www.water-alternatives.org Volume 16 | Issue 2

Rodríguez, F. 2023. Contested socio-environmental imaginaries
of water and rivers in times of hydropower expansion in Costa Rica.
Water Alternatives 16(2): 730-749

Contested Socio-Environmental Imaginaries of Water and Rivers in Times of Hydropower Expansion in Costa Rica

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ABSTRACT: A wave of applications for private concessions to build run-of-the-river dams swept Costa Rica during the 2010s. These hydroelectric project plans caused concern among residents adjacent to the targeted rivers to the extent that a water conflict erupted in several communities of the southern Pacific side of the country. In this article, I use a multi-sited ethnographic approach, including a visual analysis, to explore the resistance of local people to these plans. My focus is on the contestation over the assumptions about water that are present in the Environmental Impact Assessment (EIA) report of a hydroelectric project plan. By showing the underlying socio-environmental imaginaries that underpin the conflict over dam development, my article reveals ontological differences between institutionalised and non-institutionalised ways of knowing (and relating to) water. Reflecting on what I consider to be ontological disjunctions, I conclude that some of the technical aspects of the EIA report – such as the here-employed notion of environmental flow, which is estimated using only a hydrological approach – have constituted a technical orthodoxy, or dogma, that requires a rethinking of the institutionally dominant assumptions about the understanding and being of water and rivers in southern Costa Rica.

KEYWORDS: Socio-environmental imaginaries, environmental flow, environmental impact assessment, technical orthodoxy, water ontology, Costa Rica

INTRODUCTION

This paper uses the concept of socio-environmental imaginaries to explore the ontologies that underpin a water conflict surrounding the construction of run-of-the-river dams (referred to henceforth as 'dams') in Costa Rica. In doing so, the paper looks at the assumptions about the being of water that are articulated by technical experts through the Environmental Impact Assessment (EIA) process of a dam project; it also considers how this institutionalised way of articulating water is challenged by alternative water ontologies that are rooted in the local communities where dams were planned in the beginning of the 2010s.

In Costa Rica, the process of conducting an EIA is an indispensable requirement for any proposed dam construction project. Implemented in more than 120 countries as a requirement for building infrastructures that may have negative environmental consequences (Baya-Laffite, 2016), the EIA procedures are a key instrument of environmental governance under the sustainable development agenda. But an EIA is not only an instrument for governing the environment; it is also a way to produce it. In the words of Yearley (2008), EIAs construct, "'nature' as a baseline condition at the same time as they disclose the presumed impacts of the new development". The EIA process is not monolithic; rather, it is composed of a collection of technical tools which, as I will show, have ontological implications. One of these tools is the notion of environmental flow, which is defined in various ways by practitioners. The definition used in Costa Rica in the context of the dam construction projects that are the focus of this study is, "the water that is left in a river ecosystem, or released into it, for the specific purpose of

managing the condition of that ecosystem" (Davis and Hirji, 2003).[1] This has resulted in the application of a formula that does not take into account, for example, human and other needs. In the case of this study in Costa Rica, environmental flow, in tangible terms, means that developers who are constructing dams for hydroelectric generation have the right to divert up to 90% of the river's flow through a pipeline to produce electricity in a powerhouse, leaving 10% of the flow to continue its original course.

The EIA plays a crucial role within the sustainable development agenda by serving as a primary tool for establishing authoritative knowledge claims related to environmental issues, including of course water and rivers. Despite some exceptions however (see Li, 2009), only recently has attention been given to it from the perspective of the social sciences in general, and of science studies in particular (see, for example, Baya-Laffite, 2016).

My work aims at departing from "simplistic narratives of environmental conflicts driven by 'scarcity' or 'greed'" (Le Billon, 2015), concentrating instead on their ontological dimensions. In a context of increasing conflicts over territories (lands and waters) in Latin America, the study of the socio-environmental dimensions of environmental (and water) knowledge practices and instruments is of contemporary interest due to their ontological implications for the people (and their ecologies) that are situated in the affected areas. As Raftopoulos (2017) puts it,

> The explosion of social-environmental conflicts that have accompanied the growth and diversification of extractivist activities [in Latin America] has posed a challenge to the political and economic ontology of current development models and opened up debates about nature and the relationship between the human and non-human world.

There is a need for more work investigating the assumptions about the being of water in localised contexts. This is the case despite the increasing number of works on the plurality of water worlds (Barnes and Samer, 2012; Boelens and Seemann, 2014), the multiplicity of water (Vogt and Walsh, 2021), and the diverse ontological positions about water (Yates et al., 2017; Wilson and Inkster, 2018; Stensrud, 2019; Campbell and Gurney, 2020). This need arises because the lack of ontological sensitivity to water may even contribute to the escalation of crises and socio-environmental conflicts, especially in the context of the increasing messiness in the meanings and interpretations of water (Whaley, 2022 Anderson et al., 2019). In light of water crises around the world, for example, Linton (2010) goes so far as to emphasise "the need for a direct critique of modern water", and the need to consider and be open to alternative ways of relating to water in different contexts.

My study of the water conflict in rural areas of southern Costa Rica, then, should be of value to practitioners who wish to reflect on the socio-environmental assumptions and premises underpinning scientific and non-scientific knowledge objects, claims and practices in similar contexts. My study also aims to strengthen the scholarship in the area of ecology and human and non-human environments, in line with other authors such as, for example, Schwarz and Jax (2011), Lang (2013), and Boström and Davidson (2018). The study is aimed at building a more reflective work in relation to the concepts, techniques, and models – such as environmental flow, which is addressed in this paper – that are used in the context of environmental governance, and water governance in particular. In doing so, my work also hopes to contribute to recent debates on the topic of environmental flow, like those debates started with The Brisbane Declaration (2007) on environmental flow, which was reformulated in 2018, especially with regard to the need to include social and cultural elements in the ontological schema of environmental flow (see Arthington et al., 2018; Anderson et al., 2019).

[1] To be fair, as discussed further in a later section, the definition of environmental flow has evolved in light of new understandings of how rivers and flows should relate to their social and cultural contexts (see, for example, Arthington et al. (2018).

