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Payment for Ecosystem Services and the Water-Energy-Food Nexus: Securing Resource Flows for the Affluent?

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Received: 29 October 2018; Accepted: 24 May 2019; Published: 31 May 2019



Abstract: Payment for Ecosystem Services (PES) is not only a prominent, globally promoted policy to foster nature conservation, but also increasingly propagated as an innovative and self-sustaining governance instrument to support poverty alleviation and to guarantee water, food, and energy securities. In this paper, we evaluate a PES scheme from a multi-scalar and political-ecology perspective in order to reveal different power dynamics across the Water-Energy-Food (WEF) Nexus perspective. For this purpose, we analyze the PES scheme implemented in the Hidrosogamoso hydropower project in Colombia. The paper shows that actors' strongly divergent economic and political power is determinant in defining how and for whom the Nexus-related water, food, and energy securities are materialized. In this case, the PES scheme and its scalar politics, as fostered by the private/public hydropower alliance, are instrumental to guaranteeing water security for the hydropower scheme, which is a crucial building-block of Colombia's energy security discourse. For this, the water and food securities of the adjacent, less powerful communities are sacrificed. Examining the on-the-ground politics of WEF Nexus is key to understanding their impact on equitable and sustainable governance of water, energy, and food in the everyday lives of millions of resource users. We conclude that politicizing the Nexus can help to trace both the flows of resources and the flows of power.

Keywords: WEF Nexus; PES; scale politics; environmental justice; Latin America; Colombia

1. Introduction

Water, energy, and food production as well as governance systems are tightly interlinked. Energy production and regulations, for example, have an impact on water systems (e.g., increased water demand or alteration/pollution of water ecosystems) and food systems (e.g., competing for land in the case of biofuels or because of flooding areas for hydropower generation). These interlinkages are framed as the Water, Energy, and Food (WEF) Nexus, which is used to analyze interactions among these systems. The framework emphasizes the biophysical character of each system and how each system is influenced by, and interconnected to, the activities associated with the other systems. It also takes into account how different actors (e.g., users and regulators) and their different activities and vested interests (i.e., wealth creation, livelihood generation, economic growth, control) influence the governance of WEF systems [1]. In short, the Nexus approach aims to identify tradeoffs and synergies

between water, energy, and food systems in order to internalize any social and environmental impacts at different scales and to guide cross-sectoral policies [2].

The politics within the Nexus, however, are a relatively understudied topic [3–8]. Allouche [9] explains that one paramount political aspect of the Nexus is how it commonly analyzes and targets interactions between systems at global or national levels but ignores day-to-day realities, needs, and priorities at local/regional level. Middleton et al. [10] further argue that if the Nexus is to support sustainable development and poverty reduction, it should engage more directly with the politics of it, for example, by identifying winners and losers in natural resource allocation and decision-making processes. Moreover, many studies have indicated the need for the Nexus framework to address the issue of environmental impacts in terms of environmental justice matters. These include benefits and burdens in the form of pollution, natural resource distribution, dispossession of ecosystem goods and services and depriving welfare in local communities by damming and transforming hydrosocial territories, recognition of local norms and governance frameworks, and the inclusion of marginalized and affected societal groups in the decision-making process [3,11,12]. As one example, Williams et al. [13] refer to the WEF Nexus as part of a broader trend towards integrated environmental governance, whereby previously ‘externalized’ ecosystem services (provided for free, without compensation) are commodified and ‘internalized’ apolitically into capital accumulation processes. The WEF Nexus is thus not an undisputed approach for framing socio-environmental problems and their solutions. Cairns and Krzywoszynska [14] say that it is a ‘buzzword’ that underplays how the workings of power crucially influence the outcomes of the proposed integration. In this sense, we will use the WEF Nexus approach not only to trace flows of resources but also to analyze flows of power and their resulting effects.

Many authors have presented Payment for Ecosystem Services (PES) as a market instrument that balances externalities among water, energy, and food, and therefore, the argument is that it may ideally complement, optimize, and materialize the WEF Nexus in everyday practice [15–19]. For example, PES requires a negotiation among water, food, or energy producers for developing mutually beneficial interactions between sectors that explicitly recognize the competing or complementary use of resources [20]. In this sense, PES creates a link between ecosystem service users (‘buyers’) and providers (‘sellers’) through new institutions and the provision of a framework of economic incentives [21]. In fact, PES is assumed to establish an arena for coordination and collaboration among stakeholders, where an economic transaction, that reflects their interests, helps in mitigating negative externalities and compensating positive externalities for the production of water, energy, and food [18,22]. Proponents therefore claim that PES facilitates and fosters greener economies, user participation, community empowerment, capacity building, and sound local-level governance [23,24]. Next, PES is appreciated for its assumed capacity to catalyze environmental investments by the private sector [25]. At the same time, a growing number of critical scholars have expressed skepticism over the environmental, social, and cultural benefits of PES [26–31]. An important element of such criticism has been the attention to politics and power relations through which nature becomes governed and how the ensuing modes of market-environmental governance produce new socio-ecological, often unequal, arrangements [32–34]. Extending analysis on PES in relation to the WEF Nexus, as we do in this paper, adds another dimension for critical scholarship on how the Nexus performs and what politics are inherent therein.

