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Water conflicts, national laws, and SDG: monitoring for democratic governance

Conflitos pela água, leis nacionais e os ODS: monitoramento para uma governança democrática

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ABSTRACT: The UN 2030 Agenda recognizes, in its 17 SDGs (Sustainable Development Goals), the presence of conflicts of different degrees, nature and typology. Following the academic debate, the Agenda considers it important to record conflicts and promote mitigation actions in participatory forums. In this context, the purpose of this article is to present different conceptions, data and forms of manifestation of conflicts over water in the international scenario and, particularly, in Brazil. It also reflects on the possibilities for improvements in register with the advent of the SDGs. Historical data based on platforms, management institutions and other public data of water conflicts are highlighted. Among the results, it is highlighted that the surveys are not periodicals, methodologies are under development stage and the scope is restricted to rural areas. The records of the Comissão Pastoral da Terra (CPT), an organization of the Catholic Church in Brazil, show an increase in the number and types of water conflicts in the countryside, mostly caused by productive activities (mining, energy and agriculture). Among the gaps observed is the lack of a record and monitoring strategy on the part of State institutions, with dependence on voluntary surveys from social organizations and academia.

Keywords: conflicts; water; typology; records; SDGs.

RESUMO: A Agenda ONU 2030 reconhece, no conjunto de seus 17 ODS (Objetivos de Desenvolvimento Sustentável), a presença de conflitos de distintos graus, natureza e tipologia. Seguindo o debate acadêmico, a Agenda considera importante o registro de conflitos e a promoção de ações de mitigação em foros participativos e com amplo diálogo. Neste contexto, o objetivo deste artigo é apresentar distintas concepções, dados e formas de manifestação dos conflitos pela água no cenário internacional e, particularmente, no Brasil. Faz-se também uma reflexão sobre possibilidades de aprimoramentos nos registros com o advento dos ODS. São destacados dados históricos de plataformas, instituições gestoras e outros registros públicos de conflitos pela água. Entre os resultados para o Brasil, destaca-se que os levantamentos são aperiódicos, com metodologias em desenvolvimento e foco no meio rural. Os registros da Comissão Pastoral da Terra (CPT), entidade vinculada à Igreja Católica, apontam trajetória de aumento do número e tipos de conflitos pela água no campo, majoritariamente causados por atividades produtivas (mineração, energia e agricultura). Entre as lacunas por parte do Estado, encontra-se a falta de estratégia para registro e monitoramento dos conflitos, com dependência de levantamentos voluntários de organizações sociais e da academia.

Palavras-chave: conflitos; água; tipologia; registros; ODS.

1. Introduction[1]

There is extensive academic and public policy learning in the decision-making arenas of socio-environmental and economic conflicts, as expressed by Little (2001). As confrontational, dialectical, dialogical opinions, conflicts are seen as engines for transforming societies (Leff, 2001; Little, 2001). They reflect realities that must be understood by science and public policy because they express interests that lead people and institutions to seek solutions for some kind of issues. Direct or indirect, tacit or explicit, conflicts over natural assets occur between people, corporations, power groups and nations, among others.

In modern society, conflicts highlight divergent interests and political positions (Marx, 1977; Leff, 2001; Litte, 2001; Acselrad *et al*, 2004; 2006; Rodríguez-Labajos & Martínez-Alier, 2015) that originate in economic, environmental, social or cultural disputes and controversies, including in collegiate bodies (Vieira & Weber, 1997; Fracalanza, 2005; Abers, 2010; Petersen-Perlman *et al.*, 2017; Orta, 2018). Since the first clashes of life in society, conflicts have guided the discussion of state models, patterns of coexistence, idealizations of political systems, the choice of laws and the modeling of collectively maintained institutions. They also motivate the control or deprivation of access, possession or domination of an asset or decision-making system or strategic positions in its governance (Rodríguez-Labajos & Martínez-Alier, 2015).

Classic texts also contain structural and institutional records of disagreements of distinct types, including class struggles and wars (Mannheim, 1950; Marx, 1977; 2006). The different types of conflicts express the conditions and intensities in

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which they occur (e.g.: due to scarcity of goods, conceptions of rights, level of power and forms of mediation), as well as the type of governance and strategies adopted by the mediating actors and institutions (Rodríguez-Labajos & Martínez-Alier, 2015; Petersen-Perlman *et al,* 2017; De Stefano *et al.*, 2017).

In the absence of a consensus on a definition, this article adopts water conflicts based on the contributions of Mostert (1998), Ohlsson (2009) and Wolf (1999), who argue that they are the manifestation of discordant positions that generate friction over access, possession, or control over water. They affect not only human uses in situations of scarcity, but also modify water flow regimes (De Stefano *et al.*, 2017) and ecosystems as a whole (Al-Saidi, 2017), resulting in biodiversity losses and irreparable damage for present and future generations. Among the ways in which clashes over water manifest themselves, the literature ranges from economic, socio-cultural, or environmental motivations (Rodríguez-Labajos & Martínez-Alier, 2015; Bordalo, 2019), to violent frictions such as riots and wars (Pacific Institute, 2022).

By incorporating this debate, the United Nations (UN) has disseminated guidelines to recognize, monitor and propose agreements on the management and governance of water and its conflicts, since the Mar del Plata Conference in 1972. The theme was highlighted, for example, at the Rio 1992 Conference and at the eight editions of the World Water Forum. In a more proactive way, environmental and water conflicts are recognized in the UN 2030 Agenda, in its SDGs (Sustainable Development Goals), specifically with goal number 6, which deals with the management and governance of water and sanitation (United Nations, 2015).

In this context, this article aims to present and discuss concepts and typologies addressed in the literature on conflicts involving water in the environment, as well as the different forms of its manifestation and data recording, in Brazil and in selected international experiments. We use secondary data, obtained from public records platforms and systems, followed by exploratory data analysis. The text also reflects on the importance of documenting conflicting events, highlighting the limitations of current registration systems, considering the goals and targets of the UN 2030 Agenda and national legislation.

