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Transforming cities into sustainable and healthy territories starts with the "Culture of water": learning from traditional peoples and communities of the Carapitanga river basin

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Introduction: In a world where one in four individuals lacks assured access to water, this article investigates how the experiences of Traditional Peoples and Communities (TPCs) can serve as a guiding light in the search for solutions to water disparities, exacerbated by global warming. The study focuses on the microterritory known as Carapitanga in Paraty, Rio de Janeiro, Brazil, where the presence of indigenous, quilombola and caiçara communities highlights the significance of territorially-based and nature-focused solutions.

Methods: The research utilises the Ecology of Knowledge and Action Research as methodological pillars to investigate the Water Culture of TPCs and its impact on the Hydrosocial Cycle.

Results: The study reveals that the Water Culture of TPCs stimulates actions that propel balance in the Hydrosocial Cycle. This knowledge casts new light on the governance of water and sanitation.

Discussion: The findings offer alternatives anchored in the concept of Buen Vivir and the recognition of water as a fundamental source of life for cities worldwide. This not only contributes to the understanding of water resource management but also presents potential solutions for global water access disparities.

KEYWORDS

water culture, *Buen Vivir*, traditional peoples and communities, water governance, society-nature relations

1 Introduction

This article examines how the experience of Traditional Peoples and Communities (TPCs) can contribute to reversing the scenario of water inequality intensified by global warming. It argues that in the quest for solutions to urban socio-ecological issues surrounding water and sanitation, one can learn from the place-based solutions developed through a pioneering and unique initiative that unites strategies from a public institution of science, technology, and innovation (the

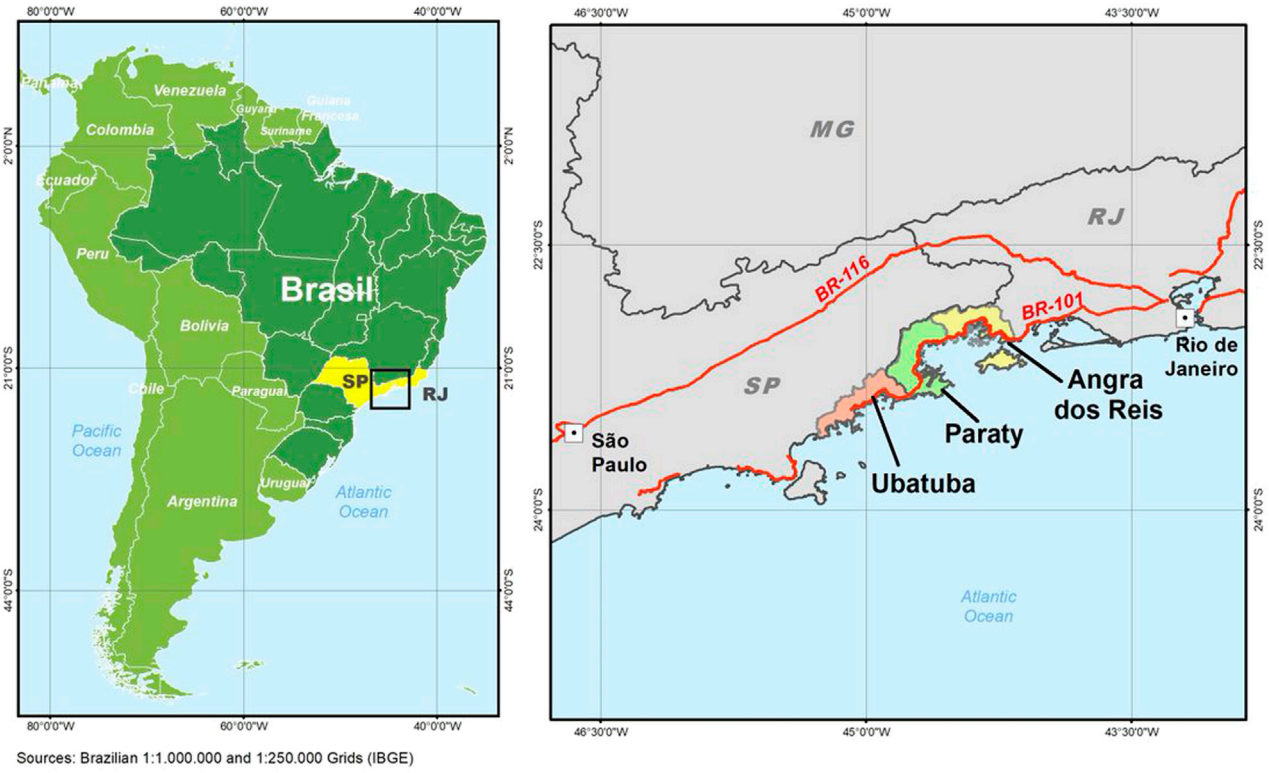


FIGURE 1
Location of the learning territory - Bocaina Mosaic (Provided by OTSS, 2023). Images provided by OTSS; we express our gratitude for their contribution.

Oswaldo Cruz Foundation–Fiocruz, associated with the Ministry of Health of Brazil) and a social movement (the Forum of Traditional Communities of Angra dos Reis, Paraty, and Ubatuba (FCT) involving indigenous, caiçara, and quilombola groups) which together establish the Observatory of Sustainable and Healthy Territories (OTSS).

Recognized as a standout initiative among others that contribute to the implementation of the 2030 Agenda, in 2020 it was chosen as a "Transformative Investment for Sustainable Development" by the Economic Commission for Latin America and the Caribbean (ECLAC-UN); in 2021, it was selected as one of the 10 most innovative solutions for the implementation of the 2030 Agenda in Brazil by the Civil Society Working Group for the 2030 Agenda, as well as first place in the "Sustainable and Healthy Territories" category at the first showcase of experiences in Environmental Health by the Pan American Health Organization (PAHO-UN); in 2023, it was awarded second place at the 27th Innovation Week of the National School of Public Administration of the Ministry of Management and Innovation of Brazil (ENAP-MGI). Since 2022, the OTSS has been conceived as a "Collaborative Laboratory–Colab" within the context of the K4P Alliances Program–Knowledge for People, the Planet, and Prosperity through Partnerships, an international strategic network that brings together over 20 institutions from across the Atlantic, with the aim to stimulate institutional collaboration and initiatives geared towards achieving carbon neutrality by 2050 through sustainable long-term pilot projects in Latin America and Africa that foster research and innovation activities with the active participation of local communities.

The OTSS is is territorially located on the southeastern coast of Brazil, within the Bocaina region, a biodiversity hotspot and the most extensive remaining section of preserved Atlantic Forest between the states of São Paulo and Rio de Janeiro. This region encompasses the Mixed World Heritage Site of Paraty and Ilha Grande, recognized by UNESCO in 2019.

Figure 1: Location of the Learning Territory Mixed World Heritage Site of Paraty and Ilha Grande (Provided by OTSS, 2020). Images provided by OTSS; we express our gratitude for their contribution.

Beyond the Mixed World Heritage Site, the OTSS operates within the municipalities of Mangaratiba (RJ), Angra dos Reis (RJ), Paraty (RJ), Ubatuba (SP), Caraguatatuba (SP), São Sebastião (SP), and Ilhabela (SP), which are home to over 200 traditional indigenous, quilombola and caiçara communities (Figure 2). The entire territory, across its seven municipalities, has a total population of 636,141 inhabitants[1], which can seasonally triple during holiday periods and summer months.

1 Data referring to the estimated population in the year 2021, accessed through the IBGE website https://cidades.ibge.gov.br/brasil on March 28, 2023.

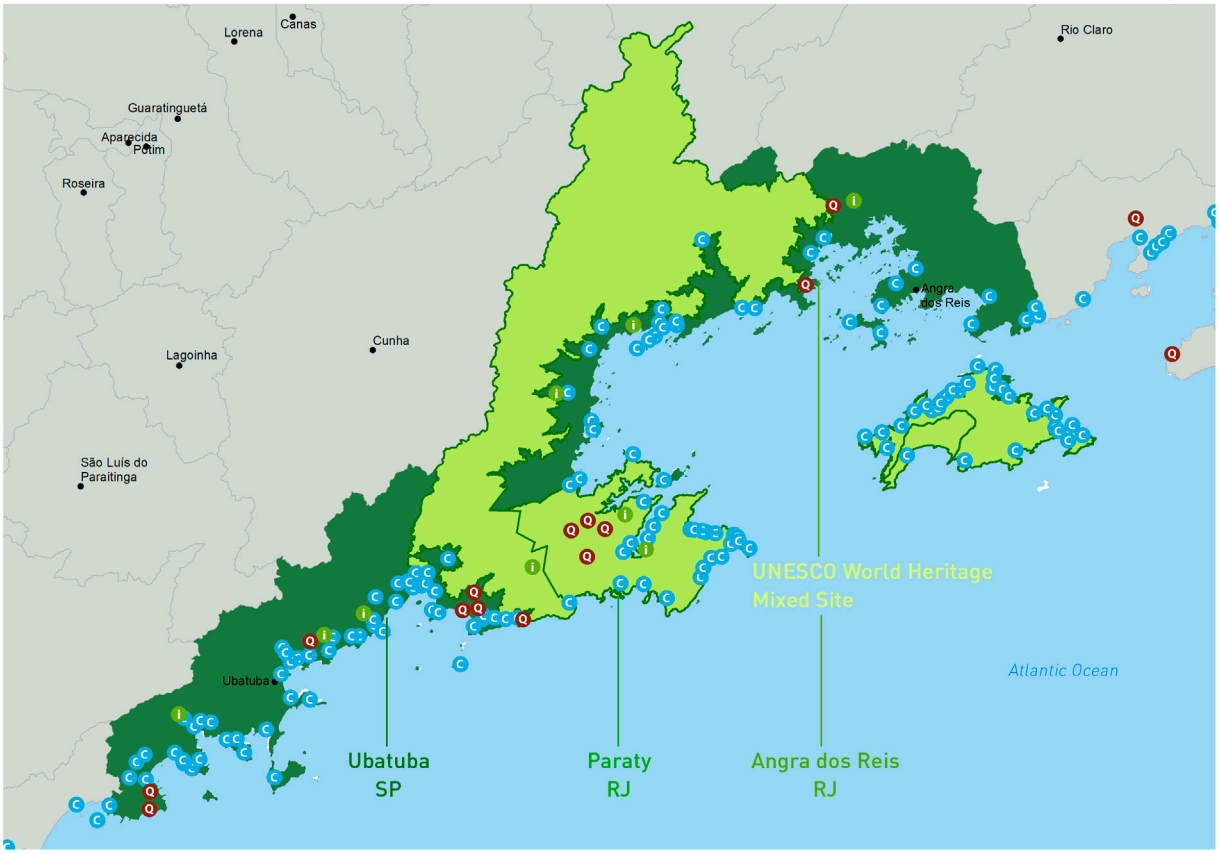


FIGURE 2
Location of the Mixed World Paraty and Ilha Grande Heritage Site Learning Territory (Provided by OTSS, 2023).

