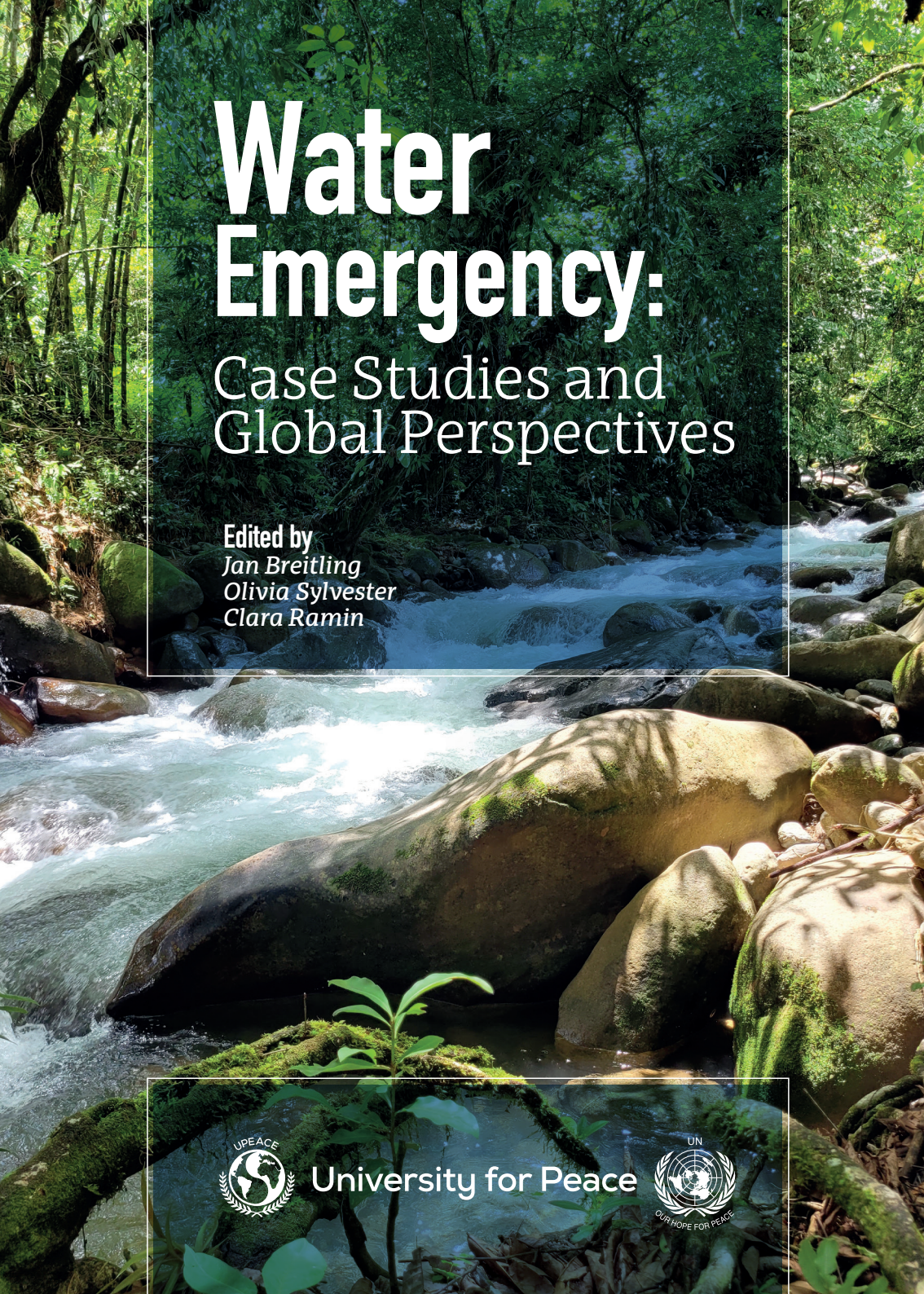

Water Emergency:

Case Studies and Global Perspectives

Edited by
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Water Emergency: Case Studies and Global Perspectives

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Foreword

It is a distinct pleasure to introduce this book. Unfortunately, "Water Emergency" has never been a more appropriate or timely phrase. The summer of 2023 has broken air temperature records and has seen devastating wildfires, floods, and storms around the world. Water – too much or too little – underpins all of these extreme events, driven by the increased solar energy in our global system as a result of industrialisation.

The chapters contained in this book are diverse; diverse with respect to the regions of focus, the water challenges described, and the disciplines and countries that the authors represent. However, the combined message is clear. Changing water quantities and quality are affecting our ways of life, our health, our connections to place, urban function, food security, and national security.

I invite you to travel through this book, reflecting on what water looks like where you live, work, and play. Think about the first peoples of the land that you call home. Think about the responsibilities that we have to our water and our environment as we claim the inherent rights we have to health, water, and peace. Above all, reflect on those who are unable to claim these rights or who have had these rights taken away from them.

As you do read through the different chapters, you will learn about Costa Rica – home to the University for Peace – a tropical country with seemingly abundant water supplies that mask local and regional water stresses and recent conflicts due to a mismatch of watersheds either having high volumes of surface and groundwater or high water demand (Breitling and Wiley; Chapter 1). Throughout the country, these are resulting in increasingly frequent water cuts in towns and cities during the dry season. Part of the reason for this is the almost doubling of water used for agricultural production in the country, which now accounts for 68% of water resources use (Ramin and Sylvester; Chapter 2). As the second largest pineapple exporter globally, this increase in water use for agriculture is a result of the growth of

industrial farms in Costa Rica, which have also led to significant water quality deterioration. While industrial farming contributes to the economy (30% of GDP), it also results in complex adverse socio-cultural impacts in the regions where these plantations have been established.

Several case studies of water insecurity in North America focus on the critical intersection between politics, water, and national security (González Hernández; Chapter 3), how water (in)security manifests in urban centres (Kolen; Chapter 4) and dispute resolution (Wiley; Chapter 5). The presence of water has shaped the location and growth of settlements over time. Its essentiality for life means that power accrues to those who ultimately control it (González Hernández; Chapter 3). In the geostrategic region that falls under the interest of the United States, national security is tied to imperialism over water supplies, not just for human and economic needs, but also with respect to navigability of waterways. This power differential is especially apparent when water crosses political boundaries. Regardless of whether transboundary watersheds exist within or between nation states, climate change is affecting water quantities and exacerbating declining water qualities that result in significant upstream-downstream tensions. The Colorado River is exemplified in this respect (Wiley; Chapter 5) as a river approaching a water emergency. In part, this is due to quantified versus proportional apportionment of flows and the resulting overallocation of water, particularly during drought periods. Consequently, effective conflict resolution mechanisms are becoming more and more important, with lessons learned possibly applicable to other watersheds facing similar challenges.

The city of Calgary in western Canada continues to experience rapid growth, in part due to the oil and gas industries. However, its dependence on snow and glacier melt from the nearby Rocky Mountains leaves it susceptible to droughts and associated wildfires (Kolen; Chapter 4). Perhaps prescient of what was to come (Calgary was subject to mandatory water restriction this summer that lasted from August 15th to October 31st), the chapter examines the drivers and potential consequences of water scarcity in this major city.

Given the differential vulnerabilities that are inextricably tied to colonialism in many nation states, the review of impacts of persistent organic pollutants (in this case PFAS) on Aboriginal ties to the land and water is particularly important (Strachan; Chapter 6). While focused on Wreck Bay in Australia, recommendations for governments to recognize the importance of lands and waters to Indigenous ecocentric worldviews and the need for culturally appropriate and participatory remediation to legacy contaminants are applicable far beyond the chapter context.

Finally, flood risk in the low-lying Netherlands (Zeijlmans; Chapter 7), represents a unique risk to its population. This chapter explores the ways in which the Dutch Water Authorities have adapted to the threat of climate change to extreme water-related events through a transition to water as a public good, a democratization of water authorities, and increased collaboration with other sectors, including municipalities.

Ultimately, none of us are able to live without water, yet water also has the power to take life. The climate crisis is a water crisis, and the only solutions are ones that move us to equitable and sustainable management of water for all. Reliable access to appropriate water underpins climate resilience, pandemic preparedness, and peace and justice. As this book presents, there are warning signs but there are also paths forward and people with the courage and tools to act.

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Chapter 1

Scarcity in the land of plenty? Exploring water governance in Costa Rica

Jan Breitling and Caitlin Wiley

Keywords: water governance, access to water, water availability and distribution, Costa Rica

Introduction

Costa Rica is a rich country in terms of total water availability. The relatively small Central American nation contains 34 main watersheds which provide a total estimated freshwater flow of 113.1 km^3 per year, 73 km^3 in the form of surface water and 40 km^3 from underground aquifer recharge (Ballestero & Zelédon, 2016). Per capita, Costa Rica is therefore relatively well off with an annual average of 23,405 m^3 of freshwater per person (Ballestero & Zelédon, 2016). The current level of water withdrawals indicate that Costa Rica has not over-allocated its water resources (OECD, 2015) and is not experiencing significant water stress as the population uses only 5% of total available freshwater (UN Water, 2020).

Despite the abundant amount of water at the national level, water stress at regional and local levels seems to be an issue, especially during the dry season, as water cuts in the urban centers of the Central Valley are common and increasingly frequent. Water resources are not evenly distributed geographically, and basins with high water availability often do not match areas with high water demand. For instance, some regions with marked dry seasons like the northwestern province of Guanacaste (Angulo, 2022) and parts of the western Central Valley around San José have experienced water cuts in recent years and will possibly experience more severe water stress due to climate change in the future (Stan et al., 2022).

Additionally, water is unevenly distributed between different water users. Agriculture, hydroelectricity production, tourism, real estate development, and other types of industry compete for water, as well as with the general population's demand for potable water. During the last two decades, conflict between different water users has arisen in some regions. This has occasionally led to violent clashes at the community level. For instance, in the province of Guanacaste, the growing demand for water of the ever-expanding coastal tourism sector has affected the perceived (if not the actual) availability of water for local communities, such as Sardinal (Angulo, 2022; Esquivel, 2017). As a result of this tension, Sardinal community members organized and resisted a planned water infrastructure project to supply the coastal region of Coco beach and Ocotal in 2008 and 2009 (Navas y Cuvi, 2015). This is the most visibly violent conflict between state and local communities over water in the country to date, however it is not the only conflict. Another conflict over water erupted in Atenas and Grecia counties in the province of Alajuela in 2014, as described and analyzed by Castillo-Leandro and León-Álvarez (2022). Similarly, as discussed in Chapter 2 of this volume, communities in the southern Pacific part of Costa Rica have also had to compete with industrial agriculture for water. In May 2022, community members from Hatillo district within San José Province set up roadblocks to protest on one of the province's major highways (Alvarado, 2022). During the week of May 2 through May 8, 2022, over 300,000 people across several counties in San José Province were expected to be affected by water cuts. The south of Costa Rica's capital had been under water stress for at least two years, with the state agency in charge of delivering potable water to every household throughout the country, the Costa Rican Institute of Aqueducts and Sewers (AyA), not able to provide the service. This is a serious problem at any given time, but obviously much more severe during the height of the COIVD pandemic.

This chapter explores potential reasons for this apparent paradox: why is a country with so much available surface and groundwater facing water stress in certain regions at certain times of the year? As such, it begins by reviewing the data and literature around the general state of water availability and distribution

within the country. Second, it presents a brief overview of the major laws and institutions governing water, its ownership and use, and a short analysis of the major actors in water provision, distribution, and quality control. Third, it looks at how and from where Costa Ricans receive their drinking water. Fourth, it presents an analysis and discussion on the possible reasons for water stress, institutional issues, and impending consequences of inaction. This chapter concludes with some specific suggestions for improvements to the governance structure. In particular, the Costa Rican legislative assembly should pass an updated water law which provides expanded protections for groundwater resources and should consolidate administrative responsibility for water management.

Literature review

This literature review combines information from academic and nonacademic resources. The first part briefly looks at the topic of water availability, distribution, and quality, while the second focusses on the legal and institutional framework of water governance in Costa Rica.

According to the State of the Nation report in 2022, Costa Rica reached its highest overall national coverage of potable water, an impressive 95.7%, in 2021 (Estado de la Nación, 2022). Nevertheless, challenges remain throughout the country regarding pollution, quality, and quantity of water. The same report also paints a complicated picture in terms of water provision, especially in the greater metropolitan area of the central valley and the coastal zones, due to water availability issues in the national aqueduct along with missing or failing infrastructure (Estado de la Nación, 2022, p.199).