PARAMETERS OF THE CONFLICT

Dam construction is on the rise, especially in South and Central America. Not without reason do some authors call this "a global boom in hydropower dam construction" (Zarfl et al., 2015).[2] In Costa Rica, the dam construction boom dates from the 1990s when the hydroelectricity sector was partially privatised. The impact of the implementation of this hydro-extractivist model on numerous rivers in Costa Rica is considerable as 30 dams were built during that decade, especially in the northern part of the country (Gutiérrez Arguedas and Villalobos Villalobos, 2020).

Due to a speculation boom, since the beginning of the 2000s the number of proposals to build hydropower plants in Costa Rica has risen dramatically. In 2011, the Law of Electrical Contingency (AL, 2011) was brought before the country's Legislative Assembly. The word 'contingent' was included to leave room for possible future energy needs of the country, even though Costa Rica produces more energy than it uses. If this bill had been adopted, the percentage of private providers of the country's electricity would have increased from 15 to 30%. Although the bill was not passed, private companies wanted to be well-positioned in case it was approved; they therefore formulated comprehensive proposals for dam construction in order to ensure a place in an increasingly private and open-market model of energy generation. In February of 2014, bidding was opened for the rights to build hydroelectric dams in Costa Rica. The number of project plans drawn up during this period was unprecedented, especially for rivers in the country's southwest (Pacific) side, and a total of 21 plans were submitted.

These plans for building run-of-the-river dams have sparked socio-environmental conflicts in different parts of Costa Rica. This article focuses on the conflict in the cantons of Pérez Zeledón and Buenos Aires. There, as of May 2014, private companies had planned the construction of more than a dozen hydropower projects on the General River and seven of its tributaries (though this figure changed while I was in Costa Rica because of the new proposals for dams in the area that were formulated by private companies).[3] The adjacent tributaries where dams were proposed to be built cover a distance of approximately 65 km; they are in a straight line that goes across several districts between La Cordillera de Talamanca (a mountain range that includes both the Chirripó and La Amistad national parks) and the Pacific Ocean.

On the surface, this conflict is between proponents and opponents of hydropower plants. While private energy companies are the leading proponents of dams, the opponents include a variety of local communities, sub-communities often supported by environmental organisations, groups of activist students, local churches, and agricultural unions, all of whom live adjacent to the targeted rivers. If we look more closely at this controversy, however, we find that it is more than a mere dispute between two parties with different interests. At stake in the socio-environmental conflict under study are the implicit rationales and assumptions that are embedded in the being of water as it is laid out in the EIA reports; these are contested by alternative ontological figurations of water in the communities of southern Costa Rica. Such assumptions, following the sensitivities of ontological approaches in diverse areas of study (Mol, 2003; Viveiros de Castro, 2004; Blaser, 2012), induce orderings of human and non-human worlds in their relation to water and rivers.

[2] Paradoxically, dam removal is on the rise too, especially in countries of the Global North; see, for example, Grabowski et al. (2017).

[3] All EIA reports for each dam project in the area passed successfully and were approved by the National Environmental Technical Secretariat of Costa Rica (SETENA). In the end, however, the project plans were cancelled due to the resistance of local communities, environmental groups, and protest movements in the south of the country. The women and men of these communities used diverse strategies such as street protests, the holding of referendums on dam construction in towns adjacent to the targeted rivers, and a legal fight to expose the inconsistency of the dam projects with existing environmental legislation (see Gutiérrez Arguedas and Villalobos Villalobos, 2020; Rodríguez, 2020).

SOCIO-ENVIRONMENTAL IMAGINARIES AS ONTOLOGICAL ARTICULATIONS OF WATER

Imaginaries are central to the ontological orientation of the world. For the philosopher Cornelius Castoriadis (1986), societies form their ontological dimensions through the significations of the social imaginary; in this way, a particular conception of the world is created. Viewed in this light, no imaginary has ever been ontologically neutral: the articulation of imaginaries about an amalgam of socio-environmental entities starts from tacit and normalised assumptions with historical components.

In order to examine the relationship of imaginaries to water and rivers, in this paper I briefly revisit the notions of sociotechnical and environmental imaginaries; they are mainly used, respectively, in the fields of science and technology studies and political ecology. I aim to capture their theoretical sensibilities and analytic orientation in a single concept that I call socio-environmental imaginaries. Below, I try to specify (loosely, to be sure) the notion of socio-environmental imaginaries about water and rivers that I use in this article.

For Jasanoff (2015), sociotechnical imaginaries refer to "collectively held, institutionally stabilised, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology". In general, most studies on sociotechnical imaginaries have only been carried out in the institutional context of science and technology in the Global North (see, for example, Hilgartner, 2015; Tidwell and Smith, 2015; Jewitt et al., 2019); they refer only minimally to rural contexts, for example, in countries of the Global South. While these studies offer valuable insights into how science and society are co-produced, they tend to overlook the wider implications of knowledge generation and contestation in specific rural territories whose relations and interdependencies, I argue, may differ from the logic of the Global North.

It is true that the concept of sociotechnical imaginaries is well suited to the analysis of the social and institutional dimensions of science and technology; however, it does not necessarily follow that the concept, per se, is appropriate for widespread application on a local or rural level to reflect environmental assumptions about water and rivers. There is thus a need to highlight not only the social context of (scientific) knowledge production, but also how the reception of knowledge is embedded in networks that are "rooted in specific territories and geographic locations" (Rocheleau, 2016) such as the rural areas near Costa Rica's rivers. As Peet and Watts (1996) put it in their development of the concept of environmental imaginaries, "there is not an imaginary made in some separate 'social' realm, but an environmental imaginary, or rather whole complexes of imaginaries, with which people think, discuss, and contend threats to their livelihoods".

My aim is to appreciate these sensibilities about the importance of grounded environmental imaginaries, while at the same time preserving the explanatory power of sociotechnical imaginaries in accounting for the implications of (scientific and non-scientific) knowledge claims and practices about water and rivers. I thus understand socio-environmental imaginaries, in a loose way, as both "collectively held, [not only] institutionally stabilised, and publicly performed visions" (Jasanoff, 2015) about water and rivers, and as a "constellation of ideas [or claims, or images] that groups of humans develop about a given landscape [or water, or rivers], usually local or regional that commonly includes assessments about that environment as well as how it came to be in its current state" (Davies and Burke, 2011).