Figure 3: Traditional Communities in the OTSS Operational Territory (Provided by OTSS, 2020).

The OTSS acts through networks that implement living governance[2] to identify priorities based on the territory and the needs expressed by its communities, conduct situational analysis, pinpoint challenges, develop solutions, design scenarios and strategies, monitor their implementation, adjust plans to situational changes, and evaluate their effectiveness.

This whole process is initiated by the traditional communities that exist along the southern coast of Rio de Janeiro in Brazil. These communities share the same territory (rivers, sea, springs, waterfalls, forests), so for the territorially-based actions of the OTSS were organized into Microterritories (MTs), smaller spatial units of territorial management, primarily defined according to the sociohistorical relations of exchange and solidarity among traditional communities—as an integrative scale of governance and management.

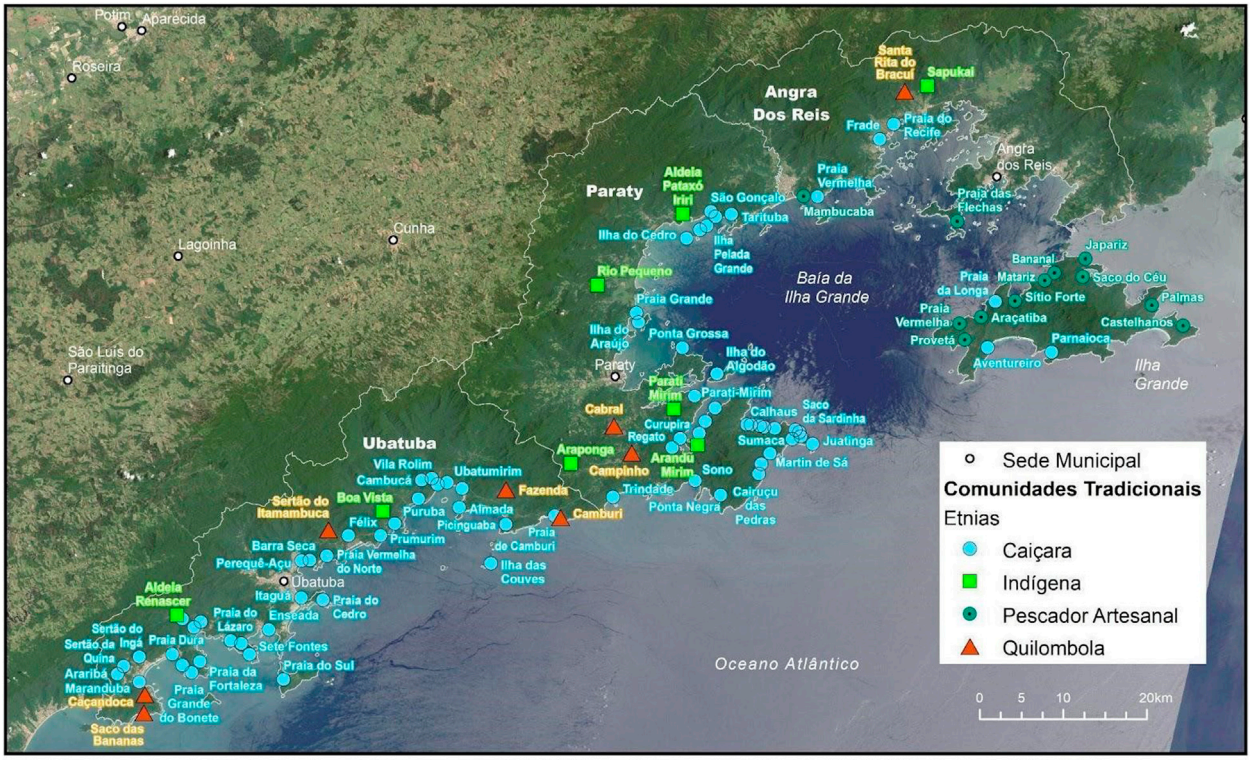
Figure 4: Bocaina's Traditional Communities (Provided by OTSS, 2020). Images provided by OTSS; we express our gratitude for their contribution.

Through flexible movements and based on pacts of autonomy and accountability (Gallo, 2021; Gallo et al., 2006), these MTs aim to transition from the hegemonic model to arrangements that strengthen and update traditional solidarity modes of production and consumption, as well as the critical appropriation of space. Social technologies are thus developed to articulate, strengthen, and contribute to community businesses and governance, fostering a conscious and emancipatory production of the territory (Gallo and Nascimento, 2019).

The OTSS employs the Learning Territories (Gallo, 2021) approach, which are distinct territorial scales conceived as open-air laboratories for the application of social technologies, within one or more communities, to facilitate exchanges, practical and extension activities. Learning Territories are important spaces for formative action, based on the dialogue between traditional and scientific knowledge in the fields of collective health, solidarity economy, sustainability, and socio-environmental justice.

This article focuses on the Learning Territory known as "Carapitanga" located in Paraty, a municipality in the state

2 The approach was developed by the Observatory of Sustainable and Healthy Territories (OTSS) and is grounded in the framework of critical and humanistic geography (Santos, 1986; Castells, 2000; Tuan, 2013), combined with the theory of social production (Matus, 2005), the theory of communicative action (Habermas, 1987a; Habermas, 1987b), and the pedagogy of autonomy (Freire, 1996).



Fontes dos Dados: Base Cartográfica Contínua do Brasil na escala 1:250.000 (IBGE); Comunidades Tradicionais: OTSS/FCT Anra, Paraty e Ubatuba/Fiocruz; Imagem: Landsat-8 image courtesy of the U.S. Geological Survey

FIGURE 3
Traditional communities in the OTSS operational territory (Provided by OTSS, 2023). Images provided by OTSS; we express our gratitude for their contribution.

of Rio de Janeiro, Brazil. Within this Learning Territory, indigenous, quilombola, and caiçara communities exist and resist, integrating practices and knowledge that underscore the importance of nature-based territorial solutions in a global scenario, where Carrington (2023) emphasizes that the Earth's vital signs are in a worse state than at any other time in human history.

Drawing on lessons from the TPCs of Carapitanga, an evaluation was conducted to ascertain how Water Culture and the Hydrosocial Cycle in cities can be used as a strategy to (re) create new ways of relating to water bodies and drive an ecological transition that reverses socio-environmental inequalities.

Specifically regarding water bodies, the reality is that one in every four humans globally is not guaranteed the right to water. This situation worsens when we observe in Brazil the death of 83,000 km of rivers, equivalent to the combined length of the world's 17 largest rivers (Resk, 2019).

In light of this reality, it is imperative to adopt more decisive political measures to mitigate human impacts on ecosystems and promote equity in the governance of water bodies. Lenton et al. (2023) indicate that by the end of the century (2080–2100), one-third (22%–39%) of the population may be excluded from an environment considered habitable, if current global warming policies of 2.7°C persist.

Inequality prevails when the emissions generated by approximately 1.2 average U.S. citizens will be capable of exposing populations, such as the Traditional Peoples and Communities (TPCs) of regions where emissions are half the global average, to unprecedented heat by the end of the century. But when it comes to water governance, what could contribute to reversing the current scenario?

1.1 Buen Vivir

The concept of Buen Vivir (Good Living or Living Well, in an attempt to translate it into English), represents the worldviews constructed by the highland peoples of the Andes, which were fought against by colonialism, patriarchy, and capitalism. It can be understood as a translation of the indigenous Aymara categories "Suma Qamaña" and Quechua "Sumak Kawsay"[3] or "Allin Kawsay." In literature, other meanings are found; in Guarani, "Teko Kavi" means "good life" and "living well (respecting life)." For the Embera people of Colombia, Buen Vivir means to live in harmony among all, in a sense of community.[4]

3 Estermann, 2012.

4 Alcantara & Sampaio, 2017, 4

FIGURE 4
Bocaina's traditional communities (Provided by OTSS, 2023). Images provided by OTSS; we express our gratitude for their contribution.

Buen Vivir is comprehended as a cosmology[5], a philosophy of life[6], an ontology[7], a development model[8], an attitude towards life[9], and as an alternative to development[10]. The value of water for original communities, through knowledge exchange, has allowed for a broader formulation of water besides a Human Right (HR): water as a source of life. Understanding this requires an exercise in decolonization and deconstruction of the Imperial Way of Life[11]. In this rationality, it is not possible to separate humans from nature, nor is there a desire to dominate it to serve humanity's interests or manipulate it. Far from defending ownership or domination, a territoriality is constructed through curiosity and love[12].

