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Analysis of governance in a complex socio-ecological system: Caroni River Basin, Venezuela

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Abstract: This article analyzes the sociopolitical transformations experienced by the Venezuelan State between 1999 and 2019, which have impacted the management of the Caroní River basin (located in the south of the country, of national importance due to its links with Colombia and Brazil). The study describes the complex scenarios and socio-ecological attributes that influence environmental governance and the management of this basin. An adaptive research method using a temporal and spatial scale protocol with multiple research cases was adopted. The results show differentiated relationships that respond to socio-institutional cultures and the meanings of ecosystem functions constructed by human groups through collective actions. The article concludes with a definition of complex governance with variables dependent on non-specific territorial boundaries and links, temporal scales, administrative levels and/or jurisdictions, and dynamic actors that restructure and redefine institutional and community practices, now with increased levels of empowerment.

Key words: complex socio-ecological system; collective actions; community empowerment; multi-territoriality; watershed management

1 Introduction

The ways in which we seek to govern natural resources not only impact the ways of life of societies and their territories, but also their cultural and natural interpretations, which can end up limiting access to the uses and values of these ecosystems. Ultimately, access to such resources translates into power, and actors exercise it in different ways. Governance is presented in this study as a system of government built on formal or informal agreements at non-hierarchical territorial levels (networks). It seeks the inclusion and action of civil society through community-based governance systems for the management of their common goods and their territories, as well as the participation of government institutions and other social actors in the management of natural resources and environmental public affairs. In this sense, we can affirm that governance exists when the competent institutions and other actors have the disposition and intentionality to structure agreements, policies, legal frameworks and any instrument that envisions the sustainability of the socio-ecological system (Silke, Esguerra and Goerg, 2017; Kok and Veldkamp, 2011).

Governance also involves conflicts between all the social actors involved, their levels of action, and even between the various geographic spaces defined for each of a territory's uses. These uses generally do not coincide with the practices, traditions, and perspectives of their users (Lugo and Lara, 2020). Thus, the ways in which agreements are structured, articulated, and common actions are generated both between decision-making bodies and at the levels and instances of participation, and the inclusion of diverse practices and knowledge, can determine good governance or, conversely, lead to its ungovernability.

Regarding these processes, there is an emerging consensus that the challenges of sustainability and governance require new frameworks for knowledge production and decision-making (Poteete, 2012). Furthermore, scale(s) play an essential role in socio-institutional analysis, despite their complex nature, depending on the discipline with which environmental issues are addressed and the perceptions held about them by those involved in environmental management. A scalar analysis helps predict the impact of a policy at one or more scales, which is measurable and relevant to the study of governance (Song, Andrew, & Morrison, 2018). In this research, the watershed was selected as the basic territorial management unit, as it houses a diversity of natural resources in its ecosystems that are essential for life. However, conflicts also arise in it over the use of resources and ecosystem services (Lebel, Nikitina, Pahl-Wostl and Knieper, 2013).

This article uses the conceptual framework developed by Gallopín (2006) to analyze the institutional system within a socio-ecological system. This approach formulates an integrated and systemic approach that replaces sectoral and linear planning by analyzing the total system comprised of nature and society (including relevant subsystems and their linkages), constituting the basic unit of analysis for development issues (local, regional, or global). This reference was considered, but in a context of difficult temporary sociopolitical transformations, as described by scientist Hebe Vessuri, leader of this novel research project (Vessuri, 2019). This framework is useful for the purposes of our study, which consists of analyzing aspects of governance in the Caroní River border basin in southern Venezuela, amidst linkages at multiple spatial scales and dynamic interactions of multicultural actors. To this end, human communities and their forms of organization with historical, geographical and cultural links were studied, whose practices include everyday elements and institutions, which are considered as social groups that intervene in decision-making, based on rights, rules and emerging social practices of their users and forms of governance that, in this case, (re)produce collective actions (State-Society) and affect their vulnerability.

2 Materials and methods

2.1 Area of study: scales and levels of analysis

The study is carried out in the southeastern state of Bolívar, with an area of 242,801 km². This state is divided into 11 political-territorial or municipal-level structures. Six municipalities (Caroní, Bolivariano de Angostura, Piar, Angostura del Orinoco, Sifontes, and Gran Sabana) overlap the Caroní River basin, covering an "area of approximately 92,170 km², where around 245 tributary rivers converge" (Sánchez, Rosales, and Vessuri, 2013, p. 91). The Caroní River is a tributary of the Orinoco River and originates on the border with Guyana (Silva, 2005). The basin is overlapped by Areas Under Special Administration Regime (ABRAE), including Canaima National Park (PNC). The basin has a rugged topography, producing rapids, waterfalls and drops of the Caroní River with a very low sediment load that has allowed the development of a system of hydroelectric dams of great importance by providing "72% of the national electrical energy and to neighboring countries such as Brazil and Colombia" (Sánchez, Rosales and Vessuri, 2016, p. 65). It is relevant that this basin is located, according to Rosales (2003, p. 11), "within the most important of the great world water reservoir for its conservation constituted by the Guiana Shield".