Hydropower development, the chief source of energy in Colombia [35], is strongly supported by the national government in order to guarantee the ‘country’s energy security’. Moreover, Colombia is one of the PES front-runners in Latin America [29,36,37], where hydropower and energy generation companies are increasingly investing in PES schemes. In this paper, we evaluate a PES scheme from a multi-scalar and political-ecology perspective in order to reveal different power dynamics and their associated outcomes across the WEF Nexus perspective. To do so, we will focus on upstream-downstream ‘externalities’ (in new-institutional theory and PES conceptualization, ‘externalities’ are defined as external uncompensated interdependencies that one economic agent generates on another due to the production or consumption of specific resources by the first agent. We use the concept of externalities for practical explanatory

reasons, but consider that it does not capture the complexities of the social-environmental problems and the dramas generated on marginal communities. Furthermore, in this paper we use PES concepts such as 'ecosystem services', 'externalities', 'buyers' and 'users', etc., in order to engage with its theory and claims, not because we agree with their epistemological meaning, institutional importance, scientific coherence, empirical functionality, political use, and moral ethics) as a problematic issue for coordination between ecosystem service buyers and ecosystem service users situated downstream. A PES scheme that seeks to conserve upstream forests in order to reduce sediment accumulation in the hydropower reservoir of the Hidrosogamoso hydropower plant located in the Department of Santander, Northeast Colombia is used as an illustration. At the same time, we use the case to analyze the WEF Nexus as a disputed approach for framing socio-environmental problems and their solutions.

2. Analyzing the Nexus and PES through a Political Ecology Lens

Political ecology understands environmental problems and its solutions as socially constructed and dependent on current and historical political-economic dynamics, e.g., [38,39]. It acknowledges how different actors, based on their interests, prioritize different resource management approaches by deploying their power positions and discourses affecting resource distribution, cultural recognition, and resource political participation of users as well as the day to day management of water, energy, and food resources [12,40,41]. Natural resource management and conservation initiatives thereby shape and constitute (material and discursive) struggles between different social actors seeking to gain and legitimize control over resources [11,29,42–44]. Different types of power shape these struggles: political power is illustrated, for example, by the political support certain actors' agendas receive from the government (an actor that is supposed to be neutral) or the differential access that actors have to influence legal and political decision-making. Likewise, control over material resources (e.g., land, water, infrastructure, financial resources) and means of production co-determines the economic power of the different actors. Next to the existing political and economic power relationships, the discursive modes of power by which PES interventions are legitimized and promoted in Colombia are considerable, see, e.g., [37].

These factors influence the importance that policy makers give to the different actors and how hydropower, PES, and Nexus policies are deployed in concrete interventions, e.g., [30,45–47]. The actors involved are also socio-politically differentiated in terms of the types of (divergently valued) knowledge and information they master, use, or represent. The ways in which power becomes manifest in hydropower, PES, and Nexus development tends to deeply reflect governmentality schemes as well as specific techniques and strategies by which societies and territories are rendered governable and disciplined [48]. Energy generation and water resource conservation are portrayed as key for the wellbeing of the Colombian population. These are issues that are assumed to have overall acceptance and express inclusionary notions of everyone sharing in progress. However, they commonly disregard what is happening to the communities affected by hydropower development. Subtly, they build on neoliberal governmentality, which refers to techniques of power that see market principles, forces and instruments as the natural regulating mechanisms for all interactions in human and non-human life [48].

In everyday natural resource governance and hydropower development, for instance, public-private sector alliances aim to shape the normative mind-set and obedient economic, political, and technological behavior of resource users and conservers. In this way, the WEF Nexus governance takes its case-particular, concrete character, and becomes configured both materially and discursively [12,49–51]. Furthermore, political ecology studies on PES have shown how power asymmetries among ecosystem service buyers and sellers are determinant and result in forcing participation and unjust arrangements for the less powerful [30,31]. They also manifest how the politics of scale become important in incorporating environmental subjects and their assets in uneven exchange relations—in practice, these scalar politics seek to bring resource security in particular for environmental service buyers [30,31,37]. Cohen and Bakker [52] (p. 132) explain that politics of scale

occur in “a process of rescaling and reorganizing governance as a strategy of either internalizing or externalizing socio-environmental externalities, or both, and thereby displacing conflicts and crises, often through the construction of (purportedly ‘natural’) ecological scales, which simultaneously depoliticize and repoliticize governance.” Lebel et al. [53] thus argue for the need to examine how power plays are at work in order to consolidate specific (re)framings of scale—they define the way in which environmental problems are formulated and addressed through particular natural resource governance regimes. Swyngedouw [54] (p. 169) mentions that scaled places are “the embodiment of social relations of empowerment and disempowerment and the arena through and in which they operate.” As we also make clear in this Colombian PES case, scale is therefore a strategic political instrument. As it re-establishes the territorial boundaries and strategies of governance and intervention, it includes or excludes actors from decision-making processes with respect to water resources management and control [53,55,56]. Therefore, Marston [57], Delaney and Leitner [58] and Harris [51] sustain that scale is not a given, external fact, but a cultural and political way of framing conceptions of reality. This has discursive and material consequences for those included and excluded from the scale framing.

In our case study, our political ecology approach helps us to analyze how humans and society in the Sogamoso River become governed technocratically through resource control instruments such as watershed PES. PES discourses and interventions are part of the vehicles that, consciously or not, are used in accumulation strategies, resulting in uneven expansion and dispossession [59,60]. Political ecology helps to contextualize these power asymmetries and scale politics, because the (ecological) scales to tackle the Sogamoso hydropower plant’s environmental problems, presented as natural and apolitical, are socially constructed in a clever political process with strong material implications. Political ecology studies on the Nexus point out how current Nexus thinking inadequately conceptualizes the scalar politics of interconnections between resource sectors. Furthermore, studies suggest a naïve focus on technical and institutional ‘solutions’, where ‘integration’ is a panacea for unsustainable resource practices [13,61].

3. Materials and Methods

Data collection focused on how energy production generates ‘externalities’ that affect food and water systems considering the livelihood strategies and perspectives of the communities neighboring the Sogamoso hydropower plant, located on the Sogamoso River in Santander department, northwest Colombia. Our investigation was designed as an explorative case study research, focusing on the effects of energy production on water and food systems in a particular socio-natural space. The study takes a political ecology approach to better understand and analyze the implementation and effects of PES and the hydropower plant in relation to the WEF Nexus. Two phases of empirical data collections were conducted. The first phase took place in the period of November 2015 to January 2016 and provides the core data for our analysis. This phase focused on the socio-environmental impacts downstream of the dam. The second phase took place in the period January–March 2018 and adds complementary data of upstream socio-environmental impacts.

