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Desalination and the Reproduction of Water Injustices in the San Andrés Island Water Crisis

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ABSTRACT: Caribbean islands are particularly vulnerable to extreme events like droughts, co-occurring with groundwater pollution, water inequalities, and weak governance. Consequently, many island communities that rely on tourism are experiencing ongoing and deepening water crises. Technical solutions like desalination are regularly employed throughout the Caribbean, yet water crises persist despite these mitigation strategies. This research focuses on San Andrés, a Colombian Caribbean Island. Following the 2016 water crisis, residents saw the crisis as social: pre-existing social inequalities led to differential water access, quantity, and distribution during the crisis. In contrast, organisational leaders attributed the water crisis to a natural hazard (drought or, more broadly, climate change), even if they recognised disproportional distribution. Interviews revealed strong support from all participants for the use of desalination to address the crisis, despite the inequities that characterise the implementation of this strategy. We argue that San Andrés is moving towards technological water dependence, disconnected from traditional local forms of collecting water and rendering islanders less able to control the resource. We posit that there is a connection between injustice, desalination, and water crises. When a water crisis occurs, it often reveals pre-existing injustices in the social system. Instead of resolving the injustices, desalination, which is often seen as the main solution to the crisis, perpetuates and reinforces them. The result is a cycle of crises that persist over time.

KEYWORDS: Water justice, desalination, water crisis, San Andrés Island, Caribbean islands, Colombia

INTRODUCTION

We posit that there is a connection between injustice, desalination, and water crises. When a water crisis occurs, it often reveals pre-existing injustices in the social system. Instead of resolving the injustices, desalination, which is often seen as the main solution to the crisis, perpetuates and reinforces them. The result is a cycle of crises that persist over time.

Water crises are intricately connected with technology and framed (e.g. by engineers and water company executives) around dominant technocratic narratives (Head, 2014; Boin et al., 2018). These crisis framers purport that crises can be avoided or overcome solely by implementing engineering measures (Vojinović and Abbott, 2012). We see this in many Caribbean islands (e.g. Cuba, Haiti, Jamaica, Trinidad, and Tobago) that suffer from water crises. The crises are predominantly portrayed as being a result of 'natural' droughts, inefficient water supply systems, overexploitation of aquifers, pollution of water sources, and growth in tourism (Gössling, 2001; Heartsill, 2012; Gilbert, 2017; Peter, 2020), and solutions trend toward the technological, emphasising that an increased water supply is the preferred path forward.

In the Caribbean, there is a growing tendency to push desalination, which is the process of removing salt and other minerals from seawater to make it potable, as a way of adapting to changing water conditions and minimising the impacts of water-related disasters. The Economic Commission for Latin America and the Caribbean (ECLAC) report states that due to freshwater scarcity, desalinisation technology will become increasingly indispensable in building the Caribbean's future water resilience (Fontes de Meira and Bello, 2020). In fact, there are currently more than 1373 desalination plants in the region (Jones et al., 2019) on more than 16 islands, including the Cayman Islands, the Dutch Caribbean islands, Barbados, Jamaica, Antigua and Barbuda, Belize, the Bahamas, Dominica, and the Virgin Islands (Cashman, 2014; Fontes de Meira and Bello, 2020).

Desalination provides some benefits, but it does not address the inequality that underlies these crises. Instead, in line with critical political ecology (Shiva, 1991; Feitelson and Rosenthal, 2012; March, 2015; Fragkou, 2018; Scheba and Scheba, 2018; Williams and Swyngedouw, 2018), we argue that desalination, if not implemented equitably and sustainably, can actually entrench injustices and increase risk. Stated more explicitly, an increased reliance on desalination has led to an increased dependence on fossil fuels, since most desalination plants still do not utilise alternative energy sources (Jones et al., 2019). Additionally, the technology fosters dependence on foreign experts and undermines local autonomy over water resources. Moreover, desalination plants cause significant environmental effects that are often ignored; this includes changes in land usage, greenhouse gas emissions (GHGs), brine runoff, extensive use of chemicals, loss of marine biodiversity through marine pollution, and open ocean water withdrawals (Cashman, 2014; Dhakal et al., 2022). Finally, the specific placement of desalination facilities can lead to the unjust allocation of benefits and drawbacks.

Drawing on DeMarrais et al.'s (1996) concept of the materialisation of power, we can understand desalination as the physical form of narratives that exercise power and domination. It represents a techno-political strategy for enduring injustices, conflicts, and tensions related to water governance (Williams and Swyngedouw, 2018; Scheba and Scheba, 2018; Velásquez, 2020a). In this sense, desalination can be a vehicle for exercising the power to produce, allocate, and control water resources or a medium for changing people's mindsets in order to concentrate global and national water-power interests.

Global water companies play a significant role in managing water resources in the Caribbean, and their approach to allocating water resources raises issues of water injustice. Distributional imbalances of this ecological resource can create or exacerbate unsafe conditions, thereby putting people at risk from water-related hazards like droughts. Water crises usually produce uneven and differentiating impacts because of pre-existing vulnerabilities and social inequities. In the last decade, social inequities in access to water have gained more attention; however, the study of water crises from a water justice perspective is limited (Boelens et al., 2018).

San Andrés, a Colombian Caribbean Island, suffers from repetitive water crises. Drawing on field observations, interviews, and reviews of official reports from 2016-2021, this paper addresses the complex and often hidden connections among justice, technological advancement, and water crisis, drawing on the voices of different stakeholders to understand the deepening processes of water appropriation by powerful actors and the parallel dispossession of weaker or marginalised social groups.

Rather than taking a positivist approach, this study combines a constructivist approach with a political ecology perspective to understand how different stakeholders perceive the crisis and the concept of water justice. That is, we are interested in how the meaning of the crisis and its solutions are collectively determined (Tierney, 2007). In doing so, this research challenges conventional assumptions about the crisis: those that are organisational-centric and top-down, or that view the crisis as linear, naturally induced, and as a defined event. This study took place between 2016 and 2021 and involved field observation, interviews, and reviews of official reports. Seventy-nine semi-structured interviews were conducted with government, public sector, private sector, and resident stakeholders. Interviews were

roughly evenly divided by gender (38 women and 41 men) and ethnic minority status (44 Raizales and 35 non-Raizales). The interviews included people from different neighbourhoods where protests regarding the water crisis took place. We employ a qualitative analysis of the interviews; this case-oriented approach views the water crisis experience through the lens of the islanders alongside the body of knowledge on water crisis, water justice, and desalination.

We focus specifically on identifying factors that influence perceptions of desalination and how this technology facilitates the reproduction and escalation of persistent water injustices, thereby maintaining the crisis. This paper asserts that the meaning-making associated with the crisis was a decisive element that led to desalination becoming the primary solution proposed by a range of stakeholders. Moreover, this was influenced by organisational leaders and water experts, who play an essential role in shaping and limiting courses of action. In this way, we found strong support for desalination expansion among participants, which is explained by the use of desalination to provide water to the tourist sector (which provides substantial employment), the sense of threat to the island's water resources, and the belief (rooted in the technocratic paradigm) in desalination as a low-risk technology and conflict-free solution. However, findings show how desalination technology creates and maintains water injustices through differentiated water markets, prioritising areas that can pay more for water and gradually fostering both the loss of water resources autonomy and the increase in technological dependence.

THE ROLE OF CRISIS

A better understanding of crises can help prevent or mitigate the impact of diverse threats – endogenous or exogenous – to a community. A crisis involves a threat related to the nature of the hazard and its effects on diverse core values; uncertainty about how to respond; an urgency to act under time constraints (usually because waiting will allow the situation to get worse); and a shared perception that the crisis exists (Quarantelli, 1993; Boin and 't Hart, 2007; Stern, 2009; Boin et al., 2018; Pursiainen, 2018). Crises do not inevitably result in disastrous situations, but they do challenge one's ability to cope with and adjust to change. Critically, a crisis opens the door to possible devastation while also creating a 'window of opportunity' to avoid it (Boin and 't Hart, 2003; Tierney, 2006; Quarantelli et al., 2007). Crises have been studied from various natural, social, policy, and management science disciplines. The terms 'disaster' and 'crisis' are often used interchangeably, but some researchers whose work straddles these areas take a more nuanced approach. For example, some investigate how policy leaders exploit crises to bring changes that would otherwise prove impossible in more stable times (Boin et al., 2016) while others examine how crises may be deliberately created to benefit some economic interests, such as the creation or preservation of companies or the implementation of new services and business. This scholarship conceives crises as mainly political (Boin et al., 2008; Stern, 2009; Boin et al., 2018; Bellamy et al., 2017).

Social scientists adopt a range of approaches to the study of crisis. The structural/functionalist perspective may focus, for example, on organisational coordination during acute "on the ground" response operations (Nohrstedt et al., 2018) while the collective behaviour perspective may emphasise the emergence of new forms of social behaviour during these periods (Rodríguez et al., 2007; Boin et al., 2009; Wachtendorf, 2017; Tierney, 2019). A decision-science perspective may be interested in how emergency managers make critical decisions under stress, while a risk perspective may try to understand the relationship between human error, technology, organisational culture, and the development of crises (Boin et al., 2009). A broader approach pivots away from the episodic consideration of crisis, centering instead on how a society produces, faces, and manages a crisis (be it through its political processes, economic activities, social practices, assignment of cultural meaning, or social differentiation) (Oliver-Smith, 2009; Ullberg, 2017). This view considers crises to be continuous, ongoing processes embedded in the social fabric, sometimes becoming invisible in daily life as a persistent condition the society has learned to live with (Vigh, 2008).

Kendra et al. (2019) draw on a risk society approach to crisis (Giddens, 1990; Beck, 1992) when they indicate that it is not sufficient to view places and communities as particularly prone to natural hazards. Rather, one must also appreciate the role modernity plays in creating threats, with technical systems prone to failure and thereby creating increasingly disproportionate risk. Despite the significant progress made in understanding crisis dynamics, gaps remain in the crisis literature. One such gap is the limited attention given to pre-existing conditions that lead to crisis vulnerability. Another is the need to understand how crisis uncovers layers of inequalities and the mechanisms used to reproduce inequality during the post-crisis stage (Tierney, 2006; Vigh, 2008; Roux-Dufort, 2016; Wolbers and Boersma, 2019).

WATER CRISIS

The World Economic Forum (WEF) in its *Global Risk Report* (2023) indicates a steady path of growing concerns around the water resource crisis, where water access is shaped among local communities, between old and new users, and for the sake of the economy (Menga and Swyngedouw, 2018). Water access directly influences people's health, livelihoods, and well-being, but is also a source of power, subject to conflicts and struggles for water justice (Roth et al., 2005; Boelens et al., 2016; Seemann, 2016).

We identify three broad discourses around water crises and in which we place our examination of the interconnection and complexity of water justice and desalination technology. Our paper draws upon all three, ultimately centring our approach within a justice discourse but more fully integrating the insights the other discourses can offer.

Water availability/scarcity discourse: Crisis as a result of nature

The first discourse focuses on water availability and scarcity (Huff and Mehta, 2019). This perspective emphasises the urgent need to stop over-exploitation, asserting that humanity is reaching its limits and thereby creating a global crisis. For instance, in the *Global Risk Report*, water crises are defined as "a significant decline in the available quality and quantity of freshwater, resulting in harmful effects on human health and economic activity" (WEF, 2023). Here, leading water crises are framed as induced by external 'natural' hazards, such as drought and climate change (Wilhite and Pulwarty, 2017). Society plays, at most, a secondary or dependent role in the formation of the crisis. This view is informed by the sentiment that a natural hazard cannot be predicted, controlled, or anticipated (Boin et al., 2008). As a result, crisis managers and water experts do not feel the need to change institutional structures, because the crisis, in this perspective, is not caused by human error or decisions.