For the exploratory data analysis, we used the information, the typology of data collection, and the records of the CPT (Pastoral Land Commission). The literature review seeks to approach the transdisciplinary approach, in a context in which part of political ecology calls "water social metabolism" – *Water Social Metabolism* (Rodríguez-Labajos & Martínez-Alier, 2015, p. 539), considering the complexity of the subject.

2. Socio-environmental conflicts, water disputes and the SDGs

The UN 2030 Agenda assumes that conflicts manifest themselves in different ways and intensities, from the scope of users (people, corporations, productive sectors), from management, regulatory and legislative bodies and institutions (executive and parliamentary) to countries (borders, corporations, strategies). The implicit thesis of the SDGs is that increased knowledge and articulations between actors lead to increased capacity of the most

advanced parts of societies to make decisions anchored in the guidelines of sustainable development.

Although the Agenda does not present a specific typology of conflicts, the reception of this issue appears both explicitly and tacitly, in the set of SDG targets and specifically in SDG 6 (United Nations, 2015), due to socio-environmental, cultural, and economic imbalances and inequalities between opportunities for people. The Agenda expresses the need to correct trajectories of access to natural goods, social and economic injustices, minority rights, as opposed to the exclusionary bases of the process of capital accumulation.

The inclusion of a specific SDG for water and sanitation in the 2030 Agenda (SDG 6), for example, stems from the clash of interests and divergent positions in the private and public arenas across the planet. Thus, the 2030 Agenda is the result of a non-binding agreement, the product of negotiations between nations and pressure groups at distinct levels and decision-making forums. This is why participatory governance is planned and makes sense.

Even before the SDGs and other UN agendas, authors such as Leff (2001), Vieira & Weber (1997), Acselrad *et al.* (2004), discussed injustices, conflicts and contradictions generated by the economic model and its impacts on populations, especially the most vulnerable ones. As a result, progress has been made on cross-cutting issues, but equity in access to water and the recognition of its *status* as a fundamental human right in national laws and policies are still pending (Castro *et al.*, 2015), although this *status* has been recognized by the UN since 2010 (WWAP, 2019).

Zeitoun & Warnerb (2006) consider that conflicts over water, especially cross-border conflicts, can lead to wars, but in a different way from other conflicts over material goods. According to the authors, the absence of an explicit war is due to the strategies and tactics of the centers of power (hydro hegemony and counter hegemony). They also consider that the actors involved, including countries, tend to accept solutions with some degree of understanding, generally under the conditions imposed by hegemonic power, i.e. state and market interests. This avoids more explicit confrontations, even within river basins. Based on the concepts of power, hegemony, and intensity of conflict, Zeitoun & Warnerb (2006) point to the path of mediation through cooperation in order to avoid more aggressive actions, even if this is based on a vision of management through institutions, or *top down.* On the other hand, the 2030 Agenda considers that water allocation presupposes dialog, participation and the sharing of responsibilities and rights.

In Brazil, the assumption of conflict dynamics is at the basis of the design of the principles, guidelines and purposes of social and environmental policies and their instruments. In seeking to reduce inequalities and coexist with plural positions, Law 6.938/1981 - National Environmental Policy (Brazil, 1981) and Law 9.433/1997 - National Water Resources Policy - PNRH (Brazil, 1997), for example, record conflicts and reflect the debate that is positioned with a view to mitigating or resolving them.

Because they reflect inequalities of power, such conflicts can be characterized in the field of political economy (Theodoro *et al.*, 2005; Acselrad *et al*., 2004; Martínez Alier, 2007; Bordalo, 2019). The debate shows that there is no "model" or pattern of conflict resolution or mediation, due to the most diverse decision-making arenas, asymmetries of information and knowledge, besides the imbalance of

political and economic power (Rodríguez-Labajos & Martínez-Alier, 2015; CPT, 2022)

Even government agents can make mistakes and act, according to Fracalanza (2005), by replicating models of privilege. For example, the location of polluting factories and dangerous infrastructures in areas inhabited by people with lower purchasing power has been an example of this (Acselrad *et al.*, 2009). The same applies to cases between sectors (agriculture vs. hydroelectricity, mining vs. conservation areas and housing, for example) or between users (small farmers vs. large irrigators). The economic and power imbalance implies distributive and access divergence (CPT, 2012, 2022), the need for arbitration and action by judicial bodies.

Castro *et al.* (2015) point out that, in the sanitation sector, the challenges are due to the failure to provide services and the failure of institutions to protect water as a human right. Market interests also prevail, including in the negotiating space in which the regulatory framework is built (Santos *et al.*, 2020), ignoring the interfaces between water management and urban, housing, environmental and social issues. In other industrial sectors, production units are relocated geographically and priorities are redefined in terms of water use according to their economic interests.

This broadens what Acselrad (2010) calls "utilitarian reason" that moves the hegemonic economy towards affirming the market and its ways of finding "solutions" to continue extracting natural resources, managing dissent without cultural change. Such "solutions" point to the notion of "locational blackmail" by capital (Acselrad, 2010), through cheaper jobs, tax exemptions, environmental facilities, remittances of profits, among others, imposed or negotiated with governments to install their productive units, in opposition to the rights and aspirations of the poorest population, their life styles and culture.

In an attempt to counterpoint, the 2030 Agenda idealizes goals in both the technical-scientific and cultural-participatory fields, proposing, for example:

1. changes in access to natural resources, means of production and services; strengthening of institutions;
2. technology diffusion;
3. participatory management;
4. partnerships and agreements between the parties; and
5. monitoring targets and indicators.

Despite its discursive nature, the Agenda has the potential to encourage new agreements to systematically record conflicts and their causes, as well as to disseminate data, as also pointed out in SDG 16 (peace, justice and effective institutions), in addition to fostering new laws and mechanisms that favor the management and collective construction of mitigation measures.