EXPLORING SOCIO-ENVIRONMENTAL IMAGINARIES

Imaginaries take shape in various forms and contexts; their study thus constitutes a challenge. As Salazar points out, when exploring imaginaries, it is necessary to focus on the "multiple conduits through which [imaginaries] pass and become visible in the form of images and discourses" (Salazar, 2012). In this article, I sought to explore such socio-environmental imaginaries by using a multi-sited ethnographic approach (Marcus, 1995); it is based on field research that was conducted at different conflict sites in 2014, 2015

and 2016. At these various sites, I conducted a triangulation of qualitative research methods (see Denzin, 2012), that included:

- Participant observation: Observing what people do during their activities, with special emphasis on the meaning they attach to water and rivers;
- Informal interviewing: Here, it is understood as "interactive conversations that take place between researchers and others in the field settings in the course of daily activities" (Schensul and Lecompte, 2012);
- Unstructured interviews: Dialogues for about one hour, to interpret how daily life stories are associated with experiences and actions in the socio-environmental contexts in which people live. In total, I conducted 14 unstructured interviews with 5 women and 9 men who are opposed to the development of run-of-the-river dams.

In addition, I conducted a visual analysis of an EIA report and of the slides of its public presentation in November 2013 (GAPRO 2013a, 2013B). I also attended two community events which I analysed from a visual interpretative standpoint. As Rose (2001) argues, "interpretation of images is just that, interpretation, not the discovery of their truth". Nevertheless, I based my interpretation on a processual approach that groups together images to select and then analyse a prototype image.[4] This approach consists, first, in identifying patterns of style and meaning across a set of images; a visual prototype is then chosen as a reference (see Müller-Doohm, 1997). Once an image (the prototype) had been selected, I performed three levels of analysis, inspired by Erwin Panofsky´s work on visual arts (1955). The first level corresponds to the "configurations of line and colour [which serve] as representations of natural objects such as human beings, animals, plants, houses, tools and so forth" (Panofsky, 1955). This involves the study of the content, colour, spatial organisation, and chosen point of view of an image. The second level is related to "the world of specific themes or concepts manifested in images" (ibid). This second level involves describing the main topics and (human and non-human) characters of the prototype image. The third and final level is about the foundations that support the components of an image, and its relations. This means a consideration of the inclusions and exclusions of images and the relations that images have with respect to other elements (Fyfe and Law, 1987).

SOCIO-ENVIRONMENTAL IMAGINARIES OF RIVERS IN SOUTHERN COSTA RICA[5]

Taking the above methodological caveats into account and using an ethnographic tone, this section shows the socio-environmental imaginaries about water and rivers that surround the conflict under study. In the first part of this section (Case I), I show how communities defy the imaginaries of water and rivers that are articulated in an EIA report. This defiance involves a radical critique of the particular scientific notion of environmental flow that is used in the EIA report of a dam. In the second part of this section (Case II), I look first at the imageries of rivers and dams that are laid out in an EIA report, including the presentation slides that are used by the dam developers for the San Rafael River. Second, I look at the images that were shown at two public events organised by the communities and environmental movements.

[4] This procedure applies for the images (or prototypes) of Figures 1, 2, 3 and 5.

[5] Throughout the rest of my paper, the concepts of imaginaries and socio-environmental imaginaries of water and rivers are used interchangeably as a synthesis between sociotechnical imaginaries and environmental imaginaries, as I previously developed.

Case I: Application of the environmental flow and public contestation

One day I was with Gabriel,[6] a farmer from Quizarrá who is opposed to the dam development in the area where he lives. As we were walking to a meeting and talking about the origins of the conflict of the dams, he told me that,

> At first, [the dam developers] came to the communities and said: "The rivers are not going to be affected by the dams. After the dam is built, the fish species downstream of the dam will enjoy 10% of the natural flow of the river, and this will allow them to live".[7]

This was a promise that developers made to all the communities where dams were planned. According to Gabriel, however, most members of the community were not very receptive to the idea that the dam developers would use 90% of the water and give 10% of the flow back to the river. Shortly after this announcement, Gabriel told me, an underlying sceptical attitude emerged in the communities towards the idea that 10% of the river could be suitable for maintaining life in the river. Gabriel himself challenged this 10-90 division, which represents a particular – but not the only – way to calculate an environmental flow.

The notion of environmental flow is related to the World Bank's machinery of knowledge production which, according to Goldman (2005), represents the world's "main producer of concepts, data, analytic frameworks, and policies on the environment". Almost all studies on the environmental impacts of run-of-the-river dams in southern Costa Rica, the notion of environmental flow is considered with respect to a study published by the World Bank in 1999 (Davis, 1999).

But the idea of environmental flow has a longer history that emerged in the 1940s in the United States. Since then, different definitions and methods have come into existence for measuring the quantity and quality of a flow downstream from where water is being removed from a watercourse (Moore, 2004). In the literature, there are four main approaches to environmental flow: hydrological, hydraulic, habitat simulation, and holistic (Linnansaari et al., 2012). The first of these, the hydrological approach, consists of measuring the average annual flow of a stream in order to calculate the environmental flow; it is based on the assumption that a percentage of an average annual flow can maintain the course of the river for various purposes. Second, the hydraulic approach to environmental flows considers the information that is provided through the hydrological approach and then adds characteristics such as speed and depth of river segments. The third approach, habitat simulation, models the biota found in the river; this is added to the information provided by the hydrological and hydraulic approach. Fourth and finally, the holistic approach emphasises the need for multidisciplinary collaboration; it focuses on the broader characteristics of rivers such as their river basins and economic and social aspects (see Jowett, 1997). There have been recent attempts to reflect on the use and impact of environmental flow in order to make it a more valuable instrument for ecosystems and affected communities. An example of such an attempt is the Brisbane Declaration and Global Action Agenda of 2007 on environmental flow, which was reformulated in 2018; it highlights the importance of the social and cultural aspects of environmental flow and of increased engagement with decision-making (see Arthington et al., 2018; Anderson et al., 2019).