Besides water quantity, water quality is proving to be a major issue. Even though national statistics draw a rather positive picture, as discussed above, cases of water contamination and poor-quality drinking water are becoming more common. Two very recent cases in the provinces of San José and Cartago exemplify this problem. In September 2023, the county of Alajuelita in the south of San José was affected by contaminated drinking water

and a simultaneous outbreak of diarrhea, as reported by the Costa Rican Social Security Agency and AyA. The AyA concluded that the quality of the water source associated with the illnesses was not apt for human consumption, but clarified later that there was no direct link between the contamination and the outbreak (Madrigal, 2023). Another example came from the province of Cartago, where the high use of pesticides linked to agricultural production is well known. At least five drinking water sources in Cartago were contaminated with chlorothalonil, a fungicide used in the region which has been strongly linked to health problems and environmental harm (Hidalgo, 2023b). These examples showcase the increasing visibility of not only water quantity problems, but also water quality issues in a country that should have more than enough water to meet its citizens' needs.

The Costa Rican constitution of 1949 does not explicitly recognize a right to drinking water or sanitation. However, Article 21 of the constitution guarantees the human right to life, and Article 50 guarantees the right to a healthy natural environment; both of these rights have been used to justify a human right to drinking water and sanitation in the country (de Albuquerque, 2009). The first national water law introduced in 1884 established surface water as a public good but considered groundwater to be a private resource owned by individual landholders (Cuadrado-Quesada et al., 2018, p. 480). In 1942, the Costa Rican legislative assembly passed an updated water law which declared that all surface and groundwater sources would instead be publicly owned. This law included specific provisions for how landowners could collect rainwater that falls on their land and make use of groundwater resources through opening wells under a concession system (Cuadrado-Quesada et al., 2018, p. 480). This is the water law that is still in effect in Costa Rica.

The provisions of the 1942 water law were expanded in 1953 with the General Law of Potable Water, which established the responsibility of the state and individual municipalities to provide public drinking water. For that purpose, the AyA was created through additional legislation in 1961 with a mandate to deliver drinking water and wastewater services to the Costa Rican public. The AyA was also given the authority to review and

approve all projects and proposed service fees for both public and private service delivery. According to other authors, there are over 20 government agencies that have responsibilities in the water sector, many of which have overlapping functions (Alburquerque, 2009; Bower 2014). Since all surface and groundwater within the country is publicly owned in accordance with the 1942 water law, the role of government agencies in delivering water to Costa Rican citizens is crucial. In this chapter, we focus on the main three state agencies responsible for water governance: the Ministry of Environment and Energy (MINAE), the Ministry of Health, and the AyA.

MINAE is the leading agency within the water sector, with a wide-ranging mandate to oversee the development of the country's water resources. Within MINAE, the Dirección de Agua is responsible for approving permits for industrial water uses, such as for hydroelectric and agricultural purposes, and for human consumption (Morataya-Montenegro & Bautista-Solís, 2020). The Ministry of Health sets standards for drinking water quality and deals with public health issues such as water-borne illnesses and pollution. It is also tasked with monitoring drinking water quality, and ensuring that wastewater treatment systems comply with regulations. The AyA is the major state agency directly responsible for planning, financing, and operating drinking water and sanitation infrastructure. The AyA also further delegates responsibility for maintaining water infrastructure to municipalities or semiprivate companies, such as the Empresa de Servicios Públicos de Heredia (ESPH) [Company for Public Services of Heredia]. In the rural areas, the AyA delegates responsibility for drinking water infrastructure to non-profit community associations known as Administrative Associations of the Systems of Aqueducts and Sewers (ASADA) Rural Water and Sewage Committees (CAAR), or Administrative Committees of Rural Aqueducts (ASANA). CAARs differ from ASADAs in that they are "less organized committees missing delegation agreement with AyA" (Morataya-Montenegro & Bautista-Solís, 2020, p. 92). The AyA usually manages administration of aqueducts in larger cities and relies on ASADAs and CAARs to oversee water resources in rural communities for cost-saving reasons (Morataya-Montenegro & Bautista-Solís, 2020, p. 92).

Finally, two autonomous state agencies have a critical role to play in assuring the technical criteria in decision making regarding water resources outside of the political agendas of any given government in Costa Rica. First, the Regulatory Authority for Public Services (ARESEP). ARESEP is the agency responsible for setting water quality inspection standards and the fees that the AyA and other water providers can charge (ARESEP, 2023). Second, the National Service of Subterranean Waters, Irrigation and Drainage (SENARA). By law, SENARA must provide research and protection of water resources, both surface and underground, and works as the scientific counterweight to the decisions made by MINAE.

The Costa Rican General Assembly has been reviewing proposals for a new water law for several years. In 2023, it approved a framework for a new law that that includes many of the changes necessary to modernize Costa Rican water management. However, it has also drawn criticism from some stakeholders and experts who see the overly anthropocentric language of the law as problematic, and fear that the new law would weaken or eliminate autonomous institutions like SENARA and ARESEP. The first criticism about the law's focus on human uses of water is linked to the wording of the law, which does not recognize how important limiting the surface water extraction is to maintain functioning ecosystems. Portilla Pastor (2020) discusses how the "caudal ambiental" or environmental or ecological flow (the sufficient water flow required for non-human species and the proper functioning of ecosystems), is an absolute limit that needs to be respected to preserve environmental wellbeing and sustainability. The second criticism is focused on what Arias Obregon (2023) describes as the intention of concentrating power with the Minister of Environment, and decreasing or eliminating the power of autonomous state institutions and community organizations. This would prompt a move towards the politicization of decision-making processes that should be technical and scientific, as they are today under SENARA. Additionally, the author claims this new law would eliminate any dialogue and communal voices, decreasing public participation in decision-making processes that affect them directly (Arias Obregon, 2023).

Methods

The research for this chapter was based on a literature review, document analysis and the review of Costa Rican online news outlets. As such, the authors began with a review of academic peer reviewed articles in English and Spanish journals on general topics or issues, and then went on to review several Costa Rican laws and relevant documents published by civil society organizations, technical and policy documents from different state agencies, as well as newspapers and other news outlets on water infrastructure, water scarcity and conflicts, and public policy in Costa Rica. Both authors have a keen interest in the broader topics of natural resource management and governance, water governance and water security. One of them is permanent resident since 1988 and the other spent 6 months as a master's student in Costa Rica.

The following Findings and Discussion section is structured around the following four key questions: 1) What is the recent situation on the provision of water, specifically in the greater metropolitan area of the Central Valley? 2) What are the different sources of drinking water at different spatial scales and what are the main challenges in both urban and rural settings? 3) Is the Costa Rican water provision system centralized or decentralized? Completely public, completely private, or a hybrid system? 4) What are potential gaps in the Costa Rican governance structure regulating drinking water access?

Findings and Discussion

Regarding the topic of recent and current problems around the provision of potable water in the Central Valley, one study performed by ARESEP determined that about 58% of the aqueducts in this region suffered from problems related to water availability. As a result, approximately 590,000 people had trouble accessing potable water during the 2020 dry season (ARESEP, 2021, cited by Estado de la Nacion, 2022, p. 199). This study also found that around 66% of the national aqueducts were suffering from some form of water scarcity in the sources of water supply, while 34% exhibited some level of water stress, which

means they had less water than necessary to supply the demand of their target populations. Additionally, some systems suffered from overall water availability, meaning they could not sustain any type of increase in water demand (Estado de la Nacion, 2022, p. 199).

In early October 2023, community members from Guadalupe, one of the main districts and the head city of Goicochea County in the central San José Province took to the streets to strike against AyA over drinking water shortages. The AyA met with community representatives and explained that the water cuts were caused by heavy rainfall and a consequent flooding of the river that supplies the water plant for Guadalupe, which damaged the local aqueduct infrastructure (Hidalgo 2023a).

Additionally, an analysis carried out by the Foundation for the Development of the Central Volcanic Mountain Range (FUNDECOR) and the International Union for the Conservation of Nature (IUCN) for the organization LandScale in 2021 verified that several factors contributed to regional and local water stress and potential problems of future water supply throughout the country. Among the principal issues identified were ongoing population growth and the absence of land-use planning, which included the lack of urban planning and resulting uncontrolled urbanization. Similarly, past, and present land-use change, from deforestation to urban sprawl into agricultural lands, have favored the degradation of water sources in the northern sub-basin of San José, turning it into the area with the highest level of water stress in Costa Rica (UICN & FUNDECOR/Aguatica, 2021).

The above-mentioned NGO FUNDECOR has been a key player in pushing forward the need to recognize ecosystem services on private forest lands throughout Costa Rica. Additionally, this initiative is part of a broader framework known as Agua Tica, the first public-private fund specifically created for water. Among their many activities, FUNDECOR has been successful in entering a formal agreement with Intel-Costa Rica. The Intel Water Restoration Project started its formal implementation in

2021 with the goal to protect 150 hectares of forest, thus mitigating Intel's water consumption by restoring over 183,000 m^3 annually as a direct result of forest conservation in areas with high capacity for water recharge. This specific project has succeeded in getting private landowners to protect existing forested areas and work to increase forest cover with the aim of guaranteeing water recharge over the length of the project. Protecting forest cover effectively prevents soil erosion and surface runoff. Landowners receive annual payments for their hectares in the project area (Carmona, et al 2023).

Costa Rican inhabitants rely on different sources of drinking water according to where they live within the country, e.g. proximity to urban centers, rural versus urban, etc. In 2021, the Costa Rican population included 5,163,000 inhabitants, according to official data published by the AyA in their Anuario Estadístico (Annual Statistics) report (AyA, 2021). The report further elaborates that 97.8% of the population has access to piped water in their homes, with only 1.9% relying on an outdoor water source and 0.3% relying directly on wells or springs for water (p. 24). The AyA also found in the same report that 95.7% of the population has access to potable water (p. 24). In terms of water treatment, 88.3% receive drinking water that has been disinfected or treated and 75.8% receive drinking water that has been subjected to quality control testing (p. 38).

Regarding what specific sources the population relied on for their drinking water in 2021, the official numbers included in the report are as follows (p. 18):

- AyA aqueducts: 2,818,000 (55%)
- Communal aqueducts (ASADAS or CAARS): 1,122,000 (22%)
- Municipal aqueducts: 761,000 (15%)
- Company or cooperative: 239,000 (5%)
- Wells: 117,000 (2%)
- River, stream, or spring: 106,000 (2%)
- Other source (ex: rain, cistern, water hydrant): 0 (0%)

There is also a marked divide in terms of where residents from urban and rural areas source their drinking water. Of the urban population of the country (estimated at 3,743,000 residents), 63.3% receive their drinking water from AyA-managed aqueducts. This contrasts with the rural population, of which only 31.6% are covered by the AyA, and 49% receive drinking water from communal aqueducts management by local ASADAs or CAARS.

In terms of whether the Costa Rican drinking water system is centralized or decentralized, the authors found that the system is indeed highly centralized and mostly public. It is centralized in the sense that all water is owned by the state, and officially under the purview of MINAE, the AyA, the Dirección de Agua, and several other state agencies, like SENARA and ARESEP. The AyA has ultimate responsibility for water delivery systems, and the Dirección de Agua makes water concessions. In the past, stakeholders have made efforts to decentralize the management of specific river basins with the formation of river basin organizations such as the Comisión de la Cuenca del Río Grande de Tárcoles [Commission for the Río Grande de Tárcoles Basin] (Blomquist et al., 2007), but the drinking water provision system remains highly centralized.

The system is mostly public as approximately 92% of the population receive water from a state managed aqueduct, whether overseen by the AyA, a local community group, or a municipal government (AyA, 2021, p. 18). It is not completely public as the AyA has delegated responsibility to some semiprivate companies, which serve about 5% of the population (AyA, 2021, p. 18). The remaining portion source their drinking water from a well or surface water.

On the topic of the main institutional challenges to the Costa Rican governance structure regulating drinking water access, the legal framework governing water in Costa Rica has increasingly come under scrutiny in the past two decades. Critiques have focused on three main institutional problems: 1) the antiquated 1942 water law; 2) the fragmented legal framework around water; and 3) the resulting institutional overlap, which causes inefficiency.

The first institutional problem refers to the fact that the 1942 Costa Rican water law is still in effect after more than 80 years, even though the National Assembly is currently discussing the adoption of the new framework for hydrological services. During that time, Costa Rica has changed dramatically, evolving from a small, mostly rural country to a mid-sized, largely urban one. Not only has Costa Rica evolved, but so have the best practices of water governance, with new ideas such as Integrated Water Resource Management (IWRM) gaining traction. The original water law focuses mostly on surface water, ignoring the fact that most of Costa Rica's water for human consumption comes from groundwater sources. There is general agreement that the current law needs a revision to address Costa Rica's modern water resource challenges (de Albuquerque, 2009; Valverde, 2013; Bower, 2014; Cuadrado-Quesada et al., 2018).

