory emerge. Recent research has pointed out how these participatory methodologies generate collective learning processes and strengthen organizational and political capacities in communities traditionally excluded from decision-making processes ([Hossen, 2016](#); [Rathwell, Armitage and Berkes, 2015](#)). In rural and peri-urban contexts, where indigenous, peasant, and urban worldviews converge, this approach contributes to the construction of shared frameworks for territorial action sustained by the recognition of epistemic plurality ([Belmonte, Peyloubet, and Pérez, 2018](#); [De Sousa Santos, 2022](#)).

Together, these elements position stakeholder mapping not only as a diagnostic technique but also as a transformative methodological device, capable of articulating local, institutional, and academic knowledge in terms of shared and sustainable territorial agendas.

### *5.2. Social cartography as a tool for raising visibility and validating the territory*

The application of social cartography as a participatory methodological tool enables a horizontal dialogue between technical, institutional, and community knowledge, favoring a deeper, contextualized, and situated understanding of socio-environmental issues. This approach not only made it possible to collectively validate the results of the diagnosis but also to co-construct agendas for territorial transformation from a perspective of environmental justice and epistemic equity. Substantial contrasts were observed between rural and peri-urban areas: in the former, a greater appropriation of water resources and a solid community articulation around water management were observed; on the other hand, in peri-urban areas, participation was more fragmented, with limited incidence of community actors in public management processes.

The integration of local and technical knowledge, triangulated with direct observation, field visits, and the production of thematic maps, made possible a robust collective diagnosis that reflects both differences and convergences in water governance and environmental health. These findings align with what was reported by [Flórez, Velásquez, and Arroyave \(2017\)](#), who highlight that social cartography allows a participatory reading of the context, revealing the social and historical dimensions of environmental problems that are often invisibilized by technocratic approaches. Hastily, [Becerra, Acosta, and Leyton \(2024\)](#) argue that the use of social cartography and participatory diagnostics in rural territories constitutes an effective strategy for the recognition of diverse socio-cultural contexts and for the co-creation of collaborative action agendas ([Hidalgo, Romero and Martínez, 2016](#)). These authors emphasize that this tool makes it possible to identify environmental and intercultural conflicts and to integrate principles of Social Appropriation of Knowledge (SAK) in rural water management.

Likewise, [Gutiérrez and Calderón \(2025\)](#) emphasize that collective water management, strengthened by community organization and environmental education processes, is fundamental for the equitable management of water resources and for generating sustainable social transformations. Recent studies in Latin America have also highlighted how participatory mapping has become a practice of territorial emancipation. This allows communities not only to make their problems visible but also to configure their own narratives in the face of socio-environmental risks and develop capacities for collective action ([Gil and Gómez, 2019](#); [Bustamante and López, 2024](#)).

In synthesis, social cartography is consolidated as a transforming methodological device that, beyond its diagnostic functionality, promotes collective learning processes, community empowerment, and

collaborative construction of situated knowledge. Its implementation contributes to making it visible and validates the territory from an integral, intercultural, and participatory perspective. It also facilitates the identification of environmental risk situations, promotes their reduction through consensual strategies, and mobilizes research and surveillance processes in environmental health. This is done under an approach of institutional and community strengthening for risk management, territorial justice, and eco-social sustainability.

### *5.3. Social transformation and critical reflection: from the experiential to the proactive*

The social transformation process identified in this study emerges because of active involvement, intercultural dialogue, and co-production of knowledge among diverse territorial actors. Facilitated by participatory methodologies such as stakeholder mapping and social cartography, this process allowed the establishment of horizontal relationships that recognize both the negative impacts and the potential of collaborative work on water and environmental health. Throughout the research, multiple structural weaknesses were evidenced, such as low participation in peri-urban sectors, water pollution, limitations in environmental education, and fragmented resource management. Key community strengths were also highlighted, such as the existence of an active social network, diversity of water sources, and organizational experiences that constitute foundations for change.

Recurrent threats such as land degradation, intensive resource use, and urban sprawl contrast with latent opportunities related to ecological conservation, transformative education, and sustainable modernization of water management systems. These dynamics were analyzed in participatory workshops using tools such as the SWOT analysis, which made it possible to transcend deficit-focused approaches and make visible capacities, resources, and ongoing initiatives. In line with these findings, recent studies affirm that the sustainability of water systems in rural and peri-urban territories depends on the strengthening of community capacities. The social appropriation of knowledge and the construction of multi-scale networks between local, institutional, and scientific actors ([Becerra et al., 2024](#); [Silva, 2020](#)).