Despite these recent developments in approaches to environmental flow, in Costa Rica and other countries the hydrological approach is the most used (see, for example, Huguenin, 2016). This is not a self-evident decision based on existing legal regulations. The 1942 *Ley de Aguas* (Water Law) of Costa Rica is outdated and is not explicit in establishing a formula for environmental flow. A new bill that is now in the process of becoming law includes a definition of environmental flow as, "the minimum quantity of water needed, both in quantity and quality, to maintain the health of the ecosystem, ensuring basic goods

[6] To protect privacy, all names of participants in this article are pseudonyms.
[7] In this paper, I have translated all quotations from Spanish into English.

and services necessary for life" (AL, 2014). In this bill, which was not yet approved at the time of writing, the procedure for the calculation of environmental flow is not determined; rather, it is left open to the "particularities of the ecosystem, the biological organisms, existing uses of the river and the location" (AL, 2014). These regulations are thus somehow ambiguous and the choice among the environmental flow models is discretionary.

As previously mentioned, compared to the other three main approaches, the hydrological approach is the simplest in terms of its procedure and the considered elements. It considers neither biological nor geomorphological aspects of the river in detail, let alone social or other ecological aspects. It, and its mathematical formula, also do not take the characteristics of a territory into consideration; instead, they just determine that the environmental flow is a tiny part of the water flow, represented as a percentage of the total flow.

The question about percentage of flow is open. As many people in the communities asked, "Why is 10% the environmental flow in our rivers? Why not 50% or 80%?" The hydrological approach usually comes with a formula that determines that only 10% of the water is the environmental flow, leaving the rest, 90%, for the infrastructure of the project developers. This is just a recommendation, with the final decision depending on developers; it is thus not clear why the environmental flow in Costa Rica is usually established at 10%. The developers are usually swayed by the most influential method within the hydrological approach, the Tennant or Montana Method.

Conducted by Tennant in 1975, the study that yielded the Tennant (Montana) Method is the most popular study within the hydrological approach (see Gopal, 2013). Based on a percentage of the mean annual flow, Tennant studied the effects on fish of removing river water; his study included rivers in three states of the USA (Wyoming, Nebraska and Montana). He concluded that in wet season 10% of flow would be the "minimum flow" to maintain a healthy habitat for the fish, and that in dry season 10% would be a "poor or minimum" quantity.

Despite the specificities of the locality of Tennant's study, different countries use this method, in most cases with minor or no revisions (Jowett, 1997). Several researchers have expressed doubts about the transferability of the Tennant Method on the grounds that it was based on research conducted on streams that resemble each other in terms of geomorphology and processes of habitats; the results, these researchers claim, can thus not easily be transferable to other contexts of practice such as a river in rural Costa Rica (see Gopal, 2013). These authors warn us about untested extrapolations.

For many members of the communities, the importance of the environmental flow does not go unnoticed; it represents a reference point for creating alternative meanings about water and rivers. During discussions about dams, references to environmental flow were frequent. For Gabriel, the farmer from Quizarrá, environmental flow as it is used in this particular context represents a magical formula:

> Imagine the river where you like to go swimming with your kids, and then remove 90% of the water from the river. The water left is what developers and the MINAE (Ministry of Environment, Energy and Telecommunications in Costa Rica) call an environmental flow. Where is the logic behind this formula? We do not understand the magical formula of the so-called environmental flow yet.

'Magical', here, is to be understood as something secret or cryptic. The members of the local communities challenge the vision of rivers as a moving mass of water, a hydroelectric force that can be diverted without consequences. In doing so, they dispute the quantification of rivers that then determines the 10-90 environmental flow that is established in the EIA report. As one neighbour told me about the implications of environmental flow,

> At first, I was curious about knowing that a hydroelectricity project was underway in Quizarrá, but when I realized the technical details and that they would steal 90% of the flow from the river, I thought that this would mean that the river got dried up due to the diversion of water. With only 10% of the flow, the level of the river would be too low, and it would disappear. Only a stone path would remain instead of a river.

Beyond the quantification of water and rivers, then, community members articulate a vision of rivers as a base for relations among neighbours and relatives who live adjacent to the targeted rivers. This is readily apparent when Costa Ricans refer to *pozas* (natural pools in rivers) instead of rivers, especially when they are referring to a place in the river where families enjoy leisure and recreation. I understood pozas to be a socialised part of the river, a place of community engagement.

I myself proved the power of pozas for the benefit of people living nearby. I swam often in the many pozas of the cantons of Pérez Zeledón and Buenos Aires, including in the pozas of Los Gemelos and De Pepe in the Chirripó River, the poza Azul in the Caliente River, the poza La Unión in the San Rafael River, and the poza La Perica in the Volcán River. On many occasions during the dry season, I was able to interact with people who were enjoying bathing in the pozas. This was an excellent opportunity to see, in situ, the significance of rivers to how people connect with each other. Depending on the day and the poza that I visited, I found people bathing or just walking along the river. Among my many encounters with my fellow bathers, there was one that particularly impacted me. It occurred in 2014 in a poza of the Peñas Blancas River, which was in peril because of its location some kilometres downstream from a dam project.

Sofía and her son Diego live between Rivas and Quizarrá. Some years ago, a degenerative illness left Diego paralysed and unable to walk, and since then his mother has been concerned with finding places where he can safely swim. She can sometimes afford the entry fee for an accessible swimming pool in a fitness centre in San Isidro del General, the nearest urban area; sometimes, however, that is not possible and instead they go swimming in a nearby poza. As Sofía tells it,

> These pozas are important because is part of our life, of our culture, and of our identity. Here we grow up with rivers. I cannot imagine the idea of our family growing up without rivers. When I was a child, on Sundays, this was a way to have fun and eat our own food without spending much money. The river is something beautiful and we must treat it right.

I heard this statement about the important relation between rivers and communities many times while I was living and doing research in the community. Water has an additional role to play in Sofía and Diego's lives, however, in that only in deep water can Diego move around without help. Despite his paralysis, Diego is able to swim slowly while his mother watches from the shore where he has left his wheelchair. "Water is his life and his world, and this world has strengthened our relation. The farther he is from me, doing his things alone, the happier I am", Sofía said to me while Diego was in the water. The Peñas Blancas River makes other worlds, like Diego's, possible. The poza becomes his infrastructure, a socio-environmental space where he does not need help from others.