It should be added that the Brazilian economic model, based on growth and accumulation with heterogeneities, as well as on power relations and institutional dysfunctions in relation to socio-environmental issues, reinforced the strategic positioning of power groups and their dominance over land and water (Jacobi, 2009; Abers, 2010; Cavalcanti Junior & Palhano, 2016; CPT, 2022, 2019). The local experience follows the reproduction of inequalities (Coletivo Brasileiro de Pesquisadores da Desigualdade Ambiental, 2012) between nations, peoples, classes, and gender, in arenas in which

the position of the liberal state contributes to the particularization of antagonisms, replicating the interests and dynamics of capital.

The Coletivo Brasileiro (2012) highlights that the separation of land and water ownership, already in the Water Code, of the 1930s, was not effective for the benefit of citizens, with sectoral interests prevailing, such as those in the energy area, to the detriment of regional issues and local populations. Conflicts persist in energy production, mining, large-scale irrigation, the appropriation of groundwater for commercial purposes, in addition to the disordered urban growth that pollutes water.

As mentioned above, the lack of perception of conflicts, the choice not to register them, the imposition of barriers to their dissemination, as well as the unbalanced choice of one side of them, are contradictory aspects of the sustainability thesis. These contradictions replicate, on the one hand, the conceptual and practical weaknesses of specific environmentalist groups and, on the other, economic agents who appropriate sustainability agendas but distance themselves from their practice.

3. Water conflicts: a possible dialog with the SDGs?

Border regions, by generating a political-spatial organization that to some extent respects the original characteristics, have a strong appeal in the 2030 Agenda, and have been the subject of a large number of studies on environmental conflicts and water in particular (De Stefano *et al.*, 2017; WWAP, 2019; Pacific Institute, 2022). Farinosi *et al*. (2018) highlight the centrality of cross-border issues, climate change and population growth, as well as the power imbalance between nations in the face of water scarcity.

In addition to specific situations across borders, and even without systematic surveys, the large number and severity of events involving water has led to a specific target of SDG 6, target 6.5: "By 2030, implement integrated water resources management at all levels of government, including through cross-border cooperation" (United Nations, 2015, p. 23). As part of the goals of SDG 6 and others, the Agenda also covers conflicts within countries, with their diversity of actors and institutions and in situations where governance is essential, as legal frameworks alone do not guarantee a balance of power and equity in access to water.

3.1. Cross-border conflicts

De Stefano *et al*. (2017) studied cross-border river basins that may present what they called hydro-political tensions, considering projects (in progress or planned) of large water works (buses to store water or to generate hydroelectric power). The study considered the institutional resilience of the countries involved to deal with the conflicts associated with such works, involving, for example, the existence of international treaties, basin organizations, mechanisms for conflict management and water allocation. Aspects that amplify cross-border conflicts are:

1. climate change and variations in river flows;
2. water scarcity;
3. armed conflicts within a country or between countries; and
4. gross income per capita.

This set of variables and classifications can be a reference for the SDGs.

According to De Stefano *et al.* (2017), Asia has the largest number of water projects (under construction or planned) in cross-border basins (807), followed by South America (354), Europe (148), Africa (99) and North America (8). The greatest risk and vulnerability are in Asia, Africa, and South America, in that order. Regarding institutional issues, Europe and North America use a series of cooperation mechanisms, while South America and Asia have limited institutional capacity, despite the presence of important cross-border river basins and a large number of dams designed or being installed. Of the 286 cross-border river basins analyzed, 22 were classified as very high risk of hydro-political tension, and 36 as high risk.

Farinosi *et al.* (2018) used a model to analyze cross-border conflicts with two scenarios: one with a 74.9% increase in interactions in 2050, population increase and moderate climate change; the other with a 95% increase in interactions in 2100, considering population increase and extreme climate change. The results show that the Ganges/Brahmaputra, Pearl/Bei Jiang, Nile, Feni (or Fenney), Indus, Colorado, Tarim, Shattal-Arab-Tigris/Eufrates, Hari and Irrawaddy river basins are the most prone to water problems. In South America, the authors pointed out conflicts and institutional gaps, highlighting the need to prioritize the Amazon and Orinoco River basins due to hydroelectric projects.

Currently, the TCA (Amazon Cooperation Treaty), involving 10 countries, stands out in the attempt to improve provisions for shared water management. Other important actions are based on OTCA (TCA Organization) studies (water, biodiversity, sustainable production, conflicts), organizational advances (partnerships, agreements, pilot projects) and attention to people (indigenous peoples, riverside communities and their socio-environmental agenda).[2] From the point of view of the SDGs, there is convergence between SDG 6 and the ATT, but there are no major programs yet, only opportunities for interfaces. The challenge, therefore, is to move from the phase of studies and cooperative actions, with pilot projects, to the phase of programs and actions, community participation, and a budget defined within the framework of the countries that make up the ATT.

3.2. Examples of situations and other aspects of water conflicts

Within countries, the example and challenges in the state of California in the United States are illustrative, as they have similar features to those observed in Latin America (LA) and Brazil. Except for local specificities, the experiences are connected by the ways in which space is occupied, by the situation of scarcity and flooding, and by the low regularity of rainwater sources.

The conflicts date back to the 19th century, according to the *California Natural Resources Agency* (2018) and relate to the fact that 75% of the surface water available in the state originates in its northern third, while demand is concentrated in the southern two-thirds. As a result, ongoing expenses (operation, maintenance, and administration) have reached an average of 35 billion dollars/year (California

[2] See more information, initiatives and structure at http://otca.org/pt/.

Natural Resources Agency, 2018). Infrastructure works have made it possible to harness rainwater and snow runoff in dams (Hanak *et al.*, 2011; California Natural Resources Agency, 2018), as well as drilling wells, reusing water and desalinization, with irrigation being the main demand for water, mitigating conflicts.