We conducted 34 semi-structured interviews with four focus groups. The first group was formed by people directly affected by the dam construction. This group includes downstream and upstream communities of the Hidrosogamoso project. The second group was formed by people participating in the PES scheme. The third group was formed by officials such as environmental authorities at national (e.g., Ministry of Environment) and regional level (i.e., Santander Environmental Authority (CAS) and the Eastern-Antioquia Environmental Authority (Cornare). The fourth group was formed by Non-governmental organizations: Censat Agua Viva, Fundación Natura and Compromiso, Corporación para el Desarrollo del Oriente. We focus on these groups in order to unravel the impacts of hydropower generation at local level and to understand how the hydropower company deploys conservation strategies that implicate food, water, and energy security.

Interview topics included the socio-environmental impacts caused by the dam construction, the compensations provided by the construction firm, ISAGEN, the role of the environmental NGOs and

official entities. We also used secondary information sources that included project reports, videos, and other online sources. Information was analyzed with software coding, and the categories reflected negative and positive externalities and their internalization or invisibilization in the political issues and compensation plans for the downstream communities.

4. The Hidrosogamoso Hydropower Plant in Santander, Colombia

In Colombia, hydropower generation represents almost 70% of the national energy production [35]. In 2015, there were seven large hydropower plants operating in Colombia, with a total effective capacity of 14,559 MW. The hydropower plant of Hidrosogamoso (820 MW) generates almost 10% of Colombia's electricity. Hidrosogamoso is owned by ISAGEN, a company that generates and markets electric power in Colombia. It has seven power plants with an installed capacity of 3032 MW of which 2732 MW is from six hydroelectric power plants, and 300 MW from a thermal power plant. In 2016, the Colombian government sold all its actions (57.6%) in ISAGEN (till then a government-owned company with private shareholders under the control of the Ministry of Mines and Energy), to Brookfield, a Canadian Company.

Hidrosogamoso is part of several large hydropower projects fostered by the Colombian government, supported by international financial institutes and the private sector. Arguments of public interest, clean development, mitigating climate change, energy security, and welfare—all boosting national economy—were deployed to legitimize it [62,63]. Several foreign enterprises participated in Hidrosogamoso's construction, such as Siemens from Germany that lent the machinery, Impregilo from Italy that operated the project, and the Banco Santander from Spain that lent capital for the project [62]. Powerful landlords connected to paramilitaries were also key actors to bargain with ISAGEN over the compensation for their flooded lands. Council members from local municipalities became important network alliance members during this negotiation, especially because they persuaded others to join in this process. Likewise, political campaigns were financed by ISAGEN and regional government and municipalities acted as promoters of the project, selling it as 'the dream of the region' [64].

The idea of using the waters of the Sogamoso river dates back to 1943, when Gerardo Streithorst Clausen proposed to use these flows for the industrial development of Bucaramanga in his engineering school thesis. It was only in the 1990s, when the country was suffering a deep energy crisis due to the effects of El Niño, that the government decided to approve the construction of the hydropower plant. In 2000, the environmental license was issued and in 2008 the project area was declared public utility. In 2008, the construction work started with roads and land removals. In April 2009, community members came forward to report that the update of the Environmental Impact Assessment in 2006, which the company presented as "negotiated with community members" (Community member, pers. comm., 14 December 2015), was neither a transparent process nor did it have consent from them: "*They only came to encourage the making of the dam,*" a villager said, "*To tell us what they were going to do, how they were going to bring benefits to the people, training and work, they never came to ask us if we wanted the dam here, or if we agreed with what they were going to do.*" (Community member, pers. comm., 14 December 2015).

Throughout the construction process, ISAGEN requested different substantial changes in the environmental license to smoothen and benefit the work of the company. These included changes in ecological stream flow, biomass clearance, and untreated water discharge, electric transfer lines, road constructions, etc. In September 2011, there was a large protest by community members because of great fish mortality in the nearby creeks. In 2012, Miguel Angel Pabon, an environmental activist who supported the creation of the social movement called Rios Vivos, (a social movement struggling against the construction of Hidrosogamoso that later consolidated as a national social movement of communities for the defense of many rivers) disappeared, adding to the killing or disappearance of another 10 environmental activists struggling against the construction of the dam since 2010. In June 2014, the filling up of the dam's reservoir dried the river downstream completely for several days. In response, another wave of demonstrations arose in the downstream communities. Like all other arguments with Hidrosogamoso, the police repressed the demonstration brutally and violently.

Despite all the drama for riparian communities and their associated social struggles, Hidrosogamoso was inaugurated in January 2015.

The Hidrosogamoso power scheme is located 30 km west of Bucaramanga (Santander Department's capital) and 285 km north of Bogotá. The power plant is 75 km upstream from where the Sogamoso river enters into the Magdalena River, and 62 km downstream from the confluence of the Suárez and Chicamocha Rivers [65]. The Hidrosogamoso dam is downstream of the Suárez river and El Ramo creek, among others (see Figure 1).