Pozas also provide a generational link for the community. Jorge, for example, is a member of the Costa Rican *Rios Vivos* (Rivers Alive) environmental movement; during an interview, he connected the preservation of the pozas for future generations with the present struggle against run-of-the-river dams:

> The pozas are places of natural recreation; places of communion with friends and nature; and places of encounter with real fun (not virtual). In a few decades, I will no longer be here physically, but I hope that, at least, the pozas continue to be those free spaces, open to everyone for recreation, regardless of age and economic condition, in which the children can say, on a hot summer afternoon: let's go to the pozas!

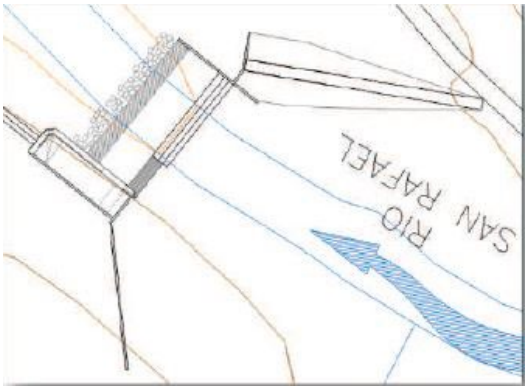
This section has shown two socio-environmental imaginaries of water and rivers, with a focus on how the institutionally dominant water ontology – exemplified by the notion of environmental flow based on the 10-90 division – is experienced and interpreted locally. In the next section, I will examine the institutionalised and non-institutionalised imageries of water and rivers, as articulated in the conflict around dam development in southern Costa Rica.

Case II: River imageries

Dams and rivers in the EIA reports

As can be expected, the EIA report includes engineering drawings. These drawings are almost the report's only visual articulations in which dams and rivers appear together. I have chosen Figure 1 as prototype to analyse in my study. It includes blue, brown and black lines in two-dimensional shapes. The image also shows an arrow that indicates the direction of the river flow. This image shares a common style and arrangement of elements with images in other EIA reports on the area. This style involves an effect of visual continuity through the blue lines between the upstream and downstream of the dam as it is drawn in the report.

Figure 1. Run-of-the-river dam in the EIA document of the San Rafael River.

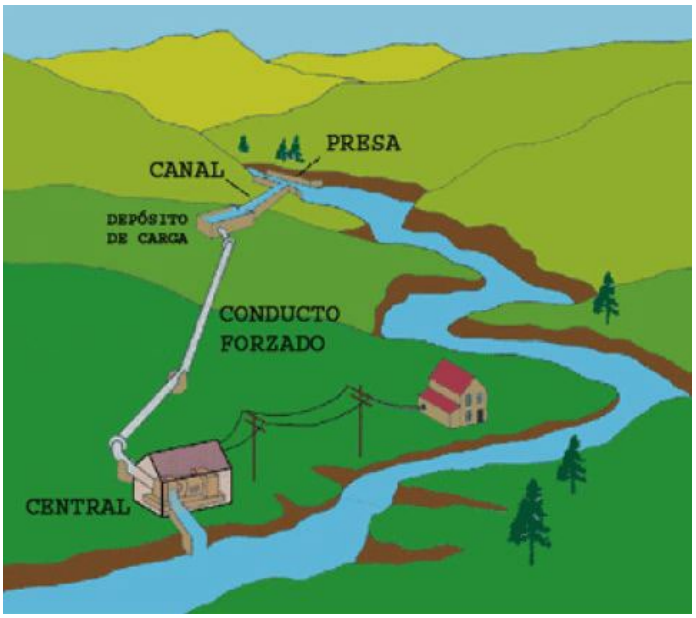


Source: GAPRO (2013a).

The visual continuity of lines undermines the view of contrasting landscapes that follows from the construction of infrastructures, and no visual difference between the upstream and downstream of the dam is noticed in the images. The rivers, as articulated in these images, co-produce an ordering of the river and infrastructures that is consistent with the assumption that the dam does not obstruct life. This can also be seen in Figure 2, where the similarities between the upstream and the downstream of the point of water diversion is easily visible. Both the blue lines of Figure 1 and the blue river of Figure 2 flow freely across the run-of-the-river dam; this suggests that the river is not interrupted despite the building of a dam and of a pipeline that brings water from the river to a powerhouse.

The continuous blue lines become "technologies of representation" (Law and Whittaker, 1987). These authors argue that, when communicated by scientists to the public, scientific models often involve "processes by which (…) technologies suppress what they purport to represent and replace it with novel and more docile elements which are often visual" (ibid). These 'docile elements' co-produced by the developers highlight rivers as quantified and reduced to numbers through the application of the environmental flow, under the reductive assumption that a part of the river that is dried up can maintain the same properties as the whole. In these 'purified' water worlds, there is no significant visual alteration between the upstream and downstream of the rivers. The infrastructure of the dam is camouflaged by a particular technology of representation and its consequences are thus made invisible. The environmental flow that is based on 10% of the water disappears, and instead a river appears that is almost unaffected despite the diversion of 90% of its water. A socio-environmental imaginary of water and rivers as divisible (through the notion of environmental flow) and not affected by the dams emerges in this confluence of significations. This modern imaginary also shows rivers as determinable, that is, as Castoriadis (1986) puts it, "the idea that everything that exists is determinable, in the sense that it possesses an immanent potential for being defined and distinguished".

Figure 2. One of the images used in the slides of the presentation entitled *Descripción pública del Proyecto* (Project public description), given by the developers of the dam in the San Rafael River.



Source: First slide of the public presentation of the hydroelectric project planned by Grupo H. Solis in the San Rafael River (GAPRO, 2013b).

Figure 2 exemplifies this landscape 'purification'. The image shows a blue river flowing through a green landscape; the river's waters are diverted to produce electricity for a powerhouse that is shown at the top of the panel, where the river enters the image. The main flow of the river downstream of the dam, however, does not seem to be affected by the water intake and does not even appear dry, as would happen if – following the environmental flow formula – 90% of water is diverted through a pipeline. The environmental flow is thus invisible in this image, which makes it a misrepresentation. Similar to the image in Figure 1, there is a continuity of lines and colours along the river that does not show any alteration caused by the water dam and the diversion of water. As a result of these visual combinations, it could be argued that the river becomes visually tamed and controllable so as to serve the purposes of dam developers, legitimating the use of the environmental flow regime.