A large number of management institutions, including federal, state, and local agencies, the productive sector and the population are working towards integrated water management, with reference to the *California Water Plan Update 2018* (California Natural Resources Agency, 2018). However, Hanak *et al.* (2011) and Walters (2019) point out that, despite its considerable size and effective cases of mitigation, the focus on works does not solve the conflicts and that the high cost of energy in the state is at the base, the cause of the economic and environmental challenges.

In the same vein, Pérez *et al*. (2006), when dealing with water conflicts in Mexico, summarize the bases which, in addition to situations of scarcity, highlight the complex situation in the country:

i) the possibility that all resources can be owned (economic model), with few exceptions;

ii) the rights are exclusive and individual, with the exception of certain collective uses and open access;

iii) the rights are transferable, indicating at least one basis of ownership for selling the access.

According to the authors, the situation of water as a market commodity is the basis of the conflicts.

In the same vein, Orta (2018) points out that, since the 1990s, countries such as Argentina and Bolivia have persisted in conflicts over access, distribution and coverage of services, as well as liberal disputes over the sanitation market. Toledo *et al.* (2009) report socio-environmental and economic conflicts and imbalances in the case of hydroelectric dams in Chile, with environmental damage and insecurity for future generations, as is also the case in Brazil (Cavalcanti Junior & Palhano, 2016). According to Toledo *et al.* (2009) the production of *commodities* has determined the management model and conflicts over water in Chile, highlighting gaps in the foundations of the raw materials export model, which is incapable of resolving the conflicts generated. Salinas & Carmona (2009) describe the damaging effects of big business - mining works - on traditional communities in Chile.

It is in this context of different types and ways of recording water conflicts that surveys such as the *Water Conflict Chronology* platform (Pacific Institute, 2022)[3] are important, although its database contains only 1,298 cases up to July 2022 (predominantly cross-border conflicts) through the continents since centuries ago. The platform has the merit of illustrating central elements of water conflicts on the planet and the possibility of agendas such as the SDGs to provide solutions on this issue.

It is important to note that countries do not publish systematic surveys of water conflicts, most likely because the reports could go against their interests or current management models. The UN does not keep such records systematically either, although the reports of the agencies linked to it point to data on environmental, social, and economic

[3] Available at: <http://www.worldwater.org/conflict/list/>. Consultation on 04/13/2019.

conflicts that affect the quality, quantity and access to water (WWAP, 2019).

The *Pacific Institute* initiative (2022) defines forms of conflict based on the events recorded by categories of use, impact, or effect that water has on the conflict. This methodology is interesting because it takes into account other interferences and reasons for conflicts beyond direct disputes over water, water bodies and all their uses. The possibilities for conflict are:

i) water/water issue as a trigger - a situation in which water is a relevant factor or the central cause of the conflict, even triggering violent disputes;

ii) water as a weapon of conflict, where water resources/water systems are used as a tool in a violent conflict;

iii) water resources/systems are negatively affected in an intentional, incidental way.

The debate also records several ways of defining criteria, measuring and monitoring conflicts, either directly or indirectly, as highlighted in Pacific Institute (2022).

Rodríguez-Labajos & Martínez-Alier (2015) advocate multi-criteria analysis in environmental studies, water, and its conflicts, from an ecosystemic and multidisciplinary perspective, in three sections:

i) conflicts over major infrastructure (dams, transpositions and waterways);

ii) imposition of centralized water management and the privatization controversy;

iii) water conflicts related to the extraction of raw materials (biomass, mining and fossil fuels).

They warn of new conditions and economic interests that are contrary to the wishes of populations, the right to water and local management. In the case of Brazil, we can add the production systems of raw materials for biofuels (soy and sugar cane) and housing in precarious conditions and at risk.

Moreira *et al.* (2012) present a summary of conceptions of conflicts and methodologies for classifying them. According to the authors, with the *Water Scarcity Index* (WSI) Falkenmark (1987) was the first to propose an index to quantitatively describe problems related to water scarcity, considering a number of conflicts. Ohlsson (2009) developed the Social Water Scarcity Index to associate water scarcity with social aspects. Another index used in the diagnosis of the basin's situation is the *Water Exploitation Index* (WEI), from which the European Environment Agency analyzes how changes in water use impact Europe's water resources (EEA, 2004).

Therefore, taking into account the guidelines of international agreements, it is desirable for UN agencies involved in water management and governance (FAO, UNESCO, UN Water, UNDP, UNEP, WHO and others) to record conflicts, forms of prevention and mitigation. The same applies to countries, states and institutions, in what would be an important contribution to achieving not only the targets of SDG 6 (water and sanitation) but also SDG 2 (zero hunger and sustainable agriculture), SDG 11 (sustainable cities and communities), SDG 13 (global action against climate change), SDG 15 (life and terrestrial environments) and others. In countries like Brazil, which have conflicts of various kinds and varying degrees of scarcity, these records are also an instrument for promoting policies and programs focused on socio-environmental justice.

4. Records and monitoring of water conflicts in Brazil

Conflicts with continuous impacts (e.g.: agriculture, deforestation, mining/mining, industrial pollution, and disorderly urban occupation) and eventual (accidents in mining, transport, industries) add up to irreparable debts to the environment and life, requiring systematic monitoring and preventive action by the State. However, tragedies such as those caused by the mining companies Samarco, in Mariana/MG, and Vale/BP, in Brumadinho/MG, have evidenced political and economic conflicts that, in addition to damage to property and life, resulted in agreements and arrangements that affect the trajectory of water management in the Rio Doce basin (Santos *et al.*, 2018), evidencing gaps in the prevention, control and corrective of the companies in the face of fatal impacts. The imposition of obligations to repair the damages and compensate those affected by the tragedies proved to be a failure on the part of the national and state executive power, occurring partially and late only after the actions of the Public Prosecutor's Office and the Justice Department[4]. In what should be planning, measures such as the National Dam Safety Plan and water safety actions also came late.