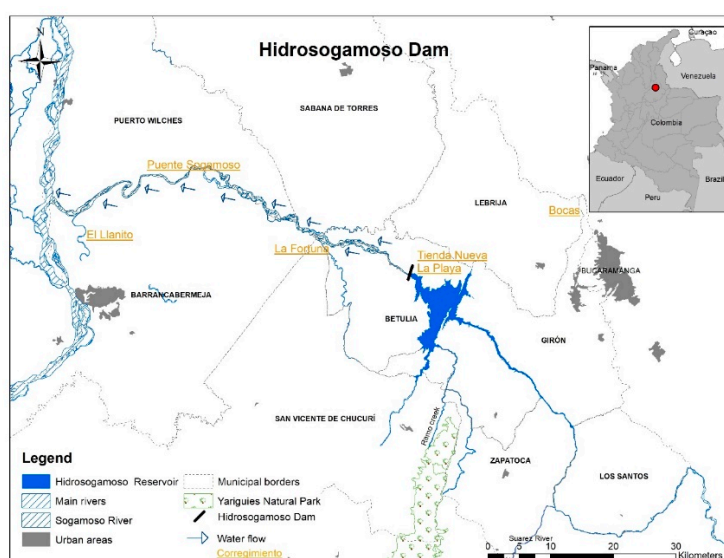


Figure 1. Location of the Hidrosogamoso power plant. Source: Reprinted with permission from PhD research Duarte-Abadía (in process).

Hidrosogamoso has an average capacity of 5056 GWh/year. Its project covers approximately 10,500 ha: 7000 ha are inundated by the reservoir, 300 ha are used for the construction works, 2300 ha for protection zones, and 900 ha determined as unstable areas [66]. The most affected municipalities according to INGETEC [66] are Girón, Betulia, Zapatocha, Los Santos, Lebrija, and San Vicente de Chucurí (see Figure 1).

The socioeconomic census carried out by INGETEC [66] reports that 283 families (1199 people) were displaced from their homes. The municipality of Betulia was the most affected with 166 families, then Girón with 72 families and Zapatocha with 30 families. The Environmental Impact Assessment estimated the following number of the affected population: 292,670 people actively working in the indirectly influenced area of the project, and 29,956 people (7010 families) living in the local area of the project. Downstream of the dam, there are 18,969 inhabitants (4810 families). Of these 2634 inhabitants (517 families) live on the affected shores of the river; another 1010 families have direct livelihood connections to the river through fishing and agriculture activities. The project's Environmental Impact Assessment estimates that around 16,335 inhabitants (4293 families) in the downstream areas may be affected by the dam development's impacts (e.g., agriculture, fisheries, water pollution, sand extractors, and other water-based livelihoods).

5. Hidrosogamoso: Divergent Water, Energy, and Food Securities

5.1. Hydropower Policies and PES Scheme Development

ISAGEN has joined a pilot PES scheme paying land users for the protection of upstream forests. ISAGEN seeks to secure provision of water-related ecosystem services (e.g., reduction of sedimentation, streamflow regulation) to Hidrosogamoso by participating in this PES scheme.

The PES scheme supported by BanCO2 (BanCO2 is an environmental trust fund that offers financial services (i.e., bank accounts) to ecosystem services sellers and buyers). It counts with an Internet platform for tracking down the environmental transactions between environmental service buyers and users, which started in 2015, pays 50 families (owning approximately 250 ha in total) located upstream of the dam (municipalities of San Vicente de Chucurí, Zapatoca and Betulia) for conserving natural forests upstream in the Ramo micro-watershed. Payment rates are USD\$ 65 per month for each hectare. For areas with three or more hectares, payments are set at USD\$ 195 per month [67]. Farmers are not allowed to use the land registered for PES while they are receiving payment, after that is up to the CAS to define if the land can be used again or not. Aside from the cash payment, capacity-building activities on sustainable forest use, ecotourism, and agroforestry are offered to the so called 'ecosystem service sellers' [67]: this group is comprised of rural families with livelihoods mainly based on cattle ranching and agricultural activities.

The intermediaries in this PES scheme are the regional environmental authority of Santander (CAS *Corporación Autónoma Regional de Santander*) and BanCO2. Buyers are ISAGEN and also CAS itself, thus, private and public actors. Payments are made to the farmers located upstream based on an agreement between the two parties. The financial resources that the ES buyers pay goes to a trust fund and is then transferred to the personal savings account of the farmers selling ES (each month, the latter receive an SMS message confirming that the payment has been completed). The coordinator of the program BanCO2 in Santander, who is also working at CAS, explained: *"The idea to implement PES arose after doing an inventory of the inhabitants who were living in ecosystems that are strategic for conservation. These families importantly suffer from unsatisfied basic needs; clearly this is due to the location where you are, good road ways are lacking, schools, and medical centers are far away. All this stimulates the bad use of natural resources. So BanCO2 seeks to satisfy the basic needs of those people while working on a process in which you explain to these inhabitants what they should do in order to make right use of the resources for strategic conservation"* (1 March 2018).

PES as a 'conservation measure' is financed by Hidrosogamoso's environmental damage compensation obligations. That is why BanCO2 has been labelled by Gómez and Echeverri [68] as a 'license to degrade the environment'. For example, they have to make an investment of at least 1% of the total investment of the hydropower plant for restoring, conserving, and monitoring the watershed where the water is taken from. Moreover, Hidrosogamoso is obliged to pay a 6% tax on the gross value of sales of energy. Vélez Gómez and Vélez Henao [69] have estimated that, in the case of the CAS and Corpoboyaca, (Corpoboyaca is the regional environmental authority that shares with CAS part of the Sogamoso River Basin) the transfers from hydropower generation to these two environmental authorities constitute half of these authorities' own financial resources. With regards to the environmental contributions of ISAGEN, during the opening ceremony of Hidrosogamoso (a venue where Santander's governor was also present), Colombian (ex-) president Juan Manuel Santos said that: *"The project is not only an engineering success, but also an environmental success [as he explains, because of its environmental investments and its contribution to climate change mitigation] where affected communities, were always taken into account and one can say that they are now much better-off than they were before"* [70]. Moreover, Angela Montoya (Head of the Colombian Association of Electric Energy Producers) explains that the energy generation sector is one of the greenest sectors in the Colombian economy, contributing to reduce climate change and to the conservation of forests, biodiversity, and watersheds [71].

In the media, the hydropower company constantly reiterates its huge contribution to sustainable water and ecosystem management and its involvement concerning mitigation and adaptation of climate change. It refers to how it generates clean energy, stabilizes the river's flow regime, and promotes the integrated management of sound water-energy-food systems through their various environmental programs [72,73].