There is a sharp criticism of this emphasis, which argues instead that water scarcity is unevenly distributed *within* communities and is not necessarily a result of water unavailability (Mehta, 2005; Wutich, 2022). Citing communities that suffer from water crises in water-abundant environments, this contrasting literature highlights the need for further research on water crisis configuration and security (Rosinger, 2018; Wutich et al., 2022). Boin and 't Hart (2000) claim that organisational leaders, through their understandings or misunderstandings of a crisis's cause, determine whether the water policy sector descends deeper into the crisis or manages to resolve the acute problems that create the crisis.

This availability/scarcity discourse also promotes the perception of a water crisis as an 'event' – after which people can return to normal – rather than a 'process'. According to Williams et al. (2017), officials will consequently neglect the cause of the crisis and will direct their response exclusively to resolving a particular episode. Temporary solutions may be employed to address water crises framed as short-term droughts and seasonal rainfall patterns, leading to constant or cyclical water challenges when root social causes are not addressed (Williams, 2016).

Technology-oriented discourse: Addressing crisis through technology

Second, the technology-oriented discourse views water as a natural resource that requires better management and sees science and technology as necessary to cope with both growth and human needs (Dryzeck, 2013; Huff and Mehta, 2019). This view recognises people's role in reducing safe water resources and perpetuating water crises. Although such problems are considered serious, this discourse contends that society can mitigate or adapt by employing technology and market-driven management solutions (Dryzeck, 2013; Huff and Mehta, 2019). Tundisi (2008), for example, points to the challenges of limited availability alongside increased demand, as well as inefficient technical management. Institutions and organisations shape policy action, and in turn create unsafe conditions. Yet it is science and technology, this view holds, that can provide the principal solutions for managing the world's water resources (Sultana, 2018; Huff and Mehta, 2019). Potable water consumption has drawn on many technological and technical advances, such as purification filters, desalination plants, the construction of aqueduct systems, mega-infrastructures for water production, well water pumping, and water meters (Camargo and Camacho, 2019). Technocratic frameworks empower water managers and experts, whose recommendations are seen as objective, impartial, and non-political, but they often exclude affected people, whose views are considered biased rather than valuable to the process (Velásquez, 2020a). Technology is often portrayed as sacred and immune to criticism (Shiva, 1991).

Desalination is identified as a crucial response to water crises (Williams and Swyngedouw, 2018), as it is considered a drought-proof water source not reliant on river flows, reservoir levels, or climate change (Dhakal et al., 2022). Yet, the critique of technology-oriented discourse is both harsh and extensive and has direct implications for those considering desalination. Among the most pointed criticisms of the technology-oriented discourse is the observation that technological responses often harm the environment and local cultures (Escobar, 2005), reinforce or undermine unequal social relations, and shift traditional water access practices (Tubi and Williams, 2020). Sometimes, they are even maladaptive, ignoring the local context and dismissing other water management options (Tubi and Williams, 2020). From a human rights perspective, new technologies can embed unequal power relations in the technology itself; frustrate and undermine traditional efforts; and transfer increasingly more authority to private actors (Land and Aronson, 2020).

In other words, crises are often opportunities for change (Boin and 't Hart, 2003; Tierney, 2006; Quarantelli et al., 2007), but water crises can foster an environment suitable for the emergence, permanency, and expansion of desalination technology (Boin et al., 2016; Velásquez, 2020b) rather than addressing the more complex socio-political dynamics of redistribution and offering comprehensive solutions (March, 2015; Aggestam and Sundell, 2016; Scheba and Scheba, 2018; Tubi and Williams, 2020).

The technologically oriented view has additional implications. With respect to desalination, the process shifts society's relationship with the biophysical world through its consumption of the ocean. It instills a problematic perspective that, given the vastness of the ocean, there are no water exploitation limits and water scarcity can be eradicated (Williams and Swyngedouw, 2018). This utilitarian view of nature treats the environment as a simple collection of resources and a recycler of pollutants (Dryzeck, 2013). Natural limits are thus seen as flexible, given the assumption that improved technologies can enhance place-based capacity. In other words, technology usurps nature as the overarching support for sustaining life.

Political ecology scholars (Shiva, 1991; March, 2015; Feitelson, 2018; Scheba and Scheba, 2018; Williams and Swyngedouw, 2018) caution that we must reveal the dangers of technology, which can lead to dependence on foreign specialised companies, impoverishing already poor societies and exacerbating social conflicts over water rights. Water then becomes a commodity to be sold to consumers for profit, while residents became consumers buying a commodity rather than citizens with a right to water. Scholars from South America (Castro and Quiroz, 2011; Gutierrez, 2011; Herrera et al., 2022) have denounced capital accumulation by multinational water corporations, highlighting its structural

implications for society's access, use, and management of water resources. These authors have underscored the urgent need for action and long-term, just, and community-based solutions to water problems.

Justice-oriented discourse: Perpetuating water (in)justice through desalination

Third, the justice-oriented discourse places a critical lens on water justice and desalination, recognising the socio-political roots of water scarcity and its inextricable connections with water injustices, both in its configuration and in its effects (Boelens et al.2018). A crisis can replicate the previously existing socio-political structures, giving primacy to certain economic activities. This view diverges sharply from the previous two discourses, although work to more fully integrate crisis perspectives within justice-oriented discourses is still needed.

Crises often expose society's latent inequalities, exacerbating existing injustices and highlighting the failures of institutions and systems purported to protect and serve communities (Tierney, 2007). By uncovering injustices, water crises can lead to both greater awareness and impetus to enact just solutions. For example, in 2000, Bolivia experienced a 'water war' when the government privatised water services in the city of Cochabamba. As a result, water prices increased and the use of all water sources, including rain and groundwater, required costly permits. Hundreds protested against the privatisation until the Bolivian government amended the constitution to include water as a human right (Berge, 2011).

According to Zwarteveen and Boelens, (2014: 14), "water (in)justices involve both quantities and qualities of water, the modes of accessing and distributing water, and the meanings, discourses, truths, and knowledge that shape water control". The concept helps explain why access to water resources is so often socially and geographically uneven (Wutich et al., 2012). Water justice draws attention to the social issues linked to water, highlighting their global connection and reinforcing claims regarding the right to water in the face of dispossession, exclusion, and inequity (Sultana, 2018). It focuses on those rendered less powerful, both through limited access to their resources and through the dismissal of their ideas about water production and allocation (Neal et al., 2016). It is these underempowered groups who are frequently viewed as "paths of least resistance" (Bullard and Wright, 2012; Mohai, 2018). The concerns of the least powerful are rarely prioritised, so communities may suffer the same environmental problems for decades – in this case, a persistent and cyclical water crisis. Zwarteveen and Boelens (2011) argue that there has been a 'normalisation' and 'naturalisation' of water injustices, which have become an essential means of legitimising and justifying inequalities of water exploitation.

Water justice is multi-dimensional, including distributive, procedural, and recognition justice (Wutich et al., 2013). Distributive justice concentrates on how group members share water and the outcomes of such methods, and it is based on community norms such as needs, desires, and required outcomes (Wutich et al., 2013). Procedural justice focuses on the fairness of the political, legal, market, and other processes that determine the allocation of harms and benefits (Bornstein and Poser, 2007). Recognition justice is concerned with how people are acknowledged and valued within society and how systemic inequities are addressed (Scholosberg, 2007). This approach emphasises the range of values and practices that impede the full recognition of a group as an accepted member of the moral and political community. Extending recognition justice to nature (such as water) acknowledges water inherent value and recognizes it as an essential component of our shared community (Scholosberg, 2007). According to Wutich et al. (2013), the recognition concept is widely known as 'interactional justice' in psychology literature, yet there are some significant differences. Interactional justice deals with fairness in social and interpersonal interactions, conduct, or treatment (Wutich et al., 2013). This distinction is significant, as even systems with equitable procedures for allocating harms and benefits can be rendered unjust by discriminatory practices in interpersonal interactions (Wutich et al., 2013).

Over the last decade, movements for water justice have grown, including cases from Ecuador, Chile, Colombia, Perú, Cuba, Bolivia, Argentina, and the Dominican Republic, among other countries.

Movements like the World Alternative Water Forum (FAMA) and the Friends of the Earth Latin America and the Caribbean (Amigos de la Tierra America Latina y el Caribe, or ATALC) have had a strong influence in Latin America, for example. Such movements point to the overexploitation of water resources to the benefit of some and the loss of others (Sultana, 2018), and assert that neoliberal models at work in Latin America both control and exploit nature, subjugate local, often historically marginalised communities, and lead to injustices (Castro and Quiroz, 2011; Zwarteveen and Boelens, 2011). Alternative South American visions of water justice demand that water be appreciated for its cultural and spiritual value and seek recognition not only of the right to water, but also of the rights of water as a non-human being. Based on this recognition of cultural diversity and the value of water itself, plural governance of water has been proposed in order to strengthen the process of resistance to water injustices (Ulloa et. al, 2020).

Water infrastructure such as desalination has been key in enabling water injustices (Land and Aronson, 2020). In this sense, the relationship between desalination and water justice is significant. While desalination technology can create a new water order, it often results in structural inequality and injustice in water access (Fragkou, 2018; Velásquez, 2020a). Desalination can be used to produce, allocate, and control water resources, thereby exercising power over them. Technology is neither good nor bad; social values and interests determine its application. However, the use to which desalination is put depends on the ideologies and socioeconomic models a society has implemented.

Water justice demands that the benefits of managing water resources and the demands of adapting to scarcity should be localised and maximised according to stakeholder-defined values and customs. Fair desalinated water allocation and use across different sectors and timescales should also be ensured. This includes transparent, participatory, and inclusive rules and processes for water offtake and allocation. Moreover, water justice implies safeguarding everyone's right to protection from natural, anthropogenic, and technological water-related hazards. This discourse holds that public policy should incorporate the equity principles of risk sharing, protection for the most vulnerable, and recognition of the value of local techniques and knowledge to address water challenges (Bullard, 2000; McDonald et al., 2010; Vanderwarker, 2012).

A few scholars, such as Sultana (2018) and Boelens et al. (2018), have advanced understandings of water in integrating crisis and justice frameworks. However, the two frameworks remain largely separate when it comes to this topic. The current crisis literature tends to overlook the importance of justice, and the same holds for justice frameworks, particularly concerning the mechanisms of water injustice reproduction before, during, and after a crisis. Furthermore, there is limited research on the intersection of climate change and technology. It is crucial to understand how various mechanisms, including desalination technology, impact access to water, participation, and equity in decision-making processes.

The cycle of crisis

Broadly, these three discourses help us better understand the root causes of water crisis configuration and what can develop into a cyclical pattern. For instance, crises develop from a scarcity of biophysical resources, a natural hazard, a technocratic approach that prioritises technological expansion, or a combination of any or all of these factors. Crises become cyclical when the underlying issues are not fully resolved, fester, and reemerge. In this sense, ineffective crisis responses exacerbate unequal water resource access, leading to greater vulnerability in the next crisis.