The second institutional problem is the fragmented legal system around water. As the 1942 water law is not comprehensive, there are now more than 30 different laws that regulate various uses of water, many of which are outdated and confusing (Guzman-Aries & Calvo-Alvarado, 2013). Because the 1942 water law also does not provide sufficient legal protection for groundwater, Cuadrado-Quesada et al. (2018) argue that Costa Rica has instead relied on a patchwork of many different environmental regulations to conserve this valuable resource (p. 477). The AyA itself cites many different pieces of environmental legislation aimed at forming part of its legal mandate in the opening pages of its Anuario Estadístico (AyA, 2021; p. 5). Streamlining these various legal protections around water under one integrated, improved water law should be a high priority, along with ensuring that water is allocated for both human consumption and ecological and environmental necessities.

The third institutional problem is the fragmented water administration system. There seems to be a significant amount of institutional overlap between the various government agencies tasked with administering water laws. There are more than 20 different government agencies with equities in the water sector (Bower, 2014) and despite sharing similar functions, the agencies frequently fail to coordinate with one another (Blomquist et al.,

2007; de Albuquerque, 2009). Drilling a well, for example, might require separate approvals from the SENARA, the MINAE, and the AyA to ensure full legal compliance (Guzman-Aries & Calvo-Alvarado, 2013). This overlap in responsibilities slows down new projects as there is frequent confusion over which agencies have jurisdiction.

Matters are further complicated because some agencies responsible for compliance "…do not have sufficient human, technical and financial resources to carry out their monitoring functions effectively" (de Albuquerque, 2009, p. 2). As such, in examining the implementation of groundwater governance in several areas of Costa Rica, Cuadrado-Quesada et al. (2018) found that a lack of personnel and inadequate financing to monitor environmental regulations were serious barriers (p. 486). Blomquist et al. (2007) suggest that this administrative fragmentation has developed over time because water in Costa Rica is managed based on its intended use, e.g., agricultural, domestic, industrial, and that a separate federal agency was created to manage each intended use category (p. 165). This weakened legal and administrative water governance system has likely endured for so long because of Costa Rica's high level of water availability historically (Guzman-Aries & Calvo-Alvarado, 2013) and the subsequent cultural view of water as a free, plentiful resource (Blomquist et al., 2007).

Institutional overlap can be tolerated when there is more than enough water to supply demand, and there has been little incentive for the government to focus on making the water provisioning system more efficient when water is perceived to be readily available. However, as the above-mentioned recent events have demonstrated, and as water availability will probably shift in the future due to population growth, climate change, or shifting water use patterns, the Costa Rican state will need to ensure that the system in place to manage water functions as efficiently as possible. Along with streamlining the laws governing water in Costa Rica, the state should also conduct a comprehensive review of the agencies tasked with water administration to consolidate them. However, in doing so the state should ensure that technical and scientific decision-making are effectively insulated from the political process so as to keep the governance of water out of

political spheres. Decentralizing control of water resources will facilitate this separation. As recent research has shown, the era of centralized water governance is increasingly being challenged. Decentralized, community-based, adaptive water management systems are promising alternatives that empower local actors to make decisions best suited to their unique contexts (Tsegaye et al., 2020; Wutich et al., 2023).

Conclusion

While Costa Rica has so far largely avoided the worst impacts of droughts and climate change on its water availability due to the country's abundant water resources, these cannot be counted on indefinitely. The existing legal framework and administrative system around water is complex, complicated, messy, and, frankly, outdated. Costa Rica's water governance faces serious challenges, including the recent lack of water access in several parts of the central valley, the outdated 1942 water law, the fragmented legal framework around water, and the institutional overlap causing administrative inefficiency and unclear responsibilities. To effectively face present and future challenges, and to protect both surface and groundwaters, the Costa Rican government and state institutions need to address these legal and institutional issues. They should do so sooner, rather than later, before the situation becomes urgent.

The first action should be to pass a new, updated water law. This new law should explicitly recognize the human right to water and sanitation and enshrine water for domestic consumption as the highest priority. Along with the recognition of domestic consumption, the law should also recognize the fundamental necessity of limiting extraction of surface waters so as to avoid negatively impacting ecosystems. It would also be helpful to integrate the disparate legal provisions around water currently scattered in various laws into one integrated, streamlined law to make implementation of the legal protections easier. A new law would further need to recognize the challenges facing both surface water *and* groundwater, and to incorporate modern best practices for each. Drafting and passing an updated water law will require extensive stakeholder participation, and the government

and state institutions should also seek expert perspectives from international organizations and academics investigating effective water governance during this process.

After passing a new, more holistic water law, the government and state institutions and organizations should then turn their attention to the various agencies currently responsible for water resource management and better define the roles and responsibilities of these agencies; to do so, an organizational review is needed to identify all the agencies with responsibilities in the water sector, and areas of institutional overlap, so they can be streamlined in an integrated but decentralized water resource administration. The new administration should concentrate expertise, financial resources, and personnel under one decentralized entity. An overall objective of this new, streamlined water management system should be to provide sustainable water access to human and non-human systems and species. It is fundamental that the latter must be done in a decentralized way. This could be done by creating offices of a water administration body in each province, like the conservation areas of the National System of Conservation Areas (SINAC), and similar to the experiences the country has gained through the ASADA system. A well organized and well-funded, decentralized water governance system would work to assure the fair and just governance and distribution of water resources, respecting the needs of human and non-human species in individual provinces, counties, or localities throughout the country.

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Chapter 2

Water and industrial agriculture: A case study of pineapple in Buenos Aires, Costa Rica

Clara Ramin and Olivia Sylvester

Keywords: Del Monte, pesticides, smallholder farmers, social movements, water access, corporate power

Introduction

El agua y el río es de todos, pero no todos lo tratamos con el mismo cariño. Hay gente quienes ven en los ríos solo una forma más de enriquecerse y sacar provecho mientras para otros, el río lo es todo: vida, sangre y refugio.

The water and the river belong to everyone, but not all of us treat it with the same affection. There are people who see rivers as just another way to get rich and take advantage of them, while for others, the river is everything: life, blood and shelter.

Doña Digna Rivera, February 26th, 2022,
in the commemoration activities of her son Jehry Rivera

Most of the world's freshwater is used in farming. On average, irrigation in agriculture uses 70% of global freshwater; this number can reach up to 95% in some countries (Huang et al., 2019; The World Bank, 2022). Moreover, these numbers are expected to increase, due to the climate crisis and land use changes (Huang et al., 2019).

Among Central American countries, Costa Rica has the highest water demand, as a country and per capita (Water Action Hub, n.d.). In Costa Rica, the agricultural sector is the main consumer of water resources with a share of 68.6% of water abstractions. Between 2000 and 2018 the percentage of water abstractions

in agriculture have more than doubled - from 33.1 to 68.6% (OECD, 2020). According to an OECD Country Note Study on Agriculture and Water Policies in Costa Rica (n.d.), the increase in water abstractions is one of the main challenges related to water in agriculture. Additionally, water quality is a growing concern (OECD, n.d.). Specifically, Costa Rica experiences contamination of aquifers, rivers, and streams due to industrial effluents, untreated wastewater, and pesticide contamination from industrial agriculture (Echeverría-Sáenz et al., 2012; OECD, 2020; Reynolds-Vargas & Richter, 1995). Additionally, 40% of the pollution of surface water is associated with the agricultural sector (Water Action Hub, n.d.).

One important agricultural product in Costa Rica is pineapple. Specifically, Costa Rica is one of the largest exporters of pineapple in the world, and it meets this demand via industrial farming (Procomer, 2023). Pineapple makes up for 30% of the agricultural GDP (O'Neal Coto, 2018), and Costa Rican pineapples cover around 84% of the international agricultural trade (Oxfam, 2018).

In Costa Rica, the growth of pineapple farming has negatively impacted human communities, ecosystems, and watersheds surrounding and downstream from plantations (Brown Varela, n.d.). For instance, in the Río Jiménez watershed in the Caribbean Coast, pineapple plantations and their associated pesticides were related to the death of macroinvertebrates as well as defective brain and liver function in fish (Echeverría-Sáenz et al., 2012). In 2017, communities in the Río Cuarto County presented a legal case against a pineapple company called ANEXO, because these industrial plantations had destroyed their aquifer and encroached on protected wetlands (Chinchilla, 2017). The negative impacts and human rights violations that industrial pineapple farming poses for human and natural communities has resulted in national protests and the creation of organizations against pineapple expansion (Chacón, 2017). Especially in the context of water, social-environmental conflicts and civil mobilization regarding pineapple have gained great visibility during the past two decades (Gutiérrez, 2019).

This chapter examines the social-ecological and political complexities of water in the context of industrial agriculture. We

specifically focus on the county of Buenos Aires in the south of Costa Rica. This county is one of the larger-scale pineapple area in the country; it is also the area where the mechanization of Hawaiian-style cultivation expanded to other parts of the country (Aravena Bergen, 2005). Today, on a national level, Buenos Aires is the county with the third highest pineapple coverage; within the southern region of Costa Rica, Buenos Aires has the highest concentration of pineapple (MOCUPP, n.d.). Production here is dominated by PINDECO (Pineapple Development Corporation), a subsidiary company of Del Monte.

In our research, we examine 1) the environmental and social impacts of unregulated pineapple expansion and 2) its intensive water use, 3) the public-private partnerships around water and how they impact the land and people, and 4) the role of civil society in water protection. Through this analysis, we show how unregulated pineapple expansion has caused erosion, pesticide contamination of soils, surface waters, and aquifers, and encroachment on protected wetlands. We illustrate how disproportionate corporate control of water has led to grave decreases in water availability in the region. Furthermore, we demonstrate how public-private partnerships can consolidate corporate power over water. Lastly, we share how members of civil society have united and campaigned to protect local water resources.

This chapter is written in critical solidarity with communities and social movements who have shown to be main protectors of water resources and especially rivers; to whom, as Doña Digna states in the quote at the beginning of our chapter, rivers are everything, life, blood, and shelter.

Contextual Background: The South of Costa Rica and the Pineapple Industry

The county of Buenos Aires is located in the rural south of Costa Rica and is the fourth largest county in the country. As demonstrated in Figure 1, the northern area of the county forms part of the Pacific La Amistad Conservation Area (ACLAP, Área de Conservación La Amistad Pacífico) with an extraordinary

biodiversity (INDER, 2014). Furthermore, Buenos Aires has high cultural diversity: six Indigenous territories are located in Buenos Aires, which cover 38 % of the county's total area and make Buenos Aires the county with the highest Indigenous population in the region (Cedeño et al., 2010). At the same time, it is one of the counties with highest inequality (Arias Ramirez et al., 2020) and one of the lowest Human Development Indices (UNDP, 2023).

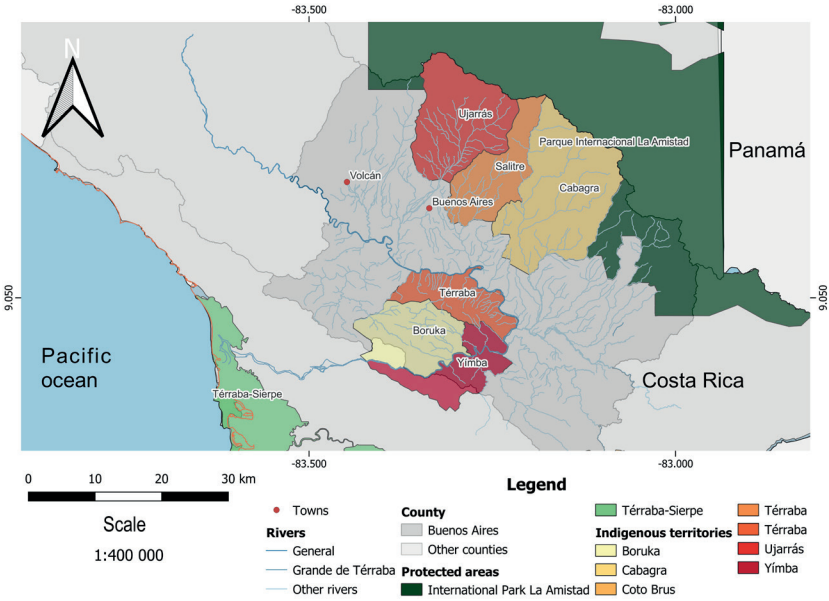

Figure 1: Map of the Térraba river basin, including the Buenos Aires County, Indigenous territories within the county and the surrounding protected areas International Park La Amistad and Térraba-Sierpe wetland. Map created for the authors by Carlos Andres Campos Vargas.

