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**Social innovation and polycentric governance:  
The case of Juan Castro Blanco National Water Park**

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**Abstract**

We focus on the role of social innovation in the governance of water-related challenges. We argue that in social-ecological challenges freshwater governance is improved by better understanding the dynamics of social innovation, specifically by analyzing the emergence of polycentric governance through processes of innovation in social relations. In particular, we pay attention to the multilevel, intersectoral dynamics of the regional networks created by APANAJUCA, a local association that supports the conservation of the Juan Castro Blanco National Water Park in Costa Rica. We analyzed the case drawing on insights from social-ecological systems, polycentric governance and water governance, and social innovation to assist in understanding the social arrangements that lie behind sustainable, innovative processes intended to enhance freshwater security. The combination of the multi-theoretical framework with the empirical evidence from Costa Rica revealed that social innovation was developed through social-ecological movements promoting new social relations and governance structures. In coping with freshwater challenges, the three dimensions of social innovation – namely satisfaction of needs, socio-political arrangements and empowerment – contributed to the emergence of polycentric structures, which shaped and renewed the freshwater governance system.

**Keywords:** bridging organizations, nature resource management, multilevel governance, social-ecological systems, decision-making, Costa Rica.

## 1. Introduction

Freshwater security is among the most important concerns of our time, as water is vital not only for societal development and human existence, but also for ecosystem sustainability and resilience (ADB, 2013; ECLAC, 2014; IDB, 2014; OECD, 2013). Water security is a normative concept, the way it is defined and actions taken towards its enhancement depend on the social-ecological and institutional context. These definitions can sometimes be too broad or too narrowly framed (Cook and Bakker, 2012; Pahl-Wostl et al., 2013). In this paper, we consider freshwater security to be a multi-dimensional concept concerned with quantity and quality of the resource, and protection of people and ecosystems from freshwater related hazards such as floods and droughts. Freshwater security is an essential component of sustainable development, defined as social, economic and cultural uses while enhancing ecosystem's health and functions (UNESCO, 2013). This paper contributes to the discussion on freshwater sustainability challenges by enhancing understanding of socially innovative initiatives addressing water security challenges and the effects on freshwater governance.

Over the past two decades, social innovation has become a key topic of several research centers around the world (Hochgerner, 2011; Moulaert et al., 2013a), and is frequently highlighted in government policy (Pisano et al., 2015). Social innovation can be understood as a territorialized dynamic (MacCallum, 2009), embedded in the social and spatial processes of the place (locality, region or nation) where it emerges. Social innovation, understood as innovation in social relations (Moulaert et al., 2013b), may occur when any sector of society addresses place-based social and ecological concerns and the interplay between them.

We address the water security challenges discussion from an analysis of initiatives outside of the conventional water management thinking, i.e. initiatives related only to the provision of water services, by highlighting the nexus between freshwater and other sectors (Benson et al., 2015; Olsson, 2013; Ringler et al., 2013) such as energy, tourism, food and land. We analyzed the Juan Castro Blanco National Water Park (PNAJCB) in Costa Rica and the role of APANAJUCA, a local, non-profit association that drives conservation initiatives in the park. We considered the park and APANAJUCA to be examples of self-organized (Ostrom, 2009), socially-innovative initiatives emerging beyond-the-state (Swyngedouw, 2005) to ensure freshwater security. We also considered the role of the social relations that underpin sustainable, social innovations (Mehmood and Parra, 2013). The PNAJCB was declared as a national water park in 1992 and provides water to approximately

150 communities and 10 hydropower projects. It also plays an important role in the conservation of vulnerable endemic biodiversity (SINAC, 2012).

