“Water is Life”: Embodied Encounters and Local Values of the Río Peñas Blancas in Response to Potential Hydroelectric Dam Development in South-Pacific Costa Rica

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by

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Introduction

Water is essential for the proliferation of life. Its flows and circulations compose and sustain our human anatomy. As expressed by Astrida Neimanis (2013), "my body—like yours—primarily comprises water[...] my existence as a body of water is a biological fact" (24). This becomes explicit upon recognizing that the human body is composed of an assemblage of "nested aggregates of autopoietic [i.e.: self organizing] systems" (Berressem 2009:66) that include "micro-organisms, cellular reactions, material artifacts, and natural stuff" (Coole and Frost 2010:1) that also depend on water. This constitution is not unique to humans but is also shared by other "animal, vegetable, geophysical and meteorological bodies" that absorb and release water, revealing a deeply embedded source of connection: "*we are all bodies of water*" (Neimanis 2013:24).

At the same time, humans and nonhumans depend on the consumption and release of other planetary bodies: animals, plants, organisms, and material 'things' that comprise water. In this sense, planetary water circulates a boundless network of contact between organisms as it navigates diverse bodies and connects us with environments in "complex relations of gift, transfer, theft, and debt" (Chen et al. 2013:12). These complex transfers between species have been reported and documented in biodiverse regions in the Republic of Costa Rica and the ethical implications of these multispecies-relations is a central concern within this paper.

With a total geographical area of 51,100 square kilometers, Costa Rica covers one third of 1% of Earth's landmass. Nevertheless, this relatively small country contains nearly 4% of Earth's biodiversity[1], due in part to the nation's variable climatic conditions, elevations, high annual precipitation rates, and its abundance of surface freshwater; containing 217 natural water bodies (Guzmán-Arias and Calvo-Alvarado 2013:53) that are each found within the country's 34 national watersheds[2] **(**Ibid). Included among the country's water bodies is a network of biodiverse montane tributaries that branch through the south-Pacific municipalities of Pérez Zeledón, Buenos Aires, and Coto Brus before feeding into the country's largest national watershed, the Grande de Térraba.

In 2013, the state published documents which revealed that numerous potable and undammed rivers in the south-Pacific were selected for the proposed construction of 18 dams—most of which are independently funded by private companies—and which are now in different stages of the state's review process. Of these projects, ten dams alone are planned for construction along every primary river that descends from the Pacific slope of the Cordillera de Talamanca (Álvarez Mora 2013); the country's highest mountain range which longitudinally divides the nation's Pacific and Caribbean slopes (Guzmán-

[1] Species biodiversity often clusters around protected areas which collectively compose 26% of the country's total landmass (González-Maya et al. 2015:1).
[2] These "34 national watersheds" (Guzmán-Arias and Calvo-Alvarado 2013:53) encompass a total of 40.5 km2 of area, and each contain additional rivers, creeks and subterranean springs.

Arias and Calvo-Alvarado 2013:54). The following essay provides a case study of how proposed dam projects are being publicly contested by community residents throughout the south-Pacific region where concerns about private diversionary-dam development is prompting mobilization.

In this paper, I present several major findings from field research that I conducted from April to August of 2016 with residents from the towns of Santa Elena, Montecarlo, and Quizarrá. These towns are located along the Río Peñas Blancas (herein referred to as 'the river'). The aim of this research was to document the concerns of these residents, many of whom dependent on the local river for agriculture, cattle, and increasingly for ecotourism. Their ongoing disputes with private dam developers and the Costa Rican government reveal the ethical concerns of the anticipated redirection of their local river away from its biodiverse freshwater dependents and local uses to generate electricity. It should be noted that national dams supply electricity to these same communities in which dam development is being opposed, in addition to having powered the devices that I used to collect and document the data that is included within this paper. It is also important to note that even within these local communities, residents are in disagreement about the costs or benefits of allowing dam development.

By using a political ecology framework, the purpose of this paper is to extend beyond the good/bad arguments that generally characterize dam disputes to explore the prominent discourses that are embedded in national and transnational water and energy politics. In particular, I consider how environmental discourses of 'ecological crisis' and 'sustainable development' are being deployed by powerful social actors to generate a national political climate that is in favour of hydroelectric development. In so doing, this paper explores how local resistance efforts against these political and discursive attempts are advancing community-based strategies to protect the national status of freshwater as a public resource (as per Water Law N° 11). With that said, I also reveal how the knowledges that underpin local definitions of riverine-access rights are themselves mediated by uneven power relations and political projects that have embedded environmentalism and conservation rhetoric within the local communities.

With the use of anthropological methods and theory, this study finds that local residents envision freshwater governance in ways that do not adhere to the dominant representations found within current water and energy policy. For riverine-residents, the ecological conditions that they encounter and engage with have fostered an appreciation for riverine-access as a 'right to life' that extends to its human and nonhuman dependents alike in ways that challenge anthropocentric and neoliberal notions of individualism. For local residents, the river's conditions are generated through human and nonhuman relations—thus revealing that the river's effective conservation is integrally tied to and dependent on a collective multi-species right to water.

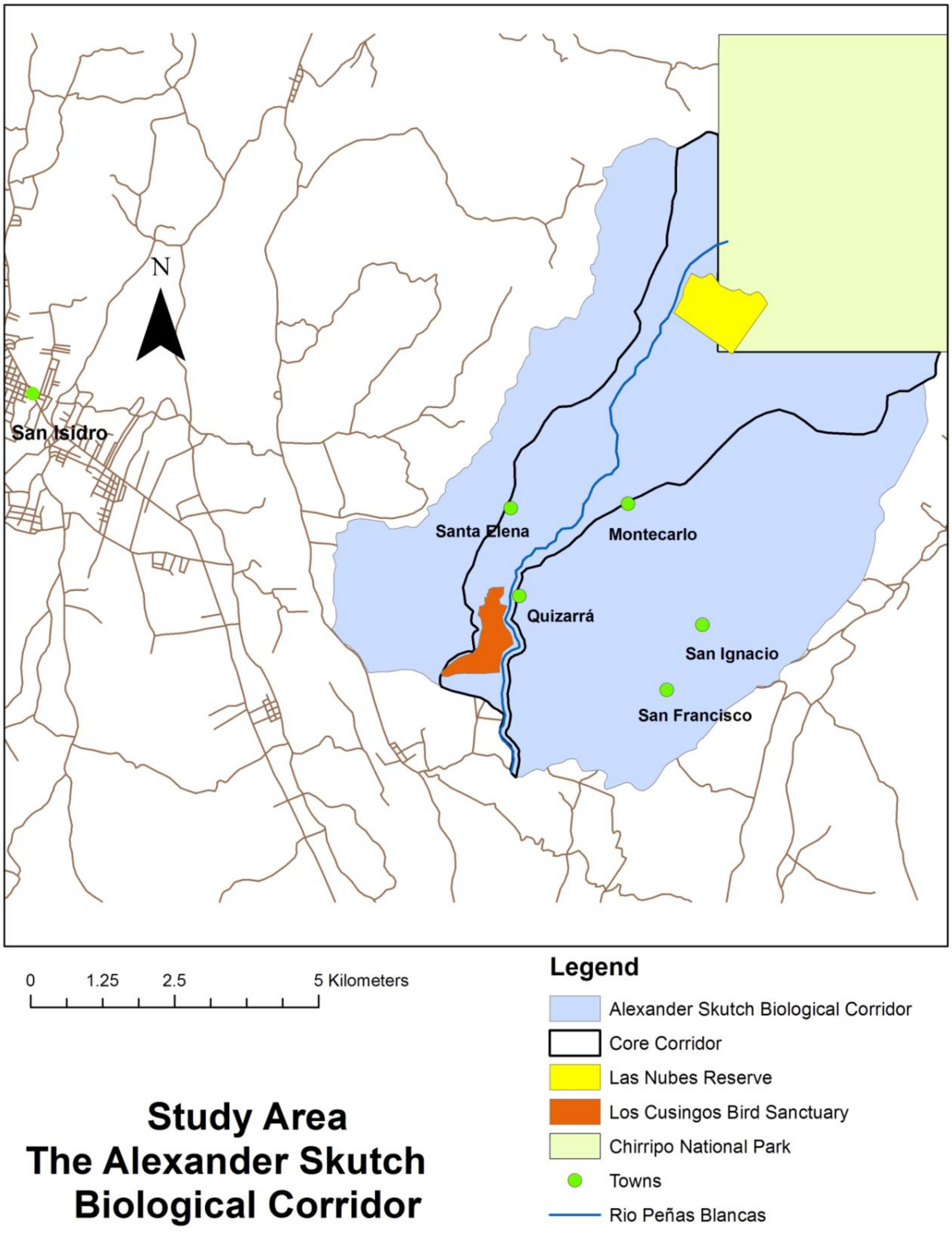

Figure 1: Map of the Study Region
The river crosses directly between Santa Elena, Montecarlo, and Quizarrá (Rapson 2008:6).

Research Design

This research was guided by several initial questions: (i) how do community residents' experiences and encounters with local freshwater sources contribute to their beliefs and values with relation to the river; (ii) how do these understandings and values operate in conjunction with Costa Rica's environmental policies and procedures to inform local water-use practices; (iii) how do these local values and state objectives inform residents' associations with, or attitudes towards, hydropower development along the Río Peñas Blancas; and, (iv) how might local knowledge contribute to future freshwater policy and praxis?

To explore these questions, I first had to acknowledge that the principal protagonist of this research is the river: a mobile 'flow' resource that evades "land based perceptions of fixity" (Chen et al. 2013:8). To account for this mobility, I conducted walking interviews, followed by focused interview sessions with 36 primary participants: 17 (47%) women and 19 (53%) men [see Appendix A]. The participant body[3] for this research included Costa Rican nationals (i.e.: Ticos) several of whom identify as campesinos (i.e.: rural peasants), conservationists (both professional and self-trained), and extranjeros (predominantly Western expatriate residents).

In adherence with their local accounts, and grounded in the work of vital materialist Jane Bennett, the river is not represented in this paper as a single channel that is fixed between two banks. This is because the river branches below and above ground with extensions that are, in essence, "always going somewhere" (Bennett 2005:451). I therefore apply Marcus' (1995) technique of "following" throughout this paper to trace the river's circulations as its water flows through local communities and becomes temporarily ordered within: meteorological occurrences, including cloud formations, rainfall, and floods; geophysical bodies such as subterranean springs, creeks, and tributaries; and, the organic bodies of flora, fauna and other biota.

At the same time, the conditions that generate the river's circulations are not a-historical, but are constantly being shaped through emergent "historical and circumstantial" (Bennett 2005:451) processes. As a result, I treat the river's current conditions as contemporary extensions of historical processes such as frontier expansion, the Green Revolution, the neoliberalization of nature, and the recent economic turn to sustainable development within Costa Rica. These processes have each been characterized by shifting market interests, transnational power dynamics, as well as their particular discursive claims and supporting philosophies. These processes have shifted over time and have unevenly contributed to the

[3] Yet, these participants do not represent the full diversity of the corridor's inhabitants, which also hosts Ngöbe families, as well as temporary residents such as Nicaraguan day labourers, and visiting students and tourists.

river's conditions as its flows have been incorporated into the global market in different ways. However, I do not wish to reduce the river's conditions to being simply the result anthropogenic dimensions.