5.2. What Happens around and Downstream of the Dam?

In 2015, while then president Santos was celebrating the opening of the Hidrosogamoso power plant, the communities from the localities of La Playa, El Puente, Marta, Tienda Nueva, and El Peaje in the municipality of Betulia were protesting outside. Their protest strongly contrasted with the eloquence and celebration with which Hidrosogamoso was presented by its supporters to the international and national public [62].

The people of the Sogamoso River basin first heard about plans for the Hidrosogamoso when project designs and final decisions were already made. Only at that moment, ISAGEN explained to them in meetings in the nine municipalities that they would be affected. The meetings were supposed to fulfill the company's legal obligation to actively consult with communities affected by the project. However, community consultations amounted to little more than a series of presentations about the benefits of the project.

The dam construction, the filling of its reservoir and its operation all dramatically affected the economic and social activities of the communities surrounding and living downstream of the dam. According to INGETEC [66], the project had several indisputable, negative impacts on 4150 ha that were used for agricultural and pastoral production, and forests. Dam construction, reservoir flooding and ecological destruction in the area of direct project influence meant that 1020 ha of agricultural land were destroyed (283 ha of perennial crops such as cassava, corn and banana and 737 ha of permanent crops such as cocoa, citrus, avocado, and fruit trees). Next, nearly 3000 ha of pastures and 160 ha of forests were affected. These impacts on productive land translate into a decrease of 10,177 tons of agricultural products and 637 tons of livestock products, meaning an economic impact of approximately USD \$2 million per year [66]. This decrease in agricultural production has a great local impact on income generation and food security.

Along with the agricultural and pastoral impacts, fishing was also greatly affected due to the decline of several fish species populations [62]. According to the fishermen, some of the reasons behind the fish decline include the dumping of waste materials from the dam construction process in the river and feeder streams, thereby contaminating the water, and the obstruction of fish passages by the dam, blocking them from reaching the upriver streams where they reproduce. Bargent [74] (p. 1) explains the resulting situation in one sector of the municipality of Betulia: *"Before the dam's construction, the overwhelming majority of La Playa's men worked as fishermen. Now most are unemployed or casually employed."*

Before the construction of the dam in 2008, the livelihoods of the riparian communities were closely linked to the Sogamoso River system. Fishing, an activity mostly carried out by men, constituted the main source of income for the families. Women contributed by selling the day's catch in roadside stalls or cooking it for tourists that came to the region for visiting the culturally and ecologically rich riparian landscapes of the area. Besides fishing and tourism, agriculture and artisanal mining of sand were other important local economic activities. More than just economic activities, the river represented an important fiber sustaining and catalyzing a broad range of social and cultural relations [62]: *"The fishes come from the swamps, they come from there because the water warms up, they take different flows upstream. Fishes have their ways in which they feed, fatten, grow and wait until the level of the river rises, to return again to the swamps to put their eggs. The river uses its forces to drag the earth and so fertilize the land. This way it forms the islands where we grow our food, it brings us the stones that we collect to sell them, the river in its own way left to each of us its gifts. We know the river, we eat and live from the river, we are the river"* (Elder inhabitant from Río Sucio locality, in Sabana de Torres municipality, 15 October 2017).

Today, inhabitants feel that the river has changed, their close hydro-ecological and cultural-emotional relation has broken up. This is also reflected in the reduction of tourism downstream of the dam. Most of the tourists that used to come to the area to eat some of the fish delicacies cooked by the fisherwomen now go to a set of newly opened restaurants located around the Topocoro Lake (the dam's lake). Downstream of the dam the degraded beauty of the landscape and the poor water quality have made tourists turn to other locations for making weekend or extended visits. *"The flows of*

people have evaporated, because fishing practices are over and the river is dead” (Fishermen association in Puerto Wilches municipality, 27 February 2018).

A very rough estimation by INGETEC [66] states that without counting fishermen and women, the Hidrosogamoso project ended up displacing 528 jobs that were dedicated to agricultural production: *“Some female community members were employed as waitresses or cooks, men were employed for construction work. At the beginning we were happy with these temporary employment opportunities as we still had our other, real livelihood incomes from agricultural work and the river”* (Community member, pers. comm., 10 December 2015). However, soon, these few activities could not compensate all the jobs and livelihoods that were lost when the dam started to operate. A similar thing happened with the capacity-building activities that the company started to give to the communities. Although initially welcomed by the communities, a bitter taste remained: *“We realized that the handy-craft sessions were not useful as with the destruction of the river, less and less tourists started to come to whom we could sell them”* (Community member, pers. comm., 6 January 2016); *“We have our wall covered by titles. The issue is that we do not have the conditions to apply what we’ve learnt, we do not have land, capital, food, our best land was flooded. We do not have a place where to throw the net to catch fish”* (group interview in ‘Rio Sucio, vereda La Mayor’, downstream of the river, 17 October 2017). During the latter interview, the community explained that Sabana de Torres, Barrancacabermeja and Puerto Wilches municipalities were excluded from the area of influence of the dam construction. This means that they do not receive money from the company to be invested in municipal development plans to enhance their life conditions (see Law of Transferences: Law 1450, 2011, in which all energy companies must transfer economic resources to the municipalities located in the area of influence of the power station, as well, as to environmental authorities with jurisdiction in the dam area and the contributing basin). *“We do not form part of their action radius, but if you go to ISAGEN they would tell you that we are benefiting, they catalogue us as users and beneficiaries of the river”* (17 October 2017). Considered to be users of the river, the company only compensates them by providing capacity building events as mentioned before. According to ISAGEN, from 2008 to 2014, 1430 families located downstream of the dam have received this kind of compensation [75].