In tracing the history of the PNAJCB and APANAJUCA, we paid special attention to multilevel and inter-sectoral dynamics (Gupta et al., 2013b), and to the regional networks (Sol et al., 2013) involved in the freshwater system. We analyzed the case drawing on insights from the literature on complex social-ecological systems (Liu et al., 2007; McGinnis and Ostrom, 2014), water governance (Gupta and Pahl-Wostl, 2013; Lobina, 2012; Pahl-Wostl et al., 2012), polycentric governance (Cole and McGinnis, 2015; Galaz et al., 2012; Ostrom, 2010) and social innovation (Mehmood and Parra, 2013; Moulaert et al., 2013a). We use this multi-theoretical framework to understand the social arrangements that lie behind the sustainable, innovative processes intended to enhance freshwater security. We argue that in social-ecological challenges social innovation and more specifically, its three dimensions, needs satisfaction, socio-political dynamics and empowerment (Moulaert et al., 2013b), stimulate polycentric governance.

We first discuss the literature on social-ecological systems, water governance, polycentric governance and social innovation. Second, we present our research methods followed by the empirical case. Third, we explore the three dimensions of social innovation and discuss the role of social innovation in the emergence of polycentric governance. We conclude with some reflections and recommendations for policy and research.

## **2. Social innovation and polycentric structures in freshwater governance**

### **2.1. Freshwater system as a system of intertwined social-ecological relations.**

Water systems are social-ecological systems in which the relations between society and nature are intertwined and their processes and dynamics are coupled (Liu et al., 2007). Therefore, recognizing the linkages between resources (Ringler et al., 2013) and the role of governance (Pahl-Wostl et al., 2013) is key in improving social and ecologic development. All water systems (i.e. superficial and ground, fresh and oceans, sewage and waste) are interconnected and affected by social dynamics. The social dynamics affect the availability, quality and stability of the freshwater system while the social system makes use of the freshwater system as a multisector

resource. Freshwater is used as potable water, for irrigation and for hydroelectric production, while land, forest, biodiversity and other ecological resources available in the freshwater system provide different services and benefits for society and the ecosystem. Understanding the nexus among water, food, energy and land sectors (Ringler et al., 2013), and the interdependency between societal wellbeing and environmental quality (Anderies et al., 2013) is critical for effective decision-making to identify the pathways for sustainable pathways.

Freshwater and its intertwined social-ecological relations have been the object of resource management, resource planning and policies at local, regional, national and global levels. Nevertheless, actions towards freshwater security and sustainable development are perceived as narrow and fragmented. Scholars argue that on the one hand, there is a lack of integration (Biggs et al., 2013; Cook and Bakker, 2012) across development dimensions, socio-political levels, and productive sectors. On the other hand, the complex dynamics of the freshwater system are usually underestimated in policy-making (Gupta et al., 2013a; Ostrom and Cox, 2010). In that sense, decision-making addressing water challenges must consider that social-ecological relations have different degrees of uncertainty (Blomquist, 2009; Pahl-Wostl et al., 2013); move throughout nonlinear paths (Lobina, 2012); manifest different multilevel and multi-loop learning processes (i.e. feedback loops) among and within the systems (Anderies et al., 2013; Gupta and Pahl-Wostl, 2013); and, over time, develop adaptive capacity (Anderies et al., 2013; Pahl-Wostl et al., 2012). Pahl-Wostl et al. (2013, p. 677) considered that water challenges emerge from a “restrictive focus on technical solutions, narrow problem framing that neglects complexity, gaps in policy implementation and lack of vertical and horizontal integration” resulting in inadequate socio-political arrangements.

## 2.2. Freshwater security as governance challenge

Water security challenges are challenges of water governance (Biggs et al., 2013; Gupta et al., 2013b; Lobina, 2012). Freshwater governance, as the governance of social-ecological relations, is a social construction aimed at satisfying needs that can be steered through sustainable pathways and towards enhancing water security (Pahl-Wostl et al., 2013). We define sustainable development as a dynamic, holistic process (Lozano, 2008) in which the social (including economic aspects) and ecological dimensions are intertwined, and in which the temporal and intergenerational dimension of sustainability are key in addressing development challenges. Sustainability may improve a region’s situation through learning and

innovation, especially if it is not seen as an end in itself but as a continuous process of adaptation (Innes and Rongerude, 2013) within the social-ecological relations, and if it is also seen as a framework that can be used to translate the understanding of those intertwined relations into policy and action (Anderies et al., 2013).