To address a common spatial scale, this study divided the watershed into two sections, as shown in Figure 1. This allowed for community action work on two case studies: a) in the Lower Watershed, with urban (Creole) communities in the Caroní municipality; and b) in the Upper Watershed, with seven Indigenous communities in Sector 5 in the Pemón people's territory, settled in the upper sub-basins of the Aponwao and Karuay tributaries.

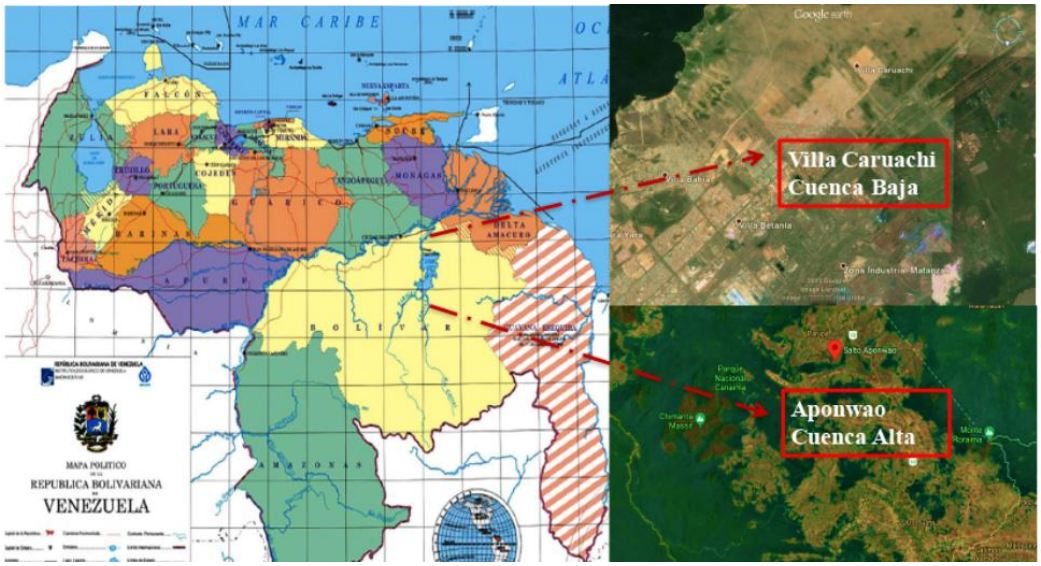

Figure 1. Location of the Caroní River basin and location of Community Scales in the study area

Source: Prepared by the author based on the map of Venezuela from the National Science Observatory (2013) and images taken from the Lower Basin of Google Maps (2017a) and the Upper Basin of Google Maps (2017b).

2.2 Methods

This is an empirical study based on fieldwork guided by participation-observation-action research. Multiple case studies at different spatial and temporal scales, as well as levels of socio-institutional action, were used. Annual methodological adjustments were made given the dynamic socio-territorial scenarios. The multiple case studies were analyzed over time scales (1940-1998 and 1999-2019), incorporating the research products generated during the fieldwork (2007-2017) (Note 1).

The stakeholder analysis was conducted at six levels of action: Level 1: community; Level 2: municipal; Level 3: state; Level 4: regional; Level 5: national; and Level 6: international. These influences and connect with three spatial scales at which the case studies were presented: Scale 1: community; Scale 2: a watershed; and Scale 3: Bolívar state.

The selection of key informants for the institutional interviews included all relevant stakeholders from institutions at different levels of public policy, environmental managers, and scientists, through open and semi-structured interviews. This process resulted in a network of 43 interviews, 17 personal communications, and six recordings of speeches in community assemblies that also included legislators and elected officials from the 2008-2019 period.

At the community level, between 2008 and 2015, an interview guide was developed and administered to Pemón elders suggested by the community. This led to 12 interviews being conducted in the Pemón language with the assistance and simultaneous translation of Francisco Pérez, a young Pemón research assistant living in the area. Subsequently, 19 interviews were conducted in the selected communities to address more specific topics such as institutional organization and articulation and current practices: i) in the Upper Basin, ten interviews and informal discussions were conducted in the communities, in focus groups made up of captains and other representatives of the Captaincies, spokespersons for the communal councils and technical water tables in the indigenous communities; ii) in the Lower Basin, nine interviews were conducted with community members and 11 community members were contacted for a workshop in the area.

In summary, 74 interviews were conducted, 26 personal communications were made, and 22 meetings were recorded in socio-institutional coordination spaces. All these recordings were fully transcribed and organized by thematic areas linked to the planned scales of analysis. The recorded actions are presented in actor network analysis graphs.