In the following chapter, I explore how the river predates anthropogenic processes in the region; a reminder that its circulations can "happen without human intervention and [can] also happen *to* humans" (Strang 2013:164). In acknowledging this, I situate this paper in the Nonhuman Turn[4], by exploring the river as more than simply an inanimate resource that provides transparent means to human action (Pyyhtinen and Tamminen 2011:140). By considering local narratives, primary source documents such as environmental policies, and secondary scholarship, I aim to explore the river's material complexity (i.e.: where its water *goes* and what it *does*) in order to highlight the local implications of damming and redirecting the river's water. To do so, I will begin the following chapter with a discussion of the river's chemical composition, as well as the geophysical, oceanic and climatic forces that generate the river.

Figure 2: A View of the River from the Las Nubes Forest
Looking northward along the Río Peñas Blancas on the Las Nubes forest trail. Photo by author, 2016.

A Brief Environmental History of the River

To begin, the Río Peñas Blancas is fed by sister tributaries that carve into the southern ridge of the Cordillera de Talamanca mountains. The river's freshwater is composed of an atomic assemblage of two hydrogen atoms and one oxygen atom (i.e.: H2O); a constitution that collects, dilutes, and transports a variety of other properties such as minerals, salts, chemicals, and bacteria. Freshwater's material state can also be modified by conditions that alter its temperature and induce it to shift between the gradients

[4] The Nonhuman turn refers to a growing shift in academic literature that fosters a critical and theoretical *turn* of attention towards the social capacities of 'nonhumans'—what are commonly considered to be 'things', such as "animals, affectivity, bodies, organic and geophysical systems, materiality, technologies" (Grusin 2015:vii) and in this case, water.

of: liquid (water), solid (ice), and gas (vapour) within the hydrological cycle. With reference to local narratives I will explain how the river's gradients continue to be generated by forces that occur (and change) beyond human control, most notably, from (1) a glacial mountain lagoon, (2) regional rainfall, and (3) groundwater springs, that all converge temporarily in the riverbed.

First, the river's larger northwestern branch spills from a glacial lagoon beginning at 3110 metres above sea level (masl) before rushing down the southern facing slope of the mountain Cerro Chirripó[5]**.** This lagoon, and the mountain that directs its flow, emerged after plate subduction lifted the country's isthmus[6] (i.e.: land bridge) from below ocean level between 15 to 6 million years ago (Ma), thereby closing "the oceanic gap between the Chortis block [i.e.: Honduras and Nicaragua] and northern South America" (Savage 2002:817). This continued subduction along the central Panama Isthmus caused tectonic uplift and layering that generated the rugged heights of the Cordillera de Talamanca mountains (De Boer et al. 1995:37).

Beginning around 4.6 Ma, the Panama Isthmus' closure caused enormous changes to deep ocean circulations (Haug and Tiedemann 1998:673), by preventing the flow of warm Atlantic water to the Pacific Ocean around the equator (Marsh and Kaufman 2013:604). Because of this oceanic division, Atlantic moisture was transferred northward, and its accumulation in the northern hemisphere is now believed to have reduced temperatures, thereby generating ice age conditions over time (Haug and Tiedemann 1998:674; Penna 2010:30).

These cooling conditions are believed to have traveled into the Global South and later contributed to the glaciation of the summits of the Cordillera de Talamanca. Between ca. 18 and 11" (Alvarado and Cárdenes 2016:55) thousand years ago (ka) the last of this glacial ice, beginning at elevations from around 3,100 masl to 3,400 masl (Ibid; Chaverri Polini 2008:45), melted to form more than 30 glacial lakes that now scatter the elevated segments of Cerro Chirripó (Chaverri Polini 2008:63; Horn 1990:289). However, the quantity of water that flows from one glacial lagoon into the Río Peñas Blancas is also modulated by climatic forces such as rainfall.

[5] With a summit that reaches approx. 3819 masl (Chaverri Polini 2008:17), Cerro Chirripó composes the highest elevated segment of southern Central America.

[6] This island bridge was joined by additional underwater volcanoes which emerged from the ocean around 15 to 6 Ma (Escobar 2008:35-36) to form what is now southern Nicaragua, Costa Rica and Panama. Around 8 Ma (Abratis and Wörner 2001:128),

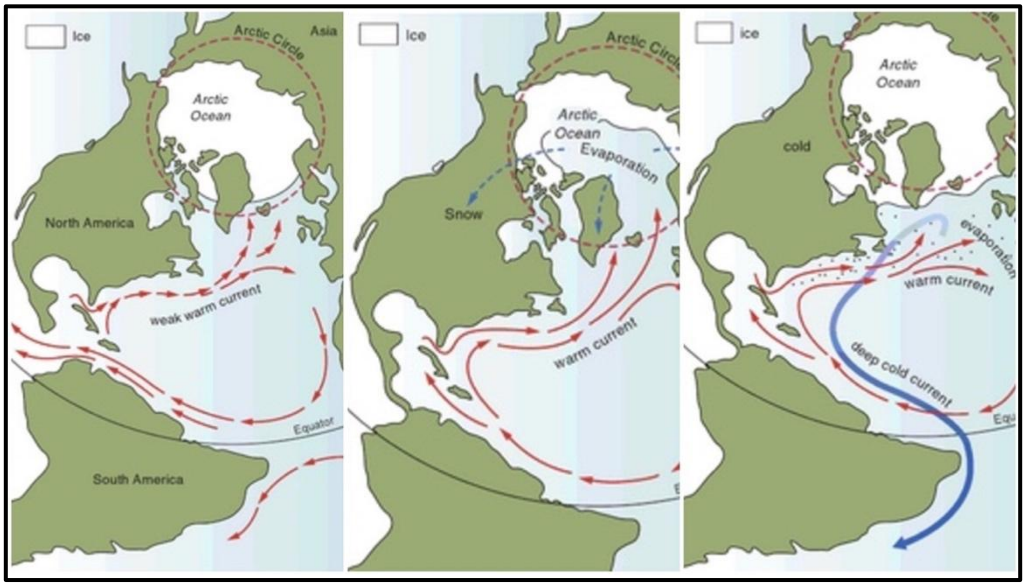

Figure 3: The Transfer of Moisture, Panama Isthmus
(L) Prior to the closing of the Panama Isthmus, warm saline waters from the Atlantic flowed into the Pacific along the equator, "leaving the northern Atlantic cold" (Marsh and Kaufman 2012:604); (Center) Following the closure, the redirected Atlantic current "warmed the northern Atlantic and Arctic oceans" (Ibid), generating ice melt, water vapor, snow accumulations and, finally, glaciations; (R) The redirected Atlantic current prompted evaporation, "ocean cooling, atmospheric cooling, and initiat[ed] the Ice Age" (Marsh and Kaufman 2012:604-605)

From late May until June, humid tropical air currents meet with the northeast trade winds and rise to create an Intertropical Convergence Zone (ITCZ) above the equator, which initiates the tropical rainy season (Chaverri Polini 2008:55). Yet, as the Cordillera de Talamanca rose its peaks captured warm Atlantic air that would otherwise cross over the Caribbean slope and rise unimpeded to the ITCZ. This capture altered cloud cover and increased precipitation at around 2000 masl along the Pacific slope of the mountain range with peak rainfall now occurring between September and November (Canet Desanti 2005:28). This rainfall decreases after December when the southeast Pacific trade winds (Chaverri Polini 2008:55-56) restrict the "Northeast [Atlantic] Trade winds [to] the Caribbean slope" (Guzmán-Arias and Calvo-Alvarado 2013:54). This process causes only the country's "Pacific [to experience] a dry season between December to April" (Ibid) during which its rivers and creeks shrink, and groundwater diminishes.

The river's third water source, groundwater springs, feed into the river's main channel through creeks and are sustained by this fluctuating seasonal rainfall. Yet, the quantities of water that are retained in the ground are also affected by the region's vegetative cover. With this, some of the flora that capture and absorb rainfall inland from the river are linked to genetic predecessors that first entered the region's hydrological cycle from North and South America following the emergence of the Panama Isthmus.

Known today as the Great American Biotic Interchange[7] (GABI), this process began after the Panama Isthmus formed around 3 Ma and was rapidly colonized by northern plains grasses (Leigh et al. 2013:6). These grasses facilitated the initial dispersal of North American species[8] with some genetic descendants currently inhabiting the Cordillera de Talamanca, including: white tailed deer, jaguars, ocelots, ant-eaters, armadillos (Meza Ocampo 2014:31), and pumas. Yet, the isthmian savannah began to recede over 1 Ma (Leigh et al. 2013:18), after which the Neotropical forests of South America, accompanied by southern species of monkeys and sloths, as well as "birds, bats, and land mammals" colonized the land bridge (Ibid). As the rising mountains continued to generate new uninhabited niches, the Neotropical forests gradually predominated in the Cordillera de Talamanca.

This same mountain range, today inhabited by expansive rain and cloud forests, continues to be maintained by a network of free-flowing glacial rivers, and contains what may be one of the four most endemic[9] ecosystems within the country's mainland (Kohlmann et al. 2010:513). In fact, this region is inhabited[10] by a recorded "215 species of mammals, 250 species of amphibians and reptiles, 115 species of fish, and 560 species of birds", while also representing "one of the most diverse and species-rich places in Central America for vascular plants" (Evans 1999:122). As this environmental history indicates, regional waters are not independent from the ecosystems and organisms that have become entwined in its flows over time.

Figure 4: Talamanca Cloud Forest

Photo was taken looking north-east over the Cordillera de Talamanca Cloud Forest, one of the county's biodiverse and endemic '*hot spots'*. Photo by author, 2016.

[7] The 'closing of the Panama Isthmus transformed the ecology of the Americas by enabling biotic dispersal between Nearctic "North America, a continent intermittently connected to Eurasia", and Neotropical South America, "an island continent [that had been in isolation] from most of the rest of the world for over 50 million years" (Leigh et al. 2013:2).
[8] These northern species, including "tapirs, deer, horses, pumas, canids, bears, [and several] rodents" (Kappelle 2016:5), were likely geographically closer to the mouth of the land bridge (Webb 1991:269) and had likely been tested by "innumerable competitors and predators from Eurasia"... giving them a potential competitive advantage over their South American counterparts that "evolved in isolation [with] far less effective carnivores" (Leigh et al. 2013:7).
[9] Endemism refers to the restricted and unique existence of a species within a particular ecological space or geopolitically defined region. With regard to the latter, "it turns out Costa Rica is a country with moderate endemism… due to the fact that [its] important ecosystems", such as the cordillera's montane forests, "are shared with neighbouring countries" (Kappelle 2016:6) such as Panama.
[10] Yet, this species data is also the result of historical socio-economic processes that enabled extensive environmental research to occur throughout the mountain range, a point to be discussed later in this paper.