Freshwater governance is understood as the process by which different actors, public, profit, non-profit and civil society, articulate around the satisfaction of water-related needs and challenges, and shape structures and processes for collective action. Governance set management rules (Pahl-Wostl et al., 2012), which in return address issues of policy operationalization, implementation, and monitoring. Freshwater governance is multilevel, as it needs to embrace the interaction of the different sectors entangled with water resource (Olsson, 2013; Ringler et al., 2013), be aware of the direct and indirect drivers of water problems (Gupta and Pahl-Wostl, 2013) and address the intertwined social-ecological relations at different levels and scales (Blomquist, 2009; Brondizio et al., 2009).

### 2.3. Emergence of polycentric structures in freshwater governance

Diverse organizational ways emerge to address the exchanges between levels and sectors in the freshwater governance. Polycentricism, as a self-organized (Ostrom, 2009) and adaptive (Blomquist, 2009) arrangement of governance which, despite significant institutional and actor diversity in its form (Galaz et al., 2012), is believed to be capable of coping with the complexity of the intertwined social-ecological relations of the freshwater system (Pahl-Wostl et al., 2012).

In polycentric governance, multiple formal and informal institutions, each focusing in particular realms, interact simultaneously through multilevel and intersectoral dynamics making hierarchies and boundaries blurry (Cole and McGinnis, 2014). Due to the multilevel characteristics, decision-making in polycentric arrangements is distributed along different socio-political levels, from local community level to national central government level, and global level. None of these socio-political levels holds absolute authority over decision-making, rather they exhibit a nested hierarchy (Pahl-Wostl et al., 2012) in which decisions need to be favored by the majority of actors involved in the process. Besides the multilevel decision-making characteristic, administrative and physical boundaries are blurry because of the complex dynamics of the freshwater system, overlapping and involving panoply of resources, sectors, and needs.

In polycentric arrangements, it is common to see the emergence of bridging actors (Galaz et al., 2012) that enable formal or informal spaces of collaboration by

connecting networks of actors and/or fostering projects among (new) partnerships. According to Gupta & Pahl-Wostl (2013, p. 3), polycentric arrangements allow “for local heterogeneity, preferences and jurisdictional competition; and creates a credible policy culture with innovation and experimentation”.

#### 2.4. Social innovation as innovation in social-ecological relations

In a world with intertwined social-ecological relations in which ecological stresses become inevitably social, social innovation is not only about addressing social issues, but also social-ecological challenges. In this paper, we use social innovation as part of a framework to analyze the social-ecological dynamics of the freshwater system in the enhancement of freshwater security to show, from a social perspective, how structural change in governance is triggered and how it is implemented on the ground. By addressing social innovation as innovation in social relations, it is possible to highlight diversity in social-ecological needs, in sectors of emergence, in actors and in actions; and it is also possible to reflect on the human capacities (Jessop et al., 2013) for social and spatial transformation.

Social innovation is never neutral (Nicholls and Murdock, 2012), it responds to particular social-ecological needs, to socio-political arrangements and to social notions and constructions of the social-ecological challenges. Policies and norms, both developed in governance processes, influence the adoption of technologies, strategies and actions by means of rules and incentives (McGinnis and Ostrom, 2014). An inquiry on social innovation, as a territorialized dynamic (Moulaert, 2009), is important for policy-making because it may focus on the interdependence of motives of agency, actor’s resources, actor’s relations and institutional context (Lobina, 2012), preventing from applying panacea solutions (Ostrom and Cox, 2010) and idealized design principles to water challenges (Pahl-Wostl et al., 2012). Social innovation could stimulate openness in governance to look in and transit through different and more sustainable paths, integrating different sectors of society and dimensions of development (i.e. political, economic, social, technical, environmental).

#### 2.5. Dimensions of social innovation

In the social-spatial dynamics of social innovation, it is possible to identify three dimensions that are intrinsically related: satisfaction of needs, changes in socio-political arrangements, and enhancement of social capabilities and resource access (Moulaert et al., 2005). The first dimension refers to the satisfaction of social-

ecological needs, the processes involving the way in which social groups collectively define those needs, the initiatives aiming at satisfying those needs (Parra, 2013), and the way new needs are created or recreated collectively by the same processes of satisfaction.