In agriculture, the sector that collects the largest amount of water (ANA, 2021a; 2021b), conflicts occur both over land and water ownership and over the damage caused by pesticides to water bodies. In addition, there are conflicts based on unequal consumption between sectors, such as energy x transportation x agriculture (ANA, 2021a), and between family and non-family farmers. The concentration of access, as shown by the 2017 Agricultural Census[5] and irrigation licenses (ANA, 2021b), is the silent part of the conflicts, with large claimants affecting the social reproduction conditions of family farmers. The social reproduction of family farmers, indigenous people, quilombolas, riverside dwellers and other traditional peoples (Porto *et al*., 2013), and can impact on the supply of cities or make their treatment systems more expensive.

By recognizing conflicts, Law No. 9.433/1997 brings multiple use directives and makes explicit one of the biggest conflicts, at the time of its enactment, between energy and transport (Galvão & Bermann (2015). Although it establishes priority for human use and animal watering in situations of scarcity, clashes remain even in these uses, especially in the countryside (CPT, 2017), with mining, hydroelectric and agrarian activities standing out. These include mining, hydroelectric dams and agrarian issues, as shown by surveys by the Osvaldo Cruz Foundation (Fiocruz)/Ministry of Health, with the Map of Socio-environmental Injustices in Brazil (FIOCRUZ, 2010; Porto *et al*., 2013)[6] and those of the Pastoral Land Commission (CPT), the Catholic Church and partners, which reduce the lack of information.

In environmental and water management, sub-themes such as the use of hazardous substances

[4] For details of legal actions, terms of adjustment and other measures, see the example of Mariana/MG, at: http://www.mpf.mp.br/grandes-casos/caso-samarco/atuacao-do-mpf/linha-do-tempo.

[5] See tables 6857 and 658 of the 2017 Agricultural Census (IBGE, 2019). Available at: https://sidra.ibge.gov.br/pesquisa/censo-agropecuario/censo-agropecuario-2017#lavouras-permanentes.

[6] Plataforma disponível em: https://www.conflitoambiental.icict.fiocruz.br/. Acesso em: 10/8/2020.

and the inappropriate use of pesticides have gained ground in the academic debate and throughout society[7], but there is a lack of periodically produced data and indicators. Examples of water information systems and data platforms that can contribute to conflicts are the Water Quality Surveillance Information System (Sisagua) of the Ministry of Health and the National Water Resources Information System (SNIRH), a component of the National Water Resources Management System (SINGREH), which is the responsibility of ANA.

In terms of typologies, in the economic, geographical, and institutional context, conflicts can be studied in three groups:

i) between entities or levels of government - for example, municipalities such as São Paulo x Rio de Janeiro, in the case of the Paraíba do Sul river, or Campinas x São Paulo, in the case of the Piracicaba, Capivari, Jundiaí - PCJ river basin;

ii) between intra-sector users - for example, farmers x farmers, as in the São Marcos river basin in Goiás, the Federal District and Minas Gerais; and

iii) intersectoral - for example, between energy and agriculture, also in the São Marcos and São Francisco basins, between navigation for transportation and other uses, in the case of the Tietê river, or between public supply, leisure or fish farming, as in the lakes.

The case of the Arrojado river, in Correntina/BA, in 2018, with large quantities of water removed by an agricultural commodities company highlighted the three forms of conflict, with the lack of coordination between the granting agencies and the granting[8] for a single agricultural company to withdraw more than that destined for the supply of the entire city.

In designing the SDGs, conflict prevention and mitigation do not depend solely on environmental agencies and bodies and water, but on policy coordination and effective action by society as a whole. In this sense, at the recommendation of experts and determinations of the Public Prosecutor's Office, the creation of situation rooms (meeting of agents involved in situations of scarcity) mediated by the government (at the federal level by the ANA) has promoted agreements in times of crisis in water supply and mitigated conflicts (ANA, 2020 and 2021a). However, the initiative, which has also been instituted in some states, is only mitigating (Galvão & Bermann, 2015).

4.1. Monitoring conflicts: the contribution of the Pastoral Land Commission

In view of the lack of systematized official information on conflicts, the CPT's initiative to organize data on water (2012, 2019, 2022)[9]. Since the 1970s, the CPT has obtained data from its own and secondary sources, at national, state, and municipal level, involving rural communities. The annual survey has been more widespread since 1985 and has undergone methodological improvements since 2002 (CPT, 2012, 2017, 2019). There are three categories of conflict:

[7] See data compiled from Siságua/MS, 2018, available at: https://portrasdoalimento.info/agrotoxico-na-agua/.

[8] Ordinance No. 9.159, of January 27, 2015-Institute of the Environment and Water Resources - Inema/BA.

[9] CPT data available at: https://www.cptnacional.org.br/index.php/publicacoes-2/conflitos-no-campo-brasil.

i) private appropriation (damming, diverting a watercourse and restricting access);

ii) dams and weirs (hydroelectric plants that do not comply with legal procedures); and

iii) other occurrences related to the use and non-preservation of nature (destruction of riparian forests, water pollution and predatory fishing).

Conflicts over water have structured records since 2002, with 2,859 cases catalogued by 2021. In the current description (CPT, 2022) the variables available on the base are:

i) municipality and state;

ii) address of the conflict (farm, settlement, fishing colonies, other communities, company involved, among others);

iii) dates and codes;

iv) number of families affected;

v) type of conflict (use and preservation, private appropriation, and dams and weirs); and

vi) situation in which the conflict occurred (impedance/obstacle of access to water, destruction and/or pollution of source or area in conflict, non-compliance with the law, lack of settlement/resettlement project, deconstruction of cultural history, and contamination by pesticides).

In expansion, events involving water (308 in 2021) account for almost a quarter of the total number of cases (1,242), which includes those by land. Considering all types, there were 934 municipalities with some event in the countryside in 2021, affecting more than 167,000 families in all states and the Federal District (CPT, 2022). Of these, water clashes occurred in almost a third of the towns (304 municipalities).