Early Waves of Human Settlement along the River

The mountain's glacial waters and biodiversity provided the conditions necessary to support the later settlement of Indigenous communities such as the Bribris, Cabécares, and Borucas who developed an ancient communication and trade network between Cerro Chirripó's Pacific and Atlantic slopes (Chaverri Polini 2008:27). Their material culture[11], which continues to be unearthed near the river, predates the colonization of Old World biota, such as: humans, domesticated animals, and plants, as well as external technologies by more than a millennium.

The region's Indigenous populations later defended these same mountains from Spanish colonists who sought to expand into south-Pacific Costa Rica to profit from the "Spanish Crown's encomienda system" (Ortiz Imalch 2014:21) a colonial-economic project that promoted the subjugation of a "semi-slave labour force" (Quirós 2004:17) to provide tribute to the Spanish Crown in exchange for land trusts. These colonial campaigns throughout the 17th century continued to be met by indigenous rebellions. By the end of the 1600s, indigenous "political and socio-economic organization" in the Cordillera de Talamanca, in combination with the region's "geographical inaccessibility" (Quirós 2004:20) due to its dense tropical forests, prohibited the encomienda system from being established to the same extent as it was throughout much of Central America.

While it is therefore believed that the mountain range remained forested throughout the Spanish conquest, these conditions waned in the early 20th century when the country's agricultural frontier expanded into the mountain's south-Pacific slope. This expansion extended to the southern banks of the Río Peñas Blancas, where its freshwater and species abundance[12] attracted Mestizo campesinos and hunters. In addition to nourishing these new colonizing bodies, the river's timber and mud were soon extracted to build housing structures and facilitate community growth.

According to local accounts, the communities of Quizarrá and Santa Elena to its northwest "*started to develop in the 1930s and 1940s, in association with 'Tierra Libre del Estado'* [i.e. Free State Land]" (Participant 27); legislation that granted land titles to nationals who removed forests to develop agriculture. In the 1950s, the river's southern forests were cleared as waves of families migrated to its banks from the nearest center for commerce, "the interior valley of El General" (Villanueva and Arias 2010:5). This valley was "intensively colonized after World War II" (Ibid) with the construction of the Pan-American Highway that connected El General with the country's capital San José in 1946 (Villanueva and Arias 2010:19). This stretch of highway was built to increase the national production of

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[11] In fact, clay pottery, pigmented with mineral deposits and formed with freshwater, continue to be unearthed in fields and construction sites—a historical record of regional hydrosocial customs. Petroglyphs carved into boulders are also prevalent on residential properties within the local communities.

[12] As Ines notes, "the forest provided subsistence [to] the majority of Costa Ricans" around this time, and "subsistence hunting and fishing were integral elements in their relationship[s] with nature" (Isla 2015:117).

coffee, vegetables, pasture, and sugarcane primarily and to improve the transportation of goods from producers to the export market (Villanueva and Arias 2010:24-26). The construction of connecting roads to the mountain's frontiers, in addition to new government incentives and services[13], facilitated a trend of upward settlement that intensified the region's logging process (Ortiz lmalch 2014:15) above 800 metres[14] (MINAET 2012:30) and virtually depleted the Río Peñas Blancas of tree cover along its settled banks.

These cleared forest patches along the river were noted to have reduced the ground's capacity to retain moisture due to the removal of canopies that had once shaded the soil from the sun[15]. Immeasurable quantities of rain were instead redirected into local agriculture, since "*most crops rely on rainwater*" (Participant 2). With the resultant produce destined for the international market (primarily coffee and sugarcane), rainwater that once filtered through springs and entered the Río Peñas Blancas expanded both nationally and internationally through an export economy that accounted for the river's early market value. This redirection accelerated throughout the Green Revolution with the emergence of the northernmost riverine-town of Montecarlo, the burgeoning of commercial sugarcane farms, and the entrance of the municipality's coffee cooperative, CoopeAgri.

The clearing of land for crops and pasture accelerated throughout the 1960s and 1970s and may have allowed "hunters to access previously inaccessible parts of forests", thereby causing "the loss of wildlife species and declines in [population] abundance" (Maguire 2017:7). The replacement of forests with commercial sugarcane cash crops also introduced controlled burnings as a harvesting method (generally conducted in March) that reportedly depleted groundwater springs and dried local soils (Participant 8; Participant 5). The fumes that this generated likely drove wildlife further inland from the borders of forests (Participant 33).

Despite noticeable changes to soil quality, groundwater levels, and species decline, this trend of deforestation "was grounded in a widespread belief in abundance theory," defined as a "pattern of thinking in the 1960s and 1970s" that was based on the belief that Costa Rica "had more than enough resources and that no [resource] shortages would develop" (Evans 1999:43-44). In line with this was the belief that "forests were only impediments to development [meanwhile] deforestation" was promoted by the state as "an 'improvement' to the land [and] a giant step towards modernization" (Evans 1999:44).

This notion extended to the Río Peñas Blancas and its tributaries with some elders recounting that

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[13] Concretely, this process involved infrastructural and services developments from the: Ministry of Busses and Public Transport (MOPT), Colonization and Land Law (ITCO), Ministry of Public Education (MEP), Ministry of Public Security (MSP), Ministry of Agriculture and Livestock (MAG), National Production Council (CNP) and Nationalized banking system that together with accelerated population growth, consolidated frontier expansion by agrarian families and the formation of additional towns, including Santa Elena (MINAET 2012:30) and Quizarrá.

[14] This was done to "plant coffee, vegetables, sugarcane, various tubers [and to clear] new pastures" (MINAET 2012:30).

[15] As one local explained, "trees are important for maintaining an areas' water supply " (Participant 8) because they capture rainfall on their leaves, from which it takes "lots of time for droplets to reach the soil and be absorbed… but since the mountain was more clearcut during past decades, there weren't trees left to capture the rainwater " (participant 8).

they once believed "*water* [to be] *an inexhaustible resource*" (Participant 27); and that "*nobody talked about not having* [water]*, because everyone thought it was infinite*" (Participant 5) at the time. These national perspectives began to change once the country's deforestation rate nearly cleared the Pacific region of primary forests which remained only in the highest elevations of the Cordillera de Talamanca (Cole-Christensen 1997; MINAET 2012:7).

The River's Role in the 'Green Economy': 1970s to 1990s

In 1969, growing political concerns about the national rate of deforestation motivated the state to establish the country's first tourism office (Chaverri Polini 2008:42) to shift the national economy from deforestation towards 'green tourism'. Under the new management of the National Parks Services Director, Mario Boza, and functionaries including Alvaro Ugalde and Sergio Salas among others (Ibid), conservation expanded with international financial support[16] that offset the office's restricted finances in the mid 1970s.

With international contributions, the state halted frontier expansion along the northern Río Peñas Blancas on July 29, 1975 when its twin branches became incorporated within the newly formed Chirripó National Park[17]. Initially encompassing 43.700 hectares, the park gained legal protection under the 1969 Ley Forestal (Forest Law #4465) that established national parks as "off-limits to forestry and agriculture" (Evans 1999:49), thus prohibiting further human settlement and criminalizing local forms of resource extraction[18] (Participant 8).

Regional conservation became part of a national strategy after 1979 when Costa Rica was confronted with its deforestation rate in combination with pressures from a national geopolitical dispute with Nicaragua, and a crippling economic crisis due to "overextended loans from international banks" (Evans 1997:109). Under the direction of then president Rodrigo Carazo, the government responded by "unilaterally suspend[ing] all payments on its $2.7 billion foreign debt [and high] debt service of $335 million" (Isla 2015:37). the country's refusal to return "one of the highest per capita external debts in the world—approaching $3.5 billion by 1990" (Isla 2015:49), prompted the International Monetary Fund (IMF) to prohibit Costa Rica from obtaining additional loans (Isla 2015:37).

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[16] This was achieved by procuring international support in 1972 with their "first grant from the World Wildlife Fund" (WWF), and additional support from Mrs. Karen Olsen, "scientists, and people with international prestige [in vocal support] of conservation" (Boza 1993:241).

[17] The formation of Chirripó National Park was originally motivated by a team of mountaineers from the University of Costa Rica who began lobbying for its protection in 1972 after climbing to the summit of Cerro Chirripó in 1971 (Chaverri Polini 2008:43; Evans 1999:96).

[18] The emergence of the "Wildlife Conservation Law of 1956 (revised in 1961) criminalized subsistence hunting and fishing practices. While not everyone followed these laws, over time they made campesinos increasingly dependent on the region's agricultural economy to provide for household subsistence.

The resulting 1981 debt crisis opened the country to external financial lenders such as, "the International Development Bank, and international private investors" (Ortiz Imalch 2014:56; Isla 2015:38) as well as the United States Agency for International Development (USAID) that began to operate "as a direct agent in the political economy and ecology of Costa Rica" (Isla 2015:48). Soon, these financial agents initiated neoliberal structural adjustments that favoured large scale agricultural producers over small-to-medium scale farmers throughout the country.

As a replacement for prior government subsidies, small credit loans became "directed to thousands of peasant families living on small farms" (Isla 2015:42) throughout the country, and along the river. To pay off national debts, IMF and World Bank stabilization policies demanded increased agrochemical use by campesinos to intensify agricultural production. However, this demand increased "production costs" (Ibid), prompting campesinos to cover costs "with revenue from subsequent harvests" (Isla 2015:42). In addition to financially destabilizing many local families, the chemicals that were used soon washed into local creeks and contaminated many riverine-tributaries. At the same time as these economic adjustments reduced the environmental conditions of farming communities along the river, USAID also promoted conservation projects that attracted international grants in order to expand the country's tourism industry.

In April 1982, with USAID involvement and international participation, the state founded what Carazo described as the "pride of the nation[…] the International Park of Friendship, La Amistad" (Evans 1999:121), comprised of "approximately 500,000 acres of tropical wilderness in the [Cordillera de] Talamanca" (Evans 1999:121) with forests that also extend into Panama. This protected park "nearly doubled the size of the entire national park system" (Ibid) in Costa Rica, and was promptly "declared a World Biosphere Reserve by UNESCO" (Ibid) for its extensive ecological diversity. La Amistad's protected status as a UNESCO World Heritage Site also extended to the reserve's adjoining conservation areas (Ibid) including Chirripó National Park, thus incorporating the Río Peñas Blancas' elevated tributaries and re-establishing the northern frontiers of the towns of Santa Elena and Montecarlo with an expansive protected area, the largest and one of the most biodiverse in Central America.

Private conservation initiatives also escalated along the river after a 1987 report by the UN World Commission on Environment and Development, otherwise known as the 'Brundtland Report' inspired a conference in Costa Rica the following year which translated to "Conservation Strategy for Sustainable Development (ECODES)" (Isla 2015:49). During ECODES, national processes of deforestation (once regarded as necessary to modernization) were reframed as a consequence of economic development (Ibid). As a proposed solution, Costa Rica's territory [was reconfigured] through neoliberal [and colonial] conservationist concepts of enclosure and preservation" (Isla 2015:50). The National System of Conservation Areas (SINAC) soon emerged as a decentralized agency "under the supervision of the

Ministry of Natural Resources, Energy and Mines" (Isla 2015:50) and became responsible for overseeing state owned as well as private protected areas that continued to emerge along the river's banks.