The second dimension relates to processes of governance which can be enacted by social innovation in the form of heterogeneous networks, and a variety of social relations that ensure the involvement of diversity of actors through a structure more horizontal, participatory (Lobina, 2012) and inclusive than the hegemonic governance system. The processes of governance nurture the definition, satisfaction and creation and recreation of needs through political arrangements, innovation and knowledge creation. By these dynamics, governance facilitates innovative actions, which stimulate identity building, reflexivity and empowerment (Mehmood and Parra, 2013).

The third dimension is empowerment, where societal groups or sectors increase their capabilities and access to resources. Empowerment is enhanced when changes in agendas and visions, and actions of actors and institutions lead to: better inclusion of social groups into various sectors at varied scales (Moulaert et al., 2013a); involvement of them in decision-making, implementation and monitoring of strategies (i.e. processes of multilevel governance); and insertion and diffusion of alternative knowledge. By these processes, the socio-political integration of groups and individuals, and the importance of access to the necessary resources that will facilitate the satisfaction of needs are strengthened (Parra, 2013).

### **3. Methodology**

Using the multi-theoretical framework presented in the previous section, we analyzed self-organized, bottom-up, volunteer initiatives that emerged to defend the natural resources of the Huetar-North region in Costa Rica, and resulted in a social process that now proactively safeguards the Juan Castro Blanco National Water Park (PNAJCB), its freshwater and its natural resources. We observed the regional networks developed around APANAJUCA to help us understand the dynamic ways in which the relations between the social and ecological are negotiated, maintained and fostered. It was not the intention to make a reproduction of the observed dynamics, but an analysis of the social relations, to grasp the implications of social innovation in the emergence of polycentric governance.

The research was conducted as a qualitative case-study research, undertaken between 2013 and 2015. As a case study, a variety of research methods was used. Data was obtained from: (1) seven in-depth semi-structured interviews with key representatives of the APANAJUCA, the Costa Rican Ministry of Environment and Energy (MINAE), the Municipality of San Carlos (MSC), and the Inter-American Development Bank; (2) attendance by special invitation at a range of meetings including at the Arenal-Huetar North Conservation Area (ACAHN) with the Vice Minister of Environment, at the Rural Electrification Cooperative of San Carlos (COOPELESCA), and a meeting with the board of APANAJUCA; (3) participant observation in the park area and surroundings; and (4) document analysis of archival, legal and on-line resources. Informed consent was obtained for all interviews. The primary author is a Costa Rican citizen and worked as a planner in the Huetar-North region. Her social contacts enabled her to have access to many sources that may not have been available to other researchers.

#### **4. The Juan Castro Blanco National Water Park**

Today, over 25% of Costa Rican territory is under one of the nine nature-management categories. The PNAJCB is a nature-protected area (NPA) inscribed in the Arenal-Huetar North Conservation Area (ACAHN) under the jurisdiction of the National System of Protected Areas of the Ministry of Environment and Energy (MINAE).

The history of the Juan Castro Blanco National Water Park (PNAJCB) is one of social-ecological mobilization and social engagement. The creation of the PNAJCB goes back to 1968 when, by citizen request, the Municipality of San Carlos (MSC) declared 2,500 ha as the National Forest Cerro Platanar, with the intention of protecting the landscapes and water springs. In 1975, to further protect the river basins (CENAP, 1990), the MSC appealed to the national government to enhance the status of protection and expand the area protected and the Forestry Reserve Juan Castro Blanco was created with a total area of 13,700 ha. By this act it was recognized not only its natural value, but also the role of the societal push, as the reserve was named after one of the most important actors within the original social-ecological movement, Mr. Juan Castro Blanco. Various studies were conducted to determine the value of the water resource and biodiversity, and to raise awareness of the still potential threat of deforestation (Bonilla, 1981). Further public pressure led to



the forestry reserve becoming changed to a protective zone in 1989, with 558 ha being added.