3 Results

3.1 Socio-ecological complexity in the Caroní River basin

The Caroní River basin presents high levels of ecological fragility (Rodríguez-Olarte, 2020; Bilbao et al., 2017), whose important resources are susceptible to serious impacts from the uncontrolled human intervention currently occurring as a result of interpretations of the rights of social groups over the goods provided by nature. In this basin, intensive uses of spaces have been determined, which have been fragmenting forests. Domestic uses include agriculture, livestock, and the subsistence practices of local communities, now in permanent settlements; also due to tourism, forestry, and, more recently, the exploitation of metallic and non-metallic minerals (Hernández, Delgado, Meier y Durán, 2012; Bilbao, Leal y Méndez, 2010; Rosales, 2001).

Recent publications such as Lozada and Carrero report for 2017, indicated that uses with "greater incidence in deforestation are livestock and agriculture" (2017, p. 73) and estimated that in Venezuelan Guiana "Mining would be responsible for just 3.2 % of the total deforested" (p. 75). In the Portal of the Observatory of the Andrés Bello Catholic University, the publication of Díaz (2021) unofficially projects "a rate between 2 % and 4 % annual deforestation and indiscriminate logging in recent years". These scenarios could deteriorate the landscape and alter the hydrological regime of the basin with great conflicts of ecological sustainability in the medium and long term.

The administration of the Caroní River basin has been driven by the former Electrificación del Caroní (EDELCA), the Corporación Venezolana de Guayana (CVG) and the Ministry of the Environment (MINAMB). However, since 1999 the scenario has been changing, generating challenges such as the articulation and operability of actions and the participation of multicultural communities, principles of the new 1999 Constitution, which have been promoted and implemented with a broad normative, from the political-ideological vision of the government of President Hugo Chávez from 1999 until his death in 2013 and of the current President Nicolás Maduro, who began his government in 2013. Each of the phases of these processes of social inclusion were preceded by discursive elements, which gave a twist to participation in Venezuela through a system of social aggregation, with particularities in the normative and in the institutional redesign to accelerate its practice (Sánchez, 2016a). Thus, organized citizens have ventured into community governments. In the country, and particularly in the state of Bolivar, these community organizations group citizens in different figures such as the Communal Councils (CC) and the Technical Water Boards, considered instances of participation and collective expression. At present, the CCs operate in urban, indigenous or rural communities and receive economic resources and technical assistance to solve the problems of their territorially defined spaces.

3.2 Socio-institutional interactions at the community level (indigenous and Creole)

In the Alta watershed, in the Gran Sabana municipality, community initiatives for reforestation, restoration and conservation activities (Rosales, Deza, Delgado, Chani and Machuca, 2012) were carried out with the indigenous Pemón, a native people located between Brazil, Venezuela and Guyana. The Pemón are divided into three subgroups: the Arekunä, the Kamarakoto and the Taurepán, and their livelihood depends on horticulture, gathering, hunting and fishing (Thomas, 1983; Urbina, 1979). In the context of the Gran Sabana, public management actors are learning to balance their links with two community management units that currently prevail, such as the Capitanía Indígena - the body that represents the indigenous collective of each community - and the indigenous CCs. Despite conflicts that have arisen between both forms of organization, the former, corresponding to uses and customs, was modified during the 1940s with the civil associations, and the latter is a result of recent government policy on community organizations.

What the Pemón argue at this scale is that most of the communities still do not have a written work plan that represents their cultural base; they only have planning documents that come from two sources: the first corresponds to the

"life plan of the Pemón people" (Rodríguez, Sánchez-Rose and Vessuri, 2010), which has been generated in reference to international experiences (World Bank, 2005) and the second, the communal plan, which is being generated by the CCs, proposed as an integral scheme to consolidate the communities as permanent settlements. Despite these divergences, interactions and practices are taking place with dimensions of collective learning spaces that are strengthening the discourse of the Pemon, also as a result of the processes of self-demarcation of the territory. All of these are current negotiation tools used by the natives to interact with other actors.

Regarding socio-ecological changes, it is worth mentioning that these may be impacted as a result of current subsistence practices explained by the indigenous people themselves and the managing institutions; among them are those derived from modified practices in horticulture and the incorporation of mining activities and tourism. To this should be added the incorporation of new practices for the management of water resources in their domestic and community uses, which include infrastructures for water distribution and treatment in the communities studied, as evidenced by a progressive and irreversible appropriation of actions and uses that are typical of the non-indigenous world. However, the cultural interpretation of water by the Pemón-arekunä people prevails, which responds to a strong linkage and understanding with symbolic and objective representations of water as an element of life (Note 3), anthropological processes, well reported in Sánchez, Rosales and Vessuri (2015), which complement the scientific explanation on the socio-ecological dynamics, found in their hydrography by Rosales (2003):

There is an approximation with the scalar structures corresponding to the hydrographic networks proper to a watershed that still remain diffuse in them in terms of the definition of the water divides that limit the watershed, although this does not occur with the surface drainage flows and networks and geomorphology, which resemble their cosmology (Sánchez, Rosales and Vessuri, 2015, p. 11).