Costa Rica's beurocratization of conservation under the title of sustainable development generated what Isla refers to as "the first green neoliberal project" (2015:26); the primary example of a transnational economic model that has been "entering an ecological phase" (Escobar 1996:326) since the 1980s and 1990s. According to this transnational model, the loss of ecological 'biodiversity'[19] became used to articulate "a master narrative of biological crisis" (Escobar 2008:277) that became disseminated at the 1992 United Nations Earth Summit in Rio de Janeiro, to be discussed later in this paper.

To mitigate this loss, environmental biodiversity was incorporated into the international market as a "new political [and] economic domain of calculation" (Goldman 2001:501) that would be best managed if "capitaliz[ed] and treat[ed] as [a] commodity" (Escobar 1996:328). To mitigate species loss in Costa Rica, private agents, international actors, and environmental 'experts' were further embedded in the daily management of the country's natural resources (Isla 2015:50; Ramírez Cover 2011:12). This decentralized authority in turn "transform[ed] conventional forms of… agency, and sovereignty" (500) and stratified "state actors, and state power" (Goldman 2001:500) within the green economy.

As Escobar elaborated, the idea "that nature and Earth can be 'managed' is a historically novel assertion" (Escobar 1996:328) for which the application of management strategies requires nature to first be 'known'. In order to claim knowledge, resource conservation is founded upon the tools, technologies and work of scientific experts that are believed to be "separate from management and policy" (Goldman et al. 2011:3). Yet, the application of particular forms scientific knowledge is generally determined through underlying relations of economic power and authority.

One team of scientific experts who expanded conservation along the river were members of the Centro Científico Tropical[20] (i.e.: The Tropical Science Center) (TSC). Included among its members was Dr. Leslie Holdridge, an American biologist whose ecological classification system became factored into conservation initiatives along the Río Peñas Blancas for decades to come. First published in 1971[21], his work envisioned "the environment as a system" (Harris 1973:187) composed of different bioclimatic land areas called 'Life Zones'. The Life Zones model became authoritative in the region after his organization, the TSC, purchased 48 hectares of riverine-property in Quizarrá from the region's first permanent Western scientific resident (and Holdgridge's associate) Dr. Alexander Skutch in 1993 (Canet Desanti

[19] As Escobar elaborates, the concept of biodiversity conservation "did not exist before 1980" (2008:277), but emerged from conservation biology in order to mitigate the loss of species.

[20] The TSC was established as a private consulting firm in 1962 "by three American biologists —Leslie Holdridge, Robert Hunter, and Joseph Tosi" (Evans 1999:26; Henderson 2002:3).

[21] This model was first published in the field study of Dr. Holdridge and his coworkers titled Forest Environments in Tropical Life Zones (1971) in which fluctuations and distributions of annual temperature and annual precipitation were philosophized to be "the principal determinants of global vegetation" (Meza Ocampo 2014:40).

2005:5).

As an aside, this riverine-property had initially been purchased by Dr. Skutch in 1941, where he spent his later years "meticulously stud[ying] the life histories of a variety of tropical birds, research[ing] many different plants" (Evans 1999:20) and producing regional species studies[22] that were "one of the earliest advances for conservation" (Henderson 2002:3) in Costa Rica. Dr. Skutch's settlement and land tenure initiated a conservation legacy of forest enclosure that would continue with the TSC. Under the management of the TSC, Skutch's property of Los Cusingos[23] was formally renamed 'The Neotropical Bird Sanctuary Los Cusingos' and Holdridge's model was applied to define the region's ecosystems. The TSC determined that the park's forests are very rare Premontane Wet Forests that continue along an "altitude belt that stretches from 1000 to 2000 metres (with an average temperature of 24° Celsius), before transitioning to elevated Montane forests between 2000 and 3000 metres (with an average temperature of 12° Celsius (Canet Desanti 2005:37). As Los Cusingos began to draw Western naturalists and tourists, the biodiverse Montane forests to its north also attracted philanthropists to the region.

Riverine Conservation and Reforestation in the Early 21st Century

The international management of local ecosystems expanded along the river in 1998, when "124.37 hectares of Costa Rican rainforest", located six kilometres upriver from Los Cusingos at the foot of Chirripó National Park, "was donated to York University's Faculty of Environmental Studies (FES) by Dr. Woody Fisher" (Baggio 2001:153). This park, referred to as 'Las Nubes' (i.e. The Clouds), was identified to contain Montane Rain Forest according to the Life Zones classification system" (Baggio 2001:153). As one conservationist explained, "since the region "*receives more rain…* [this] *means that the species can also change"* (Participant 33).

In order to preserve the river's Life Zones, and to "enable migration and [the] dispersion of flora and wildlife" (Canet Desanti 2005:16) between them, the Las Nubes Project initiated a collaborative partnership with the TSC to transform the region into a biological corridor[24]. With the support of local residents[25], and named after the region's late ornithologist, the Alexander Skutch Biological Corridor

[22] In fact, Skutch compiled these and other studies "in over 200 journal articles and a dozen books on topics ranging from ornithology and botany to tropical conservation and philosophy" (Evans 1999:20).
[23] Skutch named his property 'Los Cusingos' after its prominent toucan resident "the endemic Fiery-billed Aracari" (Montoya and Martinez 2015:6).
[24] Within the ASBCs Project Plan, it is noted that the corridor is intended to "enable migration and [the] dispersion of flora and wildlife, and ensur[e] the conservation and maintenance of the biota and their habitats, in addition to [their] ecological and evolutionary processes" (Canet Desanti 2005:16).
[25] The creation of the ASBC *"included the participation of members from* [the municipality's coffee cooperative] CoopeAgri, *the TSC, Los Cusingos, ASUCUENCA*" (Participant 27) and York University, among others. This effort grew to incorporate new community organizations including "*AMACoBAS, community bakery-cooperatives, and rural tourism agents*" (Participant 27).

(ASBC) was established in 2005 with the function[26] to "provide connectivity between [private lands,] protected areas, landscapes, ecosystems and natural habitats" (Canet Desanti 2005:16). The Río Peñas Blancas functions as the corridor's principal feature, causing the ASBC to be defined as a "fluvial [biological] corridor because it incorporates the [river's] watershed" (Canet Desanti 2005:19).

The emergence of the ASBC coincided with the initiation of a Fair Trade shade-grown coffee program that was promoted by York University, and local coffee producers of CoopeAgri (Sick 2008:199). Yet, while "*people saw the potential for a small residential market... the coffee project didn't develop much because people took more interest in resource protection*" (Participant 27). This interest was partly fostered through regional government projects that sought to compel individual citizens to abandon the extractive resource practices that were promoted by the state during prior decades. By providing formal environmental education in schools, threatening penalties for misuse of resources, and providing financial incentives to encourage local conservation (Maguire 2017), the state sought to compel residents to internalize social values and norms by self-regulat[ing] their behaviour in ways consistent with the state's goals" (Fletcher 2010:175). In short, the combined efforts of international conservationists and state bodies helped foster a local interest in ecological preservation. This direction prompted the emergence of a homestay economy and services industry aimed towards hosting researchers, students, and ecotourists, thus generating new occupational niches: particularly for women[27] whose traditional domestic roles provided households with supplemental forms of income. The region's services economy further increased as a flux of international visitors became attracted to the region's ecology following the corridor's formation.

As the ASBC began to host eco-tourists, it also attracted international real estate developers. As one participant noted, the *"CCR, the Canada-Costa Rica Company"* (Participant 13), purchased the overgrown pastures at the foot of the Las Nubes forest through the collective funds of 19.5 shares in order to develop properties. With foreign investment, these pastures were converted into Santa Elena's affluent neighbourhood of Chirripó Vistas, occupied by permanent and seasonal North American residents with an affinity for *nature* and *sustainable living*. This process stretched the socio-economic divide of residents within the ASBC while enclosing the mountain's northern frontier for international settlement.

[26] Moreover, the ASBC continues to operate as an initiative to: recover the last relics of the country's tropical seasonal evergreen forest; restore connectivity between fragmented conservation areas and forest patches with La Amistad Biological Reserve; facilitate the migration and dispersion of flora and fauna by using the river as the central migration corridor; foster shared sustainable development initiatives with other regional organizations; and, encourage community participation in the development of the ASBC (Canet Desanti 2005:5).

[27] Specifically, the home stay economy that emerged within the ASBC, whereby incoming ecotourists pay to remain with local families, resulted in the assignment of a labour value to traditionally female gendered work such as cleaning, cooking, and home maintenance that had previously been unwaged labour that was invisible to the market. Similar cases have been noted in Costa Rica (see Isla 2015:45).

Included among Chirripó Vistas' earliest residents were 'self taught' conservationists who generated a 'green' micro-economy by hiring local Ticos to reforest[28] the river's cleared western bank[29]. This process unevenly incorporated local experiential, national-political, and Western scientific environmental knowledges into the material tools, resources, and labour required to undertake reforestation. As such, these different knowledges became materially fixed in the selection and planting of new forest members. As the project progressed the planting of "three important genera that are widespread and common in Costa Rican forests" (Reforestation Record for Vistas de Chirripó 2014) took central stage: Ficus, Inga, and Cecropia.

Environmental Knowledge(s) and Co-Dependent Ecologies

Ficus (colloquially known as Figs) were selected[30] by conservationists "because of their staggering fruiting" (Reforestation Record for Vistas de Chirripó 2014) and their capacity to flower at unpredictable times such as "periods of the year when nothing else is fruiting" (Ibid). As such, these trees are essential to many of the region's frugiverous[31] species of birds (such as tanagers), fruit eating species of monkeys (such as white-headed capuchins), bats, and other mammals. These trees also depend on mammals and birds to disperse their seeds in scat and guano (Participant 19; Participant 34), thus facilitating the exponential growth of their large canopies as more seeds germinate. As one conservationist explained, *"a few planted trees can create a species rich area that can greatly expand the forest"* (Participant 34).

Yet, Ficus trees also display "plant-insect mutualism" whereby *"many fig species have their own species of pollinating fig wasp"* (Participant 34). Due to their co-evolution, "the absolute dependency of the fig on its wasp and vice versa bodes ill for figs in forest fragments" (Reforestation Record for Vistas de Chirripó 2014). Because fig wasps require extensive habitat, reforestation along the Río Peñas Blancas (Participant 34) was noted to be essential for the forest's co-dependent ecology.

[28] However, this initiative was reported to have been largely experimental since reforestation within "abandoned [pasture] is different from normal secondary succession" (Reforestation Record for Vistas de Chirripó 2014).
[29] This process initially required the cutting of pastured grass[29] with a weedwacker, and the application of fertilizers (Ibid), followed by the planting of "42 species [with] 70+ individual" trees (Ibid).
[30] It was further noted that Ficus' roots are "extremely important for holding onto soil and halting ground erosion" (Reforestation Record for Vistas de Chirripó 2014). Because of this, *"near the edge of the* [Río] *Peñas Blancas, you can see more roots than earth… they* [Ficus trees] *keep rivers in place"* (Participant 34).
[31] Frugiverous is defined as: when the entirety of an animal's diet consists of fruit.