Two months after this, the Costa Rican central government, via the MINAE, granted a concession to Eurospect S.A. to mine sulfur in the PNAJCB. The reaction of the community was swift. The Catholic Church, schools and high schools, farmers, entrepreneurs, scientists, public organizations, cooperatives, non-profit associations and other local actors, united and presented a legal demand against the central government, asking for the annulment of the concession (CENAP, 1990). While the legal dispute took place, the mining company established base-camp settlements inside the park limits and started the sulfur extraction. The strong collective action against the mining company took place during the period of national elections, and with a new government in 1990, the contract with Eurospect was canceled. But the community kept on fighting and in 1992, the Costa Rican government promulgated the Law No. 7297 in which the lands received the protective category of national park, by which the state is required to expropriate the lands. Therefore in 1993, a new decree defined the spatial limits of the new national park and expanded the area to a total of 14,458 ha, almost six times the original size in 1968. Finally, in 2003, and again by societal pressure, the park was granted a new protective category, national water park, in recognition of its ecological value and the significance of its water resources for the country.

The park ranges in altitude from 490m to 2330m above sea level (see Figure 1). It has slopes of between 10 and 70 degrees across 95% of its area. The landcover primarily comprises primary forest (70%), with the remainder being either active farmland or former mine sites that are being regenerated.

Costa Rica, similar to other developing countries, has insufficient economic resources. Although there is commitment for nature conservancy and sustainable development, the environment sector does not always receive the support it requires (Alpizar, 2006; Programa Estado de la Nación, 2013). In Costa Rica, it is possible to declare a NPA even if the land is not state-owned. For this reason, the large majority of NPAs lay in shared hands. The PNAJCB is a poignant case, with some 92% of the area being privately owned. The law that created the park establishes that the government of Costa Rica will eventually expropriate all private land for the park when it has the financial resources to do so. Until such time, the current owners may continue to live in existing dwellings and to utilize (and sell) the land for current production activities, but are constrained in development opportunities. Owners cannot reduce forest coverage and have an obligation to preserve biodiversity (Asamblea Legislativa, 1998).

The PNAJCB has an important social-ecological role at different levels and scales. At local and regional scales, it supplies water for 150 communities (potable water and irrigation), is a source of agriculture, tourism, leisure and biodiversity. At the national scale, it is the second largest water catchment (in terms of harvest capacity) in Costa Rica, producing an average of 996 million cubic meters of water per year, of which only 1% is for human consumption (SINAC, 2012). The hydroelectric production from the PNAJCB generates over 160 MW, about 17% of the national energy production. The milk production of the farms in the periphery and within the lands of the park represents about 12% of the national milk production. At international and global levels, the park is part of the Mesoamerican Biological Corridor and the San Juan-La Selva Biological Corridor between Costa Rica and Nicaragua, and is also one of the eight green cores from the UNESCO Water and Peace Biosphere Reserve.

In Costa Rica, the first social-ecological movement of national impact took place in 1970, against the Costa Rican government and the company ALCOA S.A. for a concession for the extraction of bauxite (O`neal Coto, 2010) in Pérez Zeledón Municipality. The promoters of that movement were university and high school students and professors from the capital, San José. Yet, the social-ecological movement behind the creation of the park was the first community-based mobilization in Costa Rica. The underlying issue was a local problem, challenged by the local population, but led to a national impact. The leaders of the social-ecological movement were local people, including active members of the Catholic Church, politicians, teachers and principals, retailers, tourism entrepreneurs, representatives of other communal associations, and individuals working at the electric companies, banks, municipalities and other public institutions. These individuals first came together as the Commission Pro-Defense Juan Castro Blanco Protected Zone under the auspices of the MSC. In 1990, the Commission decided to separate from the municipality and establish a non-profit association, the Ecologic Association of the North Zone (EZONO). According to a local report (CENAP, 1990), the outcomes achieved were not only the cancelling of the sulfur concession and the creation of the national park, but also the integration of a whole region under a common purpose. EZONO continues to exist today but acts primarily as an environmental activist group at a regional level.