Most research on water crises focuses on droughts, such as crises in the United States (Willhite, 2000; Missimer et al., 2014), Brazil (Soriano et al., 2016), and Australia (Head, 2014). Although there is a growing body of literature on water supply problems and droughts in the Caribbean region, research on water crises in this region is limited, particularly that which examines crises as cyclical and evolving processes. Much of the literature related to desalination focuses on the technical process, its benefits for water-scarce communities, understanding its environmental impacts, and mitigating its negative effects (Williams, 2022). Scheba and Scheba's (2018) work on the 2016-18 water crisis in Cape Town, Africa, is a

notable exception that makes direct connections between water scarcity, inequality, and infrastructure such as desalination; however, few studies have examined how desalination transforms into a maladaptation strategy. There is a need to address issues such as the creation and distribution of risk based on inequalities (Bullard et al., 2007; Boone, 2008), and the potential for desalination to generate risk – rather than solely alleviating it – is not well considered.

Boin et al. (2018: 25) explain that "crises are the product of shared perceptions (…) [and] it is the perception of threat that matters (…) which [can] force authorities to act". Our paper raises important questions about how water crises are framed and how that framing leads to strategies – in this case, technological strategies – that garner consensus but set the stage for further water injustices that become the crises of the future. This research adopts a critical-social theory using the social constructionist framework, which provides insight into the crisis and decision-making processes from the perspectives of those affected. Moreover, this research incorporates the principles of political ecology and environmental justice to explore the intricate interactions between political, economic, and ecological systems, emphasising the importance of justice and reform in addressing the root causes of the crisis and preventing its recurrence.

THE WATER CRISIS AND THE EMERGENCE OF DESALINATION ON SAN ANDRÉS ISLAND

San Andrés is a Colombian Caribbean island located in the Southwest of the Caribbean Sea, about 800 km from the continental Colombian Caribbean coast. San Andrés society fosters a strong sense of community. People often know each other and there is a strong sense of cultural heritage. Roughly half the population is composed of the Raizales or Raizal People, an Afro-Caribbean ethnic group that has special protection through the Colombian State and ILO Convention 169 on the rights of indigenous and tribal peoples, including territorial and self-government rights (Ortiz Roca, 2016; Velásquez, 2020a). Other cultural groups cohabit on the island, with ancestry from different parts of Colombia (such as Medellín, Cartagena, and Barranquilla) and from Western Asia (such as Syria and Lebanon).

The place of desalination in water management

San Andrés is a drought-prone area and has suffered many episodes. For example, droughts occurred between 1928 and 1930, 1958 and 1959, and from 1959 to 1967 (Barriga et al., 1985; Parsons, 1985). In 2006 the Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM) reported extreme droughts in 1971-1972, 1982-1984, and 1997-1998, a moderate drought in 1974-1975, and a mild drought in 1993-1995. Other droughts occurred in 1988, 1991-1992, 2009, and 2015-2016 (IDEAM, 2006).

The ways islanders – Raizales and non-Raizales – acquire water varies:

(1) Autonomous water supply, where rain and well water are stored in a cistern. Most domestic wells are located in the northern part of the island. Rainwater harvesting is a cultural survival technique, mainly used by Raizales. 42% of households on the island collect rainwater (CDM Smith, 2016).

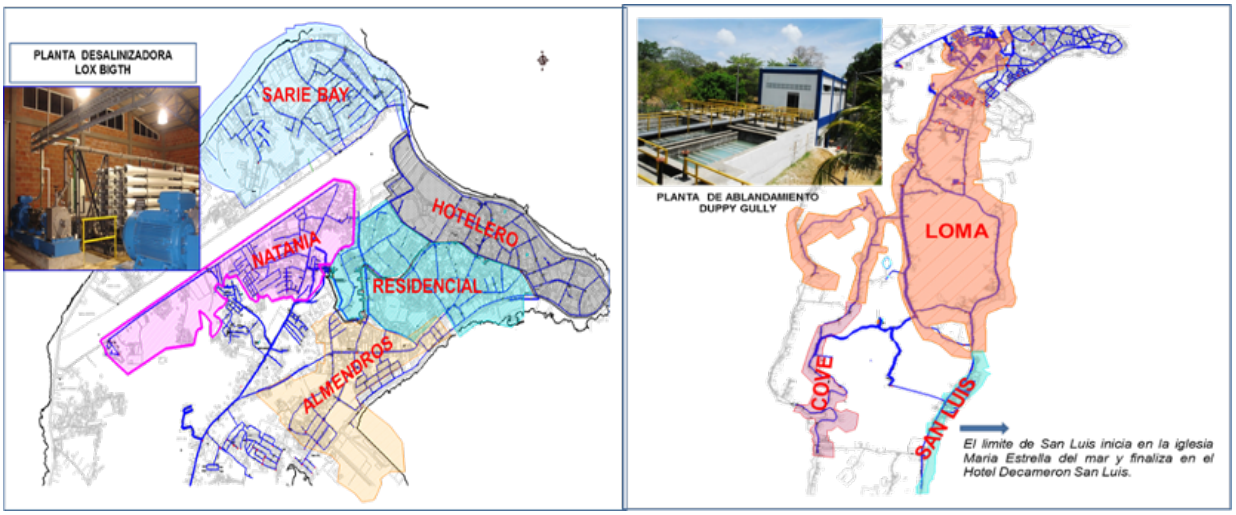
(2) Water supply from water trucks (82% of households), where water comes from the aquifer (CDM Smith, 2016), although this source of water is low quality due to the poor management of wastewater in both urban and rural areas (Corporación para el Desarrollo Sostenible del Archipiélago de San Andrés, Providencia y Santa Catalina [CORALINA], 2019).

(3) Public household aqueduct (34.2% of households), which uses both desalinated water and water from the softening plant, as shown in Figure 1. Water operator Veolia carries out desalination on the island by reverse osmosis (Bent, 2019). Water demand is 5,138,605 m^3/year while water supply is 1,003,034 m^3/year (CDM Smith, 2016).

(4) Water from the aquifer, purified by private companies and sold in bottles. Most (92% of households) of the community use bottled water as they believe it is the only water safe to drink (CDM Smith, 2016).

These diverse water sources have become interrelated, leading to islanders using multiple and overlapping methods that both compete with and complement each other.

Figure 1. Water distribution per sector, San Andrés island.



Note: Retrieved from CDM Smith (2016).

The main economic activity on the island is tourism, primarily located in the northern part of the island (Departamento Nacional de Paneación [DNP], 1992). Complicating the needs of locals is the fact that the island is visited annually by more than a million high-water-consuming tourists (Howard, 2015).

Desalination is relatively new to San Andrés, and its history includes political decisions accompanied by technical failures. In the early 1960s, water infrastructure investment in the northern region was a result of the decision to prioritise that area for tourism development. At that same time, a failed attempt to construct the island's first saltwater transformation facility (El Tiempo, 1962) planted the seed of the idea that desalination could solve its water challenges. The plant was never built due to problems in electricity generation, among others (El Tiempo, 1962). It was not until the 1980s that the first desalination plant was constructed to provide water to the tourist zone. However, technical problems and high energy prices followed. In October 2006, a new desalination plant began operations, yet this plant experienced intermittent but prolonged power outages and other operational challenges (Aguas de San Andrés S.A. E.S.P.; 2016).

Since 2005, the French contract operator, Veolia, has been the island's sole provider of water supply, aqueduct, and sewer services. The company has two subsystems to produce potable water: a water softener plant and three desalination plants. Two of these desalination plants take water from the aquifer, but through different geological formations: San Luis and San Andrés aquifers. The third, which is relatively new, takes water from the sea. Veolia is one of a small group of companies that have control over approximately 80 percent of the world's private water market and is among the two companies with the highest water market participation (López, 2011). The aqueduct coverage on the island is less than 52% (Bent, 2019), although some reports (e.g. Departamento Administrativo Nacional de Estadística [DANE], 2018) describe the coverage as significantly lower (e.g. 26.9%).

The island has four major sectors: the North End, La Loma, San Luis, and Roundy Rock. The North End is an urban and tourist area where the majority of the island's residents live (72% of the total population). Most of the infrastructure, as well as hotels, commercial activity, and government entities, are located in this sector. The sectors of San Luis and La Loma have the highest concentration of Raizal people

(Gobernación Archipiélago de San Andrés, Providencia y Santa Catalina, 2013). Roundy Rock is in the western part of the island, where a range of cultural groups live. There are five circuit zones for water distribution in the northern (or urban) part of the island and three circuit zones in the rural areas. The water supply frequency differs by zone district and is established by an agreement made in 2005 between Veolia and a quasi-governmental organisation called Aguas de San Andrés (Aguas de San Andrés, 2005).

The 2015-16 water crisis and response

The El Niño phenomenon's climatic variation started in 2015, peaking in 2016 with a deficit of 47.9 mm of precipitation (IDEAM, 2017). The mean intervals people were required to wait for water service increased from 23 days to 38 days. In some areas and during some periods, the situation was far worse. For instance, in April 2016, the Sagrada Familia neighbourhood received water every 41 days, the Barker Hill neighbourhood every 46 days, and the Courthouse neighbourhood every 45 days (Aguas de San Andrés S.A. E.S.P, 2016). On July 18, 2016, IDEAM reported that the El Niño phenomenon had ended.

Throughout the 2016 crisis, the island's north – the location of tourism and commerce – always had water. The most affected people were those residing in the south-central and hilly parts of the island. These people mainly depend on rainwater, experience more difficulty constructing wells, are not connected to the aqueduct, and are often part of the Raizales ethnic minority group.

On April 2, 2016, residents of the Lynval-Cove neighbourhood erected barricades, burned tires, shouted, and posted signs saying, "We need water". This was the island's first collective road protest over the lack of water. Water scarcity had never before triggered social mobilisation in San Andrés. Subsequently, ten additional road protests spread throughout the south-central and hilly parts of the island, where most Raizales live and where many poorer neighbourhoods are located. The last protest of that year occurred on June 10, 2016.

The government crisis response primarily involved two strategies: distributing water via trucks and desalination expansion. The immediate response involved the distribution of more than 18 million litres of water, the acquisition of a new water distribution truck for firefighters, the rehabilitation of some household water storage systems, and the installation of three 5000-litre capacity tanks. Moreover, the government developed educational activities promoting water rationing.

The 2016 water crisis affected more than 14,000 people. However, despite official reports that the water crisis had ended (Gobernación Departamental de San Andrés, Providencia y Santa Catalina, 2017), the crisis persisted. The first four months of every year during the study (2016 to 2021) brought the recurrence of water inaccessibility and related protests. The water crisis ceased to be a static and extraordinary event; rather, it became a cyclical and ongoing situation where the same people suffer from a lack of water and protest until it is trucked in.

FRAMES SUPPORTING DESALINATION ON SAN ANDRÉS ISLAND

Organisational leaders and water experts play essential roles during crises, instituting their visions, sharing their perspectives, coordinating situations, and both shaping and limiting courses of action. Boin et al. (2016) define these types of leaders as 'crisis framers', explaining that they influence the crisis interpretation and response, thereby manipulating the political process. According to Jessop (2012), when a crisis occurs, the actions taken depend on the ideas that are present. The ideas that are recognised and have a greater voice help shape the nature and outcome of crisis management and crisis responses. However, framings by organisation officials are not the only influence on popular perceptions. Findings from our study suggest extensive interviewee support for installing more high-technology reverse-osmosis desalination plants on San Andrés Island. Islanders, both Raizales and non-Raizales, also have faith that desalination will produce more water and consequently end the water crisis, thereby solving rather than perpetuating the injustices.