Buenos Aires belongs to the Térraba water basin, Costa Rica's biggest hydrographic basin that drains almost 10 % of the country's total area (FAO, 2015). As a large part of the upper Térraba basin lies inside the mountainous La Amistad International Park, historically the rivers have been protected and thus able to provide the communities with the necessary

waterflow (Cedeño et al., 2010). The vast fluvial network together with high precipitation rates and the existence of aquifer recharge areas make Buenos Aires a county with an enormous water supply (Instituto de Desarrollo Rural [INDER], 2014). This water abundance supports various activities including agriculture as the main economic activity. Specifically, 56.6% of employment in Buenos Aires is in agriculture (as compared to the national average of 20.3%; Vargas Montoya, 2020).

A large portion of the Buenos Aires agricultural land area is industrial monoculture; this has contributed to downstream water pollution as well as a high level of extraction of water for farming. Specifically, as we will further explain, extensive monoculture plantations are characterized by the heavy use of highly hazardous pesticides as well as excessive use of water in irrigation, which has led to wide environmental degradation, human health issues, and social inequality (Cedeño et al., 2010).

Consequently, the Térraba basin in Costa Rica is one of the two most polluted basins; it receives contaminated agricultural runoff and has significantly lost waterflow over time (INDER, 2014; OECD, 2020). Industrial pineapple farming has been the main driver of the modifications in the geographical landscape in Buenos Aires since the 1960's (Cedeño et al., 2010). Being one of the most pesticide intensive crops, pineapple farming causes environmental degradation via deforestation, habitat and biodiversity loss, soil erosion and contamination, and water contamination through agricultural runoff and sedimentation (Echeverría-Sáenz et al., 2012).

The production and export of pineapple in Buenos Aires today is entirely managed by PINDECO S.A., a subsidiary of the US based Del Monte Corporation founded in 1979 (Cedeño et al., 2010). Since the foundation of this company, the expansion of pineapple has grown dramatically and many small-holder farms, which historically produced a diversity of crops, have been replaced by intensive pineapple monoculture (Valverde Salas et al., 2016). This transition has created a hegemonic power imbalance where land, labor, and financial resources are concentrated in the hands of PINDECO/Del Monte, as well as it has generated a

homogenizing effect on agriculture, the economy, and the whole regional landscape.

In only four decades of operating, PINDECO/Del Monte has managed to become the largest employer in the Buenos Aires county (La Nación, 2012). At the same time, the region in and around Buenos Aires has the highest unemployment rate of Costa Rica, particularly women; the latter demonstrates in addition to the employment gap, there is a gender gap (Vargas Montoya, 2020). Furthermore, more than a third of the households in Buenos Aires receive a gross income below the minimum wage - a fact that is only surpassed by the Huetar Norte region (Vargas Montoya, 2020). The latter inequalities exist even though the pineapple industry in Costa Rica receives considerable State support, for example through export tax exemptions (Oxfam, 2018).

The negative impact of corporate control on local economies can be observed in other counties with a predominant agro-industrial monoculture model. The three main pineapple regions (Huetar Norte, Huetar Caribe, and Brunca), stand out to be the most unequal in social-economic development rankings(UNDP, 2020; UNDP, 2023).

Methods

The results of this chapter are from both primary and secondary data collection. Secondary data was gathered using document analysis (Bowen, 2009). The documents reviewed included official reports, websites, laws, and peer-reviewed journals. We used the following a priori themes to search for related documents: 1) unregulated pineapple expansion, 2) intensive water use, 3) Public-private partnerships around water, and 4) civil society's role in water protection. A priori themes are defined as "…characteristics of the phenomenon being studied… from researchers' values, theoretical orientations, and personal experiences" (Ryan & Bernard, 2003, p. 88). Since both authors have a collective experience of over 15 years working on topics related to agriculture, we used our deep knowledge of this topic and personal experience in the region to define a priori themes.

We complemented our document analysis with primary data collection. Primary data was gathered by both authors who have lived and/or done research in Buenos Aires. Specifically, author Clara Ramin has lived for 10 years in Longo Mai and Tres Ríos de Volcán, Buenos Aires. She participated in local agriculture projects, including those funded by UNDP; she is also an active member of Ríos Vivos, a national water activist group. Author Olivia Sylvester has been traveling to Buenos Aires with master's students for the past 5 years doing research on agriculture and water. The latter experiences have resulted in data gathering through lived experiences, as well as via conversation interviews with key actors and stakeholders working in the agriculture and water sectors (e.g., farmers, activists, and members of local governments).These experiences were integrated into our document analysis to corroborate our findings.

Results and Discussion

Unregulated expansion of pineapple plantations

Costa Rica is currently one of the world's top exporters of fresh and dry pineapple (OEC, 2021) which results in a large area of land dedicated to industrial pineapple farming. It is important to note that pineapple was not always produced in an intensive, industrial fashion; in the past, production was evenly distributed throughout the country, due to a natural production process where no specific technical package or conditions were imposed to speed up fruit growth (Acuña, 2006). Due to the shift to an industrial model of production in Costa Rica, pineapple exports now generate a lucrative market of US$ 1 billion each year (Federación Costarricense para la Conservación del Ambiente [FECON], 2019; Rodríguez, 2021). Especially in the past two decades, pineapple production grew by 700% (Rodríguez, 2021). While in 1995, there were 5,500 hectares planted, today the area exceeds 65,000 hectares (Monitoreo del Cambio de Uso y Cobertura del Suelo en Paisajes Productivos [MOCUPP], n.d; Rodríguez, 2021.). Despite these numbers, it is worth noting that there is no agreement on the actual number of hectares of pineapple planted in the national territory. Numbers published by different national institutions, including the National Institute of Statistics and

Census (INEC) or the National High Technology Center (CENAT) can vary by up to 20,000 hectares which demonstrates a lack of clear monitoring and planification of pineapple production and its expansion (Jiménez Corrales & Valverde Salas, 2017).

In Buenos Aires, pineapple production began in the 1960's; however, the large-scale expansion of pineapple started in the 1980's and spread out to other regions of the country (Cuadrado-Quesada, 2020). When pineapple became a key national export product, PINDECO/Del Monte became a key player in pineapple production (Acuña, 2006). With its incorporation of new varieties and an agrotoxic technological package focused on producing the largest amount of pineapple per hectare as possible, the area used for pineapple production has been growing dramatically (Acuña, 2006; Maglianesi Sandoz, 2013). In 1998, an area of 1,225 hectares of land was covered by pineapple (Briancesco Arias, 2021). In 2015, there were approximately 8,030 hectares (UNDP, 2017), and by 2018, 85% of the pineapple production in the south of Costa Rica was in the county of Buenos Aires (Briancesco Arias, 2021). The huge land areas owned by PINDECO/Del Monte have resulted in reports classifying pineapple plantations as a form of land-grabbing (Hayden, 2018).

One of the main problems with the dramatic and accelerated pineapple expansion is that there is no adequate planning or regulation of this expansion. Instead, pineapple fields are located close to springs, rivers, wetlands, and above aquifers, they have changed the course of rivers and are even grown in high and mountainous regions (C. Ramin, personal observation). As one consequence, communities bordering plantations experience decreased water availability as well as water contamination issues in rivers and aquifers used for consumption, recreation, and small-scale farming (Aravena Bergen, 2005; Brianesco Arias, 2021).

Eighty percent of the large amount of chemicals used by PINDECO/Del Monte for production are shown to be toxic and contaminant to soils and surface water and aquifers through soil filtration; these pesticides have been applied for decades which produces a cumulative environmental impact (Astorga Gättgens,

2017). The dramatic land use change has also caused excessive deforestation which led to the loss of 1,789.71 hectares of forest in Buenos Aires between 2000 and 2015 (5,579.598 hectares on the national level - most of it close to rivers and wetlands; FECON, 2019; MOCUPP, n.d.). Especially in the rainy season, deforestation and poor soil management (such as the complete vegetation clearing) lead to soil filtration and the washing of soils. As there is less organic matter in the soils, the water retention capacity is reduced, and the common and frequent rains lead to runoff and an increase in soil erosion. A dragging of sediments as well as untreated agricultural runoff are deposited in the rivers and streams, decreasing water flow and affecting the organisms that inhabit these aquatic ecosystems (Maglianesi Sandoz, 2013), as well as disturbing the balance of the ecosystems as a whole (Aravena Bergen, 2005). The erosion process is even stronger on the slopes of higher mountainous plantations. In the lowlands, it contributes to the transformation of riverbeds, which in the rainy season leads to overflows and floods that endanger local people and their housing (FECON, 2021).

For communities close to pineapple plantations, the high chemical-use and water contamination cause an exposure to a high risk of suffering from respiratory and skin diseases, allergies, cancer, and long-term chronic illnesses (Dabady & Tulk 2015). The most frequent polluting compound that has been found in water sources is the herbicide bromacil; this pesticide along with a wide variety of other contaminants have affected the quality of water resources (Maglianesi Sandoz, 2013). The first reports of bromacil water contamination occurred in Volcán, the main pineapple district of Buenos Aires, in the year 2000 in surface waters near the Volcán river. In 2013, levels of 3.2 mcg/L were detected in a well in the town of El Peje and up to 6.7 mcg/L in the Peje stream (Ramírez Muñoz, 2017). Other studies have found evidence for the existence of even higher amounts of bromacil in stream and river waters in Buenos Aires: 19.9 mcg/L, an amount 4 times higher than the value defined in Canada for the protection of aquatic life and that exceeds many surface water quality standards (Montiel Segura, 2015). As reported by the Environmental Protection Agency (EPA, 1996), bromacil is classified as a “Group C possible human carcinogen based on increases in incidence of liver tumors in male

mice, and positive trends in thyroid tumors in male rats" (pg. 2). Considering that bromacil is a molecule with a long half-life and high solubility, mobility, and persistence in the soil, water, and sediments, it has high capacity to contaminate aquifers including groundwater that serve as a source of drinking water for rural communities (Ramírez Muñoz, 2017). Despite the prohibition of its use in Costa Rica in 2017, bromacil residues are still found in community water sources (Cordero, 2022).

The environmental impacts caused by pesticides used by PINDECO/Del Monte in the Buenos Aires county also affect the Térraba-Sierpe wetland, one of Central America's largest wetland and mangrove forest (Arroyo Mora, 2013), which is located on the Pacific coast further south and has been declared RAMSAR wetland in 1995 due to its natural diversity (O'neal Coto, 2017) and a place of high environmental fragility (FECON, 2019C). As the contaminated waters and sediments of the streams and rivers of the upper and medium Térraba basin meet in the Grand Térraba river, they finally end up in the Térraba-Sierpe wetland before they discharge in maritime waters. A study conducted by the University of Costa Rica (UCR) showed the presence of bromacil and ametrine residues in the Térraba-Sierpe wetland, which are known to be used in pineapple production (O'neal Coto, 2017). Studies conducted by the Technological Institute of Costa Rica (TEC) show an increase of over 500% of nitrates in the wetland in the months of major agricultural fertilization (Umaña Venegas, 2019). Apart from the environmental damage caused by sedimentation and pesticides, families that used to fish in these wetlands are losing the possibility of maintaining their livelihoods (C. Ramin & O. Sylvester personal observation).

The government of Costa Rica has given permits to PINDECO/Del Monte to expand over 500 hectares of plantations a few kilometers away from the Térraba-Sierpe wetland, without conducting any previous environmental impact studies on the site (FECON, 2019C) and with evidence that chemicals used in these properties would immediately end up in the wetland (FECON, 2019D). Environmental groups, such as The Costa Rican Federation for the Conservation of the Environment (FECON), have appealed this expansion of pineapple as it is not complying with environmental

laws; after such appeals the Ministry of Environment (MINAE) canceled these licenses of PINDECO/Del Monte in 2019 (Mora, 2019).

Despite these licenses being canceled, there has been evidence that pineapple plantations have encroached into other protected areas in Costa Rica. Specifically, there are at least 3,800 hectares of pineapple planted in National Protected Areas, and the government has been cutting budget for the National System of Conservation Areas (SINAC), making it difficult to address the uncontrolled expansion of pineapple cultivation (FECON, 2019; FECON, 2019B). In addition, pineapple plantations have invaded 16,324 hectares of wetlands, showing a total increase of 300% of pineapple plantations within Protected Areas (FECON, 2019D). On average, the Technical Environmental Secretariat (SETENA), the entity in charge of granting construction and planting permits, approves additional three thousand hectares of pineapple each year; however, most of this expansion occurs illegally, or simply without undergoing any environmental impact assessment (FECON, 2019B). Data from 2015 illustrate how 12 RAMSAR wetlands in Costa Rica are seriously threatened by land use change (FAO, 2015). Considering that pineapple expansion continues, its harmful impacts will also increase.