With these thoughts in mind, the next section focuses on the water worlds that are visually embedded in the local communities.

Rivers as alive beings

The two images exhibited in this section show rivers as an integral and vivid part of the communities of southern Costa Rica. The first image was drawn from a gathering of approximately 30 people that took place in March 2014 at the Los Cusingos Bird Sanctuary, which is located within the Alexander Skutch Biological Corridor, Quizarrá. The second image is a collage that was made during the environmental youth camp at Montaña Verde in August 2014.

The gathering at Los Cusingos Bird Sanctuary was an opportunity to discuss ways to resist the development of dams in the area. The purpose of the meeting was mainly informative, where the most informed neighbours shared their information about the plans to build dams and the joint actions that should be taken against them. The first thing that caught my attention during the meeting was the presence of seven drawings that had been put on the walls of the terrace where the gathering took place. Children had made the posters and they and their families had brought them to the meeting.

The seven drawings were similar in layout, showing landscapes crossed by rivers from a god's-eye (aerial) view. The predominant colours were green and blue. In all the drawings, the elements of the landscape were still, except for the rivers in the distance. These provided a sense of movement both through the arrangement of fish in the surrounding water and the portrayal of the water flow in a particular direction. In one of the drawings, the dynamic sense of the landscape was further enhanced by the presence of flying butterflies.

All drawings had text in their composition, which included imperative and declarative sentences. Most commonly, the statements consisted of the act of saying things as children wished them to be, that is, for example, the imperative claim *no a la represa* (no to dams) or *cuidemos nuestros ríos* (we should take care of our rivers). An example of a declarative sentence was *el agua es vida* (water is life), but, as stated, declarative sentences were much less frequent than imperative ones.

Half of the drawings included a dammed river. Among those, I focused my attention on one which more explicitly depicted the consequences of infrastructures (Figure 3). Like the other drawings, it made a sharp distinction between upstream and downstream of the dam in terms of the effects on the river's environment.

Figure 3. The (for me) most representative drawing shown in the meeting, which I have chosen as a prototype in this paper.

Source: Photo by the author (2014).

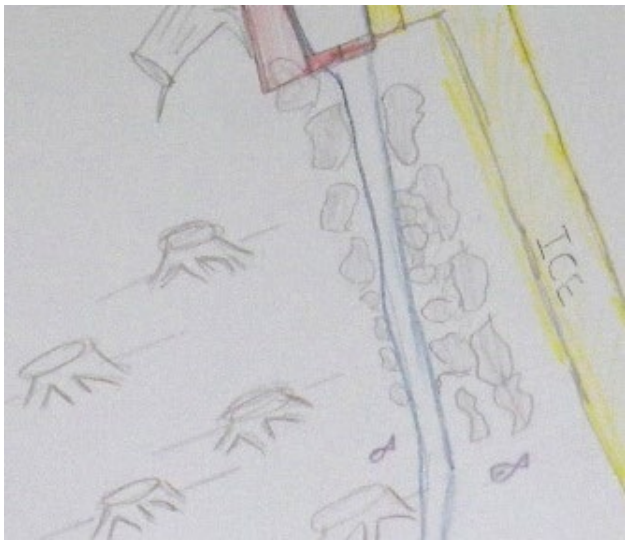
Compared to the other drawings, this one had more detail. First, the image was drawn from a god's-eye view, but there is a tree on the left of the image, which adds a more sophisticated dimension. Second, despite the absence of people in the drawing, it shows a wide variety of figures and sketches of trees, flowers, water, stones, infrastructure, and fish. I interpret the arrangement of such figures as being not random and believe that it follows a specific order that is dictated by the conditions of the river upstream and downstream the dam. The river, then, has two differentiated parts. Upstream of the dam, it is wide and contains fish and a diversity of vegetation such as green trees, flowers, and grass. Downstream of

the dam, the flow changes because of the water being diverted through a yellow pipeline; there are cut trees, stones, and fish lying on the riverbank.

The drawing contains text. The first line is the main message and says *no destruyan el ambiente* (do not destroy the environment). The second and third sentences say, respectively, *no queremos que destruyan nuestros ríos* (do not destroy our rivers) and *no queremos que destruyan nuestra flora y fauna* (do not destroy our flora and fauna). In Spanish, the second and third sentences – unlike the first sentence – are written in the first-person plural 'we'.

The river is the main character in the drawing. It flows from the top of the image to the bottom. It is difficult to use 'river' in the singular, however, because of the sharp distinction between what the river represents upstream of the dam and what it becomes downstream. Upstream, the sketches of thick vegetation and fish represent life that is compatible with the river; below the dam, there is an awareness of death that is portrayed through the representation of dead fish on the riverbank and chopped trees (Figure 4). The flow of water below the dam has decreased such that it is too low to sustain organic life; instead, stones become visible.

Figure 4. In this drawing, the landscape downstream of the dam is comprised of trees stumps, stones and dead fish lying on the riverbank.



Source: Photo by the author (2014).

The dam does not store water; rather, it uses the downward flow of the river to divert water into a pipeline for the generation of electricity. The pipeline includes the acronym ICE (Costa Rican Institute of Electricity), which is the public body that manages the production of electricity in Costa Rica.

The meanings of the text and images complement each other, and both give the impression that dams have far-reaching consequences, although of different kinds. While the images highlight the material effects of diverting the water, the text indicates the significance of such effects in terms of the daily lives of the communities. In the use of the pronoun 'our', for example, as in 'our rivers' and 'our flora and fauna', the represented material effects on trees and fish are connected with those who live in the adjacent community. There is thus a construction of a sense of belonging, with the aim of connecting the community with the rivers and other non-human beings. The idea is that if the free-flowing river is destroyed, the trees are chopped down, and the fish cannot get enough oxygen, then the daily lives of people will be altered. This notion highlights the role of rivers in co-creating a world of possibilities and relations and the dam as a harbinger of cultural and ecological decline.