The CPT's monitoring shows a worrying scenario of intensifying water conflicts over the years, as can be seen in the data in Table 1. The table highlights the average values for selected periods, with the last line comparing the most recent data, showing a consolidation of the expansion in the number of cases.

Following the 2005-2008 averages (three years after water conflicts began to be recorded), the 2018/21 average has risen from 63 to 365 cases (481%); in the same period, the increase in land conflict cases has risen by 94% (from an average of 653 to 1,269). In addition, the 280% increase in the total number of water conflicts is significant, compared with the averages for the periods 2011/2014 (96) and 2018-2021 (365). Considering only the case of water vs. mining, highlighted by the CPT since 2011, the increase reaches 516% between the two periods.

The CPT's data series, from 2002 to 2021, shows that 87% of conflicts are concentrated in the Northeast (1,001 cases), Southeast (920) and North (574) regions. Figure 1 highlights the upward trajectory of conflicts, with the number of cases increasing from 132 to 366 in the 2014-2021 period, with a peak in 2019.

In addition to the upward trend in events, CPT data (2022) shows that the states of Minas Gerais (MG), Bahia, Pará, Sergipe and Espírito Santo account for 1,752 cases, or 61% of the conflicts recorded between 2002 and 2021. The afore mentioned events in Mariana/MG and Brumadinho/MG strongly impacted the results for 2019 and beyond, in Minas Gerais and Espírito Santo (due to the Mariana/MG event). Among the causes is

TABLE 1 - Conflicts over land and water in the countryside and number of people involved - 2005-2021.

	Number of conflict cases			People involved	
Year	**Land**	**Water**	**Water and mining**	**Land (people involved)**	**Water (people involved)**
2005	777	72	2	803,850	162,315
2006	761	45	2	703,250	13,072
2007	615	88	4	612,000	163,735
2008	459	46	3	354,225	135,780
2009	528	46	4	415,290	201,375
2010	638	90	20	351,935	197,210
2011	818	69	11	458,675	137,855
2012	828	79	8	471,160	145,755
2013	802	104	28	461,065	158,180
2014	820	132	49	622,495	204,255
2015	828	157	90	642,005	217,710
2016	112	178	93	736,590	223,455
2017	1033	199	124	639,715	178,090
2018	1000	279	141	664,470	379,035
2019	1260	506	202	580,228	317,524
2020	1576	366	148	687,872	225,168
2021	1242	308	99	670,760	224,540
Average 1- 2005/08	653	63	3	618,331	118,725
Average 2 - 2011/14	817	96	24	503,349	161,511
Average 3 -2018/21	1269	365	148	650,832	286,567
Recent increase (average 2 to average 3)	55%	280%	516%	29%	77%

SOURCE: Comissão Pastoral da Terra (CPT, 2022). Organized by the authors.

the scarcity in Bahia and other northeastern states, which suffered a major drought between 2012 and 2017 (Marengo *et al*., 2016; Santana & Santos, 2020), while the state of Pará has serious conflicts over mining, hydroelectric dams, and transportation.

The events were registered, according to the typology and criteria defined by the CPT, as follows:

i) 1,418 cases involving "Use and preservation";
ii) 994 for "Dams and weirs"; and
iii) 437 of "Private Appropriation", leading to restricted access.

In only one case, there was a conflict for water use charges and in 9 cases there is no information – according to the methodology, there are event situations with more than one type of conflict and, therefore, the numbers may be different, exceeding the total number of cases in some of the measured parameters.

In all the cases registered, the main people involved and affected were squatters and settlers, farmers, residents affected by dams, river dwellers, fishermen, quilombolas and the indigenous peoples. In all of them, considering the parameter adopted by the CPT, "Situation of the conflict over water", the cases observed were: 1161 of "Destruction and/or pollution"; 661 of "Non-compliance with legal procedures"; 353 of "Diminished access to water"; 160 of "Threat of expropriation"; 156 of "Impediment of access to water"; 66 of "Non-resettlement"; 56 of "Destruction of cultural history"; 54 events of "Predatory fishing"; 53 of "Lack of resettlement project"; 47 registered as "Divergences", without details; 44 of "Inadequate resettlement"; and 41 of "Contamination by pesticides".

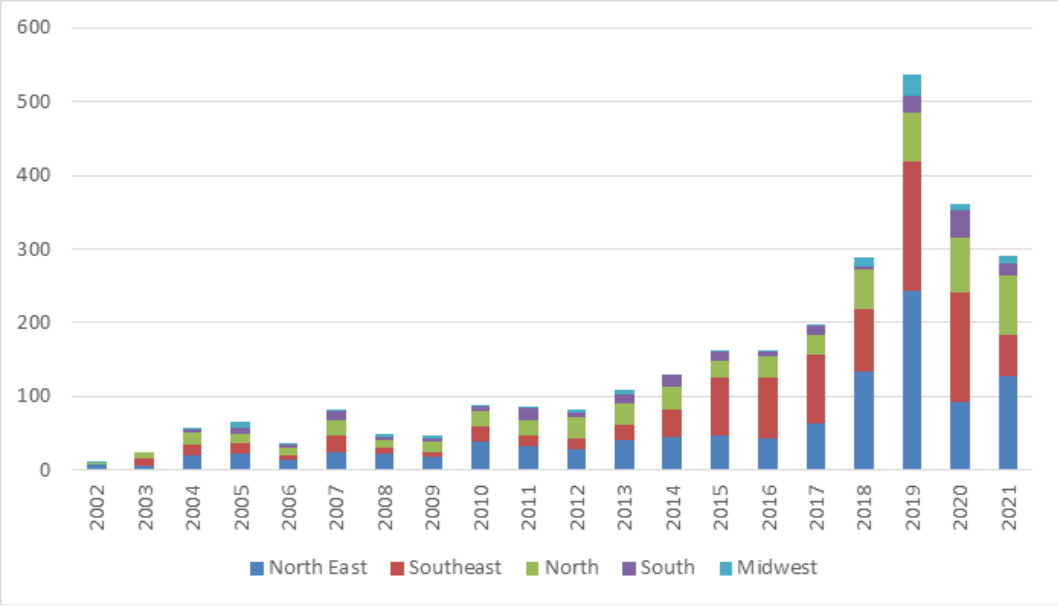

FIGURE 1 - Conflicts over water in the countryside in Brazil per region – 2002-2021.
SOURCE: CEDOC/CPT (2022). Prepared by the authors.