Figure 5: Strangler Fig

(L): A strangler fig casts shade on the riverine trail. What appear to be separate trunks are part of the same enormous root system. Photo by author, 2016

Figure 6: Bromelias

(Below): Bromelias and moss retain pools of moisture on the west bank of the Río Peñas Blancas along the rainforest trail. It was noted in interviews that the region's bird species, the resplendent "*quetzals need water from bromelias, not creeks, to make up for a fatty avocado diet"* (Participant 1). Photo by author, 2016

In addition to Figs, Inga trees of the Fabaceae family were also selected for their roles in nitrogen fixation "due to the symbiotic relationship that [their] legumes have with nitrogen fixing bacteria" (Reforestation Record for Vistas de Chirripó 2014). This association "gives a big advantage to trees" rooted in tropical soils that are "shallow and leached from heavy rainfall" (Ibid; Participant 34)**—** prevalent conditions in abandoned pastures. As such, they facilitate additional trees' access to nutrients. Finally, the third species selected was the native and rapidly growing Cecropia due to their tendency to attract wildlife. It was explained that Cecropias are dispersed by "arboreal mammals [and] birds" (Reforestation Record for Vistas de Chirripó 2014).

These accounts reveal that the collective efforts of community foresters (who have planted close to a total of 16,000 trees), the technologies they used, the insects that pollinated them, the trees themselves (with their productive fruitings), and the fauna that distributed their seeds, have helped generate lush secondary forest canopies along the river's northwest bank that continue to stretch inland. One resident of Chirripó Vistas' noted that "from the time we started [reforesting] to the time now, we see probably three to four times the wildlife, and we don't have Los Cusingos nearby" (Participant 13).

While conservationists emphasized the co-dependence between tree species, bacteria, insects, and frugiverous animals, many local Ticos revealed how such codependence also maintains the river's smaller tributaries and springs. As one Tico in Montecarlo noted, "*everyone talks about the importance of water, that we couldn't live without water, that's true, but we would not have water if it wasn't for the trees*" (Participant 5). This is because "*river ecosystems are codependent on trees on either side*" which are "*also supported by animals*" (Participant 12). For this reason, "*every bird and every puma is necessary, it's the importance of the forest:* [and of] *all the animals… in their excrement, the seeds are distributed* [and] *birds are extremely important for this, so the flora and fauna is indispensable*" (Participant 20).

With the productive roles of nearby wildlife, locals associated the forest's expansion with the renewal of high-altitude wetlands as the secondary forest's canopies captured rainfall and replenished surrounding *"spring wells on the* [nearby] *properties"* (Participant 32). In addition to feeding directly into the river, this groundwater also collected in a nearby plateau of abandoned pasture where it now hosts many amphibians (Participant 13; Participant 9). The trickling streams from this wetland to the adjacent riverbank provided conditions that were noted to host extensive biodiversity. Environmental researchers have contributed to herpetofauna[32] data by conducting species counts in Las Nubes (Grundy 2014:93-110; Luffman 2014:23-25; Maguire 2017:41). During my research, I was invited to attend one nighttime species count with biologists from the University of Costa Rica to document herpetofauna[33] along the river. Among the organisms encountered was a critically endangered (and nationally threatened) species—the harlequin toad [*Atelopus varius*], adapted to live on "the margins of shallow, rapid streams, [and being] possibly one of the few remaining within Costa Rica" (Luffman 2014:24). As one conservationist explained, *"the most valued body of water in this area is the river, it's the biggest—spectacular, it maintains the area*" (Participant 33).

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[32] The presence of several amphibians[32] was also noted to indicate the river's quality because "the reproduction of many amphibians depends on water" (Participant 1), However, because they are sensitive to changes in temperature and humidity (Participant 1),

[33] Among them were: the helmeted iguana [*Coritophanes cristatus*]; an undetermined species of lizard [*Anolis aquaticus*]; the legler's stream frog [*Ptychohyla legleri*]; the tink frog [*Diasporus diastema*]; the emerald glass frog [*Espadarana prosoblepon*]; the robber frog [*Craugastor cruentus*]; a second species of robber frog [*Craugastor fitzingeri*]; an additional species of Craugastador (yet to be determined); and, the harlequin toad [*Atelopus varius*] to name a few. Species identification was performed using fieldwork photos that were taken during the night hike, and courtesy of participants in a York University herpetofauna list project, yet to be published.

Figure 7: Herpetofauna

Harlequin Toads (as pictured) are prized for illegal trafficking, and the Los Cusingos director advised not to share its image on social media or have its exact location revealed. Photo by author, 2016.

In addition to supporting adjacent ecosystems, the river was also revealed to supply water to an abundance of migratory species. Throughout interviews, it was noted that the areas *"close to creeks and rivers are* [therefore] *more biodiverse" (Participant 1) with one participant having encountered "coati, jaguarundi, and larger cats while maintaining* [its] *paths" (*Participant 19). One Montecarlo resident described observing the return of species[34] that had not been seen since the time of commercial deforestation. As he noted,

> *Now people don't cut the mountains, so this has caused a shift to the climate… now it's fresher here when before it was hotter. Before, the river's banks had no trees, and now the river's edges have a lot of trees… so, you see species returning now that haven't been seen. There were once toucans here, because my dad told me stories that he saw them, but it's only six or seven years ago that they showed up, so this return of species also helps the ecosystem (Participant 20).*

Additionally, scientific inquiries into ecosystem functions have included species monitoring initiatives by researchers and scholars from York University, the TSC, and local residents. Between 2012 and 2014, nine motion camera traps that were installed in forests and farms along the river's banks retrieved around 1000 wildlife photos (Dicarlo et al. 2015). From this study, sixteen terrestrial mammal species were detected[35]. The data[36] indicated that terrestrial animal movements extend into protected areas along the river as well as into private farms and pastures. Furthermore, it revealed the river to be essential

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[34] Increased sightings might not demonstrate an increase in species populations, as animals may have migrated to the region due to the loss of their habitats elsewhere. However, this does reveal that the local ecology contains the elements necessary to support regional biodiversity.

[35] including the "common opossum [*Didelphis marsupialis*], common grey foureyed opossum [*Philander opossum*], lowland paca [*Cuniculus paca*], Central American agouti [*Dasyprocta punctate*], ninebanded armadillo [*Dasypus novemcinctus*], tayra [*Eira barbara*], ocelot [*Leopardus pardalis*], whitenosed coati [*Nasua narica*], collared peccary [*Pecari tajacu*], puma [*Puma concolor*], striped hognosed skunk [*Conepatus semistriatus*], northern raccoon [*Procyon lotor*], coyote [*Canis latrans*], tapeti [*Sylvilagus brasiliensis*], northern tamandua [*Tamandua Mexicana*], and red tailed squirrel [*Sciurus granatensis*]" (DiCarlo et al. 2015: Pt 3).

[36] This data was digitally transferred with instruments such as GPS, and computers, and analyzed with ArcGIS.

for species to migrate to the southwest of the corridor, where some Ticos allowed natural forest-renewal along their patches of riverbank. One resident of eastern Santa Elena expressed his joy in seeing "*monkeys, ocelots, and other animals feeding on fruit trees near the river*" (Participant 16). Similarly, to the southeast of Los Cusingos in western Quizarrá, participants fondly described observing the riverine biodiversity[37].

At the southernmost end of the ASBC, additional camera traps have been installed in Los Cusingos. One of its conservationists explained that "*the most important species* [to be recorded on cameras] *are the pumas and the ocelots… indicat*[ing] *that they have water, food, forest: as an indicator species, it reveals the ecosystem to be stable"* (Participant 33). However, these same terrestrial species are especially susceptible to seasonal changes. With that said, one resident noted that "*many* [animals] *migrate closer to the river*" (Participant 33), and "especially during the dry season when connecting creeks dry up" (Participant 4).

Figure 8: Camera Trap Images (L to R) ocelot *[Leopardus pardalis];* puma *[Puma concolor].* Pumas have been documented by camera traps both within Los Cusingos and within the cloud forests surrounding Las Nubes, suggesting that they navigate between these fragmented forest areas (Las Nubes Project 2013).

One conservationist at Los Cusingos reported that "*the creeks dry up by 90 percent* [here] *in the dry season… from the end of November until May*" (Participant 1). As a result, "*when creeks dry, trees dry and affect a lot of connected plants*" (Participant 1) in different ways. Moreover, while some regional orchid varieties were noted to offset these changes by improving their water retention capacities

[37] One resident observed seeing "a nest of motmots" carved into the river's edge; the king-fisher which lies low on the river"; and, thick neck storks which were described to "make Jesus lizards go running up the [nearby] tree[s]" (Participant 35). Additional species that were often observed include white-headed capuchin "monkeys, lizards and iguanas: I've seen the iguanas swim in the river a bunch of times… [also] big morph butterflies use the river as a path—they love when the sun hits the river… they go up and down it in the morning" (Participant 35).

(Participant 1), many species of fauna do not share this capacity to adjust to freshwater reductions. Another member of Los Cusingos further explained that "*if* [species] *don't have* water *they migrate to other areas to look for* [it]*, causing a whole ecosystem to be potentially destroyed*" (Participant 33). As this participant elaborated, "*"there is always a food chain… and these species depend on each other also... it's codependence… there are no independent species"* (Participant 1).

In addition to harming species' biological functions, one Los Cusingos conservationist noted that reduced "*water* [access] *can* [also] *genetically change animals*" (Participant 1). Many avian species demonstrate this constitution, since some "*birds genetically have a map for migration when born, and they* [also] *map out water sources,* [but] *this information may be lost, and* [can] *affect them biologically when these sources, such as water, or food trees, change into something they aren't familiar with… the rivers are very strong like that*" (Participant 1). Species dependence on the river was also noted to be escalating due to the effects of climate change.

According to local residents, rainfall variability is increasing with climate change and one resident described that when she was younger, "*the dry season wasn't nearly as dry, and now, it also rains more than ever*" (Participant 11). As a conservationist explained,

> *The winds are changing with climate change, and precipitation is changing, and this is also changing the Life Zones... even in places that are seeing the same amounts of rain. But in earlier times, the rain fell slowly daily... now there passes numerous days without rain, then there are days when it rains super hard—the quantity is essentially the same then and now, but it used to rain more slowly* (Participant 1).

As a result, "*now the hard rains are very notorious, and around here* [they've] *become prolonged*" (Participant 5). One member of the Aqueduct Council of Santa Elena (ASADA) attributed this to rising cloud formations along the mountain slope. As he noted,

> *When I was a child, I remember that just above the entrance to the Las Nubes campus, it used to be very foggy... the clouds would lower here. This area was full of clouds... and you couldn't even make fire because it wouldn't burn. But as people started cutting the mountains, the heat started rising, pushing the clouds* [up] (Participant 8).

Another resident added that "*current weather patterns are intensifying these issues; the clouds* [above] *the other side of the General Valley are too low for* [their] *water to evaporate into rain... instead, the* [moisture] *is pushed into Cerro Chirripó where it rains harder than it used to*" (Participant 3). The resulting rainstorms were noted to magnify the river's force when surface water from fields and creeks converged in the riverbed to generate flash floods, a phenomenon unique to elevated rivers, known by locals as the 'Cabeza de Agua' [i.e.: The Water Head[38]]. These drastic seasonal effects, and their strains on the local ecology, became important rhetoric against dam developers after company representatives began to conduct ecological studies along the river.