The Association for the Protection of the Juan Castro Blanco National Water Park (APANAJUCA) was created in 1998 as a result of a bottom-up process. It is a non-profit, private organization devoted only to protecting the PNAJCB. Its founders, among them some members of EZONO, decided that the park needed a dedicated

organization that not only safeguards but also represents the interests of the park and proactively acts towards the sustainable development of the region. In 2003 APANAJUCA pushed the Costa Rican government to recognize the importance of the water resources of the park, gaining the protective category of national water park, the only in the country.

APANAJUCA was constituted to protect the PNAJCB: to be vigilant of, not only the use of its resources by the population, but also of government actions and public policies that may harm the park. According to their objectives, their aim is to support the consolidation, management, protection, surveillance and development of the PNAJCB, ensuring freshwater as 'source of life for future generations' (APANAJUCA, 2009). The association is a financially weak organization depending on donations for its projects in which its members, associates, and board, do a voluntary job. APANAJUCA assumed a proactive role in freshwater security enhancement, which was recognized in 2013 by a prestigious award, the 'National Award for Improvement to the Quality of Life', which is awarded annually by the National Commission of University Rectors together the Ombudsman Office.

## **5. Social innovation for freshwater security: the emergence of polycentric arrangements, integration, and opportunity**

### 5.1. Dimensions of social innovation

Looking closely at the social innovative dynamics revolving around the PNAJCB and APANAJUCA, it is possible to see how the three dimensions of social innovation are interlinked (Parra, 2013). In the defense of the PNAJCB, the most important driver of the social-ecological mobilization was the satisfaction of the need for freshwater: its availability and quality for future generations. The fulfillment of this need required the satisfaction of other needs: the consolidation of the PNAJCB both legally and environmentally (i.e. property normalization, reforestation and maintenance); the development of public policies for sustainability; the surveillance over land use within and in the periphery of the park, and over public institutional actions or inactions; and the active protection of the ecosystems through public servants and volunteers training, school kids workshops, corporate social-environmental programs, and dissemination of the goals, and activities through mass media. The satisfaction of all those needs had required of socially innovative actions and processes, which were

held through innovative governance processes (Swyngedouw, 2005) and also, in change, created new forms of freshwater governance.

Costa Rica had developed a fragmented institutional infrastructure with overlapping legal and normative roles (Alpizar Rodríguez, 2014; Madrigal et al., 2011). Each institution deals with specific components and processes of the freshwater system, focusing only in particular water challenges and working sometimes in isolation. Based on Alpizar Rodríguez (2014) categorization, the formal water sector management structure in Costa Rica can be divided in three components: uses of water, protection of water resource, and research. Within the category uses of water, the classification extends to potable supply, sanitation, hydroelectricity, industry, irrigation, and fishery. In total, 16 public institutions are involved in the water management (2014, p. 144), of which 12 are directly or indirectly related to the PNAJCB management, being the ACAHN the direct responsible of the PNAJCB. Nevertheless, actions need to be taken and permissions to be granted and approved by those institutions, which had distributed the tasks in several departments, making the freshwater management complicated.

APANAJUCA as a bottom-up volunteer organization had developed outside the traditional initiatives related to the provision of water services, which Gupta et al. (2013a) called 'water box'. Together APANAJUCA and the ACAHN are coordinating decision-making processes and setting the agenda for the PNAJCB development. At the same time, APANAJUCA had created opportunity spaces for the community, and other public and private organizations from outside or within the 'water box' to participate in the enhancement of freshwater security. All these kinds of new socio-political arrangements, formal and informal, had changed the landscape for both the freshwater and the PNAJCB governance, bringing them together. With the socially innovative initiatives of APANAJUCA, not only the various development dimensions (i.e. political, cultural, economic, social and environment (Lobina, 2012) but also the nexus sectors (i.e. water, food, land, energy (Ringler et al., 2013) become integrated in new forms of governance. This integration under social-ecological sustainable premises had promoted empowerment (Mehmood and Parra, 2013): increasing social and political capabilities of the varied actors, and bringing the park and its resources closer to them.