Organisation officials' frames of naturally-induced crisis

During the onset of the crisis in San Andrés, organisational leaders and water experts attributed the water crisis to a natural hazard – a drought related to the El Niño phenomenon. When water-related natural hazards are largely blamed for causing crises, technological solutions become the main way to address the problem (Aggestam and Sundell, 2016). Consequently, a desalination plant was framed as the 'keystone' to solving the crisis. For example, the San Andrés representative to the Colombian Congress asserted, "The rains decreased, and then there was a crisis on the island". Likewise, the government secretariat said, "The crisis will last until the rains come back or until the desalination plants are installed; for now, we are delivering water to the community by truck".

To retain their power, ideas must acquire legitimacy (Redcliff, 1984). A decisive element in the consolidation of desalination as a crisis solution was island officials' declaration of the water crisis as a local state of public calamity; this declaration identified the El Niño phenomenon as the leading cause of the crisis. The declaration provided new and increased political, technical, and financial support for desalination while limiting the space for public discourse to explore alternatives. Moreover, less than a month after the first water shortage protest, on April 26, 2016, the Household, City and Territory Ministry signed an agreement with the local government to buy two new desalination plants. The short time that elapsed between the declaration and the purchase decision for the two plants suggests that perhaps there were prior political negotiations based on a largely technocratic response to the water crisis. Indeed, several planning documents, contracts, and reports recommended moving in this direction, be it the Water and Sewerage Master Plan for San Andrés, Providencia and Santa Catalina to the year 2027 (Cesco et al., 1997) or more recent reports in 2014 and 2015 (Aguas de San Andrés, 2014; Rojas and Guerrero, 2015). These reports make mention of various water expansion needs, including desalination. The Water Resources Master Plan indicated that one of the water alternatives for the island is the use of desalination through the acquisition of a 50 l/s plant that will allow the use of the aquifer to be suspended (CDM Smith, 2016). The agreement affirmed technology expansion as valid, reasonable, and reliable. In this sense, prearrangements determined the crisis course of action. The water crisis presented an opportunity, but not for change. Rather, it was an opportunity for a private water company to expand its water operation role on the island, increase its supply in order to sell to the tourist industry, and expand its company infrastructure with two additional desalination plants (Velásquez, 2020b).

Public and private sector officials who were interviewed offered seven reasons they rallied their support for desalination. Although an illustrative quote is provided for each, many respondents echoed these statements; some suggested more than one reason for their views:

(1) The belief that desalination *will end* the water crisis. For example, an official said, as stated above "The crisis will last until the rains come back or until the desalination plants are installed; for now, we are delivering water to the community by truck".

(2) The belief that there is *no alternative* to desalination, casting doubt on the traditional forms of water supply used on the island (e.g. rainwater harvesting and well-water extraction). For example, one official said, "There is no other alternative than a desalination plant for the island", and, "If we fail to get the desalination plants, every year we will suffer water crises".

(3) The belief that desalination is the *best solution* to increase the water supply and mitigate the impacts of climate change, drought, and the El Niño phenomenon. For example, one official said, "Declaring the state of emergency was the logical response to the 'Niño' phenomenon and a one-year drought on the island". They added, "The response to the crisis was successful; the governor managed to reorganise the economic resources coming from the national government to purchase two desalination plants".

(4) The belief that because desalination is rainfall independent, it is a *logical solution* for an island surrounded by seawater. For example, one official said, "We should not have any water problems in San Andrés because we are surrounded by water".

(5) The belief that a *lack* of desalination technology is the *primary barrier to* using the ocean surrounding the island, a limitless water supply. For example, one official attributed the crisis directly to the lack of technology in this way. They said, "We are on an island surrounded by the sea; we should not have water problems". Similarly, another official stated, "We have a limitless source of water – that is, the sea".

(6) The belief that desalination is *environmentally conscious*, conserving the aquifer from overexploitation and saline intrusion. For example, one official suggested desalination should be prioritised to protect the aquifer. They said, "Some of the wells at the Duppy Gully [softening plant] are already running out of water, and if La Loma depends on this aqueduct, another source should be considered. In the future, the Duppy Gully plant should be retired. As far as I am concerned, we have to desalinate seawater".

(7) The belief that desalination is a strategy for *improving water quality* comprehensively and equitably. For example, an owner of a water truck company supported desalination, saying, "I believe that what is needed are desalination plants, and they should produce enough water, and these waters should go through the pipeline, and it should reach each house through the pipeline to guarantee the physical-chemical but also the bacteriological quality of the water, and that at that moment we will be happy that we will no longer need water trucks on the island".

Officials tended to focus on procedural justice, highlighting that community participation in the decision-making process was absent; the government did not consider how household water demand may vary based on season, climate variability, climate change projections, or household and cultural characteristics; and more water was given to those who could pay more, like the tourism industry. Public and private officials admitted to procedural injustices in the desalinated water supply, but they did not connect this situation with the causes and effects of the crisis. Overall, the lack of community participation in the water agreement was pointed out by participants as the mechanism that established the water inequalities. This means that there was no recognition of the presence and particularities of the Raizales in water management nor in the environmental decision-making processes, and thus no fair distribution of water could be ensured.

Residents' frames of current water injustices

The results of the interviews indicate that residents (both Raizales and non-Raizales) generally perceive injustices in island water resource management. That is, residents broadly believe that there are differences in water quality, quantity, and access frequency, and they assert that these differences reflect injustice. Their views on injustice extended to desalinated water access and the prioritising of the tourist sector as well as to other water injustices, such as the availability and quality of water from the softening plant. For example, during the crisis, the softening plant experienced low water capacity; there was an intense dry period and groundwater was contaminated. In other words, residents took a broad view of water injustices in San Andrés.

Resident statements did not reflect sharp distinctions regarding whether or not the injustices were distributive or procedural, but responses did tend to concentrate on this thematic area. While outcomes were critical for islanders, their responses sometimes also implied that the injustices were inherent to the political and market processes. Residents were frustrated both by the deprivation (weeks to over a month without water deliveries) and relative deprivation compared to other neighbourhoods. For example, a woman from the Buenos Aires neighbourhood indicated: "I hope we can have water in less time. We went to the private water company and the government officials said there is an agreement where it was established that we can only have water every 20 days".

In contrast, recognition justice was not a common theme, especially for non-Raizales, although occasionally responses from Raizales aligned with this perspective. Concerning interactional justice,

interviewees stated that interactions with neighbours around the topic of water included neighbours asking for water; establishing business relationships around the people's capacity to store water; and encountering conflicts when they asked for assistance from people who had water but would not share.

Overall, some residents argued for an equal share of water, and others (primarily Raizales) saw their group as a priority. Their perceptions of water distribution and access demonstrate how technology developed by private actors for profit tends to favour economic interests. Perhaps most concerning is how the technology employed to deliver water underpins and reinforces an ideology that purports resources such as water to be merely commodities rather than fundamental rights required for life.

Residents' attribution of water management injustices falls into six broad categories:

(1) Injustice as unfair treatment and lack of respect. For example, a Raizal from the Court House neighbourhood asserted that officials forget about the local population and prioritise hotels: "Here there is no water all the time because we are the residents". Another Raizal from the Clymont neighbourhood indicated: "We want them [the government and Veolia] to not leave us in last place. We also need the water".

(2) Injustice as government missteps and discrimination against the Raizales. For example, a woman from Barker Hill stated: "What they are doing to the people is not right. It is discrimination, abuse, from the Colombia states [meaning the national government]".

(3) Injustice as unequal water distribution for different social groups (in terms of quantity, frequency, and quality). For example, a person from the Almendros neighbourhood said: "Everyone should have the same amount of water". A person from the Natania neighbourhood explained: "If we already know how many litres of water we produce per year, then they should divide it equally among everyone".

(4) Injustice as unmet water needs. For example, a resident from the Barker Hill neighbourhood said: "If there is any priority, I would think that it would be the older, the poor; they need more water".

(5) Injustice as historical displacement and exclusion of Raizales (from public services, tourism, and commerce). For example, a resident from the San Luis neighbourhood claimed: "I think water [should be] first for Raizales and then the others (non-Raizales and tourists)". A person from the Clymont neighbourhood explained: "We are the owners of the island, and we must have priority on our land".

(6) Injustice as unequal water distribution for different spatial locations (quantity, frequency, and quality differences between the northern and hilly, southern parts of the island). For example, a resident from the Barker Hill neighbourhood pointed out: "The water that is under my house [the aquifer] is not for me, but is for the tourists who come and take our resources and leave".

Overall, residents focused their sense of injustice on the current water crisis. Desalination, when mentioned, was framed as a solution to which they needed equal access, rather than a potential source of future injustices.

FACTORS INFLUENCING FRAMES SUPPORTING DESALINATION

Several factors were identified that influenced frames supporting desalination. These fall into four themes: 1) the obscuring of value judgments in technologies and agreements; 2) the historical presence of desalination in the touristic sector of the island; 3) a sense of threat to the island's water resources, and 4) the perception that desalination is a conflict-free and low-risk technology.

Obscuring of value judgments in technologies and agreements

Public and private officials acknowledged the water inequalities on the island; however, they did not link those water inequalities with either the causes and effects of the crisis or with desalination technology emergence and expansion. The 2005 Veolia water agreement established differences in water allocation among the different sectors of the island. Consequently, officials pointed to the agreement – not to themselves or their decisions – as the source of problems related to desalinated water access.

Technology and the procedural apparatuses that support it tend to obscure the root causes of problems. Moreover, this deflection makes it much more difficult to hold public officials accountable, even when desalination is the result of decisions that reflect and embody value judgments. Technology also renders procedural violations invisible, normalising an activity that might otherwise be viewed as an injustice. A Veolia official, for example, believed that water distribution differences are not problems of equity but rather technical problems related to the low water production of the softening plant and the separation between the two aqueduct systems (north and south):

> The distribution of the water depends on the technical conditions that exist on the island. For example, the desalination plant is the one that is producing the most water, but it can only give water to the north and there is no way for the water plant to reach the Loma. So, all the water from the desalination plant is distributed in the north. That connection between the north and the south has already been made with the new desalination plant that was installed. But let's say that the north and south are two separate systems. So as Duppy Gully has the lowest flow rates, water was sent every 20 days and as the desalination plant has more capacity, it can be given once a week. It is a technical issue.

The problems are attributed here to technical factors, rather than the sequencing of decisions – informed by particular economic interests and historical patterns rooted in inequity. That is not to say that technical issues do not exist. Rather, they obscure the decision-making that has prioritised certain interests over others, resulting in technical issues that systematically impact some people more than others. It is inevitable, then, that the island's water needs will be met using more of the same approach, rather than a reassessment of the technology or how it is structured for the island.

Presence of desalination for the tourist sector

The tourist industry in San Andrés has implemented its own desalination solutions since the 1990s. In 2014, the island had approximately 37 industrial, semi-industrial, and home-scale water plants (Archipelago Press). During the 2016 crisis, representatives from large-scale hotels spoke optimistically about desalination, noting that they received water from their own small desalination plants and did not suffer while others on the island did. Indeed, the number of tourists arriving on the island during the crisis did not decline (Secretaría de Turismo de San Andrés, 2020). Some with extensive experience using their own desalination plant noted that problems only arise "if the machinery is damaged or there is no energy or fuel to run the plant". One manager suggested that "the government must install two or three desalination plants to have good water production and be able to give water to everyone, including tourists and neighbourhoods alike".

The more recent experiences of well-known hotels on the island play a vital role in framing desalination as a positive experience and a comprehensive solution. This encourages other businesses, including the owners of smaller hotels, to advocate for similar access, given their own experiences with poor water access and quality in 2016. The positive experience of larger hotels positions their approach as one to strive for, amplifying the voices in favour of desalinisation.