In addition, research such as that of [Barragán \(2019\)](#) and [Bustamante and López \(2024\)](#) highlights that the genuine involvement of communities in all phases of socio-environmental programs, from planning to evaluation, is indispensable to generate sustainable solutions. Especially in issues linked to public health, sanitation, and watershed protection. The critical reflection promoted in this study, nurtured by social cartography and the exchange of knowledge, facilitated the emergence of collective narratives oriented towards action, favoring the construction of shared agendas for water management and the strengthening of territorial governance.

In this line, the research promoted not only the recognition of problems but also the generation of concrete commitments, the mobilization of strategic capacities, and the collaborative design of territorialized solutions. This confirms that participatory methodologies such as social cartography, SWOT analysis, and stakeholder mapping are key tools to activate collective learning processes, community empowerment, and socio-environmental transformation.

### *5.4. Community agendas: differential and articulated strategies for social change*

The action agendas built in this process reflect differentiated but complementary territorial approaches, deeply linked to the social, organizational, and institutional conditions of each context. In rural territories, community cohesion and organizational experience facilitated collective planning processes and the strengthening of environmental education. In contrast, peri-urban areas face greater challenges derived from social fragmentation, institutional weakness, and limited intersectoral articulation, aspects that hinder the sustainability of interventions.

These findings coincide with [Becerra, et al. \(2024\)](#) and [Guerra \(2024\)](#), who argue that sustainability in water management and environmental health requires not only community participation but also effective

articulation with institutional actors at the local, regional, and national levels. Likewise, [Sarmiento, Castro, Sandoval and Hoberman \(2020\)](#) warn about the difficulty of consolidating participatory processes in environments with low social cohesion, while [Useche \(2012\)](#) emphasizes the importance of technical support and formal governance structures to ensure continuity and legitimacy, especially in expanding peri-urban contexts.

Our research provides updated empirical evidence that confirms the need for tailored strategies and strengthened institutional frameworks that provide continuity to community efforts ([Flórez et al.: 2017](#)). Unlike previous studies, this research offers a comparative and situated view of rural and peri-urban areas of Cauca, integrating tools such as social cartography, stakeholder mapping, and participatory SWOT. The process revealed not only problems but also opportunities for articulation and shared learning among diverse communities. It also contributes to a more precise understanding of the conditions that favor (or limit) the implementation of action agendas in hybrid contexts and with different organizational trajectories.

In this sense, other studies have concluded that, although community aqueducts represent an essential response to the challenge of rural access to water, their functioning is often limited by cycles of informality and institutional precariousness. The need has been identified to implement differentiated interventions that include technical training, financial assistance, and strengthening of conflict resolution skills and participation in territorial decisions. These advances should be developed respecting the community identity to promote sustainable and resilient water governance models ([Muñoz and Estupiñán, 2025](#)).

Unlike previous studies focused exclusively on either rural or urban contexts, this research provides a comparative and situated analysis of rural and peri-urban territories within the same regional setting. Its main contribution lies in the integrated use of social cartography, stakeholder mapping, and participatory SWOT analysis to operationalize the principles of social appropriation of knowledge in environmental health. This approach not only generates contextualized diagnoses but also facilitates the co-construction of differentiated community action agendas, contributing empirical evidence to participatory environmental health governance in the territories.

## 5. Conclusions

This study demonstrates that social cartography constitutes an effective participatory strategy for strengthening community ownership of environmental health in rural and peri-urban territories. Its integration with principles of social appropriation of knowledge facilitated collective diagnoses, enhanced dialogue among actors, and supported the formulation of context-sensitive action agendas focused on water management.

The findings are limited to specific territorial contexts and rely on qualitative participatory methods; therefore, results are not intended to be generalized but rather to inform similar community-based processes. Future research could incorporate longitudinal designs and mixed methods to assess the sustainability of the proposed action agendas.

From a practical perspective, it is recommended to strengthen institutional–community articulation, promote permanent environmental education programs, and incorporate social cartography into local environmental health planning processes as a tool for participatory governance.

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### **Data Availability**

The authors declare that the article contains all the data necessary and sufficient for understanding the research.

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The authors declare that there is no potential conflict of interest related to the article.

### **Disclaimer**

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