In summary, there is a significant conflict between conserving nature, protecting human health and livelihoods, and the expansion of pineapple monocultures. Accelerated and unregulated pineapple expansion represents one of the major environmental and water emergencies in the country. It has caused alarming contamination of water sources, and it affects important ecosystems such as wetlands and coastal waters; the latter is gravely concerning due to the importance of wetlands and oceans in counteracting climate change.

Intensive water use

While water contamination due to pesticides has become an increasing issue of concern in Costa Rica, less attention has been paid to the intensive water use and concessions granted to private companies such as PINDECO/Del Monte. The latter is of great importance since the global demand for water continues

to rise while water stress is increasing (UN Water, 2019) and freshwater ecosystems, especially rivers, are critically being degraded (Lovgren, 2021). Specifically in the case of Costa Rica, as we demonstrate below, there is a lack of infrastructure for an equitable distribution of drinking water and the protection of river basins (Muñoz-Sequeira, 2022).

In Costa Rica, most of the water that is used for agriculture is used for irrigation (Programa Estado de la Nación, 2022). Cultivated land is mostly irrigated with surface water, which is provided by rivers (Water Action Hub, n.d.). In the Térraba basin, according to a study from 2011, around 94% of the granted water uses were for agriculture and its associated processes (agriculture, agroindustry, and irrigation) while human consumption made up for only 0.0003% of water use (Rojas, 2011).

To use river water for irrigation, the Water Directorate (Dirección de Agua, DA) of the Ministry for Environment and Energy (MINAE) assigns concessions and permits. These concessions are granted for a maximum of 10 years with high probability of extension (OECD Country Note, n.d.) and allow the private use of water, something that is usually managed as a public good in Costa Rica. The methodologies used by the DA to grant concessions are questionable given that concessions are based on reserving only 10 to 20% of the minimum water flow for their persistence while the rest (80-90%) can be used by the private sector (FECON, 2021). When the DA extends concessions after 10 years, it often does not carry out the necessary systematic measurements of water flows at the intake site and therefore, does not consider possible changes in the water availability through factors such as deforestation, overuse, and the climate crisis. In Buenos Aires for instance, some current concessions correspond to measurements carried out in 1988 (Brianesco Arias, 2021). This is especially concerning as Costa Rica is experiencing decreasing precipitation patterns because of climate change (The World Bank Group, 2021).

Although pineapple in tropical countries is a mainly rainfed crop, it is also widely irrigated in dry months to ensure continuous year-round production (Carr, 2012). In Costa Rica, pineapple irrigation

happens mostly during the dry season in the months between December and April or May, depending on the onset of the rainy season (C. Ramin, personal observation). For this, a large amount of basin waters is used (Cedeño et al., 2010), nevertheless, besides concessions from superficial water, PINDECO/Del Monte also owns concessions from underground water sources in Buenos Aires and surrounding counties, which means the company takes water from rivers and aquifers (see map in Alfaro & Umaña, 2021). Since there is no official agreement on the area covered with pineapple, data about the amount of freshwater being used by PINDECO/Del Monte for pineapple irrigation per year is not easily accessible (C. Ramin, personal observation). However, the FAO evaluates the national politics on irrigation as weak (FAO, 2015).

Volcán, the main pineapple district of Buenos Aires, is part of one of Térraba's sub-basins that is formed of three rivers: Volcán, Ángel, and Cañas (Brianceso Arias, 2021). According to Beita & Kiser (2022), PINDECO/Del Monte owns seven concessions in this sub-basin, taking 1,270 litres (about 335.5 gal) per second from these three major rivers. Around 98% of the concessioned river water in the Volcán sub-basin is used by PINDECO/Del Monte to irrigate pineapple plantations (FECON, 2021). With the water taken by PINDECO/Del Monte from the sub-basin each minute, a person in Costa Rica with an average daily water consumption of 200 litres (about 52.83 gal) could be supplied with water for over a year. The DA, however, grants these permits without having data about the actual availability of water in these rivers (FECON, 2021). Local environmental groups, such as members of the movement Ríos Vivos, have expressed concern about the continued renewal of concessions that are granted without sufficient knowledge of the states of the rivers, environmental impact studies and participation of community members who live in the basin, which results in too much waterflow being allowed to be taken (Brianceso Arias, 2021). The latter scenario is similar for other concessions owned by PINDECO/Del Monte in the region.

The decrease in river water flow is causing inequitable access to water, not only for downstream communities, but also communities close to the water springs. In this context, it is important to mention

that despite Costa Rica having one of the highest coverage rates for drinking water in Latin America (Suárez Serrano et al., 2019) and being considered less exposed to drought risk than other Central American countries, Costa Rica is still facing an overall low to medium drought risk (WRI Aqueduct, n.d.). In October 2023, the National Commission for Risk Prevention and Emergency Response (CNE) declared a yellow alert for the entire territory due to insufficient water supply. This is especially concerning, given that October is the month with highest precipitation rates, and still, 38% of the water systems managed through the Costa Rican Institute of Aqueducts and Sewers (AyA) reported water deficits during that time, expecting up to 66% in the following dry season (Hidalgo, 2023). Especially in rural areas, access to safe water remains exceedingly low (Suárez Serrano et al., 2019); while 5% of the total population in urban areas does not have access to drinking water, in rural areas the number reaches up to 17% (Alfaro & Umaña, 2021). Buenos Aires belongs to one of the two regions with most critical problems of water availability (Programa Estado de la Nación, 2022). PINDECO/Del Monte among others takes water from the Volcán and Ceibo sub-basins, which both originate in the Cabécar Indigenous territory Ujarrás; it is therefore, alarming, that Ujarrás has a reported lack of water access during the dry season (Bartels Villanueva, 2021). As much of the water is being diverted for other uses, the water which supplies Ujarrás is coming from a spring that is not providing enough water due to deforestation as a result of livestock farming by non-Indigenous people who usurp and occupy that Indigenous territory (Bartels Villanueva, 2021).

This inequitable distribution of water illustrates how the State clearly favors private water use over local and Indigenous community needs. In addition, the lack of political will to allocate resources (technological, economic, and human) to carry out research to better understand the state of the rivers, and to apply appropriate methodologies to grant concessions, hinders the effective protection of rivers and the ability to achieve water security (Programa Estado de la Nación, 2022). As a result, communities and small-scale businesses who depend on the rivers are left vulnerable to the current climate and water crises (FECON, 2021).

Members of the Ríos Vivos movement are advocating for new measurements in the Volcán sub-basin to prove the changes in the intake site and downstream rivers. Supported by other ecological and community movements, they further emphasize the need for holistic methodologies to calculate environmental flows (Beita & Kiser, 2022). Environmental flows, as defined in the Brisbane Declaration in 2007, refer to "the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems" (International River Foundation, 2007, p. 1). For the calculation of environmental flows and the granting of concessions, local movements and organizations highlight the value of incorporating analyses of the environmental, social, and economic impacts of water extractions, as well as taking into consideration social use and the role of rivers for people's mental health (Beita & Kiser, 2022).

In conclusion, there is a lack of adequate monitoring and control by the State (specifically the DA) regarding the efficiency in the use of water and the actual capacity of water sources. In times of increasing water scarcity, the company PINDECO/Del Monte experiences greater privilege over the civil society regarding water access, while also negatively impacting the quality and availability of water in the region as well as local communities' well-being. These advantages facilitate the further expansion of pineapple plantations and the continuity of destructive land use change. The problems which affect the Volcán sub-basin further affect the downstream Térraba basin, which plays an important economic, social, cultural, and ecological role for many Indigenous and non-indigenous communities.

Public-private partnerships around water: The GIZ - Del Monte alliance

"Water is essentially about power - the power to decide, control, allocate, manage - thereby affecting people's lives"

(Sultana, 2018, pg. 4).

In this chapter we have demonstrated how water, especially from rivers, is threatened by neoliberal politics and private interests

that exacerbate the current inequities in access to water. In the Térraba basin, specifically the Volcán sub-basin, alliances are emerging that create new models of water and natural resources management; here we examine one such alliance.

The German Society for International Cooperation (GIZ) is a service provider that supports the German Government in achieving its goals in international cooperation for sustainable development, operating worldwide and on behalf of the German Federal Ministry for Economic Cooperation and Development (GIZ, n.d.). In Costa Rica, the GIZ is focusing on three priority areas, one of them called 'climate, biodiversity and renewable energy' (GIZ, 2022). In this context, in 2021, the GIZ formed a three-year alliance with Del Monte in the form of a public-private partnership. As part of the program 'From Farm to Fork', the proclaimed goal of the alliance is to restore productive landscapes and promote economic development, while preserving water resources and providing education for sustainable development in communities close to pineapple fields (Fresh Del Monte, 2021). So far, in the Volcán sub-basin the alliance has promoted the forest conservation and reforestation of the upper basin, supported capacity building for local rural tourism, and is disseminating information about the company's two private wildlife refuges on social media (Beita & Kiser, 2022).

Members of Ríos Vivos are expressing concern about this public-private partnership, as it does not address the causes of the environmental, social, and water issues associated with industrial pineapple monoculture (Beita & Kiser, 2022). While hypothetically, the alliance could be used to support local community efforts regarding the incorporation of holistic methodologies to calculate environmental flows, the recognition of Rights of Nature or legal personhood for rivers in the basin, respect of the established minimum wages for workers, the promotion of an economic transition away from industrial agriculture, among other topics, instead, the GIZ's greenwashing overshadows these conversations. In a meeting with members of Ríos Vivos, GIZ representatives clarified that Del Monte is a client of GIZ and therefore the GIZ acts in the interest of the company (C. Ramin, personal observation). As a result, no actions

are taken to reduce the company's intensive water extraction from rivers or to diminish soil erosion and runoff on the plantations, nor to limit the uncontrolled expansion of pineapple plantations and growth of the company. Instead, GIZ is managing to place Del Monte as a regional leader for forest restoration (Beita & Kiser, 2022) and sustainable production. More recently, the company was able to announce the launch of Del Monte Zero™ pineapple, the company's first certified 'carbon neutral' pineapple (Beita & Kiser, 2023). On one of Del Monte's websites, the company states:

> For more than 30 years, Fresh Del Monte's commitment to Costa Rica's sustainable development and biodiversity conservation has played an important role in protecting the forests and supporting local communities in their efforts to restore landscapes and promote social and economic development (Fresh Del Monte, 2021, para. 5).

Considering the previously mentioned concerns around pineapple production, a global promotion of such a sustainability image is offensive for communities in Buenos Aires and other parts of the country, as well as fraudulent for consumers of pineapples in Europe and the United States. Del Monte's wildlife reserves do not make restitution for the large-scale environmental degradation and deforestation, river contamination, and water overuse; the company does not compensate for its greenhouse gas emissions, nor does it support local communities and their economic development. According to Beita & Kiser (2022), the alliance between GIZ and Del Monte is a mechanism to ensure the company's availability of water and to demonstrate this to its investors and markets. This alliance is also concerning because it represents a shift in the politics around water, from a democratic, participatory, and public water management to a non-democratic and private management directed by and for private companies.

This is one of the cases where public-private partnerships consolidate corporate power and silence important conversations about the viability and fairness of the current export-oriented and agro-industrial economic model.

Civil society's role in water protection

To openly talk about the impacts of industrial pineapple farming is not always easy in regions with a strong presence of pineapple companies. Even in cases where people suffer impacts on their water sources, they might decide to remain silent because of fearing counterattacks by the companies. To talk freely in a place where a pineapple company is the main employer can lead to unemployment for all family members (Rodríguez, 2021). The latter well describes the case of Buenos Aires, a county that has endured a long process to be able to speak openly about pineapple, and still free and open dialogue is not possible for everyone (Brianesco Arias, 2021).

However, in the face of all these challenges, it is important to note that it is community members and civil society organizations who are instrumental in protesting and preventing extractivism and protecting the land. For many people and communities, nature is much more than a resource; it is their territory and the fabric that builds identity. Today, strong national social movements exist in Costa Rica to prevent land and water destruction due to industrial pineapple monoculture as well as existing human rights violations, many of which are closely tied to the rivers.