Finally, an important aspect is that, despite the fact that private actors are the main causes of conflicts over water, there are 307 cases in which governments are held responsible, adding up the federal (160 cases), state (40) and municipal (46) levels – including the cases of police (4 cases), politicians (6 cases), and the Public Prosecutor's Office (one case). As for private cases, the CPT records as causes: 1,032 mining companies - national and international; 724 entrepreneurs/traders; 459 hydroelectric plants - all sizes; 24 ranchers; and 29 garimpeiros. A small number of cases are caused by fishermen, small landowners, loggers, churches, traffickers and others.

After this brief data overview, it is important to note that the CPT's initiative, like others, contributes to not only record conflictual events between users in general, but also highlights difficulties in water and land management, and demands for public policies. Among them is the need to improve State's actions in planning, supervising and monitoring conflicts in the countryside in order to guarantee rights and support for different life and production styles.

In this sense, it is essential to be aware of the contradictions between market interests and power groups (commodity extraction/production, land grabbing, illegal logging, hydroelectric projects and others), and the desires of the people living in the countryside, who are sometimes suffocated by conflicts. The particularity is the impact on families in situations of great social and economic vulnerability, sometimes unjustified by the contradictions of capital (concentrated appropriation of land and water, expropriation of small landowners, lack of access to policies, among others). Therefore, registration systems, such as those of the CPT and others, and their dissemination, highlight the nature of the attacks and the injustices resulting from restricting access to land and water. The surveys are therefore in line with agreements signed at the UN level, such as the 2030 Agenda and its SDGs.

4.2. How can we move forward with management that recognizes conflicts and improves decisions?

Despite the important contribution of the surveys highlighted, there is a clear need to monitor conflicts in a more comprehensive and structured way in Brazil. For this, the government must always worrying about continuity and the independence of those carrying out the surveys. The broad academic production and actions of social movements can foster new partnerships, methodological contributions, as well as form an open monitoring network. This network can extend to river basin committees (CBH), public bodies and other actors that implement the SDGs in the country. Improving data collection and expanding the systematization and dissemination of data should be the purposes.

It is also important to adopt a comprehensive typology capable of identifying the wide range of conflicts, including within the State, with methodological independence so that there are no interruptions in budgets, imposition of rules and prohibitions. For example, the CPT and Fiocruz typologies can be added to the various local surveys (municipalities, watersheds, and others) carried out by universities, NGOs and other organizations.

The next step is to make the data available on joint platforms to encourage studies. It is essential to integrate the registers, generating a platform with

national, open and time series data. Fostering and research networks is important to carry out surveys where the partnerships do not cover, because of the costs of the procedures.

Regarding the importance of the methodological issue, a brief additional consideration is required, encompassing the analysis and not only the generation of data. Conflict analysis needs comprehensive and robust data to be able to improve water management and governance. Moreira *et al.* (2012), for example, propose an index to measure the level of conflict over water based on water availability, allocated flows, and reference flows. According to the authors, "the majority of conflicts over the use of water arise from the lack of planning and management of water resources, which is closely linked to the lack of information associating the flows already granted with water availability." (Moreira *et al.*, 2012, p. 8).

With this in mind, the authors propose the Conflict Index for Water Management *(Icg*) = (flow granted upstream for the segment's mouth under study) (percentage, expressed in decimal units, of the estimated minimum reference flow at the mouth of the segment under study (*Qmr*) capable of being granted)*(*Qmr*). The index applies to situations in which all the data is available - water inflow (current and rainfall) and withdrawals with a grant. This study has the merit of recognizing the differences between local and regional demands, admits the need for different methodological criteria for conflicts verification and points out the need for conflicts indexes due to the use of water as a management tool, planning and policy support.

In fact, mathematical modeling and other methodological tools are important to anticipate conflicts, mitigate impacts, act based on knowledge of the watersheds and be guided by integrated planning. However, these models have yet to reach conflicts caused by parallel local and intersectoral disputes, especially when they are born outside the context of the basins, in their complex hydro management structure - as seen in the case of California - in order to break the hydro hegemony structure highlighted by Zeitoun & Warnerb (2006). It is necessary to incorporate the socio-political facts, the interests of groups of actors and the typology of disagreements and power that limit historically recorded access.

Another example of ways to measure water conflicts highlights the importance of the CBHs. An audit by the Brazilian Office of the Comptroller General (CGU, 2020) sought to measure the complexity and maturity of some river basins management. The agency created the "Interstate River Basin Management Complexity Indicator (IC)", two of whose components are the "Level of Conflicts" and the number of grants. It is important for public authorities to move forward with this type of initiative, with continuous monitoring. This measure is in line with the SDGs and conflict resolution, which presupposes agreements between the players (Mostert, 1998; Rufino *et al.*, 2006), consistent indicators that are easy to understand and accept in each reality.

The shortest way to advance methodologies and reduce conflicts is to comply with the legislation (Law 9,433/1997) regarding the application of the set of water management instruments (SNIRH data platform, water resource management plans, granting of water use and sewage discharge, payment for water use, classification of water bodies and monitoring of their quality). These instruments can potentially reduce conflicts and improve access:

i) productive purposes (agriculture, industry, sanitation, energy and others);

ii) environmental (ecological flows, ecological-economic zoning, water quality);

iii) social and cultural (different ways of life, forms and values under which different communities and peoples access water).