In the lower basin, we studied the collective action practices of social groups in Villa Caruachi, located north of Ciudad Guayana, Caroní municipality. This urban settlement was noted for its conflicts and a self-mobilization caused by the lack of drinking water in 2004, which was reported by both institutions and the local press. The community was founded with 700 families coming from different settlements in the south of the city, displaced by the lack of housing at the end of the 1990s. This action included the occupation of a plot of land that did not have any type of service. Subsequently, in 2000, they occupied another plot of land on which the municipality and the national government were building a housing complex, which was occupied without being completed.

At the end of 2008, working groups were held in the community to address the water problem. The community organized itself into two CCs, an action that was complemented by the decision to coordinate with the state water company Hidrobolívar. From that moment on, community work was resized with the incorporation of technical and social teams from the water company. At the end of the same year, a technical committee dedicated to the water issue was formed. In 2013, six CCs coexisted in the community. This experience showed a change in water management practices as a result of the empowerment processes that arose from participation, reflection, collective action and socio-technical training to improve their quality of life. Through co-management, this community was able to install pipe networks for the supply of drinking water. However, sewage sanitation is still a challenge for them. It has now doubled its population towards the periphery of the sector, with similar precarious situations, amid difficult economic and institutional conditions for the government as of 2016. Alekséenko and Pyatakov (2019) comment that, since 2016, the shortage of food and import supplies to the country increased, which was caused, among other causes, by the increasing pressure from the United States and the economic and commercial blockade imposed on Venezuela, which were substantially increasing and executed by other countries in the following years. In addition to domestic and international political backgrounds, world oil prices are

also declining. These factors had an impact on the acquisition and importation of equipment necessary for the maintenance and development of new community projects that forced them to rethink alternatives to the water problem.

3.3 Institutional transformations for drinking water service

Three historical moments of institutions, policies and infrastructures for water management stand out: the first generation of water agencies emerged in the 1940s with the National Institute of Sanitary Works (INOS) and the National Water Resources Development Plan Commission (COPLANARH), for the planning and administration of the country's aqueducts and the national water policy oriented at the watershed level. This centralized policy caused congestion in the sector (González, 1989). Another characteristic feature was the policy of privatization of the water sector, a failed attempt during the period between 1970 and 1990, which was influenced by policies in the international context.

The institutionalization of the water sector throughout the 1990s was not detached from the characteristics and weaknesses of the generation that preceded it, despite the fact that the idea of deconcentrating the service had been taken up again with the creation of HIDROVEN, which would be in charge of providing the service in 20 of the 23 states at the national level. In Amazonas, Bolivar and Delta Amacuro, the three remaining states located in the south of the country, the provision of the service was entrusted to the Corporación Venezolana de Guayana (CVG), which added an element to the model for the Guayana region, linked to industrial and hydroelectric development. The Corporation concentrated all the competences and powers attributed by the national executive and those corresponding to the municipalities, which at that time had not yet been installed as local governments with competences on the water issue. This condition would complicate the transfer of water management and sanitation competences in the region to the CVG, which created the Management of Sanitary and Hydraulic Works (CVG-GOSH). The latter body administered all the infrastructure for the water service with scarce resources. In short, all these elements were shaping a scenario of water ungovernability by the end of the 1990s. By then, a new vision on water arose, based on the social right to water resources with the 1999 Constitution, which allowed the transition to a third generation, facilitating decentralization and decongestion, now also managed at the community, municipal and state levels.

In the state of Bolivar, the conflict over access to drinking water from previous decades still marked the agenda between 2000-2004 and the emergence of a new order in water management. There was the insertion of several dam and reservoir systems as a result of the hydroelectric development of the middle and lower Caroní that had begun in the 1970s, constituting new structures for the distribution of drinking water and as discharge areas for effluents.

In the case of the creation of the hydrological agency and the new socio-institutional order, there is a clear directionality of the water sector, with multiple interests and visions of the actors involved, starting in 2005, between MINAMB and the new Hidrobolívar (a joint venture between the 11 municipalities and the Governor's Office of Bolívar). These aspects defined the institutional culture of water management. Also, the accumulated knowledge, in the midst of a scenario marked by the radicalization of political thinking, was a determining element in the construction of the water agency in the state of Bolivar, with great achievements in production. Between 2018 and 2019, these advances and co-management agreements between communities and water institutions have been able to be maintained, despite the economic difficulties and the unfavorable international context for access to purchases of supplies, materials and spare parts with incidences in the maintenance of equipment and infrastructure that had been able to be installed in recent decades.