Sense of threat to the island's existing water resources

Due to their size, separation from the mainland, fragility, and scarcity of natural resources, islands have a unique set of challenges in managing their water resources. At the same time, water demand can

increase due to, for example, growth in tourism and overexploitation of aquifers. Combined with the potential consequences of climate change, the implications of these challenges are increasingly difficult to anticipate. On San Andrés Island, it is feared that the expected temperature increases and precipitation decreases in the next 80 years (IDEAM, 2017) will exacerbate the problems attributed to El Niño.

As a result of these factors, islanders – particularly officials – have a heightened sense of water insecurity. Recent experiences with water scarcity have created a widespread sense of urgency and the demand for a quick and immediate response, which has led to mobilisation. Because the very definition of a crisis is the presence of a real or perceived threat, uncertainty, and an urgent need to act to prevent circumstances from worsening (Boin and ’t Hart, 2007), concern about the long-term viability of existing water resources has developed into a crisis of its own.

Almost all officials interviewed expressed the urgent need for a technological solution to address this long-term threat. Many of the frames officials use (noted above) are informed by this sense of threat to the island’s water sources. Yet, importantly, this sense of threat – combined with official frames – had also reached some residents we interviewed. Both Raizal and non-Raizal interviewees held faith that desalination would make them free to wait for the rain, increase the water supply frequency, and mitigate the impacts of tourism on the growing water demand. Some common remarks from residents included: Desalination "is the best option", "the only solution", "the way to end the crisis", and "What we need is to produce water".

For example, a woman from Barker Hill said, "If the El Niño phenomenon comes [again], I don’t know what we are going to do. We have to take seawater and boil it, remove the salt, and use it. Thank God we always have seawater, and to survive, we must use it".

Perception that desalination is a conflict-free solution and a low-risk technology

The water crisis was framed as high-conflict. Indeed, field research during 2016-2021 identified many instances of protest by residents, some developing into public order disturbances and street action with police intervention. To punctuate the severity of the crisis, officials repeatedly referred to "conflicts" and "aggression" aimed at the government, the police, and the private water company (Velásquez, 2018). They even suggested that the first alarm of the crisis consisted of multiple community protests where residents erected barricades and burned tires. It is telling that the alarm, for officials, was not necessarily the lack of water but rather the public outcry in the form of protest and disruption. With a belief that the water supply is insufficient, water on the island is transformed into a contested resource. The root causes of the conflict – manifest inequities in water distribution, frequency, and quantity – were deemphasised by officials and, instead, their proposed solutions emphasised water supply.

Desalination evolved into a solution for crisis conflict, seemingly addressing domestic needs as well as economic interests. Increasing water supply could, according to this perspective, serve residents but also benefit the tourism and water supply industries. Most interviews did not cite concerns about the safety, costs, or the socioeconomic, political, and environmental problems associated with desalinated water. Rather, participants considered desalination to be a low-risk technology. This finding is not surprising, as there is a strong inverse relationship between risk and benefit judgments, which, in turn, affects the decision-making process: "When people consider an activity or technology beneficial, they may, to be consistent, also tend to view the technology as having low risk" (Alhakami and Slovic, 1994: 1088).

Residents who were interviewed spoke about desalination enthusiastically, but perhaps their technical knowledge was minimal. King et al. (2012), who studied public attitudes to desalination in Australia, stated that a lack of perceived risk is associated with a lack of familiarity with the technical desalination process. During the interviews on San Andrés, only two residents expressed general concerns about desalination expansion. Urban growth, greater privatisation of water supplies, increasing water prices (UNAL, 2010; McEvoy, 2015; Jones et al., 2019), as well as environmental impacts such as

feed water intake, loss of biodiversity, and impacts on marine ecosystems (March, 2015) – all established risks of desalination technology – were not widely mentioned by those interviewed for the study.

LIVING IN CRISIS: DESALINATION DEEPENING AND REPRODUCING WATER INJUSTICES

Our research on San Andrés points to three ways that desalination technology on the island has perpetuated, intensified, and legitimised historical water injustices for islanders, both Raizales and non-Raizales: separate water markets, the prioritising of those who can pay, and the loss of water autonomy.

Separate water markets

First, desalination in San Andrés creates and maintains separate water markets. San Andrés Island utilises two different water provision systems: one in the northern-urban area (three desalination plants) and the other in the southern-hilly-central-rural area (one softening plant). Desalination plants were built in and produce water for the northern part of the island, the main area for tourism development and the part with better aqueduct coverage. In 2005, the water contract established explicitly that the northern part of the island would have desalinated water 24 hours a day starting from the first day of the signing of the contract (2005), while the districts within the La Loma sector would only have water from the softening plant, and only once every 20 days (Proactiva water contract, Sixth Amendment, 2008). In this sense, "the operation of the desalination plant improved the water frequency mainly for the North End sectors" (Aguas de San Andrés, 2016: 16) but deprioritised the other sectors.

After 2016, the national and local government purchased two more desalination plants to expand the capacity for water production (Convenio Administrativo de Apoyo financiero No. 9677-SAP11013, 2016). One plant has a 25 L/s capacity for production and the second plant has a 50 L/s capacity. In 2019, the local government and Veolia signed an amendment to the water agreement, Otro si. No. 9, transferring the operation of the new water infrastructure to Veolia. However, legal problems persist in the transfer process. The desalination plants were installed in the northern part of the island, making it technically easier to distribute water in this area and further perpetuating the system of two separate water markets with profound social and geographical unevenness. To distribute the desalinated water to the southern-hilly-central-rural areas, the government built two water drive lines (pipelines) connecting the northern-urban aqueduct to the southern-rural aqueduct. To date, the pipelines have been found to have multiple technical faults, making it challenging to distribute the water to La Loma and El Cove. The technical problems were embedded in the technical solutions to the water crisis, requiring additional technical solutions that created additional technical problems. Consequently, it seems that in the foreseeable future, desalinated water will be mainly distributed to the northern part of the island.

Furthermore, in 2019, Amendment 9 of the water contract established that La Loma would only be supplied with water (via desalination and softening) once per week (8 hours of tap volume) during 2019-2020. It is projected that even by 2035, La Loma will have only a 12-hour total period of both types of water per day. In this sense, this inequitable water distribution was ratified in 2008 and 2019 with Amendment 6 and Amendment 9.

The two distinct systems are maintained to date. They not only differ based on geography but also in the water treatment system used, the sources of water (Aquifers San Luis and San Andrés, respectively), and their water production capacity (the desalination plant produced 42.4 L/s for 2019; the softening plant only 14.4 L/s). In other words: expensive, readily available, and high-quality water serves the northern part of the island; lower-priced, lower-quality, and less-available water provided by the softening plant serves the hilly and rural part of the southern island. Although both water types comply with the same water regulation norms and baseline quality criteria, perceived inequalities derive from the differences in the quality of the two water types and the variances in water shortage periods.

Equally important are the people labelled as the non-subscribers who reside in the south on the island's periphery in the Roundy Rock area. During the immediate response phase of the crisis in 2016, officials considered both aqueduct subscribers and non-subscribers. However, during the mid- and long-term responses and in efforts related to desalination expansion, non-subscribers were excluded from proposed solutions, thereby maintaining water inequities. For example, there is low aqueduct coverage (60%) in this region of the San Andrés aquifer, and, according to a Veolia official, the desalinated water will mainly be distributed amongst aqueduct subscribers. In fact, there is currently no clarity about how desalinated water will reach people without aqueduct service.

Figure 2. The water crisis on San Andrés island, 2016-2023.

Sources: Frontera Azul (2016), El isleño (2017), Noticiero popular de las islas (2020), Barrios (2021), Facebook picture (Gonzalez, 2022); FAC (2023).

In April 2022, two protests took place in La Loma (Perry Hill) as people spent more than 20 days without water. In March 2023, protests took place in Schooner Bight, as shown in Figure 2. As of this writing in May 2023, Raizales and non-Raizales located in the central and hilly parts of the island still hope for desalinated water access. San Andrés provides a case study that reveals how desalination expansion does not solve the unequal distribution of water and how tourism and commerce continue to serve as the primary beneficiaries. These findings are consistent with the literature that emphasises political ecology perspectives. Desalination represents a techno-political strategy for enduring, rather than solving, injustices, conflicts, and tensions related to water governance (Scheba and Scheba, 2018; Williams and Swyngedouw, 2018).

Prioritising those who can pay

Second, desalination tends to prioritise areas that can pay more for water. This technology is one of the most expensive forms of producing water, driven by high energy requirements. For instance, reverse

osmosis desalination requires high levels of maintenance, expertise, materials, and equipment of very high standards that are not usually available locally, resulting in high import costs (Hophmayer and Kadiman, 2008). In turn, its unaffordability to domestic users requires governments to subsidise it or provide it for free. The true desalinated water price goes unseen because of government subsidies, but it consistently costs at least twice as much as other options.

This private water company official explained in more detail how water resources are distributed and how the water agreement is the legal mechanism used to establish differences between urban and rural areas.

> The national government made the contract, taking into account the culture of rainwater management, which is very good in the La Loma sector [the hilly part and where the Raizales live], and the water supplied by the company is only to make up for shortfalls. [Since 2004 it] was never thought of having a 24-hour service in all sectors and with potable water. I would say that the contract is unequal, because there are some areas that have water 24 hours a day and others once every 20 days. The other thing is that they were seeking to guarantee the water consumption of large customers [like hotels] so that they could provide for a subsidy to [lower socioeconomic] strata one, two, and three. There must be a balance, because if I give all the water to strata one, two and three, who covers the subsidy imbalance? The local government does not have the resources to cover everything.

The private water company official claimed that in the water agreement, an economic balance was sought. They explained, "It was necessary to ensure that large customers consumed water so that they could take on the subsidy of the lower strata". It seems that the government considered a water restriction, reducing the frequency and quantity of water delivered to residents, to be a benefit for them. This economic formula might have legitimised the decision that the poor would receive less water than the tourists, hotels, and upper-class sectors on the island: those who could pay more would sustain the water costs for those less economically secure. One official said in 2018,

> Well, the tourist, unlike the resident, has water 24 hours a day. Not necessarily because the company has water availability, but because the hotel sector is concerned about giving tourists 24-hour service. A hotel can pay up to 50 million pesos a month [approximately USD 14,000 equivalent] to ensure water for its tourists.

Water has become a commodity to be sold to consumers for profit. In turn, the residents have become consumers who purchase a commodity rather than citizens with water rights. As a woman from the Los Almendros neighbourhood said, "Look at the water distribution schedules. The touristic district 24 hours, the Sarie Bay neighbourhood 24 hours, the Almendros neighbourhood twice a week for 4 hours each time, and La Loma once every 20 days". She added, "What is happening is because the touristic district pays the billing, and the residential sector does not".

The water privatisation process in San Andrés established higher water prices, which the poor and Raizales could not afford (CDM Smith, 2016). There has been widespread resistance from residents to connecting and paying for the water service (CDM Smith, 2016). Since the water crisis, decisions concerning groundwater, desalinated water distribution, and water quantity remain at the company's discretion.

Losing water autonomy

Third, although residents had hoped that desalination would increase the island's autonomy over water resources, it has resulted in greater dependence on international actors and global finance. Residents, both Raizales and non-Raizales, held faith that desalination would free them from awaiting rainfall, increase the water supply frequency, and mitigate the impacts of tourism on the water demand. These interviewees believed there would be plenty of water for all islanders. A Raizal resident interviewed in 2016 stated,

> We are on an island surrounded by water, and desalination is the ideal solution. We do not need to wait until the rain comes. For example, the tourist ships get water from the sea. This island is like a big ship in the ocean. Instead of taking everything from the earth, we need to get it from the ocean.

