

## **NAVIGATING WATER GOVERNANCE CHALLENGES: A STATEWIDE ANALYSIS OF CONFLICTS IN CEARÁ, BRAZIL**

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**Palavras-Chave** – Water Conflicts Management, Conflict typologies, Semi-arid.

### **INTRODUCTION**

Water resources management in semi-arid regions faces challenges that transcend natural scarcity, encompassing socioeconomic, environmental, and institutional factors. Prolonged droughts and climate change intensify resource competition and community vulnerability. Water management is intrinsically linked to conflict management, as highlighted by Wolf (2008), with semi-arid regions serving as ideal settings for formulating innovative water governance policies.

Ceará, with its decentralized governance approach and local participation, coupled with robust water infrastructure and institutional innovation, exemplifies an adaptive water governance model (Pahl-Wostl, 2019). However, despite advances in supply and demand management, more complex conflicts persist. The negotiated water allocation system, in place since 1995, does not address broader disputes involving governance, quality, and access. This research adopts an integrated and multidimensional approach, combining historical documentary analysis with empirical methods (interviews and focus groups), aligning with the need to integrate local perceptions and stakeholder engagement to strengthen adaptive governance. The primary objective of this study is to identify, categorize, and analyze water conflicts across Ceará's 12 hydrographic regions.

### **METHODOLOGY**

The central methodology was Content Analysis (Bardin, 1977), used to systematically interpret textual data. Four main data sources were employed: Structured Questionnaires, Documentary Analysis, Focus Groups, and Semi-Structured Interviews. Data analysis utilized Categorical Analysis, grouping information into thematic categories. Conflicts were classified based on the typology of Studart et al. (2021), which defines five main categories, serving as an analytical tool to systematically identify and interpret conflicts across all hydrographic regions of Ceará.

### **RESULTS AND DISCUSSION**

The application of the conflict typology revealed a robust analytical framework of Ceará's water reality. The main findings are: (1) Water Quality Conflicts: Represented the dominant category, accounting for approximately 50% or more of reported problems in nearly all hydrographic regions. The most common subtypes included irregular occupation (predominantly in Permanent Preservation Areas – PPAs and around water bodies) and environmental degradation (wildfires, riparian vegetation

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loss, and water source degradation); (2) Water Quantity Conflicts: Historically predominant, these were significantly reduced by institutional and infrastructure advances in Ceará since the 1990s. Currently, quantity-related disputes primarily involve illegal dams (without proper licensing) and water theft (unauthorized withdrawals, infrastructure vandalism); (3) Water Allocation Conflicts: Ranked among the three most cited, these were predominantly linked to disputes between different water uses. Notable examples include interbasin transfers, such as those that emerged during water transport from the Orós and Castanhão reservoirs to the Fortaleza Metropolitan Region (FMR), affecting stakeholders in the Upper and Middle Jaguaribe and Metropolitan basins; (4) Governance-Related Conflicts: Were extensively cited in the Metropolitan, Upper, Middle, and Lower Jaguaribe regions. These included disputes over institutional representation and dissatisfaction with water transfer decisions during the 2012–2018 drought, and (5) Water Access Conflicts: Were the least reported and primarily involved obstructions caused by fencing, indicating growing public awareness that private water rights do not exist under current legislation.

Despite active involvement of Watershed Committees, the research identified limitations in stakeholder engagement, which hinders the development of meaningful collaborations. The diversity of factors triggering conflicts validates the typology of Studart et al. (2021), while simultaneously underscoring the need for contextual adaptations to address unique local dynamics, such as vandalism of water infrastructure.

## CONCLUSIONS

This analysis reveals challenges and opportunities for water management. Institutional misalignment and governance gaps continue to constrain effective conflict resolution, exacerbating environmental degradation and disputes over water quality. Persistent stakeholder resistance to reforms, such as irrigation modernization, also delays progress in sustainable management practices. Nevertheless, clear opportunities exist to strengthen the role of CBHs through capacity-building initiatives, which could empower communities in formulating localized solutions. Strengthening institutional coordination and enhancing community engagement are critical steps for water conflict resolution. Expanding stakeholder participation in decision-making processes can foster trust and reduce dispute intensity. By integrating local perceptions with structured methodologies, this study bridges the gap between theory and practice, offering actionable insights for water resources management in vulnerable regions.

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## ACKNOWLEDGEMENTS

This study was funded by the Cearense Foundation for Scientific and Technological Development Support (FUNCAP), within the scope of the Scientist-in-Chief Project.