5.3. What Happens Upstream of the Dam?

ISAGEN has invested in different conservation programs upstream of the dam with the aim to reduce the sedimentation process, but also to catch and ensure the entrance of fresh water. These programs have focused on Betulia, Zapatoca, San Vicente de Chucuri, municipalities that comprise the Ramo micro-watershed. This area is part of the ‘strategic ecosystem’ to conserve, and is located along the buffer area of the Yariguies National Park (see Figure 1). These conservation programs embrace the purchase of land to induce forest restoration and implement PES for this. To do so, the former ISAGEN transferred money to the National Parks Unit to buy farms located in these marginal mountain ranges which were affected by the armed conflict during the 1980s until the last decade. National Parks offered farmers to buy their farms since their livelihood activities do not correspond with the environmental norms of the 2005 National Park regulations in the Yariguies region. For many peasants, these rules and actions go against their land rights and life integrity: *“We agree to take care of nature, water, but we disagree with the way the National Parks imposes their rules, like displacing us, inserting terror and fear. For me they do not buy, for me it is a displacement because buying one hectare for 870 USD is like giving alms. In our case, we have 8 ha, they would give us 6960 USD. It doesn’t even give us the opportunity to buy one hectare and a half in the town”* (Farmer in Yariguies ridges, 22 January 2018) [76]. According to the chief of Yariguies National Park, around 4000 ha have been bought, corresponding to 73 farms (28 February 2018).

Next to this program for land appropriation there is a second program, of PES implementation. The Environmental Authority (CAS) approaches the community offering economic incentives to alter their livelihoods while they conserve. PES implementers consider that payments for conservation make farmers move from agricultural productive practices to alternative modes of earning income, not linked to actually working the land. PES payments began in 2015 and stopped in 2018. The ES sellers

are being monitored by CAS to evaluate the effectiveness of the commitments and the results in terms of water quantity and quality.

Farmers' opinions are divided. Some families align with the project, others are skeptical about PES implementation. They prefer not to get involved in these schemes; others even left the program. From the beginning they got upset because they could no longer work their plots as they wanted, not for farming nor for cattle-ranching: *"When they came (the CAS officials) they brought wires to fence some areas of my plot, I did not like it and I dropped out. I like to see my hens walking around freely. I know what and how I have to care without enclosure of my land. They came with measuring tape and as time goes by they may even leave you on the street"* (Farmer in the high mountains in Zapatoaca (4 March 2018)). Many farmers explained that when they receive payments for more than three years, they would no longer be allowed to work on their land again, see, for similar critiques [26–31,77]. Environmental law enforcement intensified with PES implementation and has increased control and restricted activities in these previously forgotten mountain ranges in the buffer area of the National Park. Those receiving PES can no longer use their plots in accordance with their own rules, knowledge, and agro-cultural histories.

ES sellers are reluctant to talk about PES, and they need to ask permission to CAS if they are going to give an interview about the topic to outsiders. In coordination with several environmental NGOs, CAS is in charge of vigilance and monitors if farmers obey the conservation rules. They also assume self-vigilance by the farmers, and what is more, they have even obliged the PES participants to police their neighbors: *"When the project finishes we hope that they value natural wealth and stop affecting the ecosystem. They signed a commitment letter in which they are required to inform us, when a neighbor is logging, hunting or making a bad use of natural resources. Then we will be in charge of investigating, and implementing the right sanctions."* (Coordinator of the Program BanCo2 in CAS, 1 March 2018).

However, while the hydropower company is showcasing itself as a committed conservation actor and while conservationist NGOs echo this cynical claim, many farmers and inhabitants interviewed did not know much about the PES program. Community members did know, expressively, about the microclimate changes that were generated by the new, artificial Topocoro Lake. They manifested that these are reducing the yields from their cocoa, coffee, citrus, and avocado crops. The lake has increased humidity, and this has generated fungus in the crops: *"We noticed that in summer time the heat is unbearable and at night the cold is intense. However, the company wants to distract our perception through the installation of climate monitoring stations, they want us to believe that the climate has not changed. But we see the damage to our crops after the dam has been filled"* (teacher in the rural area of San Vicente de Chucuri, 15 February 2018). Other inhabitants, especially those who live in the La Estrella sector of Betula municipality, complain how they were disconnected from the urban centers due to the construction of the new roads that ISAGEN organized as a part of their socio-environmental program for compensations. For them, the services they aspire to cover their basic needs are now far away from their homes, and further away than ever.

6. Discussion: Politics of the Nexus

6.1. The PES-Hydropower Miracle: Strengthening (upstream) Its Water Security While Greenwashing (Downstream) Its Environmental Destruction

PES is presented as an important tool for building greener economies. PES funding comes from the legal obligation that companies have to compensate for environmental degradation. In actual reality, this environmental degradation means the loss fish biodiversity, impoverishment of water quality in the swamp systems and therefore the harsh disruption of fishermen communities' sociocultural relation to the river. Meanwhile, PES locks up upstream food production (and its related livelihoods) in order to secure the provision of water for hydropower production. Similar to other studies, e.g., [30,78–81] the results show that government and private actors financing upstream conservation via PES do so not to enhance distributive, political, and cultural justice, but to guarantee their access to water sources, secure permanent water flows, and control water decision-making for capital accumulation. As a *deus ex machina* solving a seemingly hopeless situation, this PES provides them with a conservation-friendly

and poverty-alleviation aura that, simultaneously, enables to shift the focus from the hydropower plant's many negative externalities inflicted upon marginal communities further downstream (see Figure 2).