It can be observed that the development model of accumulation based on intensified natural resource exploitation that has been implemented in Latin America, has led to a renewed cycle of social struggles around the defense of territories and natural common goods (Svampa, 2019). In Costa Rica, many social-environmental struggles fundamentally criticize this extractive development model as a whole and create new discourses that propose different social-environmental relationships (Guitiérrez, 2019). Especially in the past two decades, social-environmental conflicts around the access, use, and management of water have gained visibility, in both rural and urban contexts of Costa Rica (Gutiérrez, 2019). These struggles for water aim to change power inequalities and the consequences of the resource-intensive, extractive development model that threatens all water, rivers, and communities alike. For many rural communities in Costa Rica, peasant and Indigenous, rivers are central elements of daily

life, they are common goods of incalculable value that constitute culture and identity (Alpízar et al., 2022). Rivers are spaces around which community life is built. Rural communities also depend on rivers directly for the reproduction of life. Therefore, the moment a river is threatened, it means losing what is most valuable to these communities (Gutiérrez, 2019).

Within the above context, a series of new social movements in defense of rivers have arisen; these movements are networks of community and environmental organizations of national scope and based on collective action (Gutiérrez, 2019). These movements are composed of a diversity of people who work together to defend water as a common good. It is worth highlighting that, according to Felipe Alpízar (2019), during the last four decades, the main actors of collective action for water in Costa Rica have been local community members (82.3%), environmental groups (8.6%), and workers (2.9%), demonstrating the importance and power of communities and civil society action. Specifically, communities and ecologists have been instrumental in pressuring the State to prohibit the above-mentioned use of bromacil, (Pacheco, 2018).

Members of the county of Buenos Aires and its neighboring county Pérez Zeledón have been central players in the defense of the rivers in the fight against hydroelectric dams. Since 2012, all the 19 proposed dams have not been built due to the strong opposition of local forces (Gutiérrez, 2019). In the context of these proposed dams, the Ríos Vivos Movement and defense committees for each specific river were formed. Currently, the Ríos Vivos Movement is carefully monitoring energy politics to prevent the return of hydroelectric projects, while at the same time demanding the following: ending the expansion of pineapple monocultures and deforestation as well as applying regulations of pesticide use and water extraction by private corporations, and stronger national water politics for the civil society. Another important aspect of the movements' work is offering dialogues for a just transition and about the Rights of Nature and River Rights (C. Ramin, personal observation).

In the specific context of industrial monoculture, many communities of Buenos Aires, such as residents of the community Longo Maï, have protested against pineapple expansion and corporate-controlled excessive water extraction. This was also the case during the expansion of PINDECO/Del Monte plantations in the Térraba-Sierpe wetland (Brown Varela, n.d.); these efforts have helped to halt the expansion. Furthermore, members of the Ríos Vivos Movement in Longo Maï are part of the FECON. Via networks like these, members of the Ríos Vivos Movement have been active participants in the formation of a River Basin Commission in Buenos Areas in order to address the negative impacts of industrial agriculture on water sources (C. Ramin, personal observation).

These movements in defense of rivers, both in Costa Rica and internationally, fight for water to be a common good that must remain outside of private markets. Therefore, the struggles in the defense of the rivers have a social, environmental, ethical, and political relevance; they are not only crucial for the future of water and rivers, but also for the values and principles that will determine our path as a society (Gutiérrez, 2019).

The data presented in this chapter illustrates that we cannot wait for governments, international agencies and/or public-private partnerships to solve the ongoing water crisis in Costa Rica. Due to their past successes in protecting water, we need to continue to support civil society organizations and global social justice movements, as well as joining forces among movements, as those will continue to challenge the dominant development model imposed in Costa Rica and fight for water justice. Barlow and Clarke (2002) describe how citizens all over the world are the "reformers and fighters […] the heroes and heroines of the story. […] If we follow their example, we may be able to save our vital supplies of fresh water before it is too late" (pg. xv).

Conclusions and Recommendations

Clean, safe water is vitally important as it is crucial for people's ability to live a full and healthy life (Sultana, 2018). Rivers, as we have illustrated here, are central to communities' health, as well as their livelihoods, recreation, and culture; as Doña

Digna Rivera states, in the opening quote of this chapter, for communities, rivers are much more than a resource, they are everything. This case study demonstrates the social, environmental, and political impacts of industrial pineapple monoculture on water in Buenos Aires, Costa Rica. Our findings are relevant to industrial agriculture farming in general in Costa Rica and globally; specifically, because most of the world's freshwater is used in farming (The World Bank, 2022) and considering that the agriculture sector in Costa Rica is the main consumer of water resources. It is this agriculture sector that is responsible for widespread contamination of aquifers, rivers, and streams (Echeverría-Sáenz et al., 2012; Pomerada García, 2022). Specifically in Buenos Aires, the impacts of industrial farming on water are driven by the transnational corporation Del Monte, a United States food production and distribution company, a company that operates in other counties in the country.

In this chapter we examined four topics: 1) unregulated pineapple expansion, 2) intensive water use, 3) public-private partnerships regarding water, and 4) the role of civil society in water protection. Through our analysis we demonstrated how unregulated pineapple expansion has caused erosion, and pesticide contamination of soils, surface waters, and aquifers in the Buenos Aires county. Furthermore, we emphasized how current pineapple farming practices are adversely affecting the health, economy, and water access of the communities. Given that Costa Rica is one of the world's largest pineapple exporters, with an expanding production area, national policies have permitted alarming encroachments into protected areas, water sources, and communities in the region. Additionally, there is significant exploitation of water resources, exemplified by 98% of water concessions in the Volcán district being controlled by the transnational corporation Del Monte. We therefore highlight that it is imperative to reassess corporate practices and the granting of concessions as well as the objectives and action plans of public-private partnerships to ensure the responsible use and improved conservation of the Térraba basin, Costa Rica's largest hydrographic basin. Specifically, the alliance between GIZ and Del Monte does not address the root causes of the destruction caused by Del Monte in Buenos Aires nor does it limit the

uncontrolled expansion of pineapple plantations and growth of the company. On the contrary, the alliance positions Del Monte as a leader in sustainability, silencing important conversations about the non-viability of the current extractive and export economic development model, and alternative ways to protect the region's rivers as offered, for example, by the discourse on the recognition of river rights. Lastly, in this chapter, we share how members of civil society have united and successfully campaigned to protect local water resources, especially rivers. Rivers play a key role in the health, well-being, and livelihood of rural communities in the south of Costa Rica and members of these communities have proven to be their main guardians. One such movement, Ríos Vivos, is composed of a diversity of people who work together to defend water as a common good and who have been central actors in the defense of rivers that were about to be dammed, as well as against the damage caused by Del Monte in the region. However, not only in the south, but in rural and urban contexts throughout the country, socio-environmental activism around the access, use, and management of water is strong. This activism aims to change the power inequalities and consequences of the intensive extractive development model and demonstrates not only the concern but also the power of civil society when it comes to water protection. We conclude that these efforts and movements could benefit from the union with other movements that are composed of various sectors (such as the National Front called Frente Nacional de Lucha) to articulate the broader dangers of neoliberalism and advocate for possible economic alternatives, for Costa Rica and other countries in the region. Through unions like these, alternative discourses, such as the discourse around river rights and others, can be strengthened in international mainstream spaces and conferences which are still increasingly dominated by corporate actors and their fundings and agendas.

Based on our findings and analysis, we recommend the following: 1) increased State transparency and the enabling of active civil society participation regarding water concession allocation and management; the latter should include long-term planning and holistic management approaches that guarantee water rights for human communities, 2) State regulation regarding numerous elements of industrial agriculture including prohibition of: a)

the use of highly hazardous pesticides, and b) the encroachment into forests, wetlands, water recharge areas, and protected areas, 3) repatriation of Indigenous land (Costa Rica's 1977 Indigenous Law) since Del Monte is illegally extracting water from these lands without consent, 4) respect for human rights to a healthy and ecologically balanced environment (article 50 of the Costa Rican Constitution) and Indigenous communities rights to manage resources on their lands (Article 15 of C169, ratified by Costa Rica), 5) a revisioning of Costa Rica's dominant extractivism development model, based on the appropriation of nature and over-exploitation of natural resources (Svampa, 2019) a model we illustrate here that serves to consolidate corporate control over public resources and violates local people's human rights. Such revisioning should be led by local peasant and Indigenous communities in Buenos Aires County that already embody development models that are not based on the control of nature or productivity visions of development; instead, the county of Buenos Aires has a wealth of indigenous and local knowledge on how to live in harmony with the land, what is needed is for the rest of the world to value this wisdom.

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Chapter 3

Liquid Mesoamerica: US National Security and the control of regional water resources

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Keywords: Water, War on resources, Mesoamerica, Strategic Dependence, Global Collapse

We will never apologize for carrying out our mission
John F. Kelly, 2017, former White House Chief of Staff (2017-2019)

Introduction

It is possible to trace in history the important role played by the relationship between water and politics. From its function in the civilizing process with the figure of cleanliness and hygiene, which served to mold bodies and perfect their behavior (Vigarello, 1997), to the geographical fact that cities and ecumenical centers were mostly settled on the margins of rivers and coasts. It is also found in its industrial and energetic uses, which places it, together with petroleum and other strategic resources, as a driver of the economy. But, above all, water is necessary for life on the planet. And it is in this point that the main political importance of water lies, not only as a resource, but also in its control, insofar as it inserts life in the political sphere, which turns life into a field of direct political intervention (Esposito, 2005). In other words, the control of water implies the control of life and, consequently, is closely related to an imperial project of governance of the species (Ahuja, 2016).

In a context of global collapse such as the current one, in which we are facing an accelerated depletion of common goods, considered in terms of strategic resources, water control becomes indisputable in the political sphere due to its deep dependence.

This brings us to a geopolitical analysis of the water situation in the 21st century. Specifically on the imperial dynamics for its domination, through the control of its deposits, its distribution, sanitation, including its navigability. Focusing the attention on the Mesoamerican region, which I consider of great geostrategic importance in the so-called chessboard of International Politics.

Literature review or Contextual Background

This is an analysis of a given geopolitical situation whose main objective is to characterize the hydro-strategic importance of the Mesoamerican region in a context of global collapse, mainly concerning the depletion of and dependence on strategic resources. For this purpose, it is important to begin by understanding the historical-geopolitical momentum in which this geopolitical situation occurs and transpires. This leads me to characterize this *momentum in* temporo-spatial terms; defining, in the first place, the epoch in which this analysis takes place: the Plutocene. Secondly, the geopolitical space in which the situation to be studied is manifested: Mesoamerica.

About the Plutocene. The historical moment we live in is characterized by the global ecosocial collapse (Saxe, 2005), in which different planetary catastrophes, biological annihilation (Ceballos; Ehrlich; Dirzo, 2017), ecological destructions, accelerated depletion of the most indispensable resources and total war converge. I call this period the *Plutocene* (González, 2020), which implies a critical rethinking of this new era of global collapse, not under the idea of human action as a geological force, which is hegemonically defined as the *Anthropocene,* but the accumulation of power and capital as the real geological force that is destroying the planet and annihilating the different forms of life that inhabit it, including humanity.

The concept of Plutocene does not exclude the anthropogenic character present in all the scientific analysis carried out by the scholars of the Anthropocene concept, because indeed the world collapse is not the result of external agents such as meteorites, divine wrath or an extraterrestrial invasion; nor by natural processes such as volcanic explosions, earthquakes, among others;

but it is the result of human agency. However, it does not reaffirm the slogan of the "human enterprise" as a unit. The responsibility for the world's collapse lies, for the most part, in the hands of a few and their desire to accumulate power. The Plutocene shares the criticism present in the idea of Capitalocene (Altvater, 2014), a powerful concept that makes it easier for us to understand that not all human activities are destructive or adverse to the possibility of cohabitation with other forms of life on the planet. The Capitalocene explains how "the capitalist mode of production generates geological history and [that] it has done so to the point of integrating a new phase that geologists would call the Anthropocene. Phase that would be more appropriate to describe as Capitalocene (Kapitalozän)" (Altvater, 2014, p. 7). However, this concept retains a relative semantic ambiguity similar to that of the Anthropocene, by placing us in struggle against a mode of production, a system, a process, an ideology, that has filtered into the web of life (Moore, 2015). and made one with reality (López, 2009). In short, an entelechy that ends up keeping those directly responsible for planetary destruction hidden and protected.

Along with this, the concept of the Plutocene condenses not only the dominance of one class over all the others and the means of production, also the control of the former over the total means of destruction, also sharing reasons similar to those of Andrew Yoram Gilkson (2017), for whom "the greatest dissemination of radioactive nuclides on land, oceans and in the atmosphere heralds the Plutocene[1], a geological era that began with the Trinity atomic test in 1945 and that will persist for at least 20,000 years, recorded in layers of plutonium-rich clay in ocean sediments" (2017, p. 2).