Residents highlighted their expectation that they would be free from climate variations and saw the ocean as a limitless water source with no exploitation limits. As this corporation official indicated, "We need to implement technologies that allow us to take advantage of the water supply that exists, and what we have is salt water".

The islanders' optimism, expressed during interviews in between 2016 and 2021, is contradicted by the actions already underway. Infrastructure investment supports the private water company's extraction and distribution goals, and household and community strategies have shifted over time from traditional rainwater harvesting and home wells to the private company. San Andrés residents, in turn, grow more dependent on private water companies, who control water distribution, treatment, and safety. Indeed, even as this paper was under preparation for publication (May 2023), the water company Veolia announced that they could not supply desalted water to the La Loma neighbourhood (the hilly part and where Raizales live) on San Andrés island. The problems cited were: 1) contractual issues; the two national government agencies (UNGRD and FINDETER) have not transferred the 50 L/s desalination plant to the provincial government and then to Veolia, so that the company could not legally deliver the desalted water, and 2) one of the national agencies (UNGRD) not having repaired the pipeline constructed for distributing desalted water to La Loma. From May 2, 2023, Veolia, in coordination with community leaders, will be delivering water by tank truck according to the agreed-upon schedule, and water will only be delivered to users who are not more than two bills late on water payments. Simultaneous to this announcement, there have been more than five protests over the lack of water in different neighbourhoods, including Orange Hill, Matlina Hill, Barrack, Brooks Hill, and Flowers Hill. The recent change, which perpetuates water access inequality, demonstrates how the technology alone is not a panacea for water injustices or addressing cyclical crises.

Desalination represents a technical solution that is high-energy-consuming and, therefore, a high greenhouse producer (Williams, 2022). In this sense, it may inadvertently increase people's vulnerability to droughts (Williams and Swyngedouw, 2018). The advancement of water technology brings resource dependence and excessive consumption. Desalination claims to maximise water security by maximising water consumption, yet it obscures natural water limits, management and governance problems, inequalities in water allocation, or the need to reduce water demand from mass tourism.

As islanders' attention has shifted from rainwater and groundwater (traditional forms of water access) to desalinated water, their social relations to water have been reconfigured. The future currently sought for San Andrés is one of a water resource-abundant island with no water limits. This necessitates enhancing the island's carrying capacity and, consequently, placing no limits on tourism growth. Here lies a contradiction between residents' views: The technology and mindset that stems from its expansion – something they see as a solution to injustice – may also cause further rapid expansion of tourism, with various negative consequences, including further injustices.

During the crisis response, the government said that desalinated water would reach other sectors of the island in the near future. When this happens, other sectors will become more dependent on the technology. Additionally, the timing and implementation of desalination dependence may detonate new conflicts among users, be it between residents located in the north where desalted water is already plentiful, those of the central-hilly part, where residents currently depend mainly on water from the softening plant and wish to have access to desalinated water, or the Roundy Rock zone, where there is no aqueduct service. The attempts to solve the water problems in San Andrés by desalination do not take into account the collateral consequences likely generated by this modern solution. It is telling that recognition and interactional justice perspectives were not widely employed by all residents as they

described water injustices, yet these may become the perspectives that manifest if water inequities persist after desalination investment.

Redclift (1984) and Escobar (2005) explained how technology leads to dependence on foreign specialised companies, impoverishing an already poor society. In addition, the technology requires specialised knowledge, which is usually absent in the place where it is implemented. These assertions resonate in San Andrés, where there is an increased reliance on technical expertise, impeding the possibility of expanding participatory decision-making by locals. One official we spoke with stated it very clearly, explaining that there are no qualified local personnel able to operate the plant. Therefore, they claimed, Veolia must operate the plant with outside personnel.

CONCLUSIONS

Central to this study is the finding that water injustices are embedded in water crises, and, consequently, technological solutions that do not fully appreciate the extent of that embeddedness run the risk of falling short; indeed, they may reproduce crises in the post-crisis stage. That is, when distributive and procedural justice frames predominate over recognition and interactional justice frames, even strategies that have positive intentions are prone to not addressing the full spectrum of injustices and may set a path to reproducing those injustices.

This study calls for a critical understanding of our human-environment-technology relationship for a more just and sustainable approach to water crisis response. Despite official frames, the island's water crisis was not marked by absolute scarcity, but instead was coupled with political, social, and economic decisions that had negative consequences. In turn, technical solutions that use the same decision frames are likely to maintain the same water injustices. In the name of the water crisis, the water contract operator officially expanded its water infrastructure and therefore its corporate control over more water resources (not only groundwater but also seawater) for an additional 15 years (to 2035).

Desalination has created two separate markets on the island: an expensive available water, and a lower-priced scarce water. The company has focused on the expensive market where high profit is available. The crisis, instead of leading to reduced injustices in water allocation through the technology expansion, contributed to exacerbating the differences between these two markets and set the stage for a technocratic path with a high potential to exacerbate – rather than ameliorate – injustices.

This study is one of the very few describing and analysing the water crisis in San Andrés Island from a crisis and water justice perspective. We anticipate future risk scenarios for San Andrés by showing how vulnerability is manufactured and varies according to the desalination plant's location and desalted water allocation. We warn that desalination will bring further social conflicts between users. San Andrés Island is moving towards a technological water dependence, disconnected from traditional local forms of collecting water and obscuring the social and environmental problems, the lack of sustainability, and the high ecological costs that desalination may produce. Several potential implications of desalination are revealed in this study, including the reduction of San Andrés' autonomy over its water and the promotion of unlimited consumption of water resources, as well as an increasing reliance on technical expertise which impedes the possibility of opening participatory decision-making by locals. Additional emerging concerns include increasing water supply prices and the potential exacerbation of unequal access to what has been increasingly considered a fundamental human right. These findings are consistent with those outlined in previous work by critical scholars employing the political ecology perspective (Redclift, 1984; Shiva, 1991; March, 2015; McEvoy, 2015; Feitelson, 2018; Fragkou, 2018; Scheba and Scheba, 2018; Williams and Swyngedouw, 2018). Ultimately, studies on desalination and findings from our study of San Andrés suggest that the positive perceptions of desalination and water justice might not be compatible. Technology played and will continue to play a central role in the configuration and prolongation of the water crisis. Its impact on individual and community autonomy reduces many Islanders' decision-making power over their own water resources and their capacity to cope with water-related crises.

Not only is the research important in its own right, for the island and its people, but too often must countries and regions in the Global South rely on research conducted in areas where geographic, historical, economic, social, and cultural conditions significantly differ. The findings from San Andrés add considerable value to the literature on crisis and water justice, as well as their intersections.

More research is needed to better understand the implications of using alternative paths for water justice, be it the implementation of a rainwater-harvesting program that includes construction, pre-cleaning inspection, and maintenance of cisterns; greater transparency in the water supply system for water equity; the impacts of renegotiating or terminating water agreements so hybrid energy sources can be considered; and the implementation of a comprehensive water information system to monitor data that identifies sectors prone to suffering from water-related hazards. It is beyond the scope of this paper to address these strategies, but any path forward for San Andrés society, of which one of the authors is a part, should critically consider the role technology plays in islanders' lives and in the modern communities we are building.

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REFERENCES

Aggestam, K. and Sundell, A. 2016. Depoliticizing water conflict: Functional peacebuilding in the Red Sea-Dead Sea water conveyance project. *Hydrological Sciences Journal* 61(7): 1302-1312.

Aguas de San Andrés S.A. E.S.P.-PROACTIVA Aguas del Archipiélago S.A. E.S.P. 2005. Water operation agreement. September 8, 2005. p 58

Aguas de San Andrés. 2014. Supervisión al contrato de operación del servicio de acueducto y alcantarillado en la Isla de San Andrés. San Andrés. Colombia

Aguas de San Andrés. 2016. Supervisión al contrato de operación del servicio de acueducto y alcantarillado en la Isla de San Andrés. Cuadragesimo segundo Informe Trimestral, 1 de abril -30 de junio de 2016, version 1.0. UNIÓN TEMPORAL PGP S.A.S – CYDEP S.A.S. San Andrés. Colombia

Alhakami, A.S. and Slovic, P. 1994. A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis* 14(6): 1085-1096, https://doi.org/10.1111/j.1539-6924.1994.tb00080

Archipielago Press. 2014. La desalinización del agua, una alternativa válida y real en San Andrés. San Andrés isla, Colombia. 13 mayo 2014.

Barriga E.; Hernández J.; Jaramillo I.; Jaramillo R.; Mora L.; Pinto P. and Ruiz P. 1985. La Isla de San Andrés: Contribuciones al conocimiento de su ecología, flora, fauna y pesca. Bogotá: Universidad Nacional de Colombia.

Barrios J. 2021. Facebook webpage. Facebook image.

Beck, U. 1992. *Risk society: Towards a new modernity*. Translated by Ritter, Mark. London: Sage Publications.

Bellamy, J.; Head, B.W. and Ross, H. 2017. Crises and institutional change: Emergence of cross-border water governance in Lake Eyre basin, Australia. *Society and Natural Resources* 30(4): 404-420, https://doi.org/10.1080/08941920.2016.1272729

Bent, O. 2019. Diagnóstico de la isla de San Andrés como insumo para la revisión y ajustes del plan de ordenamiento territorial vigente decreto 325 del 2003. Informe técnico. Gobernación Departamental de San Andrés, Providencia y Santa Catalina.

Berge, J. 2011. Acumulación y expropiación de los derechos de agua potable por parte de las empresas multinacionales. In Boelens R.; Cremers L.; Zwarteveen (Eds), *Justicia Hídrica acumulación, conflicto y acción social*. Lima Instituto de estudios peruanos.

Boelens, R.; Vos, J. and Perreault, T. 2018. Introduction: The multiple challenges and layers of water justice struggles. In Boelens, R.; Perreault, T. and Vos, J. (Eds), *Water justice*, pp. 1-32. Cambridge: Cambridge University Press. doi: 10.1017/9781316831847.001

Boelens, R.; Hoogesteger, J.; Swyngedouw, E.; Vos, J. and Wester, P. 2016. Hydrosocial territories: A political ecology perspective. *Water International* 41(1): 1-14.

Boin A.; 't Hart, P. and Kuipers, S. 2018. The crisis approach. In Rodríguez, H.; Donner, W. and Trainor, J. (Eds), *Handbook of disaster research* [Second ed.], pp. 23-38. Cham: Springer. Doi: 10.1007/978-3-319-63254-4

Boin, A. and 't Hart, P. 2000. Institutional crises and reforms in policy sectors. In Wagenaar, H. (Ed), *Government institutions: Effects, changes and normative foundations,* pp. 9-31. Leiden: Kluwer Academic Publishers.

Boin, A.; 't Hart, P.; Stern, E. and Sundelius, B. 2016. *The politics of crisis management: Public leadership under pressure* (Second Ed.). Cambridge University Press.

Boin, A.; Ekengren M. and Rhinard M. 2009. The study of crisis management. In Cavelty M. and Mauer V. (Eds), *The Routledge handbook of security studies,* pp. 452-463. Routledge Handbooks Online.

Boin, A.; McConnell, A. and 't Hart, P. 2008. *Governing after crisis: The politics of investigation, accountability and learning*. Cambridge: Cambridge University Press.

Boin, R.A. and 't Hart, P. 2003. Public leadership in times of crisis: Mission impossible? *Public Administration Review* 63(5): 544-553.