3.4 Environmental institutions for the management of the Caroní river basin

Since the 1960s, mechanisms were created for natural resource management in general, which considered principles for watershed administration in Venezuela. However, the evolution of the Caroni river basin management indicates that

after almost six decades of visions for its development, in recent years it has reached a dynamic level in the actions implemented on this scale. In spite of this background, the Caroni river basin only managed to carry out an important Study of the Integral Master Plan of the Basin, prepared by CVG-EDELCA (EDELCA, 2004), which was a requirement of the Inter-American Development Bank (IDB) with the financing of the hydroelectric development of the Caroni, despite the limited participation of academic scientists, whose contributions would have complemented the techno-institutional baggage of the then EDELCA and MINAMB with the participation of researchers and technical experts on the subject, as co-responsible for the process. In any case, this would be reformulated in 2007 with the *Water Law*.

The approach undertaken differs from that applied in the past by including various actors within the basin, as seen in Figure 2, who have been structuring spaces for coordination and new schemes for managing it. These processes have also added a particular feature to state-society relations, evidenced by a (re)distribution of power, as many institutions competent in basin management have joined the action. Furthermore, there has been an explicit (re)definition of the roles and practices of the actors who have had to join the management and learn about their competencies and uses. Currently, the actions indicate certain transpositions, with a greater expansion of individual and collective actions amid a growing and dense map of actors. In 2013, management of the basin was shared among many actors, with the predominant role being the National Electric Corporation (CORPOELEC, which now includes EDELCA), the Ministry of Communes (MINCOMUNA), the Ministry of the Environment (MINAMB), the Regional Government of the Basin (CVG), and the Ministry of Communes (MINCOMUNA). This last actor emerged as an indicator of community participation policies in the midst of differentiated realities (indigenous, rural, and urban Creoles).

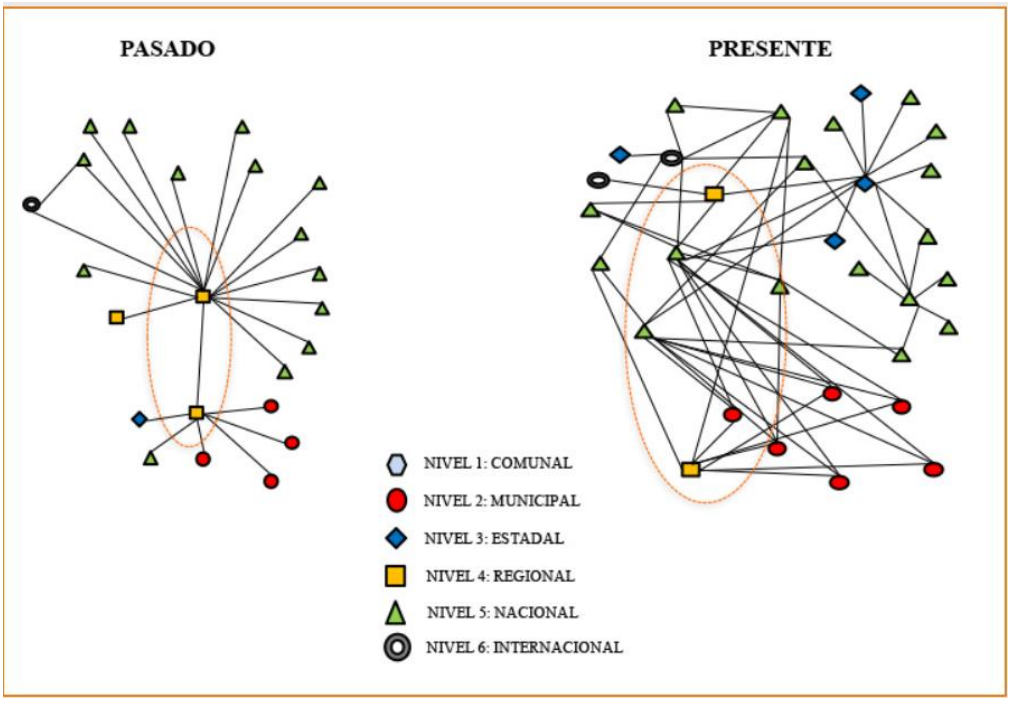

Figure 2. Redistribution of stakeholder participation at multiple levels of action, past and present, after the reform of the Venezuelan State in 1999 at scale 2 - Caroní River basin

Source: Prepared by the authors.

Among so many divergences, it was noted that the expressions and meanings of territory vary according to the historical connection and dynamics of life of each of them, their cultures, and a plural knowledge system. In this regard, Sánchez, Sánchez-Rose, Rosales, and Vessuri argue that: The frameworks observed in each case also indicate that they continue to have an overlapping dynamic link when viewed as a whole, which are complex due to the multiple scales and

levels of action, which direct attention to the way in which interactions are interwoven amidst a variety of differentiated territorial processes, actors and dynamics, where space obeys: 1) At the institutional level, to the multiple uses that imply political-territorial jurisdictions, as well as areas of action granted by institutional competences and interests. 2) At the community level, it is defined by the historical sense of occupation, relocation and, even, by the same perceptions of the collectives regarding the cultural representations of the territory and its social relevance. 3) At the natural level, without a doubt, it is given by the structures, functions and ecosystem dynamics (2014, pp. 126-127).