1 There is a well-defined conceptual and etymological difference. On the one hand, the Plutocene proposed by Glikson refers to the radioactive transuranic chemical element called Plutonium and whose name refers to the Roman god of the underworld called *Pluto*. On the other hand, the Plutocene I propose characterizes the era of ecological destruction and biological annihilation by the government of the rich, the "Plutocracy", whose meaning refers to the Greek god of wealth, *Plutus*. Now, Glikson's Plutocene is a post-Anthropocene era that focuses on the consequences of the development of atomic weapons and the contamination of the biosphere caused by their use. The Plutocene I propose is not a later, but a present phase, which focuses on the devastating character of hierarchies and their accumulation by destruction.

The sustainability of the capitalist system depends on the supply and control of a series of resources considered strategic for its functioning and development; Many of them are considered critical, either because they are difficult to access or because they are scarce, which in an era such as the plutogenic one, characterized by an accelerated depletion of many of these strategic resources, has led to define international politics in the 21st century in terms of a real struggle for the remaining resources, pushing the great powers and their corporations to increasingly resort to all the means at their disposal to ensure control of the most strategic resources, as is the case of water. This has consolidated with greater virulence the most predatory character of the so-called disaster capitalism (Klein, 2007) in peripheral countries, mainly in the destruction of their sovereignty over their resources and assets, through their privatization (Loewenstein, 2015) under the mantra of more efficient public-private integrated management, necessary in a world of scarcity. In this late Plutocene phase, the imperial rapacity for the remaining resources accelerates, among them water, whose critical situation has become decisive for the 21st century, which means a race for the control of life on the planet.

The future of the global water situation looks catastrophic. Water resource projections for 2050 continue to warn of the imminence of a critical situation unparalleled in history. A report prepared in 2009 by the Nestlé company for the U.S. State Department, leaked by Wikileaks in 2016, warned that "the situation only becoming more dire thereafter and potentially catastrophic by 2050. Problems will be severest in the Middle East, Northern India, Northern China, and the Western United States" (Nestlé, 2009). However, this was already openly acknowledged by the US intelligence apparatus in 2012, as stated in the *Global Water Security* report, prepared by the Office of the Director of National Intelligence of the United States (ODNI):

> According to the 2030 Water Resources Group (WRG), one-third of the world's population will live near water basins where the water deficit will be larger than 50 percent by 2030. A number of countries (or regions within countries) are already experiencing high "water stress"-when the annual renewable

> freshwater supplies are below 1,700 cubic meters per person per year. Such areas include the western United States, northern Africa, southern Africa, the Middle East, Australia and parts of south Asia and China (ODNI, 2012, p. 2).

The same warnings about the future of water were made by international bodies such as the United Nations, as manifested in the 2018 *World Water Development* report, prepared by the interagency mechanism UN Water:

> The global water cycle is intensifying due to climate change, with wetter regions generally becoming wetter and drier regions becoming even drier. At present, an estimated 3.6 billion people (nearly half the global population) live in areas that are potentially water-scarce at least one month per year, and this population could increase to some 4.8-5.7 billion by 2050 (2018, p. 3).

Similar warnings were made by the Intergovernmental Panel on Climate Change (IPCC) in 2022, stating that currently, "roughly half of the world's population are experiencing severe water scarcity for at least one month per year due to climatic and other factors" (IPCC, 2022, p. 1).

In addition to this critical water situation, official projections, as a whole, predict a worsening of dependency on the part of States, their populations and industries, and with it, greater pressure on the remaining reservoirs and the countries that possess them. According to the *Global Trends 2040* report by the Office of the Director of National Intelligence of the United States:

> Countries that are unable to address water-related challenges will probably face a confluence of challenges, including greater risk of disease, growing inequality, poor economic growth, and a heightened risk of internal political instability. Shared water resources among states are increasingly likely to become flashpoints as water security diminishes and geopolitical competition grows (ODNI, 2021, p. 1).

It is in this context of depletion, privatization, and militarization of the crisis that this reflection on water and the imperialization

of the territories of the region called Mesoamerica, a geopolitical space of great strategic relevance due to its geographic position and the resources it possesses, mainly its water reserves, is developed.

About Mesoamerica. The research is situated in the territory of what is called Mesoamerica, understood as a dynamic geopolitical space, within which act "reciprocally the geographical and political factors that make up a geopolitical situation to be studied or resolved" (Marini, 1983, p. 45). The idea of Mesoamerica arises in the U.S. geopolitical imaginary since the origins of the northern power, specifically with the understanding of the strategic importance of the Caribbean Sea, considered since then as the U.S. *mare nostrum*.

The dominion of this portion of the sea and of the countries that had access to its waters was intrinsically related to the projection of U.S. power. This was pointed out by Admiral Alfred Thayer Mahan, at the end of the 19th century, when he stated that "the position of the United States with reference to this route will resemble that of England to the Chanel, and of the Mediterranean countries to the Suez route" (Mahan, 1987, p. 33).

The realization of the idea of Mesoamerica occurred in the context of World War II, when the American geopolitician Nicholas Sypkman took up Mahanian approaches to conceive an area of immediate influence of the United States, which he called *American Mediterranean, a* space in which the Americans "holds a position of unquestioned naval and air supremacy" (Spykman, 2008, p. 60).

This conceptualization of Mesoamerica should not be confused with its anthropogeographic version proposed by the German-Mexican anthropologist Paul Kirchhoff in 1943, with the purpose of pointing out "what the peoples and cultures of a certain part of the American Continent had in common, and what separated them from the others" (Kirchhoff, 2009, p. 1); considering it as a region that "brings together cultures that flourished three thousand years ago, mostly related by ethnographic and linguistic characteristics of Mayan and Nahuatl influence, in a territory whose borders vary. 1); considering it as a region that "brings

together the cultures that flourished three thousand years ago, mostly related by ethnographic and linguistic characteristics of Mayan and Nahuatl influence, in a territory whose borders vary according to the cultural diffusion carried out by the migratory movements and social and commercial exchanges of the different peoples that inhabited the region (González, 2020, pp. 87-88).

Contrary to this, the Mesoamerica studied here is, more than a geographical reality, a political concept with spatial effects. This implies that "its meaning and extension cannot remain fixed but will be in a continuous state of fluctuation" (Weigert, 1975, p. 148). This implies understanding Mesoamerica as the projection on the ground of a political practice and of the power and class relations that define it, that is, as an *imperialized territory*. The Mexican anthropologist Pedro Carrasco is therefore correct when he states that "Mesoamerica was really [a concept] not very theoretical, but it is something that has practical utility" (González, 2000). Mesoamerica, therefore, represents the figure of a spatial set of approximately 5,150,066 km2, whose limits are defined by the geostrategic interests of the United States, and which includes the entire territory of Mexico, Central America, Colombia, Venezuela, and the Caribbean, mainly.

In short, in a context of accelerated resource depletion, in which water is one of the most fundamental for the dynamism of the capitalist mode of production and, mainly, for the continuity of life on the planet. Mesoamerica acquires a strategic relevance in the confrontation of the great world powers in their struggle for control of the remaining resources, which is defining the complex dynamics of international relations in this 21st century.

Methods

This chapter is of a theoretical documentary type, so the main sources of information “are made up of documents (bibliographic, iconographic, phonographic), that is, if the basic information with which it works has been previously collected or collected and printed” (Gallardo, 2013, p. 170). It is linked to the particular procedures of the bibliographic review, so as primary sources, documents and official statements from governments and public institutions involved, laws and decrees related to the subject

were reviewed and used; as well as technical and investigative reports from International and Non-Governmental Organizations in conjunction with the review of secondary sources, specifically books, theses, scientific and journalistic articles, that study the topic or aspects related to it, and that facilitated the critical and interrelational analysis to the be contrasted with the information collected from primary sources.

Analysis and Discussion

The analysis will focus mainly on two fundamental aspects. On the one hand, it addresses the geostrategic importance of the Mesoamerican region in relation to its water reserves. On the other hand, the issue of national security and strategic dependence on resources is studied in relation to what we can call water imperialism, which instrumentalizes water as a weapon for the political domination of entire countries and populations.

A. The hydro-strategic importance of Mesoamerica in the plutogenic era

Understanding the strategic importance of Mesoamerica implies positioning oneself from a reading of the imperial rationality that produces a geopolitical space, which has been considered "the most important place in the world for the United States. Colossally important (...) to vital national interests" (Kirkpatrick, cited in Grandin, 2006, p. 71).

The "colossal importance" perceived by Jeane Kirkpatrick, then US ambassador to the United Nations during the Reagan administration, which makes the region a neuralgic space in international politics, lies mainly in its geographical position and in the enormous reserves of resources that these territories possess, which acquire greater strategic value as the global collapse deepens. Their domination is fundamental for U.S. power, as Michael Klare rightly points out, who considers that,

> Without a stable and guaranteed flow of essential materials, the U.S. economy would not be able to develop and generate the products necessary to maintain U.S. competitiveness in world markets. Particularly critical are the flows of energy materials;

> the United States needs access to foreign supplies; otherwise its entire economic system would collapse (Klare, 2003, p. 26).

Regarding water, it is necessary to characterize the elements of power that make Mesoamerica such an important geopolitical space and the reason for the development of an imperial hydro-strategy aimed at securing the region's large water reserves. I am specifically interested in analyzing two elements: the geographical position of Mesoamerica and its water reserves.

Geographical position of Mesoamerica. First, the strategic value of water is not only related to its consumption, but also to its navigability. Therefore, the development of an imperial hydro-strategy for the region depends on the use and control of its geographic position. The territory comprising Mesoamerica connects the two great continental masses of North and South America, as well as the two largest oceans on the planet, the Pacific and the Atlantic.

This geostrategic particularity was enhanced with the construction of the Panama Canal, as Nicholas Spykman argues:

> This passageway, completed in 1914, gives the United States the full benefit of her geographic location on two oceans. The canal, although outside the borders, is, nonetheless, an important link in our coastal navigation and has shortened the sailing distance between Atlantic and Pacific ports by eight thousand miles. Even more important is the fact that it shortened the route from the Pacific states to Europe and from the Atlantic states to Asia, where their respective products are in demand" (2008, p. 49).

On the other hand, the insular arc in the Atlantic that forms the Caribbean Sea has been of vital strategic importance for the United States throughout history, which is why it was considered in the U.S. geopolitical imagination as its *mare nostrum,* with a strategic weight as great as that of the Mediterranean Sea for the British Empire. Its dominion has made possible the U.S. imperial projection worldwide, as well as the custody of access to the Mississippi River, the main artery that crosses a large part of its territory.

From the perspective of its geographic position, Mesoamerica can be considered a pivotal area for U.S. power, fundamental for the defense of its homeland and the securing of its geostrategic and geoeconomic interests in the region, such as raw materials, strategic routes and infrastructure, telecommunications control, technology transfer, military supremacy, among others. Because of its proximity to U.S. territory, the region has become a kind of spatial border security device. The Mesoamerican states, mainly their police-military apparatuses, organize and interoperate with U.S. government agencies and armed forces to block and eliminate any threat to U.S. interests. This is what emerges from a speech at George Washington University by former Secretary of the Department of Homeland Security John Kelly, who was also commander of the Southern Command and held other positions in President Donald Trump's administration. For Kelly, "border security starts 1,500 miles to the south of the United States with incredible partners like Colombia, the Central American countries, and Mexico" (Kelly, 2017). Because of this, the custody and protection of Mesoamerica falls mainly on the United States Southern Command, created in June 1963, nine months after the beginning of the Cuban missile crisis (October 1962), an event that demonstrated the extreme strategic vulnerability that the region represents for the United States, to the point of provoking a tension that endangered its very existence on the planet.

It is the Southern Command's responsibility to protect U.S. interests in the region, as well as to ensure the defense of Mesoamerican maritime routes, mainly the Panama Canal. Strategic passages that "can be easily blocked, are very vulnerable and are potential targets of choice for possible terrorist movements and other pirates" (Sébille-Lopez, 2006, pp. 43-44), which makes the Southern Command a sort of *gatekeeper*, managing all movements through these routes. In Spykman's words, "the international trade of the region is at the mercy of the United States, and the littoral states can be blockaded and cut from their access to the world market with the greatest of ease" (Spykman, 2008, p. 60).

This aspect is not considered by Sébille-Lopez, because the custody of maritime routes is not exclusively for their protection from non-

state actors, such as terrorist groups or pirates. On the contrary, this custody must also be seen in terms of imperial management of the territories and their political instrumentalization, such as the naval blockade, which has historically been used as a weapon of war to pressure and subdue other states. In the case of Mesoamerica, the naval blockade has been used repeatedly by the United States over the years as a means of destroying the countries of the region in order to subjugate them.[2]

Together with the participation of the Southern Command, the protection of Mesoamerican maritime routes is carried out through a series of mechanisms such as: joint patrol agreements with countries in the region; naval military exercises (UNITAS, PANAMAX, Tradewinds, among others); joint operations (e.g., Operation Martillo; risk management operations, humanitarian assistance in natural disasters; and deployment of the Fourth Fleet, reactivated in April 2008, in the midst of the biggest mortgage and stock market crash suffered by the United States since the beginning of that year and the tensions in Latin America, since March 1, due to the military operation Fénix, as Colombia's attack against the Revolutionary Armed Forces of Colombia (FARC) in Ecuadorian territory was called.