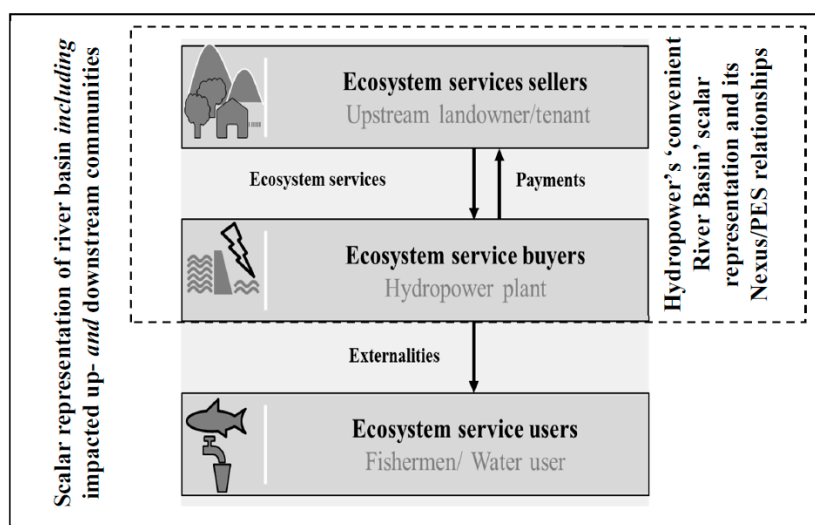


Figure 2. Hydropower-convenient and inconvenient scalar representations of ‘River Basin’ and their Nexus/ Payment for Ecosystem Services (PES) relationships. Source: based on Rodríguez-de-Francisco [82].

Our results confirm the claim made by Allouche [9] and Allouche et al., [3] that looking at the energy, water, and food linkages as a simple systems approach question, where biophysical optimization is the only variable, disregards day-to-day realities and local priorities and needs. The case further illustrates how ES buyers seek to achieve water security by paying other ecosystem service users, the potential ‘ES sellers’: those who can support the company’s water security necessary for the production and selling of energy—no matter if that comes at the cost of upstream and downstream food security. PES contracts end up locking upstream lands for the water security of the hydropower company and, meanwhile, the impacts downstream of the hydropower plant are rendered invisible by the company’s conservation credentials. By doing so, the large-scale hydropower energy generation in Sogamoso creates social and environmental externalities (e.g., food reduction) for riparian and neighboring communities. The hydropower public/private regime, rather than acknowledging these impacts, uses PES to present itself as a green player.

Despite these contradictions, the Colombian government heralds Hidrosogamoso as an illustrative example of environmental conservation and sustainability. Paradoxically, the market-environmentalist discourse allows for green washing by presenting ecosystem service markets and the possibility to offset environmental impacts as the solution to the problems that the market has created. Hidrosogamoso’s market-environmentalist project rationality is presented as establishing the exemplary code of conduct. Thereto, it invokes modes of neoliberal governmentality [48,83–88] as the sole possibility to sustain the welfare and (energy) security of the population [89]. This market framing silences people’s voices who experience environmental degradation as environmental injustice, and instead only refers to it as a mere economic conservation problem to be solved by market forces [77,86]. In practice, however, fishermen and peasant communities downstream are dispossessed from their ancestral livelihoods in order to foster the economic accumulation of the hydropower company; and upstream communities lose autonomy and control over their livelihood production, being severely restricted in their food security strategies. As a clear spatial-material and political-discursive strategy, upstream, the hydropower company invests in conservation to guarantee its water security, while green washing destruction and dispossession downstream and upstream. To understand the creation of negative externalities for communities around the hydropower plant, it is therefore important to consider politics of scale as well as the workings of overt and covert political and economic power.

6.2. Politics of Scale: The Power to Conveniently Define the Boundaries of ‘River Basin’ and ‘Impact’

Different stakeholders have different interest in and concerns about the scale at which to tackle Nexus interactions. Williams et al. [13] mention that Nexus research has focused disproportionately on national or state level. Similarly, Cairns and Krzywoszynska [14] explain that while the Nexus’ impacts are felt at a range of scales, the overall Nexus discourse is global in scope, both in terms of interlocutors and analytical focus. In our case, we observed that the narrative constructed by the hydropower company places emphasis on global, national, and PES-watershed. The global and national scales are deployed to discursively create sustainable development through clean energy generation. The company also uses their contribution to PES and the rationale of this instrument to highlight the link between environmental service sellers and buyers in a basin approach. Through this argumentation, the company reconstructs the river basin scale to an artificial one: one that starts from the headwater and finishes at the scheme’s water works operated by the “environmental service buyers.” This very particular techno-political decision on “the company’s PES and Nexus-convenient” scale (see Figure 2), is presented as “natural” or as an “eco-scalar fix,” following from “nature’s intrinsic properties,” and allowing the hydropower company to define the environmental issue to be solved, see also, [90]. Namely, they define climate change and upstream deforestation as the most important environmental issues to be tackled while reducing, at the same time, the visibility of the impacts of hydropower generation on the environment and the people dependent upon water resources further downstream—including the damages to the latter’s food and water securities.

Brown and Purcell [91], Warner et al. [92], Hensengerth [93] and Hoogesteger et al. [94] draw attention to the fact that in a politicized environment, the river basin scale loses its connotation as a pre-given scalar unit that can be delineated by using territorial or ecological boundaries. In contrast, river basins and watersheds are contested hydrosocial territories [55,90] whose boundaries, contents, meanings, interlinkages, and definitions are fluid and dependent on the issue in question, and especially, on the power of the definer(s).

The government justifies Hidrosogamoso by shifting attention to the national scale with respect to energy security, and the global scale with respect to climate change mitigation. Without looking carefully at the multiple and diverse complexities and socioecological dramas at local scales, problems are dismissed under their alleged legality. The use of a very detailed scale (such as a PES) that reduces the river basin scale to the space between environmental service sellers and buyers, as well as a very broad scale (such as global for climate change), causes oversight of the local conflicts that energy generation creates and which are not addressed by PES. In this respect, when analyzing a certain Nexus situation, is important to acknowledge that WEF connections are complex and pervasive, and therefore call for trans-scalar approaches to comprehend their politics.