This collective rethinking of the territory, both within communities and institutions, has not only been a consequence of the regulatory framework but has also entailed a rethinking of the territorial dynamics and logic that have emerged in Venezuela. Thus, these spaces and perceptions of the territory in permanent transition, a product of ongoing sociopolitical transformations, have been restructuring the institutions present in the basin. Despite this, all stakeholders still await clear "direction" regarding its management, amid unfulfilled visions and expectations since 2013 regarding the functioning of the "Caroní River Basin Council" and the official promulgation of the "Basin Planning Plan", both required components for the development of a "Comprehensive Management Plan for the Caroní River Basin", processes explained in Sánchez, Rosales, and Vessuri (2013).

For many years, specific actions have also been undertaken to mitigate mining activity, which is impacting the socio-ecological dynamics at this hydrographic scale due to soil degradation and other implications of the activity. Current mining conflicts are generated by human occupation for illegal mining in the basin. This hydrographic territory also overlaps with areas of conservation importance, such as Specially Managed Areas (ABRAE), including Canaima National Park (PNC).

The conflicts surrounding mining activity in the south of the country have been addressed as a state policy through agreements and commissions (Note 4) to coordinate actions to resolve them. Among the various multi-stakeholder commissions that have been established, we have interacted with the "Piar Mission" in 2003, the "Mining Reconversion" in 2005, the working groups of the "People-Government Alliance" in 2006, the "Caura Plan" in 2010, the "Canaima Plan" in 2012. Recently, there has been a committee for the "2019-2025 Strategic Vision Plan for the Mining Sector", which has been defined and divided since 2016 through the "Orinoco Mining Arches" project. This project is a national strategic development unit that overlaps with the Guiana region due to its abundant mineral resources (Ministry of People's Power, 2018).

As of May 2019, 1,000 mining alliances, as these labor agreements for mining extraction are known, had been established; 946 were undertaken with small-scale miners working in the upper and middle Caroní basin, and the remaining agreements were with joint ventures formed by foreign investors. Despite these actions, which receive divergent views regarding their sustainability, they will continue to generate numerous conflicts because they have accentuated the use of mining in all its dimensions and practices, whether controlled or not, actions that will degrade soils and water structures, impacting the socio-ecological system of Venezuelan Guayana. Finally, currently, mining exploitation represents a significant source of income and employment in the south of the country. In a context of declining operations and oil revenues, it is the main source of income for the Venezuelan national budget.

4 Discussion

The multiple characteristics, including the multi-scale of management, the multi-actors and the multiple levels of actions, as well as the limits, edges or gaps of the same system associated with a primary unit, such as the hydrographic basin scale, are a fact that is assumed as a multi-territoriality. This phenomenon defines functional areas or management scales that allow the presentation of a diagram derived from the relationships of the socio-institutional subsystem and its impact on governance, as observed in Figure 3.

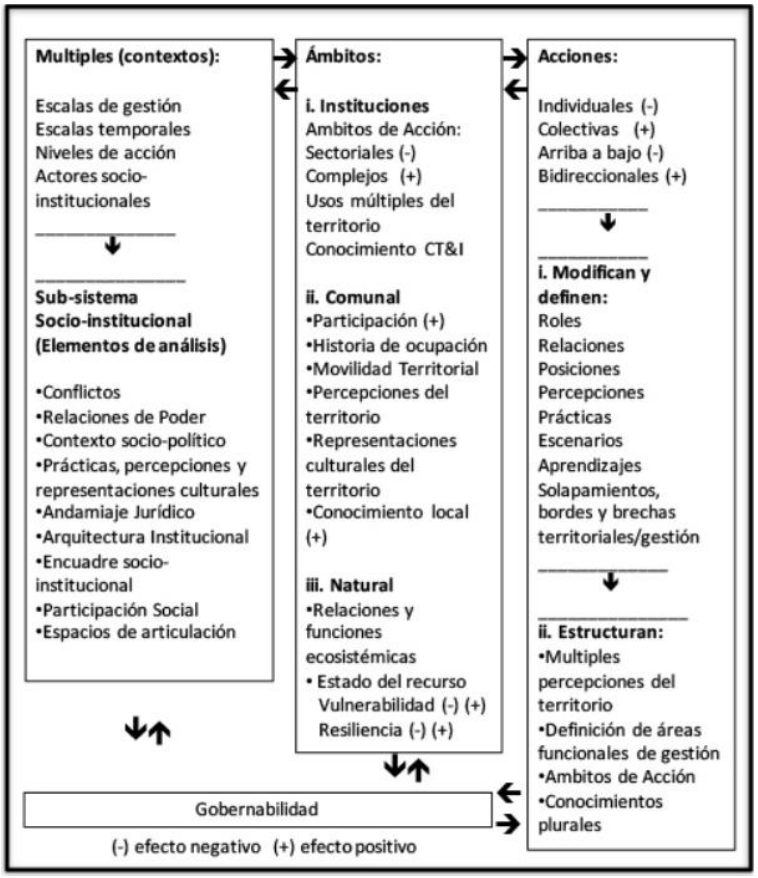

Figure 3. Summary diagram of the relationships of the socio-institutional subsystem and its impact on governance

Source: Prepared by the authors.