Boin, R.A. and 't Hart, P. 2007. The crisis approach. In *Handbook of Disaster Research. Handbooks of Sociology and Social Research*. Springer, pp: 42-54. New York, NY., https://doi.org/10.1007/978-0-387-32353-4_3

Boone, C.G. 2008. Environmental justice as process and new avenues for research. *Environmental Justice* 1(3): 149-154, https://doi.org/10.1089/env.2008.0530

Bornstein, B. and Poser, S. 2007. Perceptions of procedural and distributive justice in the September 11th Victim Compensation Fund. DigitalCommons@University of Nebraska-Lincoln.

Bullard, R. and Wright, B. 2012. *The wrong complexion for protection: How the government response to disaster endangers African American communities*. New York: New York University Press.

Bullard, R.D. 2000. Dumping in Dixie: Race, class, and environmental quality, 3rd ed. Peace Research Abstracts, 37, 4.

Bullard, R.; Mohai P.; Saha, R. and Wright, B. 2007. *Toxic wastes and race at twenty, 1997-2007*. Cleveland, OH: United Church of Christ.

Camargo, A. and Camacho, J. 2019. Convivir con el agua. *Revista Colombiana de Antropología* 55(1): 7-25.

Cashman, A. 2014. Water security and services in the Caribbean [Technical note. No. IDB-TN 514]. Inter-America Development Bank, Environmental safeguard Unit.

Castro, M. and Quiroz, L. 2011. La crisis del agua en Chile: El futuro de Chile requiere una nueva política de aguas. In Boelens, R.; Cremers, L. and Zwarteveen, M. (Eds), *Justicia Hídrica acumulación, conflicto y acción socia*l. Lima Instituto de estudios peruanos.

CDM Smith. 2016. Plan Director Del Recurso Hídrico de San Andrés Isla (Contrato 008 de 2015). Bogotá: FINDETER. www.observatorio.biosferaseaflower.org/index.php/es/publicaciones/item/download/146_45728a4facf8bea52925e875b9d48457

Cesco, Consorcio Angel and Rodriguez Ltda. 1997. Plan director de acueducto y alcantarillado para San Andrés, providencia y Santa Catalina-Balance oferta-demanda. San Andrés.

Convenio Administrativo de apoyo financiero No. 9677-SAP11013, 2016. Ministerio de Medio Ambiente y Desarrollo, Gobernación departamental de San Andrés, Providencia y santa Catalina.

Corporación para el Desarrollo Sostenible del Archipiélago de San Andrés, Providencia y Santa Catalina ([CORALINA)]. 2019. Diagnóstico actualizado del estado del recurso hídrico en cuanto a la cantidad y calidad. San Andrés Isla

DeMarrais, E.; Castillo, L. and Earle, T. 1996. Ideology, materialization, and power strategies. *Current Anthropology* 37(1): 15-31.

Departamento Administrativo Nacional de Estadística (DANE). 2018. Censo Nacional. www.dane.gov.co

Departamento Nacional de Planeación ([DNP)]. 1992. Plan para el Departamento de San Andrés, Providencia y Santa Catalina (Documento Consejo Nacional de Política Económica y Social -CONPES, 2594). Bogotá D.C.; Colombia.

Dhakal, N.; Salinas-Rodriguez, S.G.; Hamdani, J.; Abushaban, A.; Sawalha, H.; Schippers, J.C. and Kennedy, M.D. 2022. Is desalination a solution to freshwater scarcity in developing countries? *Membranes* 12: 381, https://doi.org/10.3390/

Dryzeck, J. 2013. *The politics of the Earth: Environmental discourses*. Third Edition. Oxford University Press.

El Isleño. 2017. Gobierno crea medidas para mitigar escasez de agua. Online newspaper. Facebook image.

El Tiempo. 1962. Turismo – La Intendencia acometerá obras para fomento turístico en 1962. Bogotá. 2 Enero 1962.

Escobar, A. 2005. Una ecología de la diferencia: Igualdad y conflicto en un mundo glocalizado. In Escobar, A. (Ed), *Más allá del tercer mundo. Globalización y diferencia*, pp. 123-144. Icanh/Universidad del Cauca. Bogotá, Colombia.

Feitelson, E. and Rosenthal, G. 2012. Desalination, space and power: The ramification of Israel's changing water geography. *Geoforum* 43: 2720284.

Feitelson, E. 2018. On the implications of seawater desalination: some insights from the Israeli case. In Williams, J. and Swyngedouw, E. (Eds), Tapping the oceans: Seawater desalination and the political ecology of water, pp. 60-76. London: Edward Elgar Publishing.

Fontes de Meira, L. and Bello, O. 2020. The use of technology and innovative approaches in disaster and risk management: A characterization of Caribbean countries' experiences, Studies and Perspectives series-ECLAC Subregional Headquarters for the Caribbean, No. 93 (LC/TS.2020/106-LC/CAR/TS.2020/3), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC).

Fragkou, M. 2018. Disclosing water inequalities at the household level under desalination water provision: The case of Antofagasta, Chile. In Williams, J. and Swyngedouw, E. (Eds), *Tapping the oceans: Seawater desalination and the political ecology of water,* pp. 76-97. Edward Elgar. Cheltenham, UK.

Frontera Azul. 2016. Protesta en los barrios de la isla de San Andrés. Online newspaper. Facebook image.

Giddens, A. 1990. *Consequences of modernity*. Cambridge, England: Polity Press.

Gilbert, J. 2017. Cuba's water crisis: Coping with water scarcity in Havana and Santiago de Cuba. Spectrum: Vol. 6: Iss. 1, Article 2. https://scholars.unh.edu/spectrum/vol6/iss1/2

Gobernación Archipiélago de San Andrés, Providencia y Santa Catalina. 2013. Plan Departamental de Gestión del Riesgo. Archipiélago de San Andrés, Providencia y Santa Catalina, http://gestiondelriesgo.gov.co/sigpad/pnud/Descarga.aspx?id

Gobernación Archipiélago de San Andrés, Providencia y Santa Catalina. 16 de Agosto de 2017. Declaración del final de la Calamidad Pública en el Departamento. [Decreto 0340 de 2017].

Gössling, S. 2001. The consequences of tourism for sustainable water use on a tropical island: Zanzibar, Tanzania. *Journal of Environmental Management* 61(2): 179-191.

Gutiérrez, Z. 2011. Diversidad de escenarios de riesgo y construcciones locales de (in)justicia hídrica en Bolivia. In Boelens, R.; Cremers, L. and Zwarteveen, M. (Eds), *Justicia Hídrica acumulación, conflicto y acción social*. Lima Instituto de Estudios Peruanos.

Head, B. 2014. Managing urban water crises: Adaptive policy responses to drought and flood in southeast Queensland, Australia. *Ecology and Society* 19(2).

Heartsill, T. 2012. Freshwater Resources in the Insular Caribbean: An Environmental Perspective. *Caribbean Studies,* 40(2): 63-93.

Herrera, A.; Senent-De, Frutos and Molina, E. 2022. Murky waters: the impact of privatizing water use on environmental degradation and the exclusion of local communities in the Caribbean. *International Journal of Water Resources Development* 38(1): 152-172, DOI: 10.1080/07900627.2021.1931052

Hophmayer, S. and Kadiman, T. 2008. Water management on islands – Common issues and possible actions. Conference paper. The Center for Clean Technology and Environmental Policy, University of Twente.

Household, City and Territory Ministry and National Unit for Disaster Risk Management. 2016. Convenio interadministrativo de cooperación y apoyo financiero. Convenio 9677-SAPII013-307-2016

Howard, S. 2015. Turismo sostenible en el Gran Caribe. Conferencia de Centro de Pensamiento del Gran Caribe. San Andrés islas.

Huff, A. and Mehta, L. 2019. Untangling scarcity. In Jonsson, F.A.; Brewer, J.; Fromer, N. and Trentmann, F. (Eds), *Scarcity in the modern world: History, politics, society and sustainability, 1800-2075*, pp. 27-46. London: Bloomsbury Academic. http://dx.doi.org/10.5040/9781350040946.ch-003

Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM). 2006. La sequía en Colombia: Documento técnico de respaldo a la información de la página web del IDEAM. IDEAM-METEO/004-2006 nota técnica del IDEAM.

Instituto de Hidrología, Meteorología y Estudios Ambientales [IDEAM]. 2016. Boletín informativo sobre el monitoreo de los Fenómenos de variabilidad climática "El Niño" y "La Niña". Boletín número 96.

Instituto de Hidrología, Meteorología y Estudios Ambientales [IDEAM]. 2006. La sequía en Colombia: Documento técnico de respaldo a la información de la página web del IDEAM. IDEAM-METEO/004-2006 nota técnica.

Instituto de Hidrología, Meteorología, y Estudios Ambientales. IDEAM. 2017. Tercera Comunicación Nacional de Colombia a la Convención Marco de las Naciones Unidas sobre Cambio Climático. Bogotá, http://documentacion.ideam.gov.co/cgi-bin/koha/opac-detail.pl?biblionumber=38208

Jessop, B. 2012. Narratives of crisis and crisis response: Perspectives from North and South. In Utting, P.; Razavi, S. and Varghese Buchholz, R. (Eds), *The global crisis and transformative social change.* Series International political economy series. Palgrave Macmillan.

Jones, E.; Qadir, M.; van Vliet, M.T.H.; Smakhtin, V. and Kang, S. 2019. The state of desalination and brine production: A global outlook. *Science of the Total Environment* 657: 1343-1356.

Kendra, J.; Knowles, S.G. and Wachtendorf, T. (Eds). 2019. *Disaster research and the second environmental crisis: Assessing the challenges ahead*. Series Environmental hazards. Springer. https://doi.org/10.1007/978-3-030-04691-0

King, T.J.; Ooi, D.; Cary, J.; Fisher, A.; Schibeci, R.; Murphy, K.; O'Toole, K.; Mearns, M. and Donaldson, J. 2012. Public perceptions of, and responses to, desalination in Australia: A report on findings. Working Paper No.39. Alfred Deakin Research Institute. https://hdl.handle.net/10536/DRO/DU:30051882

Land, M. and Aronson, J. 2020. Human rights and technology: New challenges for justice and accountability. *Annual Review of Law and Social Science* 16: 223-40, https://doi.org/10.1146/annurev-lawsocsci-060220-081955

Lopez, M. 2011. Water distribution as an indicator of social inequality, The case of Medellin, Colombia. www.desigualdades.net

March, H. 2015. The politic, geography, and economics of desalination: A critical review. *WIREs Water* 2: 231-243.

McDonald, A.; Clarke, M.; Boden, P. and Kay, D. 2010. Social justice and water. In Hester R. and Harrison R. (Eds), *Issues in environmental science and technology: Sustainable water*, pp. 93-113. RSC Publishing. https://doi.org/10.1039/9781849732253

McEvoy, J. 2015. Can the adoption of desalination technology lead to aquifer preservation? A case study of a sociotechnical water system in Baja California sur, Mexico. *Water* 7(10): 5224-5238, https://doi.org/10.3390/w7105224

Mehta, L. 2005. *The politics and poetics of water: The naturalisation of scarcity in western India*. Hyderabad, India: Orient Blackswan.