6.3. Power Asymmetries

The Nexus approach argues for the need to work towards a more coordinated and negotiated management and use of natural resources across all sectors and scales [1]. However, there are no blueprints explaining its optimization, or the specific balance of trade-offs and synergies. As such, this optimization is to be reached through political negotiation and coordination among interested groups representing water, energy, and food sectors, based on their stakes and the information readily available. As Boelens and Seemann [95], Zeitoun et al. [96] and Jepson et al. [97] elaborate, food, energy, and water security is inherently relational and political. Therefore, when there are intrinsic power asymmetries among the people negotiating, how fair can the results of such negotiations be?

The Hidrosogamoso case shows that power asymmetries can be so strong that powerful actors, like the hydropower company, only informs the communities about the construction of the plant, instead of negotiating with them [62,64]. Ardila Valderrama [98] also explains how the hydropower company has taken advantage of the blurry land property situation in the area in order to expel farmers from the territory. Next, she relates how the leaders of the social movement have been stigmatized and the social protest has been criminalized under the strong influence of those who wanted to push

the hydropower project forward. Hommes et al. [4], Middleton et al. [10], Warner et al. [99], among others, accurately show how major decisions around water, energy, and food (even more in projects where these sectors are strongly interlinked) are highly political, and take place within arenas of unequal power relations that often lack democratic checks and balances to enhance transparency and public participation.

The case also highlights how the Nexus is interpreted in such a way that it does not question the structural inequalities in the local and national economy, but rather reinforces them [100]. Such utilitarianist, unequal distribution can be seen in how the negative impacts of energy generation and conservation are pushed on to less powerful populations—the ‘minorities’ who live nearby while benefitting the far away ‘majorities’: in particular, the elite and industrial sectors [36,46,101,102].

Finally, the case of Hidrosogamoso illustrates how power plays are not restricted to monetary, legal and discursive techniques for achieving national energy security. Energy securitization also involves outright military and physical violence, as a way to keep resistance low. In fact, after the killing of several leaders of the social movement for the defense of the Sogamoso River, many of the members of this social movement have backed-off from defending their own rights [103,104].

6.4. *There Are No Neutral Actors*

Nexus is about balancing externalities among water, energy, and food systems. However, who is to create such balance? The Colombian government puts energy generation projects’ development high on its political agenda (2010–2018): “The mining energy locomotive [supposed to pull Colombia’s economy forward] is at full speed and we hope it continues that way” ((ex-)President Juan Manuel Santos, August 2011). Consequently, the expansion of large scale hydropower and biofuel projects was a priority for the government. Despite the social opposition, Santos had outspokenly supported the power plant: “Hidrosogamoso will give Colombia certainty with respect to energy provision” ((ex-)President Juan Manuel Santos, January 2015). In this case, the political power of the company is strong. To this respect, Hildyard et al. [105] highlight how the word “energy security” here is often a synonym for justifying energy enclosures such as water, food, and land dispossession and cultural alienation [see also 5]. Likewise, economic growth discourse is constantly deployed to justify the many violations against local communities [106] and environmental destruction [107].

Moreover, Duarte-Abadía et al. [62] have also shown how regional government and municipalities, instead of controlling the company, got out of their way. Instead of serving to defend their constituencies’ interests they rather became facilitators and enforcers of the intervention—through legally biased decisions or violent practices.

7. Concluding Remarks

In this paper, we evaluated a PES scheme from a multi-scalar and political-ecology perspective in order to reveal and understand associated power asymmetries and outcomes across the Water-Energy-Food (WEF) Nexus perspective. We have shown how WEF and PES logics tend to draw a highly simplistic picture of the problems and solutions in the river basin, ignoring how power asymmetries mediate and how powerful actors utilize PES and the apolitical logic of the Nexus to support their goals. As a consequence, these policy concepts and strategies counteract the interests of those population groups with less economic and political clout, who are affected by the hydropower scheme, rather than supporting them. Our research thereby defies the discourse and policy strategies that see PES as an ideal instrument to materialize a political Nexus approach in practice. The Hidrosogamoso case illustrates how PES is made instrumental for the hydropower company in guaranteeing its own privileged access to water and highlighting its conservation efforts while, through scale politics, rendering its socio-environmental impacts invisible further downstream. Moreover, our results dispute the idea that governments are neutral actors seeking integration and a balance of externalities created by a project that is very close to their interest. In all contexts where unequal power structures, disputed resource access, rights and governance forms converge, resource

security (be this water, energy or food) is always an intrinsically political, plural and contested notion of diverging resource securities. Power asymmetries among actors play a fundamental role in the definition of which actors' resource securities are prioritized over others within the Nexus context, challenging integration.

As illustrated by the Hidrosogamoso case—mirroring everyday hydro-policy and intervention practice in most places around the world—it appears that the energy and water securities of the hydropower company and its political-economic allies are more important than the food and water securities (and the livelihoods) of the surrounding and downstream communities. Echoing Williams et al. [13], there is a sore necessity of developing a politicized progressive concept of WEF integration and PES, so that redistribution of resources, recognition of actors and political participation of less-powerful actors is put forward. Therefore, politicizing the Nexus can help to trace not just the flows of resources but, at once, the flows of economic, political, and cultural power.

Author Contributions: J.C.R.-d.-F. and R.B. conceived the presented idea. All authors developed the conceptual approach. J.C.R.-d.-F. and B.D.-A. performed fieldwork and analyzed the information. R.B. oversaw the conceptual coherence and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

Funding: The German Federal Ministry for Economic Cooperation and Development (BMZ) supported this research and the Administrative Department of Science, Technology and Innovation in Colombia 'COLCIENCIAS'.

Acknowledgments: We thank C.P. for supporting us with the elaboration of the final map and all the people that provided us with valuable information for this research. We would like to thank the reviewers for their valuable and constructive comments and effort to improve the article.

Conflicts of Interest: The authors declare no conflict of interest.

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