Company Studies and Community Responses: 2013 to Present

In 2013, locals overheard that representatives from the private national hydropower company Hidroeléctrica Buenos Aires began to generate a species list along the river. Yet, their local whereabouts and research findings were concealed from most community members until later the same year after the studies were reviewed and published by the state's National Environmental Technical Secretariat (SETENA). The published Environmental Impact Study (EIS) only listed "19 forest species, 10 terrestrial fauna species, 31 species of birds, 3 species of fish [with] no endemic species" (Hidroeléctrica Buenos Aires 2013:58,67) along the river. Locals soon pressured SETENA to halt the projects by highlighting how the company's findings starkly contrast prior ecological data. The 2005 technical study for the design of the ASBC, alone records an estimated "414 species of birds, 133 species of mammals [and] 251 species of butterflies" (Canet Desanti 2005:41) in the corridor. A fish species[39] that is endemic to the Río Peñas Blancas has also been documented through local research. Despite public access to prior studies conducted within the ASBC, the inclusion of this data was not required by the state when determining the project's viability. As one local explained,

> [Companies] *don't report* [on] *the* [previous] *biological studies in the zone. They only walk around* [the river] *and they say… this this this* [species] *and done. They don't review the literature, the state's knowledge, [or] investigations, they don't review technical studies, proposals like for the ASBC, they don't revise project plans and diagnostics for protected areas like Chirripó and Los Cusingos. I, without being a biologist, know that I could take that information and enter these areas and find very interesting things biologically. But they do absolutely none of that. When one revises the EIS of* [the dam project] *Hidrosur, in* [the neighbouring] *Río Chirripó, they are very similar… they just use a different name* [but] *they put the same* [ecological] *information for each place* (Participant 12).

In fact, comparable riverine-studies were not only conducted along the Río Chirripó to the west of the ASBC, but also in the neighbouring municipality of Buenos Aires to its east, where residents in the town of Longomai learned of potential dam development along their local river. Once residents from these dispersed communities overheard that the proposed dam development was regional [see Figure 9],

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[38] Given the potential dangers of this phenomenon, community residents avoid swimming in the Río Peñas Blancas throughout the rainy season. Given this, recreation tends to occur more during dry months thus supporting the notion that the river can affect social activities and behaviors within the corridor.

[39] This endemic species of sardine, known as Bryconamericus terrabensis, was initially encountered and reported in the research of Fabricio Pardo (2014:4).

the western movement La Defensa de Río Chirripó Pacifico united with eastern communities along the Cordillera de Talamanca, and national dam-critics alike, to form the regional social movement Movimiento Ríos Vivos (i.e.: The Living Rivers Movement). This movement also incorporated international actors and institutional members "*like York* [University who] *can bring knowledge about issues of Costa Rica's environment to international attention* (Participant 5). In short,

> *This movement operates as... a solitary network. When one community mobilizes, members from other communities come to their aid. For* [the defense of the Río Peñas Blancas] *people from all over,* [including] *San José University, united with local groups... Ríos Vivos does not have active meetings but when issues happen the community mobilizes, usually with 50 to 60 protesters* (Participant 12).

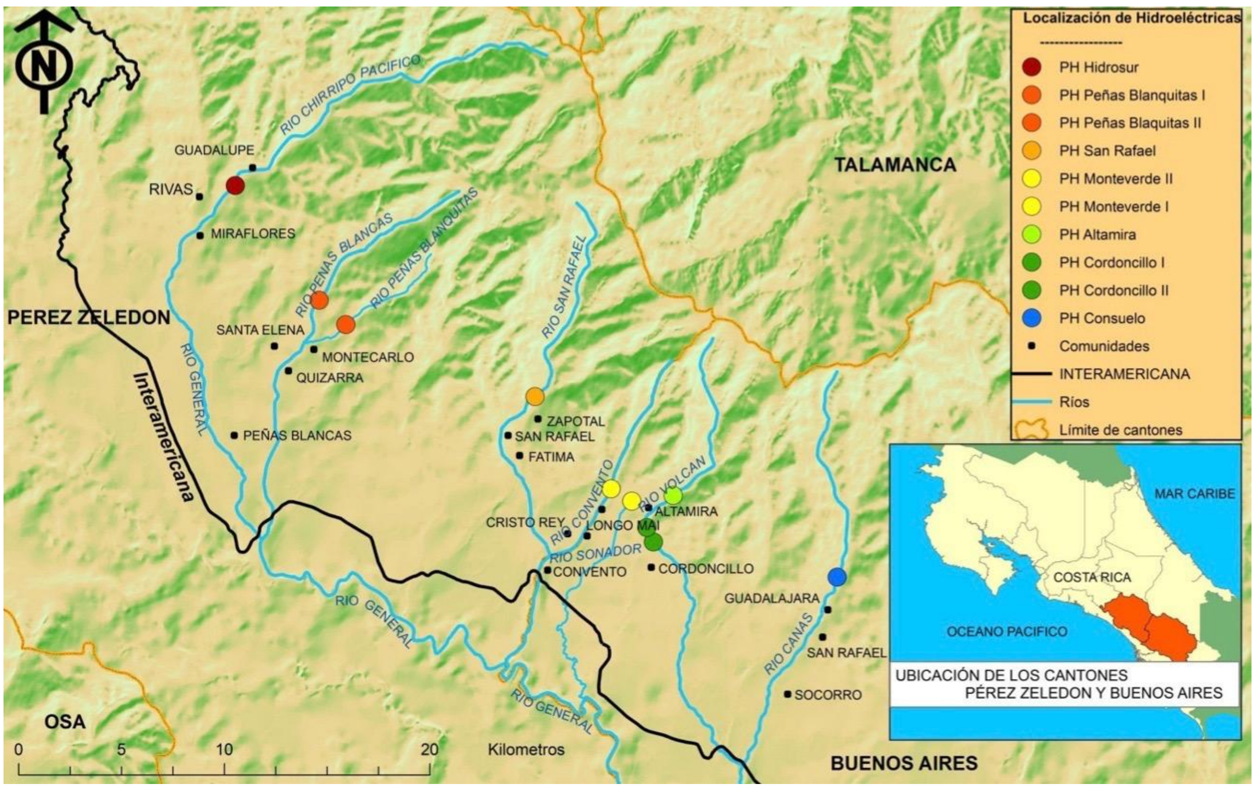

Figure 9: Map of Proposed Dam Sites
A map of the proposed sites for ten private hydroelectric dams in the municipalities of Pérez Zeledón and Coto Brus. The two red dots (center-left) represent the dams that are to be constructed along the river (Espinoza and Villalobos 2013).

Through mobilization, Movimiento Ríos Vivos aimed to halt regional dam development and reduce the country's dependence on hydropower in favour of green energy alternatives by revealing the environmental, and socio-economic consequences of dam technology; as well as the inadequacy of EIS standards to effectively assess and disclose this information. Their concerns are supported by human rights groups, lawyers, the World Commission on Dams (WCD), environmentalists, scientists, experts, and private citizens who emphasize the consequences of hydropower technology (McCully 2001; Strang

2013; Bakker 1999; Lindo 2006; Fletcher 2010). Included among these noted environmental consequences are: "flooding of natural habitat, loss of terrestrial wildlife[40][…] deterioration of water quality, downriver hydrological changes, [impacts on] fish and other aquatic life, [and the release of] greenhouse gases" (Ledec and Quintero 2003:4-7).

In fact, an investigation by the School of Sciences at the University of Costa Rica (2014) determined that dam reservoirs release methane emissions; the level of which is modulated by "several environmental parameters, both chemical and physical[41]" (Fernández Mena 2015:77). Building on these findings, McCully noted that some tropical forest reservoirs can contribute to climate change "even more than fossil fuel-burning power plants [that] produce an equivalent amount of electricity" (2001:141). In addition to these environmental consequences, socio-economic implications of dam construction can include: involuntary displacement of communities and loss of cultural property (Ledec and Quintero 2003:4-7), destruction to local economies (WCD 2000), and the loss of location-specific cultural sites and social customs (McCully 2001).

The company's inadequate disclosure of these potential consequences was largely attributed to the conditions that allow studies to be conducted at the convenience of companies. As one resident explained, the environmental impact "studies are done by the same companies that want to develop the projects… because the state doesn't have the economic resources, personnel or technical capacity to do [them]" (Participant 5). In short,

> *The problem* [is that] *SETENA accepts the study that the company provides... SETENA* [approves] *the company's presentation, and because of this the company can easily manipulate data*[42]*. They can give a list of participants* [from] *informative meetings or interviews to* [show] *that locals supported* [dams]*... then they give the data to SETENA and show how they performed the study, which is easy to manipulate* (Participant 26).

These accounts reveal that new assessment requirements should be incorporated within future EIS standards in order to minimize conflicts of interest. In particular, a bibliography of prior ecological data should be incorporated into assessment processes and in accordance with regulation. Additionally, the required participation of (perhaps elected) community representatives in an initial species count to be sent directly to SETENA would also increase the transparency of project assessments. Finally, the species data collected by the company should be made publicly accessible to the community prior to the project's

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[40] Additional scholars within Costa Rica have observed numerous consequences from dammed rivers, such as: the eradication of [terrestrial] and aquatic biodiversity (Lindo 2006), the reduction of fish stream assemblages (Anderson et al. 2006), changes to water sedimentation levels, flooding, river fragmentation, and the dewatering of rivers downstream (Anderson et al. 2008).

[41] Among these noted parameters are "soil temperature, water table levels, the concentrations of chlorophyll and total solids, which show positive correlations with methane fluxes measured in the dam reservoirs of Costa Rica" (Fernández Mena 2015:77).

[42] Due to this conflict of interest, "*the study can present false* [data]… *for example the study here offered a photo of the river* [to show its ecology in the EIS]*, but this wasn't an honest picture—it looked more like a* [dry] *pasture from Guanacaste*" (Participant 5).

approval process. However, it should be noted that technical species lists favour[43] the data of actors with formal research training—while discrediting the knowledge of locals who use colloquial species names. Moreover, traditional species lists do not account for the ways in which biodiversity is understood and represented at the local level, revealing future potential for participatory studies that capture the complex co-dependence of riverine-biodiversity.

Moreover, with project data coming from company research, locals expressed their concern that only some of the potential consequences of the dams' construction phase were included in the EIS. This concern was directed towards company claims that the dams would not interfere with land use patterns since the river's surrounding area is used for agriculture (i.e.: coffee and sugarcane) and livestock (Hidroeléctrica Buenos Aires 2013:8). In fact, the EIS stated that the dams would benefit nearby communities by creating construction and operational jobs, including 100 positions for locals during the dams' construction "to cover different specialties, such as engineers, surveyors, geologists, builders, carpenters, machine operators, construction laborers, mechanics, electricians, [and] drivers" (Hidroeléctrica Buenos Aires 2013:16). Yet, when considering the occupations of corridor members, only a fraction are trained in construction and fewer still are certified engineers, electricians, etc. Given this, most community members would be relegated to temporary manual labour positions.