## 5.2. Emergence of polycentric governance

Social innovation as innovation in social relations (Moulaert et al., 2013b), first developed by the PNAJCB social-ecological mobilization and later by the creation

and operation of APANAJUCA, had promoted a multilevel and multisector governance. In a top-down management structure, typical of Costa Rica and many other developing countries, the decision-making around and power over resources is controlled by the state and public local authorities. This structure was challenged by the socially innovative actions of APANAJUCA. In 2009, the association was declared a “public utility in the interests of the State” (Ministerio de Justicia y Gracia and Presidencia de la República, 2009) giving it the right to manage public funds and public property for the benefit of the State. With this empowerment, APANAJUCA changed the governance structure of the PNAJCB from being top-down towards a more bottom-linked structure (Baker and Mehmood, 2013) in which decision-making is shared between multiple actors. Moreover, the intervention, rather than participation, of the local communities, private sector, and universities via APANAJUCA, promoted social innovation in governance processes in which power over resources and decision-making had been diluted and redistributed. These processes shaped a governance system characterized by different centers of decision-making and action over the freshwater and the park’s resources in general.

APANAJUCA’s objectives of landownership normalization and biodiversity conservation had brought to the park’s decision-making network three important actors and three new centers of decision-making: COOPELESCA, the School of Biology of the University of Costa Rica (EB-UCR), and MINAE. COOPELESCA became the major landholder in the PNAJCB, thanks to a trust fund, a financial mechanism designed by APANAJUCA and by which COOPELESCA was able to buy 8.5% of the parklands. The lands bought via the trust fund have a restricted land use, dedicated to conservation purposes only. This acquisition act opens possibilities for different public and private organizations to participate in the park conservancy. As an example, the EB-UCR signed a contract between APANAJUCA, the ACAHN, and COOPELESCA to develop scientific research in the park for the enhancement of water security and biodiversity conservation. This contract positioned the EB-UCR as a new center of decision-making in terms of research and conservation agenda. The third center is the MINAE, playing a different role: their interest is placed in the reproduction of the experience of co-management between APANAJUCA and the ACAHN. The MINAE recognized the impact of APANAJUCA as social innovation for conservancy and freshwater security, positioning itself in the new governance structure, not as a command-control center, but as a contingency center. The MINAE is interested in fostering the governance dynamic by the creation of new policies and incentives that may encourage the emergence of social innovations within the intertwined social-ecological relations.

The governance structure of the PNAJCB and the freshwater system is as complex as the system it is governing (Pahl-Wostl et al., 2012). In this multilevel governance system, the community, local authorities, local public and private organizations and national environmental and academic offices are coexisting and cooperating. Varied sectors come together to participate: politicians, Catholic Church, community, entrepreneurs, academics, industrials, environmentalists, and also other resource use sectors with a clear interest in the PNAJCB. The formal top-down management structure proved to be unarticulated and fragmented, yet, the emergent polycentric governance structure seemed to integrate all levels and sectors by sharing the responsibility of decision-making, and dissemination and production of knowledge (Gupta and Pahl-Wostl, 2013). Following Cole and McGinnis (2015), we consider that the PNAJCB governance system is polycentric to the extent that collective organizations developed socio-political arrangements over shared concerns and benefits, crossing political, sectoral and physical boundaries. For Gupta and Pahl-Wostl (2013), such kind of governance arrangements are of value because they might lead to sustainable development pathways.

### 5.3. Bridging organizations: outcomes of social innovation

A characteristic of polycentric governance settings is that often the coordinated action is undertaken by bridging organizations (Brondizio et al., 2009; Galaz et al., 2012). Such organizations play an important role in setting agendas and negotiation, and are supported by credibility and trust from other actors in the governance structure. According to Ostrom (2010), trusting in commitment and responsibility of others can be more effectively undertaken within linked networks in which proximity is key. Proximity understood as a space where relations can be produced and renewed, in which not only the scale of the network is important – small to medium scale (Ostrom, 2010) – but also the share of interests and engagement (Cole and McGinnis, 2015). APANAJUCA as a bridging organization within the polycentric structure of the PNAJCB and the freshwater social-ecological system fostered innovation in social relations while obtaining outcomes such as partnerships, agreements, strategies and actions carried out by a mixture of the community and public and private organizations.