One example of how to move forward using these instruments is the integrated and participatory planning of water use and design granting concession models that address the demands of future generations. This indicates, as broadly as possible, criteria of equity between the claimants. Thus, when awarding a grant to a large agricultural company, the future demands of family farmers in the same region, the regulator agent must consider population expansion, sanitation, and other uses. In addition, environmental management instruments such as licensing, and ecological and economic zoning (EEZ) can contribute to the management of environmental and water conflicts and should have integrated management. Finally, we need to publicize everything to make progress in line with the set of SDGs.

In this sense, public managers and water users must consider the causes of scarcity, disasters, and incidents, which are the basis of local conflicts, in addition to environmental parameters, flow rates and the purpose of grants:

i) a reference function for grants based on the flows upstream and downstream of the catchment (in the case of aquaculture in dams);

ii) ecosystem/ecological parameters and socio-economic demands;

iii) variables (measured and/or estimated) that incorporate the characteristics of demand, the profile of the local/regional economy and its connections;

iv) past and present measurement of conflicts, implying an input variable translated into met and possible demands;

v) attention to the other instruments of the National Water Resources Policy (PNRH, Law no. 9,433/1997);

vi) periodic reassessment and adjustment of the models;

vii) attention to the concepts of integrated management, multiple uses of water, management and governance with shared responsibilities; and

viii) attention to forest and riverside communities and their traditional uses of water.

In this way, by registering and disseminating conflicts, improving management tools, paying attention to the SDG targets highlighted in this text, especially SDG 6, new commitments and partnerships with regular financial contributions, Brazil can bring its legislation into line with international agreements. The targets of SDG 6, by invoking the universalization of services, the monitoring of water bodies, participatory management, and the sharing of responsibilities with partnerships, reinforce the need for participatory governance, which the literature and UN agendas treat as essential at local and international level.

In turn, water conflicts in cities can be monitored through SNIS and SNIRH, Sisagua and IBGE surveys. In the case of SNIS and SNIRH, the government must develop both a typology, methodology and ways of guaranteeing the quality of the information, as well as campaigns to raise

awareness among the population and those responsible for registering conflicts such as:

1. the dumping of pesticides in rivers that affects the population of cities;
2. damage to water catchments and the quality of water supplied to the population in rural areas and cities;
3. water and sewage tariffs, or the factors that limit social participation in water management and governance.

Finally, it is important to structure a national data platform for registering conflicts over water (or socio-environmental conflicts, including water), while encouraging existing initiatives. This need is growing, especially against the backdrop of greater commercialization of land, water, and nature, as is the case today. The collegiate bodies of SINGREH have the responsibility and power to organize this information. Among them, the National Water Resources Council (CNRH), state councils and basin committees or entities that replace them locally can generate data and monitor situations before they become contentious. However, the interests of the dominant players in these councils (including the government) must be kept at bay, given the limits of their composition. The Public Prosecutor's Office and the Courts of Auditors, at state level, are able and competent agents to structure/support such a system or data platform.

5. Final considerations

Throughout this article, our purpose was to present and discuss concepts and typologies of conflicts over water, in its multiple uses, highlighting data and gaps in records, focusing on field disputes in Brazil. It has become clear that the UN's agendas, particularly the socio-environmental agendas, are responses to such conflicts, whether they involve tacit or explicit restrictions on access, imbalances of power and wealth, or the definition of priorities, management, and governance. SDG 6 expresses some of these in several of its targets; for example, by pointing out failures in the provision of services, the inefficient use of water, the concentration of its ownership and dominance, as well as gaps in governance and monitoring.

Data platforms and academic studies point to dissonance between scarcity situations and land water uses between countries, communities, and productive sectors. The international (De Stefano *et al.*, 2017; Farinosi *et al*., 2018; California Natural Resources Agency, 2018; WWAP, 2019; Pacific Institute, 2022) and national (Porto *et al.*, 2013; CPT, 2022) surveys provide lessons and general analyses, but it is required to advance and expand the databases, typologies of conflicts. In Brazil, there is recognition of this situation in legislation, but there are gaps in implementation, including the lack of official records and a proper system for the dissemination of conflict records and their use in public policy.

The research found that in the absence of structured official data in Brazil, the important voluntary surveys carried out by civil society and academia stand out. In this sense, partnerships such as the one led by the Pastoral Land Commission are indispensable for monitoring conflicts over land and water. The data collection model, typology and systematization are aspects that need to be improved, for example by focusing on river basins.

CPT data shows that in 2879 cases of conflicts in the countryside, between 2002-2021, there are:

i) covering divergences between individuals and between production systems, cultures and socio-environmental and economic visions;

ii) violence resulting from inequalities in distribution, power and institutional dysfunction in Brazil;

iii) and disparities in access, ownership and control of land and water in the country.

The data analyzed also highlight the dispute over nature's resources, water, as a commodity, with a focus on short-term exploitation, affecting present and future activities and generations.

In this sense, the SDGs, their targets and indicators can strengthen water and environmental management instruments, in line with national legislation. The improvement of water use concessions was listed as an example among the instruments of the national water resources law that could be improved, in line with the UN 2030 Agenda. As with the environmental management instruments, the improvement must include concession models aimed at sustainability, integrated management, and fair access.

In order to align national laws with the most advanced goals of the SDGs, it is necessary for collegiate bodies such as the CNRH, state water resources councils and river basin committees to play a leading role in this issue. One way to encourage this is through partnerships to create a platform for conflicts (socio-environmental or over water) in Brazil. Within the executive branch, the ministries and agencies involved have the capacity to do this and the duty to structure themselves to make the registers effective and, at the same time, to improve the policy instruments in this area. The Public Prosecutor's Office and the Courts of Auditors have the role, autonomy, and independence that government agencies and bodies do not have to organize and sponsor the full functioning of a platform.

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