Furthermore, the company stated that the residents employed for the construction of new public roads would "improve the quality of life for residents, who [would] inherit and benefit from this work (Hidroeléctrica Buenos Aires 2013:2). The dams, once constructed, were presented as a potential tourist attraction that could lead to "the establishment of shops and related services" (Hidroeléctrica Buenos Aires 2013:2). Yet, as one local argued "*they said they would fix the roads and increase tourism because lots of people will come to see the dams... but this isn't true… nobody is interested in seeing dams so they came with lots of lies to gain local support*" (Participant 11). It is therefore more likely that the dams would disrupt the region's growing eco-tourism industry. One resident argued that dams "*would eliminate the river... it would no longer be a river... what is more economically valuable than the dam is* [the river's] *importance to students and tourists*" (Participant 9). As another local confirmed, "*the goal is to create a tourism project, so the dams would destroy both nature and the future economy… meanwhile a few company members would profit*" (Participant 27). The impacts on tourism[44] would primarily affect participants within the home staying industry, who are increasingly women, revealing that the gendered consequences of dam development have not been adequately explored.

[43] This highlights an area for collaborative species research between institutions and locals resisting dam development, both within the ASBC and elsewhere.

Finally, the effects of climate change were entirely omitted from the EIS document, despite local evidence that substantial reductions to the river's flow have occurred throughout the past decades due to the combined effects of anthropogenic behaviour and climatic variability. One local stated that the EIS "*said that the dam wouldn't affect communities downriver... but it would fully remove* [the river's] *flow—especially in the summer dry season*" (Participant 7). This variability was noted to be of particular concern for the towns of Santa Elena and eastern Quizarrá whose domestic freshwater supply arrives "*from the springs at the top end of the river"* (Participant 32). Residents further noted that many local springs have dried within recent memory, and combined *"with the population growth that is expected within these communities, water security within people's homes is a serious concern...*" (Participant 2). This was confirmed by members of the ASADA of Santa Elena who emphasized that *"the river must be protected for security… because one day, if there are no more water sources* [i.e.: springs] *the river will be essential"* (ASADA). In addition to straining local water supplies, the prospective generation of hydropower energy during the dry months was noted to be implausible. As one local explained,

> *These rivers are small, so the energy they produce doesn't make much of a difference,* [especially] *in the summer* [when] *electricity is needed. So it should not be permitted for dams to be constructed along this type of river* (Participant 11).

Taken together, these various omissions from the EIS revealed the false nature of the company's claim that the dams would not cause negative impacts to the local economy and ecology. In fact, these numerous concerns of Movimiento Rios Vivos helped the movement to facilitate a regional dialogue that gained the political attention of SETENA. This outcry succeeded in achieving a temporary moratorium on both dams in 2014, as well as on all other hydropower dams within the municipalities of Perez Zeledón and Buenos Aires. This moratorium has since ended, and the companies involved in regional projects are continuing to push for development.

A Company Outline of the Proposed Dam Development

The dam projects PH Peñas Blanquitas I (PHPB I) with 8650 kilowatts (kW), and PH Peñas Blanquitas II (PHPB II) with 3816 kW are to be located between the biodiverse protected parks of Las Nubes and Los Cusingos. Specifically, the dam crest[45] of PHPB I is positioned to reach 1075.6 masl with the crest of PHPB II to its east at 1068.25 masl. They are to be located along the river's sister branches before the river's point of flow convergence (Hidroeléctrica Buenos Aires 2013:5), near the coordinates of (9.35750°, -83.61208°).

[45] As Luffman elaborates, "The dam structures themselves are low, approximately two meters, and almost thirty meters wide" (Luffman 2014:11).

Both dams are to be developed by Hidroeléctrica Buenos Aires (Álvarez Mora 2013) composed of "*a consortium of companies under the head of Hernan Solis*[46]" a member of "*one of the richest families in the country*" (Participant 12). As previously noted, the company submitted an Environmental Impact Study to SETENA in 2013, a legal requirement to begin project development (Lindo 2006:302). The EIS noted that both projects will be diversionary dams, meaning that they will function by "diverting water from a watercourse, down a channel" (Luffman 2014:10) and into a regulation reservoir with a capacity to hold the 48,300 cubic metres (m3) of water that is required to "comply with demands at peak hours" (Hidroeléctrica Buenos Aires 2013:13). This process is certain to impact the downriver communities of Santa Elena, Montecarlo, and Quizarrá.

In compliance with national requirements, the EIS for PHPB I and II maintained that the dams will comply with an environmentally 'sustainable' flow measurement, known as the 'designated flow standard'. The river's flow standard refers to the minimum quantity of water flow "necessary to maintain water quality and the survival of dependent ecosystem varieties" (Burchi 2007:7). In other words, its claimed purpose is to maintain riverine-biodiversity by leaving enough relatively clean water available for freshwater-dependents.

Keeping this purpose in mind, state legislation recommends that "small dam projects [should] leave a compensation discharge that corresponds to 10% of [the river's] average annual flow" (Anderson et al. 2006:398). The removal of 90% of the rivers flow is said to therefore ensure social and ecological sustainability; an unlikely scenario. In adherence to this standard, the company calculated the Río Peñas Blancas' available annual flow to be 2981 litres per second (l/s) (Hidroelectrica Buenos Aires 2013:5). The minimum flow standard projects that the river's flow can be reduced to a mere 298.1 l/s[47], (Ibid) with the additional 90% to be redirected away from what will potentially be several kilometers of the riverbed and into a regulation reservoir.

While the construction of PHPB I and II is conditional upon leaving 10% of the Río Peñas Blancas' initial flow, the EIS measured this quantity with rainfall data that was collected in 1992 from rain stations that were located outside of the study region (Hidroelectrica Buenos Aires 2013:36). The EIS also presented the dams to be compatible with the region's prominent rainfall due to the "the mountainous barrier of the Cordillera de Talamanca to the north, and its oceanic influence" (Hidroeléctrica Buenos Aires 2013:35). These conditions were said to "generate seasonal heterogeneity [that is] ideal for dam development, [since] the dry period is very favourable and short, with a humid tropical climate and rainfall all year round" (Ibid). The company therefore claims that the river's annual flow quantity has been stable for more than two decades and will remain fixed for the foreseeable future, despite

[46] The legal representative of PHPB I and II is Melida Solis, his daughter.
[47] Of this total, 202 l/s are expected to flow from the dammed western branch, and the additional 96.1 l/s are to flow from the eastern Río Peñas Blanquitas (Hidroeléctrica Buenos Aires 2013:1).

insurmountable climatic and oceanographic evidence, as well as lived accounts, that reveal the increasing variability of rainfall between montane elevations and throughout the region.

Moreover, the energy that is to be generated with 90% of the river's water will not be used to service local homes due to the region's nearly complete rate of electrification. This demonstrates that the electricity generated by PHPB I and II will be exported from the region. As such, Hidroeléctrica Buenos Aires is aiming to conduct a case of water grabbing; defined as "a situation where powerful actors are able to take control of, or reallocate to their own benefits, water resources already used by local communities or feeding aquatic ecosystems on which their livelihoods are based" (Mehta et al. 2012:197). Water grabbing can therefore be considered an "enclosure of the commons", which rely on mechanisms to "appropriate and convert resources into private goods [through] processes of commodification, privatization and large-scale capital accumulation" (Franco el al. 2014:4). As such, water grabbing is a growing trend due in part to the proliferation of private dam development that is occurring throughout the country.

In Costa Rica, private participation in energy generation began in 1990 with Law 7200. This law initially made rivers available to private hydropower companies with a maximum capacity to generate 20MW (and to collectively generate 15 percent of domestic energy), with the requirement that they sell all energy back to the ICE (Anderson et al. 2006:683; Lindo 2006). In 1995, this law was amended to increase the energy capacity to 50MW, allowing private companies to generate up to 30% of the country's total domestic energy needs (Lindo 2006:303). Moreover, tariff[48] adjustments that were instituted the same year reduced the costs that hydropower companies were required to pay for the use of surface and groundwater by nearly 95 percent (Zeledón Calderón 2013:7). This represented the greatest tariff adjustment among the eight major water-using industries and, at .12 colons per m3 of surface water, allowed hydropower companies to pay bulk tariff costs that were far below the 1.46 colons per m3 that many citizens were paying for domestic water consumption by 2005 (Zeledón Calderón 2013:7). These uneven cost adjustments were further presented as compatible with the state's "description of water as a public domain" (Cover-Ruiz et al. 2009:3) under the 1942 Water Law, currently still in effect as "the national water law of Costa Rica" (Ibid).

The private energy sector's privileged access to freshwater allocations points to the state's preference for public, followed by private, hydropower dams which collectively generate "over 80% of

[48] The MINAE defined this new water tariffs system as: An economic instrument for the regulation and administration of water use that permits sufficient water availability for the reliable provision for human consumption and the socio-economic development of the country[...in] addition to generat[ing] economic resources for the long-term funding of sustainable water resources management in Costa Rica (Zeledón Calderón 2013:2).

the nation's electricity" (Lindo 2006:298). This energy grid is maintained[49] by the Institute of Electricity, or Instituto Costarricense de Electricidad (ICE), which produces an estimated 82% of the country's total generated hydropower (Guzmán-Arias and Calvo-Alvarado 2013:55). The additional 18% is generated by private companies (Ibid). This national dependence on public and private dams helped Costa Rica achieved a near "complete national rate of electrification: 99.2 percent [by 2010]" (Hernández et al. 2013:162). Given this rate, local accounts revealed that the electricity that will be generated by PHPB I and II will certainly be destined for international consumers because the country's "*energy matrix [is] at nearly full capacity* [and] *above what is needed...so it's obvious that the electricity is for export"* (Participant 12). As another participant stated, *"Costa Rica has enough electricity"* (Participant 11).

Since national energy demands are being met, the state's approval of new private hydroelectric dams is grounded in two dominant discourses that pervade transnational and regional politics: namely, that there is a global water crisis; and, that the 'sustainable' industrial use of water is an essential market solution for achieving environmental preservation (Bakker 1999:210). To elaborate, global freshwater is "indispensable [for] industrialization and urbanization" (Bakker 2003:51) since its uses are increasing both directly and indirectly for the production of agriculture, livestock, products, chemicals, raw materials, to sustain laboring human bodies that are essential for commodity production, and to generate electricity. Given this market dependence, "water scarcity represents a significant threat to continued capital accumulation" and remains "one of the most important [and common] 'bads'" (Ibid) that is framed within sustainability discourse.