In polycentric arrangements bridging organizations create opportunities to integrate different sectors and levels in a concerted decision-making process, although they might also bring challenges to the process. We mention three of them. First, there is a risk of the withdrawal of public authorities, while leaving responsibility

to the community and non-public sectors (Moulaert et al., 2013b) to satisfy their own needs and establish the mechanisms of control and implementation of strategies. Second, there is a risk that there are (or will be) negative interactions between the participating organizations (Galaz et al., 2012) and that shared but sometimes conflicting interests will shift the configuration of the network from collaboration to competition (Cole and McGinnis, 2015). Third, there is a risk that the system will lose flexibility in decision-making and action over time. According to Galaz et al. (2012), as the governance system is recognized and institutionalized, it becomes a more formal system, the actors are required to increase their level of responsibility and reinforce the ties among them, making difficult to keep the network together. Nevertheless, Cole and McGinnis (2015) insisted that polycentric orders are intrinsically dynamic: renewing while new forms of governance emerge. In the case of the PNAJCB and APANAJUCA, social innovation not only appeared to promote the emergence of polycentric governance, but also collaborated in the dynamic process of governance renewal.

## **6. Conclusion**

In this paper we argued that understanding the challenges of water security needed a multi-theoretical approach that observed innovation in social relations and how this contributed or not to addressing freshwater challenges. In building up our framework, first we followed Nicholls and Murdock (2012), and instead of conceptualizing social innovation as a sub-set of technological innovation, we addressed social innovation in its capacity to nurture all kinds of innovation processes. Second guided by Ostrom (2010; 2012), we avoided the prescription of panacea solutions and highlighted the diversity in institutions and social-ecological relations. Third in agreement with Pahl-Wostl et al. (2012), we recognized the complexity of water security challenges and gave governance a key role in building sustainable pathways. And fourth inspired by Moulaert et al. (2013b), and by the contribution of our empirical analysis, we showed how social innovation is an area of research, action, and social-ecological change.

The combination of the literature review on complex social-ecological systems, water governance and social innovation together with the empirical evidence from Costa Rica helped understanding social innovation as innovation in social relations, encouraged first by ideas aimed at sustainable development and later by reactions towards externalities endangering the social-ecological system.

Through local mobilization for the defense of the Nature Protected Area, new social relations were created behind disruptive processes of an imposed resource extractive model. The research provided insights into how outcomes and processes of social innovation were developed through three interconnected dimensions: needs satisfaction, socio-political arrangements, and empowerment. The examples we provided highlighted the important role social innovation can play in water security enhancement. At last, we offered a closer look into how social innovation collaborated in the emergence of new forms of social-ecological systems governance. Specifically, we explained how the socially innovative actions and processes of APANAJUCA, as a bridging organization, stimulated the creation of varied centers of decision-making, and knowledge production and dissemination within the PNAJCB governance network. Promoted by social-ecological movements and maintaining their volunteer essence, APANAJUCA fostered a polycentric freshwater governance structure where all actors, public and private developed alliances and partnerships for the enhancement of freshwater security. Social innovation, we concluded, was key in the shaping and renewing the freshwater governance system of the PNAJCB.

The complexity of social-ecological relations, in particular the intertwined relations of the freshwater system and challenges such as sustainability and governance, demand solutions and processes tailored for each context. The advantage of a social innovation approach to freshwater security challenges is that it allows an understanding of the emergence of actions and processes embedded in social-ecological relations, addressing problems and needs particular to that social-ecological system. The identification and understanding of social innovation for freshwater security enhancement, and for social-ecological challenges in general, may encourage the development of assessment methods that focus on the particular benefits and costs at different levels; and the creation of incentives and policies that are aware of the intertwined social-ecological relations and the nexus of water-energy-land-food that foster the emergence of social innovation.

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