The formulation of Buen Vivir reaffirms the need to rethink sustainability based on nature's capacity for use and resilience, analyzed from a new ethic of life organization, since for this rationality "development and progress" lead to a disastrous dead-end path.

An important challenge is to give concreteness to the concept through plural dialogue and territorialized practice, to fight and remedy environmental destruction, damage caused, and the inequality established by developmentalist ideology and the Rationality of Capital (Borges, 2023). In this sense, Buen Vivir is presented as a local initiative and complementary to European currents that support the theory of degrowth.

It is identified that the central idea of Buen Vivir serves as the foundation in the Learning Territory, promoting a distinct approach to living and understanding the world, with a focus on people's lives, with centrality to Pachamama[13] and water itself. As a result of the bibliographic research, we find that this same conception is reflected in international laws, such as the Constitutions of Ecuador (2008) and Bolivia (2009), which prohibit the privatization of water and are considered relevant international milestones in the approval of the Human Right to Water and Sanitation (HRWS)[14].

1.2 Water culture

Theoretical reflections are presented based on Borges (2023) and Vargas (2006), agreeing on the necessary paradigm shift in relation to water, stemming from a (re)connection with the Culture of

5 Walsh, 2010
6 Acosta, 2010
7 Thomson, 2011
8 Radcliffe, 2012
9 Cortez, 2011
10 Gudynas, 2019
11 Brand & Wissen, 2021
12 Acosta, 2010

13 Mother Earth
14 Portanov, 2011

Water, which is the Culture of Life as the central axis of a new governance process seeking paths to Water Security in social and environmental harmony.

Water Culture is the meeting point between natural elements (ecological system and its geomorphological, edaphological, biological, climatic subsystems, and their variations) and social elements (cultural and sociopolitical matrices) that acquire an integrative dimension in the Matrix of Human Needs and Satisfiers in Water Culture (Vargas, 2006).

Vargas (2006) proposes in each territory the formulation of the Matrix of Human Needs and Satisfiers in Water Culture[3], which can be applied as a methodology to reverse the chaotic reality experienced in Latin America, where despite having the largest *per capita* freshwater availability in the world with 20% of the global total, it is the continent with the greatest injustice regarding water on the planet (Barlow, 2015).

This represents a project for the future that allows us to move from centuries of delay to build our own history and uniqueness in our cultural sources and origins, working to reverse the damages from the colonization of water.

Water Culture refers to the symbolic representations, values, practices, and social perceptions related to water within a given society. Building upon Vargas (2006) and Borges (2023), Water Culture involves the different ways in which water is understood, valued, and utilized by social groups, considering their historical, cultural, economic, and environmental aspects.

It is stated that there is a process of desertification of the meanings of water, resulting in its devaluation and loss of associated meanings, culminating in an exhaustion of symbolic and cultural values attributed to it. In this context, the need for an approach that rescues and reaffirms the importance of these meanings and values is highlighted, promoting a broader and more conscious understanding of water's vital role in different sociocultural contexts (Borges, 2023).

Water Culture is intrinsically linked to "Buen Vivir," as it recognizes water not only as a vital resource, but as an element that sustains both physical and spiritual life. In various communities, a respectful and harmonious relationship with water is foundational to Buen Vivir, reflecting sustainable practices, deep connection with nature, preservation of cultural identity, and the construction of more balanced and conscious societies. Thus, preserving water is an essential path for the full flourishing of communities and a harmonious ecological transition.

1.2.1 Water culture or new water culture: conceptual intersections

The call for a New Water Culture has emerged in various countries, advocating for the construction of citizenship in relation to Water Policy and its governance in a democratic and participatory manner, replacing clientelist practices with a new Water Culture (Martínez Gil, 2008).

According to Gómez Fuentes (2012), the concept of the New Water Culture was coined by Martínez Gil and was further developed by Federico Aguilera Klink and Pedro Arrojo Agudo. Both authors were significant participants in the movement of those affected in Spain in the early 1990s, who opposed the National Hydrological Plan which involved the construction of a large number of dams and the diversion of the Ebro River.

Ten years later, the "Plataforma en Defensa de l'Ebre" was established in Tortosa and considered a landmark in the protests against inter-basin water transfers in Spain. With the success of the mobilization and the abandonment of the transposition project in 2004, the New Water Culture "[.] was valued as a reference of principles and alternative foundations to the dominant logic of water management in Spain, gaining international notoriety" (Magalhães, 2017, p. 5).

The manuscripts prepared by Martínez Gil were published in a book entitled "La Nueva Cultura del Agua en España," edited in 1997 by Bakeaz and the spanish Coordinator of People Affected by Large Dams and Water Transfers (COAGRET). Martínez Gil (1997) went beyond the issues of the particular territories of conflict and advanced in formulating the logic that permeates public water policies in Spain, based on the Rationality of Capital.

Martínez Gil (2003) leads us to question whether the value of water is merely that of a resource and what alterations to water bodies would be morally permissible?

The differentiation between "Water Culture" and "New Water Culture" may be subtle, but it entails specific conceptual and historical connotations within the Spanish context. The following are some of the distinctions:

a) Water Culture: As proposed by Vargas (2006), the concept of Water Culture underscores the significance of the interplay between water and society. It emphasizes the imperative for dialogue among disparate knowledge systems, acknowledging the plurality of methods in addressing water-related issues. This notion includes the view that water transcends mere resource status, representing a fundamental facet of life, cultural identity, and community heritage.
b) New Water Culture: Introduced by Martínez Gil, Federico Aguilera Klink, and Pedro Arrojo Agudo within the Spanish milieu, the "New Water Culture" (also referred to as "Nueva Cultura del Agua") emerged as a reaction to contentious water policies in Spain during the 1990s.

It originated as a movement opposed to the Ebro River diversion and the construction of numerous dams, advocating for a more sustainable and participative approach. It gained international prominence after successful mobilizations against unsustainable projects, becoming a benchmark for alternative water management approaches.

In summary, the relationship between the "New Water Culture" and "Water Culture," as outlined by Vargas (2006), underscores the importance of dialogue and recognition of the diversity of approaches in managing water bodies. By promoting the rationality of Water Culture, there is an effort to construct a new territoriality, moving away from positivist approaches that deny traditional knowledge in favor of the commercial efficiency of water.

Water Culture is perceived as a vital component of collective culture, whose democratization is central to ensuring lasting peace. In the face of climate change, the concept of "Buen Vivir" challenges

centralized water management models, offering viable alternatives amidst extreme challenges.

At an intersection, we identify the quest to break with capital-centric logic, highlighting the importance of participatory democracy in water governance. To overcome inequalities, valuing Water Culture emerges as a powerful tool, enabling citizen empowerment in the search for sustainable solutions. For the exercise of understanding the Learning Territory, it is crucial to break with paradigms that marginalize local knowledge, acknowledging cultural diversity.

The proposal for an Interconnected System for the Water Culture Matrix from a Learning Territory, presented in the following chapter, builds on Vargas's (2006) work with the Matrix of Human Needs and Satisfiers in Water Culture. This approach offers a path to equitably consider traditional knowledge in addressing water challenges, thus transcending a unified vision of power and contributing to the construction of a democratic water culture and to mitigating climate change in a context of planetary transition.

1.3 Hydrosocial cycle

The hegemonic conception reproduces a Water Cycle that is devoid of human influence, as if its phases were disconnected from the ecosystemic context: Evaporation, Condensation, Precipitation, Infiltration, Runoff, Transpiration, and Evapotranspiration. This article contends that one cannot discuss this cycle without acknowledging that it occurs within ecosystems and is subject to both direct and indirect influences from the productive system and social relations.

Figure 5: Water Cycle (adapted from Dennis Cain/NWS.) https://www.noaa.gov/education/resource-collections/freshwater/water-cycle.

Conversely, the Hydrosocial Cycle (HC) recognizes that the Water Cycle is in constant interaction with social, economic, and ecological systems, both directly and indirectly. It underscores the intricate relationship between human activities, water governance, and natural ecosystems.

Swyngedouw (2019) suggests a redefinition of the relationship with water, presenting an analytical framework that dissects the intricate interactions between the natural and social facets related to water. This framework involves processes and relationships that shape the availability, distribution, access, and utilization of water in a specific society. Consequently, the molecular composition of water, H2O, is susceptible to societal influence and can become polluted, contaminated, or alternatively, restored. The process of water degradation or remediation is not solely dependent on technological interventions but is fundamentally influenced by power structures. Treated water is employed both by the productive system and power structures and is processed to stimulate economic activities and support the capitalist system.

Swyngedouw (2004), p. 68 questions the concept of "water scarcity" through a case study of Guayaquil, positing that this scarcity is "socially and politically constructed" rather than being a result of environmental or production limitations. He argues that the volume of water produced would be adequate for "a daily *per capita* consumption of 220 L".

The author concludes that Guayaquil's water supply infrastructure ensures high-pressure and high-quality water in areas near to reservoirs, while regions further away experience diminished pressure and a supply restricted to mere hours a day (Swyngedouw, 2004). Through this analysis, it becomes apparent that there is a process of water appropriation by a financially privileged minority, which simultaneously results in the dispossession of others. This process is inherently non-neutral.

Understanding water and its flows through the prism of social relations enables a critical examination and questioning of prevailing concepts such as water scarcity or surplus. It necessitates a focus on the dynamics of power, including the discourses and practices within territories Otero et al. (2011), p. 129) consider that the presence or absence of water scarcity is actually the result of negotiations over "[. . .] alternative visions of the future and which [among these visions] will prevail."