Figure 5. One of the collages made during the environmental youth camp, which I use as a prototype in this paper.

Source: Photo by the author (2014).

Second, the two days of the environmental youth camp at Montaña Verde consisted of talks about different aspects of the rivers and communities, among other subjects related to what is usually understood as environmental education. One of the activities on offer during the camp was a workshop session involving informal collage creation. Those present, including myself, were divided into two groups. The goal was to create a collage out of pictures found in dozens of newspapers and magazines that one of the organisers had brought. Each group had to answer the same two questions, What do rivers offer to the community? and, What do the communities offer to the rivers? Once the two groups completed their collages, a representative of each group was given an opportunity to make a 10-minute presentation on its intended meaning. The workshop also included 15 minutes for discussion among all those present.

The two collages created by the participants were similar in their layout. The organisers provided a white sheet of paper as backing for the collage, onto which both groups applied about 20 pieces of paper. The image chosen for analysis in this article is a landscape scenography representing an area affected by the dam (Figure 5). This collage includes a branch with leaves to represent trees. The use of text is marginal in the collage, except for indicating the goals of the activity in the workshop. In this collage, the river runs roughly from top left to bottom right; it takes a third-person perspective and an aerial view.

The collage shows the consequences of dams. Its style is similar to that of the prototype explored in the other gathering (Figure 3), that is, a river flowing from the top to the bottom of a landscape frame. The collage is made of a mix of pieces of paper, sketches, finished paintings, and branches with leaves. In the middle, there is a river that is divided into two parts corresponding to upstream and downstream of

the dam. An abundance of fish is found immediately upstream of the dam, where water is painted in blue, while downstream of the dam there is no water in the river, just stones and mud. On the riverbank downstream from the dam, fish skeletons appear along the contaminated part of the river near a dump. The dump also contains bottles, TVs, fridges, cans, tires and washing machines, and some other unidentified waste. A digger and an operator remain close to this polluted area (Figure 6).

Figure 6. Collage showing an accumulation of garbage and mud near the run-of-the-river dam.

Source: Photo by the author (2014).

One piece of paper represents a city; from the comments of participants, however, it was clear that it was meant to indicate human settlements, not necessarily a city. Above the dam, the human settlement is surrounded by trees and below the dam it is next to the dump that is mentioned above. An agricultural area is reachable via a bridge over the river; it contains trees, fruit and vegetables. Near it, there is a rainforest and mounted horses crossing a grassy area. Irrigation channels transport water from the river to the farms.

There is a stark contrast among the different areas of the collage. The farm surrounded by the rainforest and the human settlement are places where life can grow. In contrast, the dam and the dump are places where the stream becomes dry, and waste accumulates. As a result, this area becomes a waste disposal site where a digger operator seems to be busy with routine work. As in the previous image, the state of the river upstream and downstream of the dam differ strikingly. The dam not only becomes a border between life and death; except for electricity generation, it also stops the river's many contributions to the community.

As shown in the collage, the river offers the possibility of life in many forms. Urban life and farm life are compatible with large rainforests. Farming, in this context, does not refer to industrial-scale farm practices; instead, as one of the creators of the collage said, "the farm represents a way of subsistence to live in the community". In this way, the collage seems to be articulating sustainable farming practices. The river offers the necessary conditions for the development of urban areas. The creators of the collage warn, however, that human settlements produce a large amount of waste that may end up in the septic system and the river.

Taken together, the two images featuring water worlds in the community (Figures 3 and 5) articulate rivers that are at contrasting stages due to the effects of the diversion of flow by a run-of-the-river dam.

This variation highlights the stark distinction between upstream of the dam, which sustains life, and downstream, which negates life. This contrast highlights the consequences of infrastructure development in terms of material and relational transformations. The dam is a barrier not only to water, but also to the connectivity of life. The lack of flow downstream of the dam breach zone represents a discontinuity that draws a boundary between life and death.

Such visions of rivers as alive or dead do not emerge in a vacuum; rather, they are revealing of larger webs of signification that show that life in rural communities is deeply entwined with the river. I thus observed that a river is not only a resource for the community; it is also infused with rural consciousness and, in turn, infuses the community. The river running free, in part, marks what it means to be human as a member of a community; it allows the establishment of links that are essential for rural life. Indeed, in a certain sense a river is a member of the community. As one participant in the workshop said, "I live very happy near the river because I love it very much. The river is my best neighbour. For me, the river is a way of de-stressing. When I see the water coming down, I feel tranquillity and inner peace".

CONCLUDING DISCUSSION

My study has focused on the socio-environmental imaginaries about water and rivers that were articulated through a series of knowledge claims, imageries and practices observed during a dam-related conflict in southern Costa Rica. In my multi-sited ethnographic study of conflicts over dam construction, I tried to demonstrate that water and rivers can have different ontologies for different groups or individuals, rather than having a single ontology understood from different perspectives. It is important to note, however, that these imaginaries are not static, self-contained entities; rather, they are permeable and subject to change. As I discuss later in this section, for example, modifying the environmental flow to achieve a more equal distribution of water (instead of the current 90%-10%) could potentially blur the contrasts I highlight in this study.

In summary, my article shows, first, that there is an imaginary of the river as a divisible flow of water that, when diverted from its natural course, neither generates waste nor causes any other problem to the community. The institutionally dominant figuration of rivers embedded in EIA reports carries imaginaries of water that are reminiscent of mechanical and divisible entities; they are considered to be determinable by a very particular technical calculation, without seeing the multiple connections that exist between rivers and human and non-human beings. The environmental flow mechanism, which in this case is based on the diversion of 90% of water, is reinforced through images and scenes that place rivers and dams in 'purified' landscapes without showing the impacts of the dam. This imaginary abstracts people and communities from the rivers and is in line with the notion of modern water that Linton (2010) defines as, "the presumption that any and all waters can be and should be considered apart from their social and ecological relations and reduced to an abstract quantity".