Regarding management scales, it became evident in practice that there are different meanings of territory related to social groups, with reinterpretations, but also with emerging uses for each use of geographic spaces. In this regard, Cash et al. (2006) had identified a series of scales that are relevant to socio-ecological systems. Applying this analysis shows that policymakers do not respond to the complexities of these systems by trying to impose a standard scale for management, as has been the case for decades in Venezuela. That is, the limits of administrative action do not coincide with the limits of natural or human systems, a characteristic of complex systems.

The relationships and connections between actors constituted an exercise in the analysis and interpretation of the scalar realities of action, which is graphed in Figure 4, integrating each of the dynamic layers in their maximum complexity, as an anthropic process that is undermining both the associated ecosystems and those of the basin. . In this case, the practices and knowledge generated by these interactions strengthen Eleanor Ostrom's (2010) hypothesis of collective action in some way, and in this context, Sanchez (2016a) explains a comprehensive social and institutional redesign. The way in which they are constituted and how the State-Society relationship is developed based on the process of State intervention, establish a new set of norms and rules for social participation in the urban communities of the Baha

Basin. In contrast, in the indigenous communities of the Upper Basin, it has been observed that they adjust to these arguments in a differentiated manner, due to their identity traits as indigenous peoples described in Sánchez (2016b). In both cases, the State has had an interventionist direction for empowerment and common actions, promoting various valid experiences with bidirectional actions and responses from the top down and vice versa.

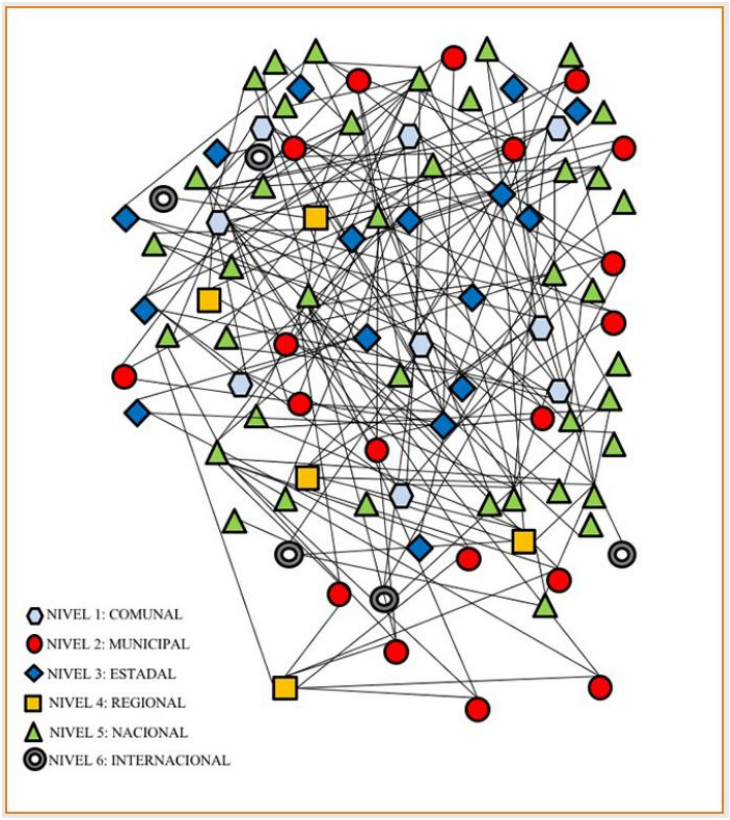

Figure 4. Integrated dynamic layers at their most complex; interactions of actors at multiple scales and levels of action linked to the Caroní River basin after the Venezuelan state reform in 1999.

Source: Own elaboration.

Working with communities and institutions, and understanding their cultures, which are the result of a set of underlying rules, norms, and practices, was crucial. This is amidst dynamic social construction processes that are subjectively linked and determine and configure scenarios for action. Furthermore, to understand institutions in their actions and the interactions that occur between them (Young, 2007), it has been important to analyze the State's intervention processes (structural and circumstantial), as well as the dynamic sociopolitical apparatus that always appears to be in transition and that will be interesting to observe with the emergence of emerging forms of action and participation in the COVID-19 pandemic and post-pandemic context.

These processes have revealed novel dynamics from the local to the international level, with new spaces for articulation. Based on these multi-stakeholder dynamics, the analysis of practices allowed us to understand their structuring for the development of collective actions, which even involve the rapprochement of those actors with individualized tendencies. In short, all actions generate conflicts, tensions, agreements, and commitments that are reproduced as a result of good or bad practices. It was crucial to study multi-level socio-institutional actions, which became a cross-cutting theme, covering diverse topics such as forms of participation, decentralization, decongestion, and new power relations during these nearly 20 years of participation-observation-action. This was recognized as having a strong impact as a collective action due to the existence of differentiated competencies at each level of management and the roles of actors who

subscribed to their interests, interpretations, and institutional cultures.