2 Materials and methods: case study in the Carapitanga river basin

The Carapitanga river basin was employed as a Learning Territory, connecting four traditional communities, namely, Tekoa Araponga; Quilombo Campinho da Independência; Tekoa Itaxi Mirim; and the Caiçara Community of Parati-Mirim.

The decision to undertake a case study in the Carapitanga river basin was anchored in the need for an in-depth and contextualized comprehension of the dynamics of Water Culture and the Hydrosocial Cycle, specifically from the viewpoint of Traditional Peoples and Communities (TPCs). The case study provides an investigative methodology that allows for a detailed analysis of the interactions between traditional communities and their specific water environment, acknowledging the distinctiveness of Carapitanga as a learning territory that includes four communities from different ethnic backgrounds, enabling insights into the challenges associated with the Hydrosocial Cycle in urban settings.

Figure 6: Social Cartography of the Carapitanga Microterritory (OTSS, 2020, p. 20).

The structure of this article is based on the concepts of Water Culture and Hydrosocial Cycle. Regarding methodology, a participatory Action Research approach was adopted, in conjunction with an Ecology of Knowledge framework. This was conducted in the context of the exchange between the Observatory of Sustainable and Healthy Territories and the State University of Northern Rio de Janeiro Darcy Ribeiro, with the aim of identifying the Water Culture of the TPCs within the Carapitanga basin, as part of Borges' (2023) doctoral thesis and the social technologies developed by OTSS concerning the potential of nature-based solutions and the teachings of TPCs from the Learning Territory.

Through interviews, previously authorized by the Forum of Traditional Communities of Angra, Paraty, and Ubatuba (FCT), which together with the Brazilian Research Ethics Committee allowed access to traditional territories and the conduct of semi-structured interviews with five women from each traditional community, totaling 20 interviewees from quilombola, indigenous, and caiçara communities within the Carapitanga Territory. It is worth noting that women were chosen for the interviews due to literature indications that they are the most

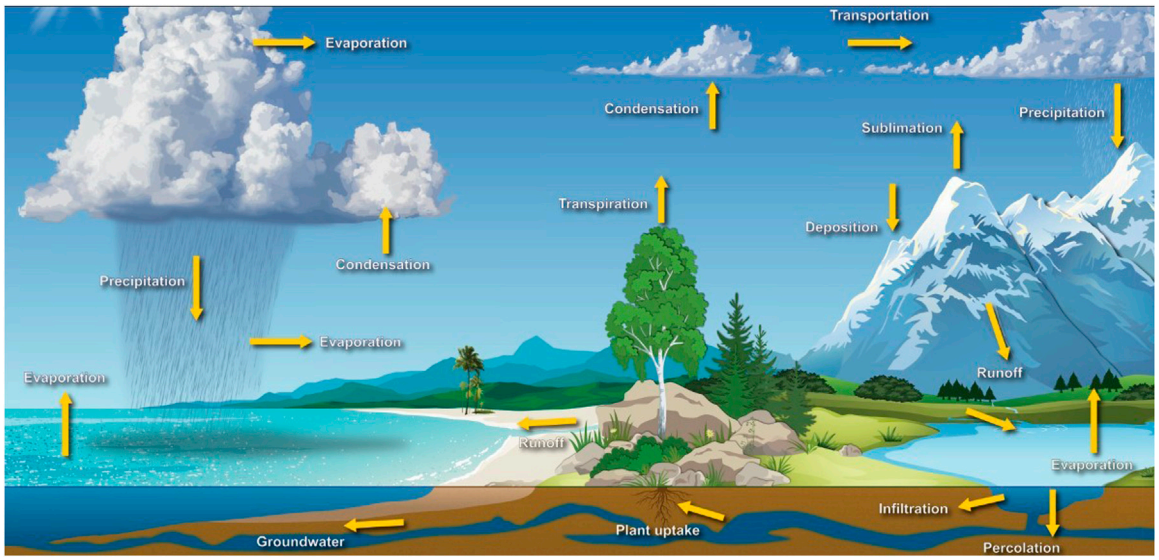


FIGURE 5
Water Cycle (Cain, NWS, 2022).

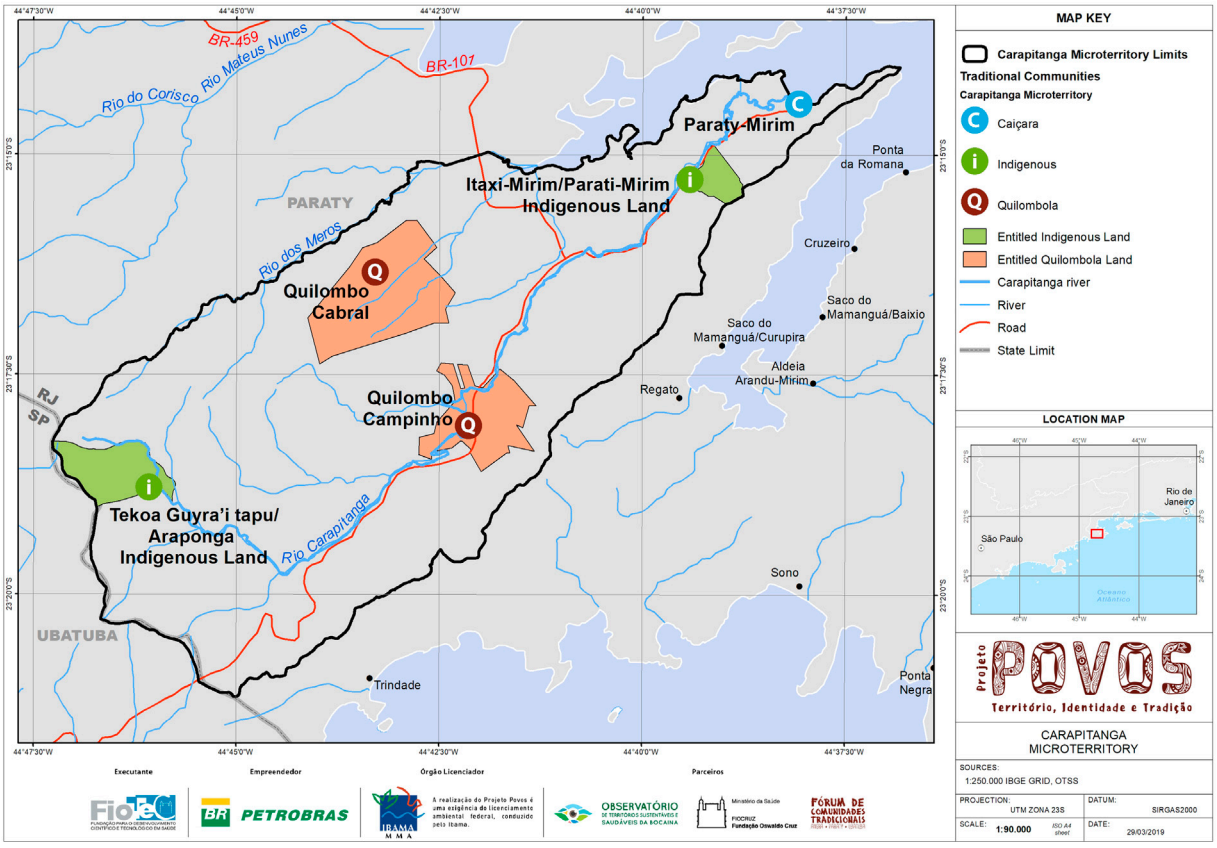


FIGURE 6
Social cartography of the Carapitanga microterritory (OTSS, 2020, p. 20).

TABLE 1 Interviews by community and authorization to record [adapted from Borges (2023)].

Community	Did not authorize recording or dissemination	Authorization only to record	Authorization to record and disseminate	Total interviewees
Tekoa Araponga	2	2	1	5
Tekoa Itaxi Mirim	0	4	1	5
Quilombo Campinho da Independência	3	0	2	5
Caiçara Paraty Mirim	0	3	2	5
Total Overall	5	9	6	20

TABLE 2 Interviews with experts by area, both scientific and traditional [adapted from Borges (2023)].

Area	Community expert	Academic expert	Total
Health	1 expert in Ecological Sanitation	1 physician	2
Environmental Governance	3 Environmental Educators (1 Guarani and 2 quilombolas) female leadership of the FCT	1 lawyer and 1 ICMBio officer	5
Total Overall	4	3	7

affected when there are violations of the right to water and sanitation.

Furthermore, seven academics (comprising two men and five women) were interviewed. A total of 27 individuals were interviewed, out of which 6 authorized recording—one from Araponga Community; two from Quilombo Campinho da Independência; one from Tekoa Itaxi Mirim; and two from the Caiçara Community of Paraty Mirim, as can be followed in Table 1:

To integrate scientific and traditional knowledge, the ecology of knowledge approach (Santos, 2010) was considered, identifying "OTSS experts" as people with recognized expertise and organizing them into "community experts" (when they are indigenous, caiçara, or quilombola, and therefore belong to a traditional community) and "academic experts" (wh they have formal technical-scientific training and do not belong to a traditional community). Intervews were conducted with four "community experts" and three "academic experts," as shown in Table 2.

All the interviews were conducted as part of Borges's doctoral research, which aimed to identify the relationship between the Water Culture of Traditional Communities and the guarantee of the Human Right to water and sanitation, with a special focus on women. The study involved a total of 27 interviews with members of traditional communities and academics.

The objective was to integrate scientific and traditional knowledge to comprehensively address the subject matter. We hope these additional details clarify your query satisfactorily. Please feel free to reach out if you have further questions or require additional clarification.

The bibliographic analysis was conducted as a Narrative Review, an approach in which existing literature is reviewed and synthesized based on the research objective to identify trends, gaps in knowledge, and emerging perspectives related to the topic at hand (Richard, 2001).