Second, my article also suggests that there is an imaginary that articulates water as much more than an inert river that is isolated from people and communities. The river is both constitutive of life and an enabler of interconnections among and between human and non-human living beings. The prevailing notion among local people is that if run-of-the-river dams are built, then the rivers would die and such interconnections would be broken; waste and other by-products would also be generated, as can be seen in Figure 6. The contrasting spatial arrangement found in the drawings emphasises the issue of the emergence of sacrifice zones; these are reminders of the *espacios basura* (garbage areas) (Mantilla, 2012) that are spreading across Latin America, driven mainly by extractive industries. Mantilla defines espacios basura as areas that (especially mining) corporations exploit for several decades and then abandon, leaving behind a terrain of loss and displacement that often lasts for several generations.

My conclusion, then, is that during this conflict the imaginary of rivers as divisible and manageable flows of water – in contrast with imaginaries of rivers as living entities that are connected to the (more-than-human) community – gives rise to a reductionist way of calculating environmental flow. In this case,

this calculation happens through the use of a simple formula that is based on a hydrological approach. Perhaps the two imaginaries could be reconciled by rethinking environmental flow in a way that reflects the embeddedness of a river in its adjacent communities. The implication then, from an institutional point of view, is that water and rivers should neither be taken for granted nor conceived as a neutral phenomenon that can be quantified and isolated separately from the communities in which they are embedded and to which they are connected. Water and rivers (or pozas), in this case, are immersed in ontological worlds that may not reflect the imaginaries that are articulated from an institutional standpoint. The complexity of these fluid worlds must be considered as extending beyond an imaginary that is based on the quantification of rivers as a simple inert resource, an isolated moving mass of water, and a hydroelectric force, one that can be almost entirely diverted without consequences. The field of environmental flow should be further developed to ensure that such flows are capable of sustaining communities where life is lived with the river.

The relevance of seeing rivers as alive, as living phenomena, is in line with Pearson's (2011) position that life and the defence of territorial sovereignty are becoming key components of social (and environmental) struggles against extractivist development in Costa Rica (see also Stensrud, 2019). This further supports the notion of '*buen vivir*' (living well), which refers to the perspectives of various Latin American social movements and indigenous knowledges that are based on the "radical questioning of development and other core components of modernity" and the "offering at the same time [of] alternatives beyond it" (Chuji et al., 2019). In this sense, the motto "water is life", according to Yazzie and Baldy (2018), "has become almost ubiquitous across multiple decolonization struggles" in America and beyond. Putting life at the centre means making water and rivers available to everyone in the community and not treating a reductionist version of an environmental flow as part of a healthy river.

Dividing up a river's waters according to the 10-90 formula has no place in communities' experience. Their experience, rather, is grounded in what Code (2006) calls 'ecological situations'. This refers to,

> [a]n epistemological position whose starting point is in the ecological situations and interconnections of knowers and knowings. [These depart] radically from inquiry directed toward analysing discrete, disparate beings, events, and items in the world, only subsequently to propose connections among them or to insert them into 'contexts' conceived as separately given.

In challenging the dominant water ontology that is present in the EIA reports in this conflict, this ecological situation reveals what I call a 'technical orthodoxy'. This is based on Forsyth (2003) who refers to 'environmental orthodoxies' as, "institutionalised, but highly criticized conceptualizations of environmental degradation despite the growing evidence of the inadequacy of such concepts". This term is similar to "mother [or father] statement", which Calder (1999) defines as, "myths [that are] often promulgated by both the media and, perhaps more seriously, by national and international environmental and water-related organisations, [such] that they have permeated and affected land use and water resource planning at the very highest levels". Drawing on these notions, I refer to technical orthodoxies as assumed scientific or technical conceptualisations that are used unilaterally in different contexts without adaptation, despite the ontological disparity between the context of their origin and that of their application in a new setting. This being said, I do not mean to imply that such conceptualisations are false or groundless; rather, I mean to say that they are co-produced for a particular context, and then, as "immutable mobiles", they are applied in other contexts through "chains of reference" without a critical interrogation of their local whys and hows (Latour, 2013). This seems to be the case in the particular Costa Rican dam projects under study here, where the environmental flow divides the river into a pipeline (90%) and a small stream (10%) – a ratio that uses a hydrological formula based on the Tennant Method. This method emerged from a 1975 study by Tennant in the United States; it was developed for a particular purpose and in a specific environment, but has since come to be applied in other contexts. Using Choy's terms (2005), the circulation of this technical orthodoxy represents a

"universalizing" move towards domination that does not respect the "particularizing marks" of local communities and their way of life with rivers.

It is also worth considering what may have happened if the environmental flow had been calculated using a different method, one that allocated more water to the community than the current 10% that is dictated by the employed formula. I believe that under such a hypothetical scenario, it could have been more challenging to discern differences between imaginaries, and perhaps the quantification of the river would not have been done at the expense of the communities' seeing the river as 'dead'. In short, unlike an approach that is based on a simple hydrological formula, environmental flow should be compatible with life as it is lived in communities adjacent to the targeted rivers.

Unilateral approaches to environmental flow that consider rivers only as a resource and only as a divisible and determinable flow are likely to face communitarian resistance. Depending on the circumstances, such lack of awareness of the multiple associations of people with rivers are bound to cause failure again and again. In this situation, overcoming such ontological barriers seems to be a precondition for any attempt at promoting a more inclusive and participatory water governance model. Indeed, in a time of increasing calls for public participation in (environmental) decision-making, if ontological disjunctions such as the ones described in this paper are not resolved, it will remain unclear who should participate with whom and why; occasions for participatory decision-making will also not be well understood, nor will the influence of the respective assumptions about water and rivers. Overall, then, my study points to the need to radically interrogate the dominant institutionalised water ontologies present in EIA processes. This would involve seeking alternatives to the notion of environmental flow that is used in these proposed hydroelectric projects, while simultaneously recognising the relevance of the water ontologies that are present in the communities of southern Costa Rica.

ACKNOWLEDGEMENTS

My sincere gratitude goes out to all the people who I met while living and working in Costa Rica. What I learnt from them is invaluable. Also, my gratitude to the rivers that make life possible in Costa Rica and all over the world. Financial support for this study, which enabled me to carry out essential research work in Costa Rica, was provided by the Ontario Trillium Foundation and the Faculty of Graduate Studies at York University in Canada. I would also like to thank the three anonymous reviewers for their suggestions and comments.

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