Menga, F. and Swyngedouw, E. 2018. States of water. In Menga, F. and Swyngedouw, E. (Eds), *Water, technology and the nation-state,* pp. 1-19. Series Earthscan studies in water resource management. Routledge, https://doi.org/10.4324/9781315192321

Missimer, T.M.; Danser, P.A.; Amy, G. and Pankratz, T. 2014. Water crisis: The metropolitan Atlanta, Georgia, regional water supply conflict. *Water Policy* 16(4): 669-689, https://doi.org/10.2166/wp.2014.131

Mohai, P. 2018. Environmental justice and the Flint water crisis. *Michigan Sociological Review* 32: 1-41

Neal, P.; Greco, F.; Connell, D. and Conrad, J. 2016. The social-environmental justice of groundwater governance. In Jakeman, A.J.; Barreteau, O.; Hunt, R.J.; Rinaudo, JD. and Ross, A. (Eds), *Integrated groundwater management*. Springer, Cham, https://doi.org/10.1007/978-3-319-23576-9_10

Nohrstedt, D.; Bynander, F.; Parker, C. and 't Hart, P. 2018. Managing crises collaboratively: Prospects and problems – A systematic literature review. *Perspectives on Public Management and Governance* 1(4): 257-271, https://doi.org/10.1093/ppmgov/gvx018

Noticiero popular de las islas. 2020. Protesta en la isla de San Andrés. Online newspaper. Facebook image.

Oliver-Smith, A. 2009. Anthropology and the political economy of disasters. In Jones, E.C. and Murphy, A.D. (Eds), *The political economy of hazards and disasters*, pp. 11-28. Lanham, Maryland: Rowman Altamira.

Ortiz Roca, F. 2016. Los derechos del pueblo raizal del archipiélago de San Andrés, Providencia y Santa Catalina, Colombia, Caribe Occidental en el marco del Convenio 169 de la OIT in Puyana, A (Ed) "*Consulta Previa y Modelos de Desarrollo: Juego de espejos.* (GIZ) GmbH; Proindígena-Colombia.

Parsons, J. 1985. *San Andrés y Providencia*. Bogotá: El Áncora Editores.

Peter, S. 2020. Worsening water crisis in the eastern Caribbean. *Eos* 101, https://doi.org/10.1029/2020EO147278, Published on 22 July 2020.

Proactiva. September 30, 2008. Sixth Amendment. Water agreement's between Proactiva y Aguas de San Andres, https://www.sanandres.gov.co/index.php/280-aguas-de-san-andres/5146-otrosi-6-cont-proactiva

Pursiainen, C. 2018. *The crisis management cycle*. Routledge.

Quarantelli, E.; Lagadec, P. and Boin, A. 2007. A heuristic approach to future disasters and crises: New, old, and in-between types. In Rodriguez, H.; Quarantelli, E. and Dynes, R. (Eds), *Handbook of disaster research*. Handbooks of Sociology and Social Research. Springer, New York, NY.

Quarantelli, E.L. 1993. Community crises: An exploratory comparison of the characteristics and consequences of disasters and riots. *Journal of Contingencies and Crisis Management* 1(2): 67-78.

Redclift, M. 1984. *Development and the environmental crisis: Red or green alternative*? London: Methuen.

Rodriguez, H.; Quarantelli, E. and Dynes R. (Eds). 2007. *Handbook of disaster research.* New York. Springer.

Rojas, M. and Guerrero, T. 2015. Diagnóstico actual del recurso hídrico subterráneo frente a la alerta de fenómeno del Niño para 2015. Reporte técnico, CORALINA.

Rosinger, A. 2018. Household water insecurity after a historic flood: Diarrhea and dehydration in the Bolivian Amazon. *Social Science and Medicine* 197: 192-202.

Roth, D.; Boelens, R. and Zwarteveen, M. 2005. *Liquid relations: Contested water rights and legal complexity*. New Brunswick, NJ and London: Rutgers University Press.

Roux-Dufort, C. 2016. Delving into the roots of crises: The genealogy of surprise. In Schwarz, A.; Seeger, M. and Auer, C. (Eds), *The handbook of international crisis communication research,* pp. 24-33. Hoboken, NJ: John Wiley and Sons.

Scheba, S. and Scheba, A. 2018. Desalination as emergency fix: Tracing the drought-desalination assemblage in South Africa. In Williams, J. and Swyngedouw, E. (Eds), Tapping the oceans: Seawater desalination and the political ecology of water, pp. 98-120. London: Edward Elgar Publishing.

Schlosberg, D. 2007. *Defining environmental justice: Theories, movements, and nature.* Oxford.

Secretaria de Turismo de San Andrés, 2020. Ingreso De Pasajeros A San Andrés Isla. https://www.datos.gov.co/en/Comercio-Industria-y-Turismo/Ingreso-de-pasajeros-a-San-Andr-s-Isla/xf6t-3jdr (accessed 17 February 2020)

Seemann, M. 2016. *Water security, justice and the politics of water rights in Peru and Bolivia*. Palgrave Macmillan. https://doi.org/10.1057/9781137545237

Shiva, V. 1991. *The violence of the Green Revolution: Third World agriculture, ecology, and politics*. London: Zed Books.

Soriano R.; Londe, L. de R.; Di Gregorio, L.T.; Coutinho, M.P. and Santos, L.B.L. 2016. Water crisis in São Paulo evaluated under the disaster's point of view. *Ambiente and Sociedade* 19(1): 21-42, https://doi.org/10.1590/1809-4422asoc150120r1v1912016

Stern, E. 2009. Crisis navigation: Lessons from history for the crisis manager in chief. *Governance* 22(2): 189-202.

Sultana, F. 2018. Water justice: Why it matters and how to achieve it. *Water International* 43(4): 483-493, https://doi.org/10.1080/02508060.2018.1458272

Tierney, K. 2006. Social inequality, hazards, and disasters. In Daniels, R.; Ketti D. and Kunreuther, H. (Eds), *On risk and disaster*, pp. 109-128. Philadelphia: University of Pennsylvania Press. https://doi-org.udel.idm.oclc.org/10.9783/9780812205473.109

Tierney, K. 2007. From the margins to the mainstream? Disaster research at the crossroads. *Annual Review of Sociology* 33(1): 503-526.

Tierney, K.J. 2019. *Disasters: A sociological approach*. Medford. MA.: Polity Press.

Tompkins, E.L.; Nicholson-Cole, S.A.; Hurlston, L.; Boyd, E.; Hodge, G.; Clarke, J.; Trotz, N. and Varlack, L. 2005. *Surviving climate change in small islands: A guidebook.* Tyndall Centre for Climate Change Research, UK.

Tubi, A. and Williams, J. 2020. Beyond binary outcomes in climate adaptation: The illustrative case of desalination. *WIREs Clim Change*. 2020; e695, https://doi.org/10.1002/wcc.695

Tundisi, J. 2008. Water resources in the future: Problems and solutions. *Estudos Avançados* 22(63): 7-16, https://doi.org/10.1590/S0103-40142008000200002

Ullberg, S. 2017. La contribución de la antropología al estudio de crisis y desastres en América Latina. *Iberoamericana – Nordic Journal of Latin American and Caribbean Studies* 46(1): 1-5, https://doi.org/10.16993/iberoamericana.102

Ulloa, A.; Damonte, G.; Quiroga, C. and Navarro, D. 2020. Gobernanzas plurales del agua: Formas diversas de concepción, relación, accesos, manejos y derechos del agua en contextos de gran minería en Colombia y el Perú. Lima: Documentos de Investigación, 103.

UNAL, Universidad Nacional de Colombia. 2010. *Modelacion del acuifero de San Andrés islas bajo escenarios de Cambio Climatico y usos del recurso* [Informe final]. Universidad Nacional de Colombia, San Andrés isla.

Vanderwarker, A. 2012. Water and environmental justice. In Christian-Smith, J.; Gleick, P.H. and Cooley, H. (Eds), *A twenty-first century US water policy,* pp. 52-89. Oxford: Oxford University Press.

Velásquez, C. 2018. Making sense of 2016 water crisis in San Andres. A Colombian Caribbean Island. *Anais Brasileiros de Estudos Turísticos-ABET* 8(3): 59-73.

Velásquez, C. 2020a. Surrounded by water but none to drink: Water crisis in San Andres, a Columbian Caribbean island. PhD Thesis, University of Delaware, Newark, US.

Velásquez, C. 2020b. The 2016 Water crisis in San Andrés Island: An opportunity for change? *Ciencia Política* 15(29): 73-109.

Vigh, H. 2008. Crisis and chronicity: Anthropological perspectives on continuous conflict and decline. *Ethnos* 73(1): 5-24, https://doi.org/10.1080/00141840801927509

Vojinović, Z. and Abbott, M.B. 2012. *Flood risk and social justice: From quantitative to qualitative flood risk assessment and mitigation* (Ser. Urban hydroinformatics series). IWA Publishing.

Wachtendorf, T. 2017. Disasters and society, theoretical approaches [Power point presentation]. Disaster and Society class 667-011.

Wilhite, D. 2000. Drought as a natural hazard: Concepts and definitions. Chapter one, in Wilhite, D.A. (Ed), *Drought: A global assessment*. Natural Hazards and Disasters Series, Routledge Publishers, U.K.

Wilhite, D. and Pulwarty, R.S. (Eds). 2017. *Drought and water crises: Integrating science, management, and policy.* Second edition. CRC Press LLC.

Williams, A. 2016. On the right: no easy solution to water crisis. Nationnews, https://www.nationnews.com/nationnews/news/81479/-easy-solution-water-crisis

Williams, J. 2022. Desalination in the 21st century: A critical review of trends and debates. *Water Alternatives* 15(2): 193-217.

Williams, J. and Swyngedouw, E. 2018. Mobilising the oceans to quench our thirst. In Williams, J. and Swyngedouw, E. (Eds), *Tapping the oceans: Seawater desalination and the political ecology of water*, pp. 98-120. London: Edward Elgar Publishing.

Williams, T.; Gruber, D.; Sutcliffe, K.; Shepherd, D. and Zhao, E. 2017. Organizational response to adversity: Fusing crisis management and resilience research streams. *Academy of Management Annals* 11(2): 733-769.

Wolbers, J. and Boersma, K. 2019. Key challenges in crisis management. In Gephart, J.; Miller, C. and Helgesson, S. (Eds), *The Routledge companion to risk, crisis and emergency management,* pp. 17-34. Routlege companion essay, Taylor and Francis.

World Economic Forum. The Global Risks Report 2023. 18th edition. https://www.weforum.org/reports/global-risks-report-2023/

Wutich, A.; Brewis, A.; York, A. and Stotts, R. 2013. Rules, norms, and injustice: A cross-cultural study of perceptions of justice in water institutions. *Society and Natural Resources* 26(7): 795-809.

Wutich, A.; Beresford, M.; Montoya, T.; Radonic, L. and Workman, C. 2022. Water security and scarcity. *Oxford Research Encyclopedia of Anthropology*, https://oxfordre.com/anthropology/view/10.1093/acrefore/9780190854584.001.0001/acrefore-9780190854584-e-475

Wutich, A.; York, A.M.; Brewis, A.; Stotts, R. and Roberts, C.M. 2012. Shared cultural norms for justice in water institutions: Results from Fiji, Ecuador, Paraguay, New Zealand, and the U.S. *Journal of Environmental Management* 113: 370-376, https://doi.org/10.1016/j.jenvman.2012.09.010

Zwarteveen, M. and Boelens, R. 2014. Defining, researching and struggling for water justice: Some conceptual building blocks for research and action. *Water International* 39(2): 143-58.

Zwarteveen, M. and Boelens, R. 2011. La investigación interdisciplinaria referente a la temática de «justicia hídrica»: unas aproximaciones conceptuales. In Boelens, R.; Cremers, L. and Zwarteveen, M. (Eds), *Justicia hídrica: acumulación, conflicto y acción social*. Lima Instituto de Estudios Peruanos.