In this sense, the analysis involved reading, listening, and critically observing various materials collected (such as texts, videos, podcasts, pamphlets, teaching materials, presentations, cartography, OTSS reports, etc.), as well as secondary data provided by the Observatory. This was done to examine how the experiences of the TPCs can serve as a reference in addressing water inequality exacerbated by global warming.

3 Results

3.1 The Carapitanga river and its connections with the Maritory: connecting the lands of traditional peoples and communities

The potential for elaboration was identified as a way to challenge dominant power structures, deconstruct oppressive narratives, and build more equitable relationships with water and among people. It is an invitation to a continuous process of learning, dialogue, and action in pursuit of water management that promotes social justice, environmental sustainability, and the valorization of the multiple cultures that comprise our Learning Territory.

In Tekoa Guyraitapu Pygua, also known as Tekoa Araponga, lies the source of the Carapitanga River, a watercourse of extreme significance for the approximately 15 families of the traditional Guarani Mbya community.

This river flows through wells, providing water for the 180 families that make up the 13 family units of the Quilombo Campinho da Independência. It then reaches Tekoa Itaxi Mirim[15], known as Paraty Mirim, where it serves approximately 260 people from 49 families. Ultimately, the Carapitanga discharges into the sea at the Caiçara community of Paraty Mirim, representing a space for learning, sustenance, and income for many of the 32 Caiçara family units in the area.

15 From this point forward, it is referred to as Itaxi or Itaxi Mirim to avoid confusion with the name of the Caiçara community.

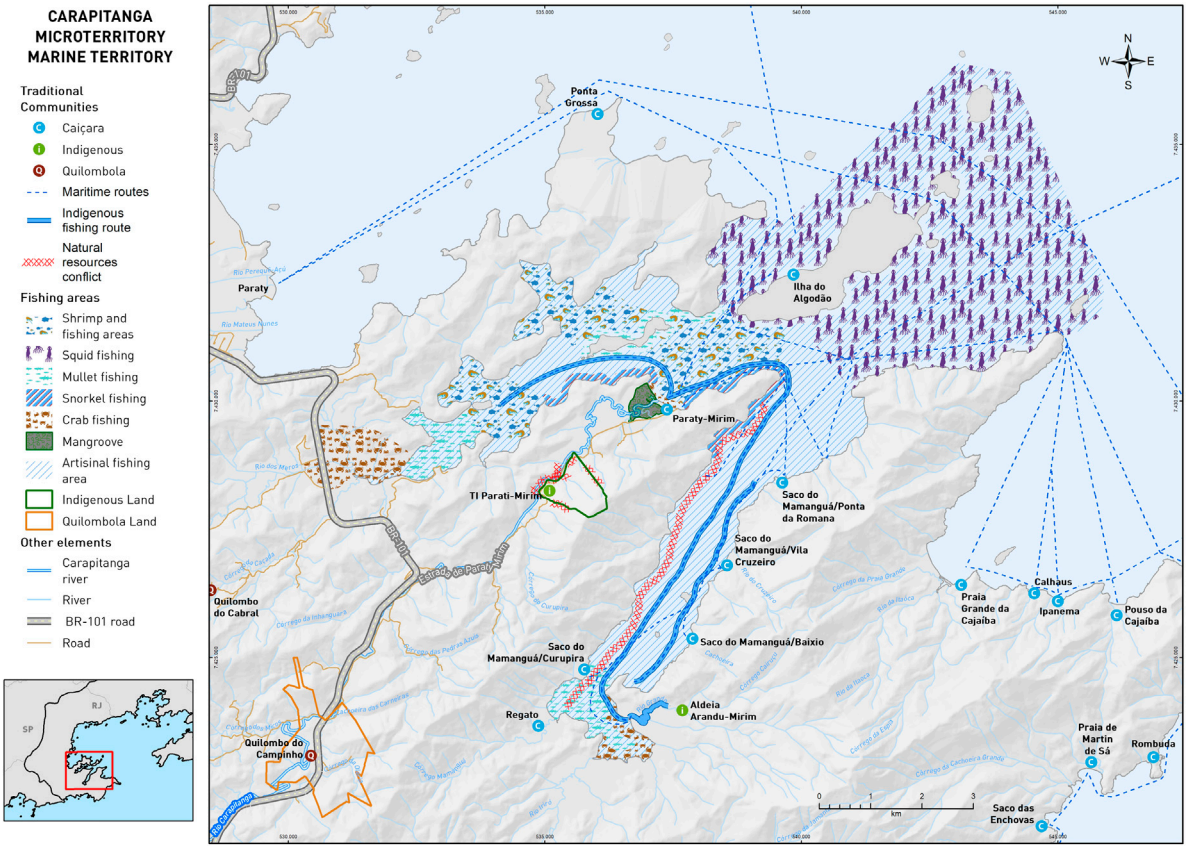


FIGURE 7
Maritory of the Carapitanga microterritory (OTSS, 2020, p. 88).

It is noteworthy that Quilombo do Cabral, not being situated along the Carapitanga River, was not included in this study. By highlighting the Carapitanga River and the TPCs from whom we learned, this research emphasizes the significance of this water body as an essential territory for the life of traditional communities. This perception allows an appreciation and acknowledgment of the profound interconnection between water bodies and nature, underscoring the need for an integrated, holistic, and sustainable approach to democratic water governance and preservation of traditional identities and knowledges.

All traditional communities have a direct relationship with the river, and in all interviews, the individuals were knowledgeable about the river's source and could trace its journey to the sea, highlighting the connection between the river and the sea as territories for learning and transmitting ancestral knowledge.

Termed as "Maritory" (OTSS, 2020), this intersectional territory between land and marine environments is considered a fundamental space in Water Culture, where the communities maintain a vital connection with aquatic resources.

Figure 7: Maritory of the Carapitanga Microterritory (OTSS, 2020, p.88).

In this context, the "maritory" serves as a center of learning, where the transmission of knowledge is essential. Generations share knowledge about fishing, swimming, net casting, and rowing, forming traditions that are fundamental to both subsistence and cultural identity. Moreover, the "maritory" is a space for leisure and relaxation for the local community, offering significant recreational activities.

Its importance extends beyond material aspects to encompass spiritual and religious dimensions, with the sea often regarded as sacred, influencing cultural practices and rituals.

However, the "maritory" is also a scenario for conflicts arising from distinct projects. Large-scale ventures, like oil exploration often clash with the traditional practices of local communities. This dispute is not merely over resources, but involves contrasting worldviews and societal projects, resulting in inequalities, diverse forms of rights denial, and segregation led by initiatives of the Brazilian state and capital agents, such as:

- Expansion of the BR 101 Highway: This development has contributed to the pollution of all rivers in the Maritory, including Carapitanga, due to haphazard urbanization around traditional territories, causing a deterioration in the living conditions of local communities.
- Pre-salt oil extraction: The exploitation of pre-salt reserves in the country's largest offshore sedimentary basin, spanning over 350,000 square kilometers, leads to significant conflicts between capitalist interests and traditional communities, impacting both the environment and these communities' ways of life.
- The operations of Angra 1 and two nuclear plants and the construction of Angra 3: The operations of nuclear plants and

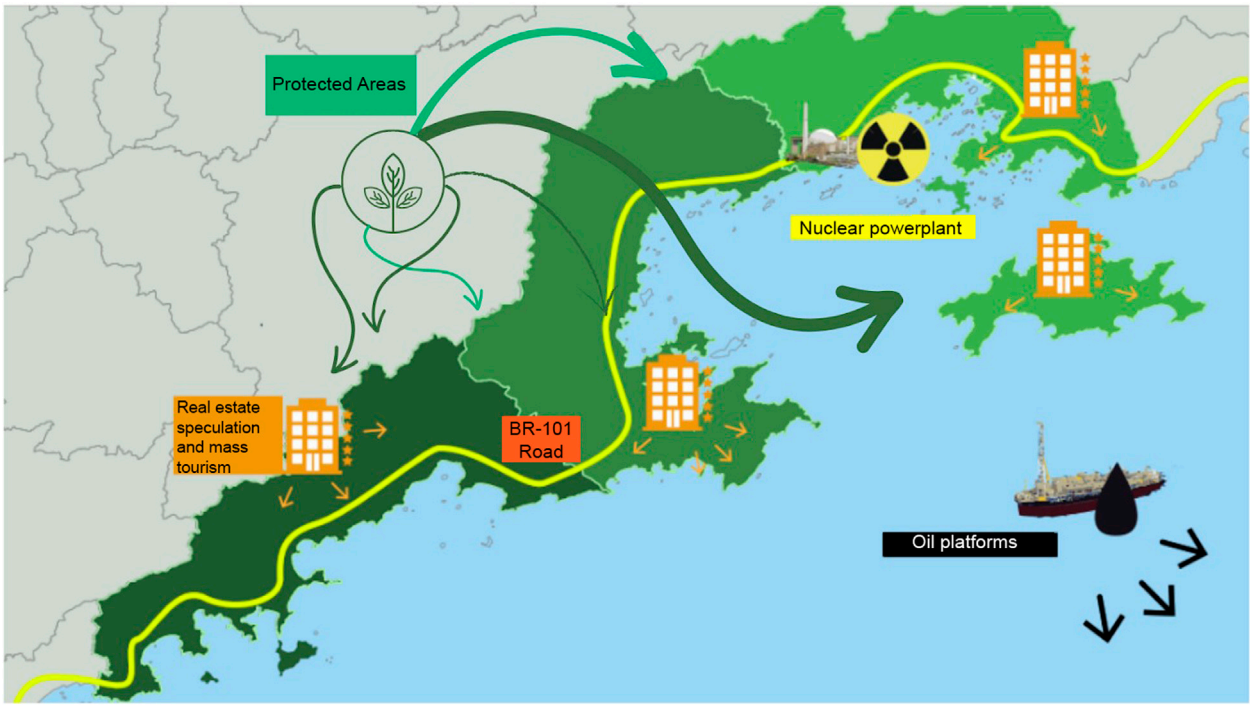


FIGURE 8
Capital rationale and its operations at the intersection between maritory and territory (adapted from Borges, 2023).

the construction of new facilities like Angra 3 heighten tensions in the "Maritory", representing a project aligned with capitalist rationality but at odds with the perspectives and needs of local communities.