Accordingly, the combined effects of global climate change, population growth, and prior freshwater extraction for industry are believed to have caused global water insecurity, and have prompted the emergence of a transnational 'crisis control strategy' to manage nations' available freshwater (Escobar 1996:326; Bakker 2003:51). At present, concerns about a water crisis are becoming prominent in Costa Rica as potable water shortages have increased in some urban regions[50]. In order to mitigate this growing crisis, governmental organizations have targeted the activities of household consumers by increasing the cost of domestic freshwater and by enforcing behavioral interventions[51] in order to reduce household water consumption (see Datta et al. 2015). In spite of these actions, 2005 estimates indicate that household freshwater consumption (in addition to tourism, industry and agribusiness) collectively

[49] Private companies are legally required to sell the energy they produce to the ICE. This state organization therefore maintains a monopoly over the distribution of the national energy supply by retaining the authority to administer and allocate water resources for energy generation (Cover-Ruiz et al. 2009:3).

[50] Water shortages are a growing reality within some major cities and throughout the north-Pacific Province of Guanacaste and are commonly regarded by policymakers to be a 'tragedy of the commons' (see Hardin 1968), whereby individual rates of water consumption generate a collective water crisis, thus warranting the control of individual consumption.

[51] Governmental organizations, in collaboration with World Bank funded research groups, generated water conservation strategies that focus on reducing household water consumption by enforcing behavioral interventions. This is discussed within a 2015 study that was performed in Belén, Costa Rica (see Datta et al. 2015).

accounted for only 6.8 percent of the country's total freshwater withdrawals[52] (Guzmán-Arias and Calvo-Alvarado, 2013:53). In fact, 21.2 percent of water withdrawn in Costa Rica that same year was used by the agricultural industry; while the vast majority—approximately 72 percent[53]—was used to generate power (Ibid).

While the condition of freshwater scarcity has become naturalized by state and non-state actors, theorists including Lyla Mehta argue that the notion of scarcity is "usually socially mediated and the result of sociopolitical processes" that tend to "naturalize its anthropogenic dimensions" (Mehta 2011:372) and causes. With this in mind, the allocation of water for hydropower generation is justified with the argument that dams are a sustainable energy solution to the growing global ecological crisis. Known as the 'crisis control strategy', dams now rely on a discursive direction that has reconfigured natural capital by first acknowledging the existence of this environmental crisis, and then by scrutinizing the contributions of prior industrial behaviour (Escobar 1996:326; Bakker 2003:51).

The crisis control strategy, or alternatively known as the 'economy of repair', aimed to conserve freshwater by reconfiguring this element's economic value through the global launch of 'sustainable development projects' (Escobar 1996:327). These global projects emerged "with the report of the World Commission on Environment and Development by the United Nations [in 1987]" (Ibid). Since then, sustainable development became part of a global political priority during "the [1992] United Nations Conference on Environment and Development, or Earth Summit, held in Rio de Janeiro" (Isla 2015:6) when "development and environment were linked together in Agenda 21" (Isla 2003:6; Isla 2015:4).

In response to this summit, a transnational agreement involving ten[54] Latin American countries, known today as the Mesoamerican Integration and Development Project (MIDP), became promoted as the ultimate 'sustainable development' strategy that would reduce poverty and ecological destruction throughout the Neotropics (Isla 2015:159). Included among the most extensive initiatives within the MIDP, is the System of Electrical Integration for the Countries of Central America (SIEPAC), a transnational energy integration agreement involving the redirection of electricity from participating nations' domestic grids for export to Panama **(**Pickard 2004:5; McElhinny 2004:15**).** SIEPAC has since been adopted by the governments of Guatemala, El Salvador, Honduras, and Nicaragua, with additional electrical lines beginning to appear throughout south-Pacific Costa Rica. As residents revealed, *"there is an electrical network here that connects all of Central America... they have all the machines and*

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52 The country's total withdrawals were equal to an estimated 22 cubic kilometres (km3) or 20 percent of the total available water volume of 113 km3 (Ibid).

53 The increasing percentage of energy from dams is estimated by some scholars to have escalated to as high as 94 percent (Alpizar Rodriguez 2014:171).

54 These countries include: Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, Panama as well as Mexico and Colombia.

everything ready and [set] *up… they just need to find rivers* [like the one here] *and attach the dams"* (ASADA).

With so much capital invested in expanding SIEPAC, one local expressed his concerns about increasing violence related to hydropower development... "*In Central America, around ten people have been assassinated within the last several years with reasons having to do with hydroelectric power: in Honduras, in Guatemala, and in Mexico too*" (Participant 12). In addition to increasing violence against dam opponents, SIEPAC is further criticized for its erosion of national control over freshwater resources. To elaborate, critics of SIEPAC contend that negotiations would overrule the rights of national governments to determine their energy decisions (McElhinny 2004:15), partly since dams "almost always require the involvement of foreign capital and expertise" (Bakker 1999: 211), and also despite the fact that the owners of the project's transmission lines would include nationalized organizations such as the ICE of Costa Rica (McElhinny 2004:15). In short, while SIEPAC is promoted as an improvement the region's electricity connectivity and telecommunications services, it *actually* operates as a 'sustainable development' strategy; one among many that is aimed at "ecological commodification, marketization and financialization" that dispossess communities of their local water resources and leads to the "deeper penetration of nature by capital" (Smith 2007:2).

This industry 'green-washing' therefore operates according to what Nilsson and Wallenstein refer to as "the doctrine[55] of economic neutrality" (2013:59). Through this doctrine, economic 'facts' such as the ecological-sustainability of dams are presented as objective truths that are "universal and politically neutral" (Ibid). As a result, the argument that hydropower contributes to the country's efforts to reduce carbon emissions obscures the real economic incentives that attract private companies and state actors to the nation's rivers. This commodification of freshwater for energy is therefore increasing with contemporary globalization, and is occurring within a larger resource paradigm that has been described as 'green neoliberalism' (Goldman 2007), 'market conservation' (Smith 2007), and 'market environmentalism' (Bakker 2007), to name a few.

This paradigm is founded upon the idea that the objectives of "economic growth, efficiency, and environmental conservation" can be collectively achieved by establishing "private property rights, employing markets as allocation mechanisms, incorporating environmental externalities [such as water] through pricing" (Bakker 2007:432), and by instituting formal pillars of neoliberalism such as "individual libert[ies], unencumbered markets, [and] free trade" (Harvey 2007:22). In this way, the incorporation of the Río Peñas Blancas' energy generating capacities into the transnational energy market accomplishes

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55 As "one of the most important ontological tenets of economic neoliberalism" (Nilsson and Wallenstein 2013:59), this doctrine makes economic discourses hard to challenge since doing so requires "contesting economic truths" (Nilsson and Wallenstein 2013:66).

what Harvey argues to be the primary aim of the neoliberal project: "to open up new fields for capital accumulation in domains formerly regarded off-limits to the calculus of profitability" (2007:35).

Conclusion

The implications of a 'green' economy continue to exacerbate global ecological and social conditions in the Anthropocene[56], namely through capitalism's growing contribution to anthropogenic climate change, Earth's sixth mass extinction, and "the large-scale destruction of ecological communities" (Kirksey and Helmreich 2010:549). At the same time, local conservation initiatives along the river have also embedded the local ecology and riverine-residents (both by choice and by necessity) further into the global market. Actors within these various industries are therefore engaging in a regional dispute to define the appropriate use and allocation of the river's water.

At the same time, local understandings of the co-dependence of riverine species provides an alternative narrative that appears to be grounded in "ethical ideas about relationality that reframe human-environmental interactions in egalitarian terms" (Strang 2013:163). This relationality between species bodies and the river that connects them demonstrated to locals that the river is quintessentially co-constituted. Local accounts and scholarship further reveal that the river's associations shifted over time from the bodies of native species and biota to include the new colonizing bodies of domesticated crops, livestock, humans, and introduced organisms.

In prior research, Ortiz Imalch determined that the identities of campesinos within the ASBC "delay the appropriation of the individualism that is [at] the core of neoliberal philosophy" (2014:82). With relation to this, the collective accounts of residents conveyed a vision of interconnectedness and shared inter-dependence in ways that "challenge pretensions to discrete individuality" (Chen et al. 2013:12) and encourage a relational approach to freshwater access that considers how all bodies "reside within and as part of a fragile global hydrocommons" (Neimanis 2013:27). The fragility of this hydrocommons was regarded by some community members to be a collective concern. As one local argued, *"the river has to be preserved, for flora and fauna… the flora need good water to live, and fauna too... and they are important"* (Participant 19). Another local expressed that *"water needs to be protected for the future… it's like the animals of the mountain, there's concern that the youth will not be able to experience these rivers because the environment wasn't protected well enough" (Participant 21).*

In this context, the biological importance of the river not only provides a deep source of connection between organisms across space, but also through time. Since ancient glacial waters spilled

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[56] The Anthropocene is a term used by climate researchers to describe what may possibly be the current "epoch in Earth's history" (Kirksey and Helmreich 2010:549).

down the mountain, the river has been additionally modulated by rainfall and groundwater springs. These same flows, while in a constant state of mobility and change, have in one sense remained part of a 'closed' hydrological system. As Neimanis elaborates: "Our planet neither gains nor relinquishes the water it harbours, but only witnesses its continual reorganization and redistribution. The water that temporarily composes and sustains any body brings with it a history that is at least 3.9 billion years old" (Neimanis 2013:31). Therefore, the river's ability to facilitate the emergence of biologically diverse communities extends the future promise of "inaugurat[ing] new life, and also the infinite possibility of new communities" (Chen et al. 2013:12) on the blue planet. This infinite potentiality and deep vitality link all past, present and future life into what Neimanis describes as an interdependent "aqueous gestational milieu" (2013:30). To offer a final reflection on the river's milieu, I end this study with a selection of words from the river's dependents:

"El agua es vida"
"Water is life"
(Participant 3; Participant 5; Participant 10; Participant 14).

"los ríos son las venas del mundo"
"Rivers are the veins of the world"
(Participant 12; Participant 34).

"Cebradas y nacientes son el sangre del río"
"Creeks and springs are the blood of the river"
(Participant 27).

"El agua no tiene precio… es vida, la sangre de nuestras venas"
"Water has no price... it is the lifeblood of our veins"
(Participant 3).

"sin agua no somos nada"
"Without water, we are nothing"
(Participant 8).

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Appendix A: List of Participants

Participant #	Gender	Community (of residence)
1	Male	Quizarrá
2	Female	Santa Elena
3	Male	Santa Elena
4	Female	Quizarrá
5	Male	Montecarlo
6	Male	Santa Elena
7	Female	Quizarrá
8	Male	Santa Elena
9	Male	San Fransisco
10	Female	Quizarrá
11	Female	Quizarrá
12	Male	Santa Elena
13	Female	Santa Elena (Chirripo Vista's)
14	Male	Santa Elena
15	Female	Santa Elena
16	Male	Santa Elena
17	Female	Quizarrá
18	Female	Santa Elena
19	Male	Santa Elena
20	Male	Montecarlo
21	Female	Santa Elena
22	Male	Santa Elena
23	Female	Santa Elena
24	Female	San Fransisco
25	Female	Santa Elena
26	Male	Longomai
27	Male	Cedral
28	Female	Montecarlo
29	Female	Montecarlo
30	Female	Montecarlo
31	Female	Santa Elena
32	Male	Santa Elena (Chirripo Vista's)
33	Male	Quizarrá
34	Male	Santa Elena (Chirripo Vista's)
35	Male	Quizarrá
36	Male	Santa Elena