Regarding community organizations, although they have been the product of a process of state intervention, they have also incorporated initiatives and practices that have emerged from these citizen groups, which attribute autonomy and legitimize their self-governance. These processes were observed both in the urban context and in the indigenous context, with particular experiences that include elements of flexibility, adaptability, and transformability of the socio-ecological system, as mentioned by Skrimizea and Parra (2019) and Folke et al. (2010). This research has shown that these are complex and multifactorial elements that impact governance through a clear bidirectionality: multi-level actors pressure the community scale with their top-down actions, but they are in turn pressured from that community scale from the bottom-up. This phenomenon arises because communities have responded to public policies and provided feedback on every social and political process resulting from their autonomous practices, knowledge, and resilience.

In this sense, features are provided that support the postulates of the phenomena of governance, affirming that these elements are structuring conceptual schemes for the study of horizontal and balanced governance, recognized, referenced, and desired as the most appropriate (Pilkienė et al., 2018). However, profound transformations are highlighted here in the ways in which they are found or diverged, articulated, structured, and applied within plural knowledge regimes, as well as the way in which they are articulated for the implementation of collective actions, without implying that a valid common language for the management of natural resources exists or is possible.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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Notes

1. This article represents the systematization of the unpublished results of the author's ongoing research for more than a decade in Venezuelan Guayana, in southern Venezuela, and other results previously published in publications by the author and other researchers from the "Risk Project". The Risk Project and its multidisciplinary approaches were developed with researchers from the Venezuelan Institute of Scientific Research, the National Experimental University of Guayana, the Simón Bolívar University, and the Center for Development Studies at the Central University of Venezuela. Public institutions such as the Bolívar State Government, the Venezuelan Corporation of Guayana, and the Interterritorial Compensation Fund of the Federal Government Council of Venezuela were also involved, until 2017. We would like to thank the National Fund for Science and Technology of Venezuela for funding four research projects since 2007. We also thank researchers Hebe Vessuri of the Center for Research in Environmental Geography (CIGA) at the National Autonomous University of Mexico (UNAM) and Judith Rosales of the University of Guyana for their comments on this article. We also thank Ramses Ortiz for his collaboration in network layout. We also thank designer Maria Elena Jansen and Maziad Naime for their suggestions.

2. In 2005, President Chávez promoted community organization and the beginning of civil participation in Venezuela with the creation of Communal Councils. Their mission is to self-manage projects and plans to improve living conditions through the *Special Law on Communal Councils* of 2006. The Communal Councils are currently known as bodies for participation, coordination, and integration among various community organizations (Water Technical Roundtables, Indigenous Captaincies, among other preexisting organizational structures), social groups, and citizens.

In 2009, concepts were reconsidered and redefined based on the practices achieved by communities and their Communal Councils after four years of experience. The way in which they would continue to organize, conform, or adapt to the new law is also made explicit, with two key elements: First, the number of family groups that must comprise it, and second, the areas and territorial boundaries that collectively belong to it for action, thus avoiding possible overlaps of community territories and community divisibility. These conditions were established in the Preamble and in the content of the new norm, now as an *Organic Law of Communal Councils*, a legal status granted to give it greater force since they have been generating experiences and contrasts that have been described as part of the socio-institutional transformations in Venezuela (Sánchez, 2016b).

3. The Pemón understand water as an element of life and a connection to the practices of their world. Thus, certain natural physical components of objective representations linked to hydrology, such as rocks, tepuis, waterfalls, rivers, springs, and ravines characteristic of their territory, have served as references in their oral mythical narratives to locate and describe both landscapes and sites of natural importance to their culture. Hydrography is of particular importance because this people has lived in its immediate surroundings. Furthermore, in these places there are important geographical features or features for the symbolic representations that we have described in Sánchez, Vessuri and Rosales, on the interpretation of water in three areas: i) the area of religious ritual or water as a means of the ritual itself, ii) the eschatological values

of water as punishment, and iii) water as a fundamental element in Pemón cosmology and its imminent cause-effect relationship with the natural world (2015, pp. 16-17).

4. Over the years, these commissions have been formed by competent national bodies, such as the Ministry of the Environment and other ministries that have addressed the mining issue. These promotional teams incorporate representatives from the Bolívar State Government, municipalities with a mining vocation, various national and local institutions, and the captaincies of indigenous peoples and peasant communities, which are the predominant ones in these areas where mining has been practiced. Working methods have been developed in assemblies to inform national guidelines for addressing conflicts, and workshops to inventory and map mining activity in some cases. As the scientific community, we have been able to participate in these processes as observers and advisors in most of these activities.