- The rise of predatory tourism is an increasing concern due to the excessive presence of visitors on beaches, resulting in pollution from waste such as body oils and fish remains, as well as the indiscriminate use of aquatic vehicles, like jet skis and schooners. These harmful practices compromise the ecological balance and negatively affect marine species. This type of tourism, focused on constant visual recording for digital platforms, emerges as a direct threat to the environmental integrity of the Living Maritory. This underscores the urgent need for critical reflection on the limits of tourist exploitation and the implementation of sustainable policies to preserve the ecosystem and promote fair coexistence between visitors and traditional communities.

As we can observe in Figure 8: Capital Rationale and its operations at the intersection between Maritory and Territory (adapted from Borges, 2023), the democratic, sustainable, and healthy governance of these territories is essential for the balance of the ecosystem and to ensure the autonomy of traditional communities in harmony with marine ecosystems. The concept of "maritory" encapsulates a complex network of relationships between land and sea, where survival, culture, and resistance intertwine in a dynamic narrative, demanding a decolonial and antiracist approach for understanding and resolution.

3.2 Respondent insights

3.2.1 Water culture from learnings with Carapitanga peoples and communities

From the practices and interviews conducted, essential elements emerge that constitute the Water Culture in the Carapitanga communities, as a result of the research. It was observed that water management is intrinsically linked to conflict management, and Water Culture reflects the dynamics of these tensions, their balances, and imbalances.

These aspects are fluid and vary according to the culture or society in a specific location and moment. Water Culture is a social production, shaped by values and sociocultural perceptions that permeate and circulate, nourishing rationalities and territorialities. It manifests dynamically and continuously through social interaction between different cultural and political matrices.

Through the interviews conducted, enlightening perspectives on Water Culture in the Carapitanga communities emerged. One interviewee emphasized: "Water is truly the essence of our existence here in Carapitanga; it is intrinsic to our traditions and way of life." Furthermore, a participant expressed: "Preserving water resources, such as rivers and springs, is of utmost importance to us. We pass on this knowledge to future generations, ensuring the continuity of our ancestral practices."

In parallel, field observations during community meetings highlighted discussions led by members on strategies to protect and conserve local water bodies. Similarly, workshops held in the community provided a space for sharing traditional water management techniques, underscoring their relevance for environmental sustainability. These accounts and observations

TABLE 3 Social practices of women in carapitanga.

Social practices of women in carapitanga	Description
Participation in social movements and leadership	Assume leadership roles in social movements and institutions such as in the Quilombo do Campinho and the Tekoa Araponga in defense of community ways of life, particularly the Culture of Water
Transmission of traditional knowledge	Share traditional knowledge and ancestral wisdom related to water management and sanitation Compartilham conhecimentos tradicionais e saberes ancestrais relacionados à gestão da água e ao saneamento
Care for water bodies	Preserve and maintain rivers, springs, and wells through sustainable management practices
Implementation of hygiene practices	Promote and teach appropriate hygiene practices within communities, aiming to prevent diseases Promoção e ensino de práticas de higiene adequadas nas comunidades, visando à prevenção de doenças
Collection and storage of water	Responsible for daily water collection using traditional techniques and local knowledge
Participation in sustainable fishing and hunting	Engage in sustainable fishing and hunting, respecting natural resources and the communities
Traditional and agroecological agricultural practices	Develop traditional and agroecological farming practices, promoting sustainability and food security
Participation in community-based tourism	Involve in community-based tourism, valuing local culture through sustainable nature management
Engagement in solidarity economy	Participate in solidarity economy initiatives, promoting cooperation and community development
Promotion of ecological sanitation	Encourage and implement ecological sanitation solutions within communities, aiming at environmental preservation and public health
Valuing the ecology of knowledge	Recognize and value local knowledge and different forms of wisdom related to nature and water, in initiatives such as the Postgraduate Specialization in Territory Management and Knowledge at the Federal Fluminense University

offer crucial insights into the interconnection between local culture and water resource management, highlighting the importance of these practices for community sustainability and wellbeing.

The following presents an understanding of Water Culture, based on the learnings with the TPCs of Carapitanga, to relate them afterwards to Social Policies for water governance and sanitation in cities based on Buen Vivir[16] as an alternative for balance and connection of people with the Hydrosocial Cycle.

Interviewee 1, Indigenous woman: "To me, the Water Culture means recognizing that water is not just a resource we can use at will. It's a vital, sacred element interconnected with everything around us. We can't see the 'juruás' (non-Indigenous people) treating it as just a commodity to be exploited and controlled."

The Culture of Water acknowledges water as a vital, sacred element interconnected with all forms of life. It represents a break from dominant paradigms that treat water merely as an economic resource to be exploited and controlled. Through interviews conducted in Carapitanga, the profound impact of climate change on water availability and quality was underscored by local perspectives.

Interviewee 2, academic expert: "Water is essential for life, and we need to change our way of thinking and acting towards it. Governance based on this water culture can truly reshape our social, political, cultural, and economic relations, which is crucial to overcome the inequalities and exploitation we witness today."

The research adds to efforts to provide support and grounding for the formulation of equitable socio-environmental policies. By understanding the complexity of Water Culture and the Hydrosocial Cycle of traditional territories, it becomes possible to contribute to the development of strategies to ensure the Human Right to Water and Sanitation (HRWS) and to overcome water inequality in the ecological transition.

Interviewee 3, Quilombola woman: "We need to break away from models that see water merely as a resource to be exploited for profit. This only perpetuates injustices and the destruction of our territories. I believe that if we adopt the Water Culture to guide us (with this vision of Good Living that we put as a counterpoint to the rationality of capital), I believe we are heading towards a more sustainable and equitable future."

The Culture of Water acknowledges water as a vital, sacred element interconnected with all forms of life. It represents a break from dominant paradigms that treat water merely as an economic resource to be exploited and controlled.

When adopted as a basis for water governance, it proposes to reconfigure social, political, cultural, and economic relations around water. This implies overcoming colonial structures that perpetuate inequalities, exploitation, and environmental degradation.

The paradigm shift proposed by the (re)connection with the Culture of Water brings with it a holistic and interdependent vision, valuing traditional knowledge, sustainable practices, and a plurality of perspectives towards nature.

3.2.2 Perspectives on climate change and water availability in Carapitanga: insights from interviews

The interviews conducted with local residents in Carapitanga provided a deeper understanding of the challenges faced by communities regarding water availability, especially in the face of climate change.

Interviewee 4, an Indigenous woman from Itaxi Mirim, stated: "Climate change has drastically affected the water sources crucial to our community's survival. We struggle to secure potable water amidst increased droughts and pollution, threatening not only

16 The Good Living Rationale was identified in interviews with women from the four traditional communities encompassed by this study. For more details, see Borges (2023).

our physical wellbeing but also our spiritual connection with the land and waters."

Interviewee 5, a Caiçara woman, emphasized: "Our relationship with the waters is central to our identity and way of life. We observe changes in natural cycles of the Carapitanga river and springs, stressing the need to adapt while advocating for the protection and preservation of these sacred waters for future generations."

Interviewee 6, a woman from the Araponga village, further illustrated: "Global warming has made local water sources increasingly unpredictable and contaminated, endangering the lives and health of our community. This underscores the pressing need for action to safeguard and restore these vital resources before irreversible damage occurs."

Interviewee 7, Indigenous woman from Itaxi Mirim[17]: "The more frequent and intense droughts have been drying up our well more and more. Often, we face water scarcity for basic consumption, forcing us to drink water from the Carapitanga river, which is getting increasingly polluted. We see household sewage flowing into the river, but when there's no water in the springs, the only option is to drink from it."

Interviewee 8, caiçara woman: "We observe changes in the water temperature in the Carapitanga river and at the beach. This directly impacts aquatic life and fishing, affecting our sources of income, wildlife, plants, and the transmission of our culture. If the fish are disappearing, how can we teach the younger generations to fish? Each species requires a different fishing technique."

These narratives vividly demonstrate the real-world implications of climate change on water availability in Carapitanga and underscore the importance of proactive measures to address these challenges.

3.2.3 Impacts of women's practices on water governance in Carapitanga

The social practices of women in Carapitanga are intrinsically linked to Water Culture and the Hydrosocial Cycle of the Learning Territory, as they reflect the interaction between communities and local water bodies. These practices play a fundamental role in the hydrosocial cycle amidst climate change, as they encompass the dynamic interrelation between social, cultural, economic, and environmental aspects related to nature.

Table 3: Social practices of women in Carapitanga, highlighting their active roles in community engagement and environmental preservation. From assuming leadership positions in social movements to promoting ecological sanitation, these practices reflect the deep connection between women and the preservation of the region's water bodies.

For example, by assuming leadership roles in social movements and local institutions, all interviewed women contribute to the defense of community livelihoods and Water Culture, promoting more sustainable management of water bodies. Additionally, the transmission of traditional knowledge about water governance, which from the interviewees' perspective includes sanitation and the promotion of proper hygiene practices within communities, is essential to ensure the preservation and availability of local water bodies.

Field observation: During a quilombola movement meeting, women led discussions on the preservation of water bodies and the importance of Water Culture for the community's way of life.

Transmission of traditional knowledge: Interviewee 3 statement: "Since we were young, we have learned from our mothers and grandmothers how to take care of rivers and springs, following our traditions and respecting nature."

Field observation: During a community workshop, women shared traditional water conservation techniques and discussed the importance of this knowledge for environmental sustainability. The main social practices carried out by women identified during the research and the proposed categories for the Water Culture of Carapitanga are presented below.

In this way, women in the Learning Territory play a vital role in the hydrosocial cycle, contributing to the maintenance of community health and wellbeing and the sustainability of local ecosystems. The interviewees' statements and field observations provide concrete evidence of the active role of women in water management and the promotion of community health and wellbeing.

3.3 The new water culture matrix in the Carapitanga learning territory

As a result, in Vargas's work (2006), categories such as "Being, Having, Doing, and Being Present" are proposed to understand the relationship between communities and their territories and natural resources.

By identifying the Water Culture of Carapitanga, a critical perspective is presented, grounded in the Rationality of Buen Vivir. In this context, new categories such as BEING and TERRITORY are suggested, which broaden and enrich the understanding of the communities' connection to water and territory.

These categories aim to transcend the conventional view of natural resources, emphasizing the importance of humans and their territory as essential elements of a more comprehensive and integrated approach. This analysis contributes to a deeper understanding of water culture in these communities, highlighting the interconnectedness between cultural practices, the relationship with the environment, and the fundamental values of community life.

The category of BEING represents the collective and personal attributes that are intrinsic to the identity and culture of the TPCs. This category acknowledges that the relationship with water and territory is not limited to ownership or property, but rather to a profound and spiritual connection with nature. It is from this state of being that practices of governance and care for water are constructed.

The category of TERRITORY encompasses not only the physical dimension of the space occupied by the TPCs in Carapitanga, but also the cultural, spiritual, and historical significance associated with these

17 In October 2024, while we were writing this article, the Itaxi Mirim Indigenous community spent ten days without water supplies in its village. We express our solidarity with all the people, animals, and plants affected and join their collective effort to raise awareness of the issue, ensuring that everyone has the right to water and sanitation, as well as the preservation of their culture and ways of life.

territories. Territory is understood as a space for life and relationship with nature, where water plays a fundamental role in the sustainability of communities and the maintenance of traditional knowledge and practices.

Therefore, it is essential to understand that the category of BEING is intrinsically linked to TERRITORY, being inseparable in the worldview of the TPCs. From this understanding, it is learned that one can promote democratic water governance that respects and values identity and traditional knowledge.

Moreover, two other categories are presented: COMMUNICATING and RELATING. The category of "COMMUNICATING" is essential to recognize the importance of norms, mechanisms, and tools that enable interaction and the exchange of knowledge among people and the pursuit of solutions.

Organization, mobilization, governance, struggle, resistance, dialogue, conflict resolution, and democracy are key elements for participative and inclusive water management. These communication practices are fundamental for constructing more equitable power relations and for promoting social justice in water governance.

The category of "RELATING" highlights individual and collective activities that can be expressed through verbal actions. Feeling, creating, resting, learning, planting, hunting, fishing, harvesting, managing, trying, succeeding, eating, making mistakes, seeing, and teaching are examples of actions that demonstrate the diversity of people's interactions with water. These activities reflect the profound connection between cultural practices and water, revealing the importance of an approach that values the diversity of knowledge and practices related to water; as can be seen below in Figure 9: Water Culture, based on learnings from the TPCs of Carapitanga (adapted from Borges, 2023).

3.3.1 The category of being

All interviewees mentioned the intrinsic relationship between water and life. Specifically, we identified that the Guarani people, both in the Araponga Village and in Itaxi Mirim, perceive their existence intertwined with the essence of water, viewing it not merely as a resource but as a sacred entity with which they share a profound spiritual connection. This perspective guides their cultural practices and rituals, reinforcing their identity and sense of belonging to the land.

3.3.2 The category of territory category

Territory is Alive, reported by eight of the interviewees at various moments of their speeches, relating this category as fundamental to the social construction of their peoples. Specifically, interviewees in the Campinho Quilombo identified that territory represents more than just physical space; it embodies collective memory, ancestral heritage, and cultural identity of their people. Their relationship with water is deeply rooted in this territorial context, as rivers and springs hold spiritual significance and serve as vital sources of sustenance.

3.3.3 The category of communicating category

Through community meetings, traditional gatherings, and participatory decision-making processes, the TPCs engage in effective communication to share knowledge, exchange ideas, and collectively address water-related challenges. These communication practices foster solidarity, cooperation, and empowerment within the communities.

3.3.4 The category of relating category

Caiçara women interviewed indicated that water (sea, springs, rivers, waterfalls) is part of their lives and that they engage in various activities such as fishing, harvesting, and boat-building, all deeply intertwined with their relationship with water. These actions not only sustain their livelihoods but also reinforce their cultural identity and traditional knowledge passed down through generations.

3.4 Hydrosocial cycle

It is proposed that, through the redefinition of the relationship with water–by correlating the Hydrosocial Cycle with Water Culture–the analytical approach should be expanded to identify power relations and their consequences, thereby enhancing the effectiveness of observation, analysis, and intervention in existing interactions.

The Hydrosocial Cycle is a concept that acknowledges the complex interaction between social, economic, and ecological aspects of water governance. It allows an analysis of water bodies within a system that both influences and is influenced by social and ecological systems. From this standpoint, it proposes identifying its main phases to consider the socioecological challenges of urban environments.

a) Hydrological Phase: In this phase, water is considered in its natural context, including precipitation, runoff, infiltration, storage in aquifers and water bodies, as well as water quality.
b) Social Phase: This phase involves the interaction of water with social systems, including Water Culture as well as cultural, political, and economic systems. It encompasses the use of water for domestic, industrial, and agricultural supply, as well as social aspects such as water distribution, equitable access, and issues of water justice.
c) Political and Governance Phase: The third phase considers decision-making, policies, and governance structures related to water management. It involves regulation, public policy, urban planning, governance, and community participation in policy formulation.

Figure 10: Hydrosocial Cycle in the Learning Territory (adapted from Simón Ruiz & Aravena Rodríguez, 2020).

By redefining the relationship with water - by relating the Hydrosocial Cycle to Water Culture - an expanded analysis approach is proposed. This seeks to identify power relations and their consequences, thereby enhancing the effectiveness of observation, analysis, and intervention on existing interactions:

4 Discussion of results

Our findings underscore the importance of a participatory and community-centered approach to addressing issues related to water management and environmental governance. By living and learning with local communities, we gained a deeper understanding of their worldviews, cultural practices, and relationships with water resources. This allowed us to recognize the intrinsic value of these community perspectives and the need to more meaningfully integrate them into environmental management policies and practices.

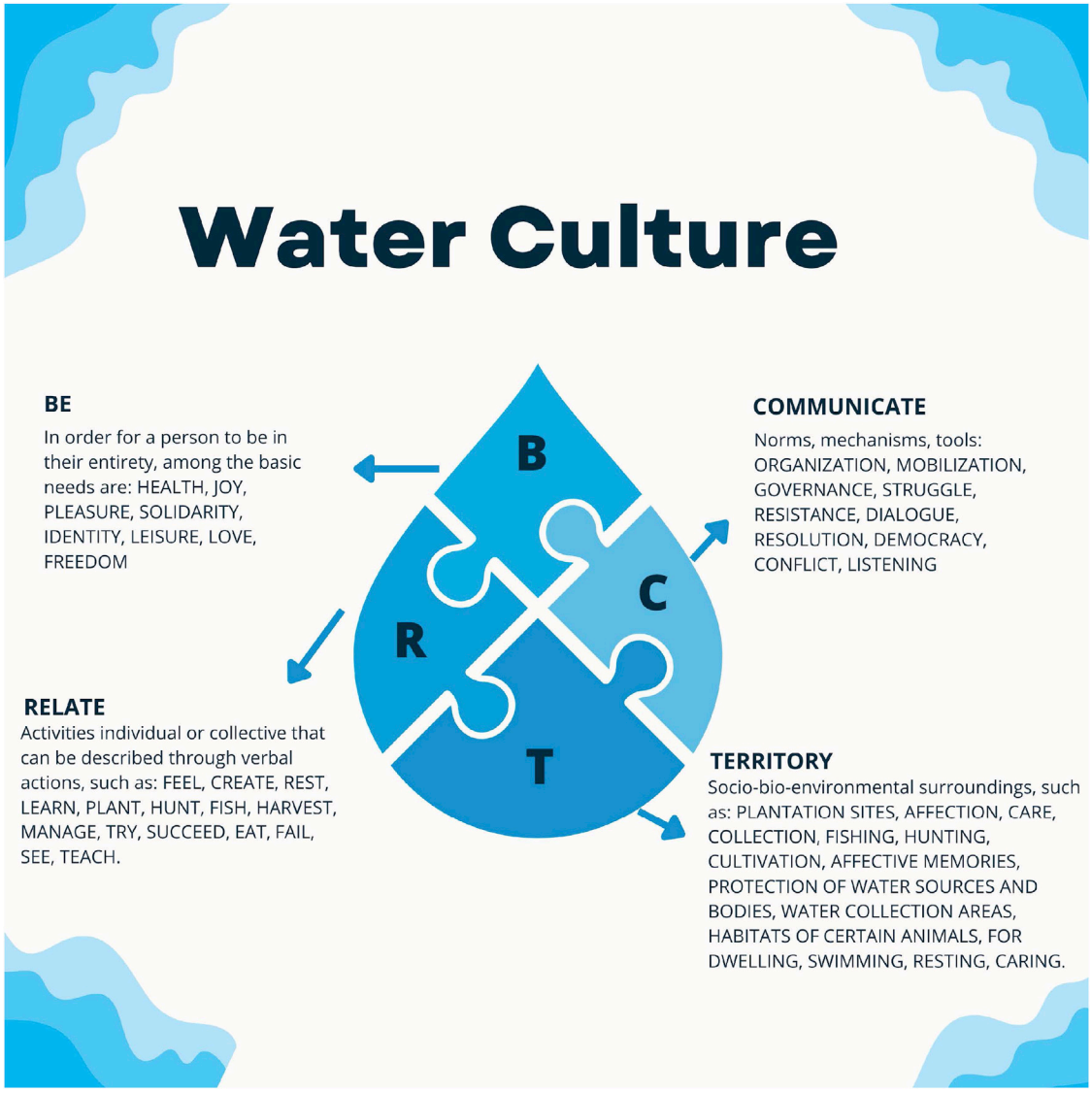


FIGURE 9
Water culture, based on learnings from TPCs in Carapitanga (adapted from Borges, 2023).

Furthermore, by acknowledging the centrality of territory, we understand that the protection and sustainability of natural resources are intimately linked to the preservation and respect for community territorial spaces. These insights are crucial for promoting more inclusive governance, tailored to local needs, and oriented towards sustainable long-term outcomes.

After analyzing the studied context, it was found that the mentioned elements are fundamental to understanding Water Culture. They are intrinsically linked to how each community relates to water, sharing knowledge, values, specific practices, and sustainable actions, contributing to the preservation of water bodies and the sustainable development of the community.

There is an invitation to rethink forms of governance that promote water justice, connect and revitalize bonds between humans as part of nature. In this sense, the Culture of Water becomes an inspiration for building a more equitable, sustainable, and respectful future for life in all its manifestations. It is an opportunity to transform relationships with water and redefine the paths of water governance, aligned with a decolonial and emancipatory perspective.

In addressing urban environmental challenges, Carapitanga's experience offers valuable insights into sustainable solutions that promote community engagement and environmental stewardship. Through initiatives such as the implementation of small decentralized biosystems and community-based tourism, the region has demonstrated a commitment to fostering collaboration and innovation in urban sustainability practices.

From each of the experiences described, we present possibilities for dialogue with cities in Table 4:

Experience with these initiatives underscores the importance of community collaboration and the inclusion of social technologies in urban development projects. By integrating decentralized biosystems, promoting community-based tourism,

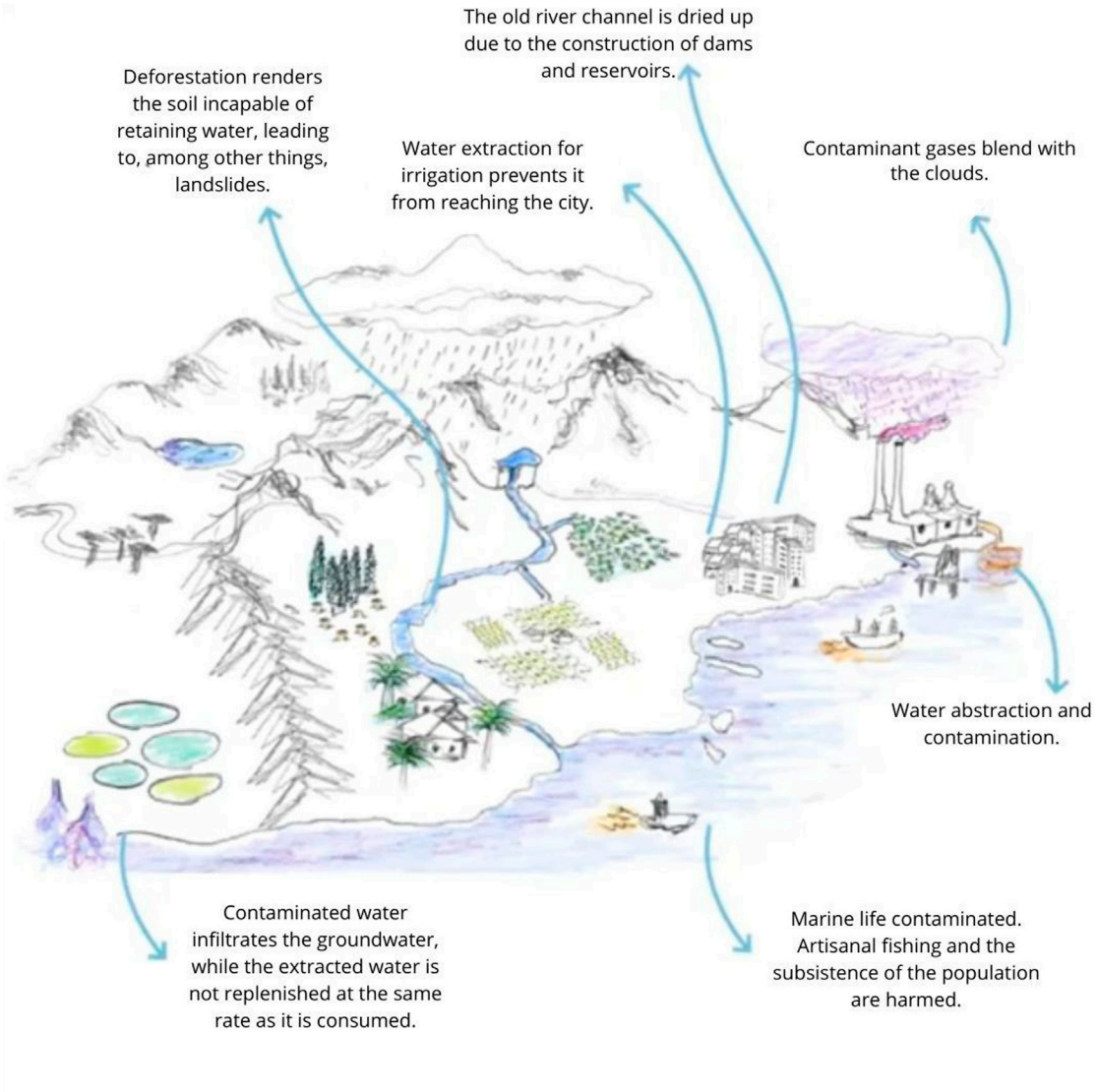


FIGURE 10
Hydrosocial Cycle in the Learning Territory (adapted from Simón Ruiz & Aravena Rodríguez, 2020).

TABLE 4 Experience in carapitanga and its relationship with cities.

Experience	Relationship with cities
Decentralized Biosystems	Implementation of small decentralized biosystems in urban areas, treating wastewater at a local level. For example, water treatment systems by block or neighborhood, reducing reliance on large centralized sanitation works
Community Collaboration	Encouragement of collaboration between neighborhoods or communities in urban areas to implement sanitation solutions and water treatment. Collaborative projects can expand the capacity to address common challenges
Community-Based Tourism	Development of community-based tourism (CBT) itineraries in urban areas, highlighting sustainable practices such as urban agriculture, rainwater harvesting systems, and community initiatives. This would promote a more conscious connection between urban residents and their environment
Environmental Education	Implementation of educational points in urban areas, like ecological parks that highlight sustainable water treatment and sanitation practices. These places could be integrated into educational routes for schools and tourists
Inclusion of Social Technology	Integration of social technologies into urban projects, such as the use of water treatment systems based on principles from traditional communities. This could include implementing rain gardens, biosystems, and other decentralized solutions

and emphasizing environmental education, Carapitanga exemplifies how cities can embrace sustainable practices while fostering a deeper connection between residents and their urban environment.

5 Conclusion

Engaging in dialogue with the Water Culture of the TPCs and understanding the Hydrosocial Cycle in the Territory of Carapitanga, particularly where indigenous, caiçara, and quilombola communities exist and resist, highlights the significance of this knowledge in guiding cities toward alternatives that are aligned with the philosophy of Buen Vivir and sustainable governance of water and sanitation.

This is based on the following central points:

a) Integration of Buen Vivir into Urban Policies:

The practices of TPCs, centered around Buen Vivir, offer valuable lessons for the redefinition of urban policies, emphasizing the importance of a balanced relationship between society and nature.

b) Sustainable Hydrosocial Governance:

The TPCs' understanding of the Hydrosocial Cycle underscores the need for more holistic governance that considers not only technical aspects, but also cultural, social, and environmental factors in water management.

c) Environmental Education inspired by Practices Connected with Nature:

Promoting Water Culture in cities can serve as a foundation for environmental educational programs, fostering a deeper understanding of the interconnection between society and water bodies.

d) Adoption of Place-Based and Nature-Based Solutions:

Implementing nature-based solutions inspired by the territorial practices of TPCs suggests a more decentralized approach tailored to local contexts, strengthening socioenvironmental resilience and overcoming challenges posed by global warming. Decentralizing water treatment areas can reduce damage in case of extreme climate events.

e) Recognition and Valuation of Traditional Wisdoms:

As an essential element for building more equitable societies that are environmentally aware.

In summary, the TPCs of Carapitanga offer a rich and inspiring legacy, not only for the preservation of their own traditions, but also as guiding beacons for cities worldwide to embrace more sustainable practices aligned with the principles of Buen Vivir. Continuous learning from these cultures could be the key to build a future that is more equitable and balanced, with humanity as part of nature.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by the Forum of Traditional Communities of Angra, Paraty, and Ubatuba (FCT), and the Brazilian Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

JB: Conceptualization, Formal Analysis, Investigation, Methodology, Supervision, Validation, Writing–original draft, Writing–review and editing. EG: Conceptualization, Formal Analysis, Investigation, Methodology, Supervision, Validation, Writing–original draft, Writing–review and editing. ST: Conceptualization, Formal Analysis, Investigation, Methodology, Supervision, Validation, Writing–original draft, Writing–review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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