Another aspect related to geographic position is aerospace verticality, "commonly associated with domination and force projection" (Adey, Whitehead, Williams, 2013, p. 2) In the Mesoamerican case its importance lies in being located near the

2 In 1898, the U.S. blockade against Cuba marked the beginning of the U.S.-Spanish-Cuban war and U.S. expansion towards the Caribbean. Another example was the blockade of the Venezuelan coasts between 1902 and 1903 by the navies of the British Empire, Germany and the Kingdom of Italy, demanding the payment of debts contracted. As a result of this event, President Theodore Roosevelt proclaimed in 1904 his well-known corollary of interference to complement the Monroe Doctrine. Other more recent cases are the blockade of Cuba in 1960, which was tightened in 1962 when medicines and foodstuffs were included in the list of products blocked by the United States, in order to punish the Cuban population and destroy the revolution. The embargo on the island still remains in force, despite repeated international condemnations against it and despite being an open violation of the United Nations charter (HispanTV, 2019). In 2019, the Trump administration reactivated Title III of the 1996 Helms-Burton Act, with the purpose of pressuring Cuba financially, while blocking the arrival of vessels with fuel. Added to this is the case of the current blockade against Venezuela by the United States. Apart from the diplomatic, economic, political and military pressure suffered by Venezuela, as aggressive measures by the United States to overthrow the government of Nicolás Maduro.

equatorial line on which the geostationary orbit is located, of high strategic value, mainly for the deployment of satellites for telecommunications, climate and earth surface monitoring, and for military purposes; making the Mesoamerican region of great consideration for Astropolitics.

These types of practices are not unrelated to what is stated in the United States Global Water Strategy 2022 and the action plan for its implementation prepared by the White House, which openly states the strategic importance of collecting information on water reserves, using all the technological tools available for storing and analyzing the data collected. According to the Action Plan, the role of the United States in this regard will focus on:

> Supporting partners with high-quality data and providing training on available tools to support data collection and use and application of best practices in water resource planning across sectors. Working with both interagency and non-government partners, scientific and technical agencies will translate their information about countries' and regions' water resource endowments and water use - including identifying root causes of water insecurity and potential water shocks - into accessible formats (White House, 2022, p. 7).

Satellite and other technological instruments for Earth observation monitoring of planetary water reserves is the responsibility of NASA's Earth Science Division's Applied Sciences Program for Water Resources, whose main objective is "to discover, demonstrate, and transfer innovative uses and practical benefits of NASA's Earth science observations, research, and technologies for improved water management to the water resources management community" (NASA, 2020, p.4). The fulfillment of this objective involves a wide range of actors that make up the so-called "water resources management community" (NASA, 2020, p.4), a sort of university military industrial complex, as an organized network for water resource management, made up of organizations of various kinds, such as federal agencies, universities, large corporations, intergovernmental agencies, non-governmental organizations, philanthropic foundations such as the Walton Family Foundation and the Gates Foundation,

together with the U.S. Air Force and the U.S. Army Corps of Engineers. The link between these military devices and NASA was formalized through the Department of State Interagency Water Working Group (IWWG), specifically with the IWWG Science and Applications Team (ISAT), through a two-year close collaboration, whose objective has been "aimed at improving and fielding science and engineering technology that bridges the gap between prediction of Earth global hydrologic cycle properties and decision-making processes in order to more thoroughly understand global food and water security challenges" (NASA, 2020, p. 13). This type of linkage with the military apparatus reflects the strategic value that information has acquired in a context in which information and communication technologies are part of military operations. The control and analysis of available information on water resources will provide the United States with a competitive advantage over other States, mainly in terms of their location, quality and available quantity, which is why it is openly recognized that the global water situation is a matter of National Security for the United States, as stated in the White House Action Plan for the 2022 Global Water Strategy:

> This Action Plan highlights and reinforces existing U.S. Government tools and resources that explicitly recognize and address the critical links between water security and national security and, for those that insufficiently address these links, can reorient relevant initiatives. Because water security can both contribute to and mitigate these challenges, it is clear that the United States cannot achieve its foreign policy and national security objectives without global water security. (White House, 2022, p.4)

Mesoamerican water reserves. The second element of power to be analyzed in relation to the hydro-strategic importance of Mesoamerica is its potable water reserves, of vital importance for human consumption as well as for hydroelectric generation. As will be analyzed later, the various regional integration mechanisms that have been created in the region, such as the Puebla-Panama Plan and later the Mesoamerica Project, focus a large part of their efforts on the control of these water reserves, mainly for the construction of hydroelectric projects. The countries of the region

individually possess large water reserves that together make Mesoamerica a fundamental strategic space in the war for water in a context of collapse. An example of this is Mexico, which "has nearly 320 hydrological basins with an average annual water volume of 410 km3" (Aguilar, 2003).

Of great strategic importance, with respect to Mexican water reserves, is the south of the country that concentrates 68% of Mexican water, an abrupt difference with respect to the remaining 32% that is distributed between the North and Central zone of Mexico (Celis, 2017). Of the large water reserves in the south of Mexico, it is relevant to mention with special emphasis the Lacandon Jungle that possesses 25% of the Mexican water resource, in addition to generating 45% of the hydroelectric supply (Fazio, 2018), protected by indigenous peoples and the Zapatista Army of National Liberation (EZLN). This is in addition to the Central American water reserves, which contain 4.6% of the water of Latin America and the Caribbean and with 1.5% of the world (Arias, et al, 2019, p. 5). According to the study conducted by Luis Diego Arias, Juan Manuel Retana and Daniel Torres (2019):

> Central American countries exceed more than three times the average per square kilometer of the world and more than four times that of North America. In addition, although this region is not the most important in terms of total amount of freshwater, its attractiveness goes more for the efficiency of the territory especially in Costa Rica and Panama (p. 5).

Colombia is of high strategic value in Mesoamerican water geopolitics and is one of the countries with the largest water supply in the world, third after Brazil, which is in first place. According to the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), attached to the Ministry of Environment and Sustainable Development of Colombia, the country "has an average water yield that is equivalent to 6 times the world average and 3 times that of Latin America; in addition to groundwater reserves that triple this supply and are distributed in 74% of the national territory" (Cusgüen, 2018). Colombia also has Amazonian territories, the Amazon basin being the largest in the world, with a total area of 6.15 million km2. Venezuela, on the other hand, also has enormous water reserves, estimated in:

> 1,320 km3 of water or 60,300 m3 per capita. Almost half of Venezuela's 1,000 rivers flow into the Orinoco River, which is the third largest river in Latin America. Its accumulation pond occupies approximately four-fifths of the country's territory (RT, 2015).

The Alter do Chão aquifer, in the states of Pará, Amapá and Amazonas, in Brazil, which also includes southern Venezuela, mainly the states of Bolívar and Amazonas, adds to these large reserves (Larotta, 2016). It is estimated that this aquifer exceeds the Guarani Aquifer in water volume, having a water reserve estimated at 86,400 cubic kilometers of water, making it the largest on the planet, with the capacity to supply the world's population up to one hundred times (Araújo, 2010).

B. Water imperialism: Strategic Dependence and National Security

On July 21, 2017, through Presidential Executive Order #13806, then President Donald Trump requested an analysis on the current and future status of the U.S. defense industrial base and supply chain, with the objective of ensuring and maintaining U.S. military superiority (White House, 2017). In response to that Executive Order, an Interagency Task Force was established to conduct this analysis, resulting in the September 2018 report Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States.

The report produced by the Department of Defense in coordination with other Secretaries such as Commerce, Labor, Energy, and Homeland Security concludes that the Defense industrial base faces an "unprecedented" set of challenges, which when presented in combination, have "erode the capabilities of the manufacturing and defense industrial base and threaten the Department of Defense's ability to be ready for the "fight tonight," and to retool for great power competition" (DOD, 2018, p. 2). This unprecedented challenge was seen as a "blueprint for action" to strengthen the U.S. defense industrial base and imperial architecture, to ensure unrestricted access to resources, making clear its strategic dependence on them, mainly on the large reserves held by Latin America in general. This was reaffirmed in a January 2023

interview for the think tank Atlantic Council by the commander of the United States Southern Command, Laura Richardson, for whom the importance of Latin America lies in the amount of strategic resources it possesses, such as lithium, oil, rare earths and, of course, potable water reserves, which the commander assumes to be the property of the United States when she states that "*we* have 31 percent of the world's fresh water in this region" (Atlantic Council, 2023).

For Commander Richardson, control of these resources is a matter of National Security for the United States, and the United States must "step up our game and we need to be faster, and we need to work and deliver capabilities at the speed of relevance for this region" (Atlantic Council, 2023).

Richardson's insistence in pointing out that Latin American resources are a matter of National Security should not go unnoticed by anyone, especially if we take into consideration the definition of National Security which, without any ambiguity, the United States Department of Defense defines as "A collective term encompassing both national defense and foreign relations of the United States with the purpose of gaining: a. A military or defense advantage over any foreign nation or group of nations; b. A favorable foreign relations position; or c. A defense posture capable of successfully resisting hostile or destructive action from within or without, overt or covert" (DoD, 2021, p. 150). A favorable foreign relations position; or c. A defense posture capable of successfully resisting hostile or destructive action from within or without, overt or covert" (DoD, 2021, p. 150).

The fact that in the *Global Water Strategy* itself and in its Action Plan prepared by the White House, the so-called water security is considered a matter of National Security should set off all the alarms, specifically when it is stated that "As the world becomes increasingly water insecure, the significance of water security in U.S. foreign policy and national security goals is coming into sharper focus" (White House, 2022, pp. 2-3). Without room for any kind of relativism, what lies at the heart of the matter must be understood as Water Imperialism, which tends to the militarization of the world's water problems are being militarized,

both for their defense and unrestricted access for the United States and its allies, as well as for their potential use as a weapon of war against their enemies. In other words, that the emphasis of the *Global Water Strategy* should *be on:*

> The need to explicitly link water security to national security to improve global resilience; elevate data-driven methods; use resources more efficiently; and work in partnership with states, Tribes, local governments, and Indigenous peoples, as well as non-governmental entities including the private sector (White House, 2022, p. 3)

What is pointed out is, based on the same definition of the Department of Defense, that resilience, information gathering, more efficient uses of resources, relations with other states, local governments, indigenous peoples and corporations, have clear military purposes that seek to give the United States an advantage over all other actors, taking advantage of the uses it can make of water in the context of war.

All the aforementioned information shows the strategic nature of regions such as Mesoamerica for the United States, and the reason for the imperialization of its territories has the clear objective of ensuring unrestricted access to the strategic resources found in the region, for which it has been necessary to develop a whole series of infrastructures that allow it to fulfill this purpose. The long process of imperialization of Mesoamerica was consolidated on June 28, 2008 at the Tenth Tuxtla Summit, held in Mexico, when the heads of state and government of the countries of the region proposed a restructuring of what until then was known as the Puebla-Panama Plan (PPP), and the beginning of a new phase of regional integration, This instrument, together with a series of political, diplomatic, police-military, economic, legal and socio-cultural devices, articulates and consolidates the imperialization of the territories of this region according to U.S. interests. The imperialization of Mesoamerican territories through regional integration plans such as the PPP and the MP, has meant the construction of strategic infrastructure necessary for the defense, domination and exploitation of the territories of the region, such as the construction of highways, development

corridors, hydroelectric projects and the construction of energy infrastructure (oil and gas pipelines, power lines, ports, airports, among others), which connect the different territories, facilitating and accelerating the transportation of goods and raw materials, as well as ensuring the custody of strategic elements.

Consequently, the processes of imperialization are not presented as such, but as cooperation projects for security, integration and regional development, conceived not from the vertical imposition, typical of imperialism, but as a sort of horizontal "partnership" between the parties twinned by geography and history. This is alluded to by the former commander of the US Southern Command, James Stravridis in his book, *Partnership for the Americas. Western Hemisphere Strategy and US Southern Command*, when he states that:

> We, the United States, must also strive to ensure that our fellow residents recognize and believe that we are truly in this together; we want them to see the United States as the partner of choice in a cooperative approach to our shared destiny of a secure, peaceful, flourishing, and egalitarian home (Stravridis, 2010, p. XVII).

Thus, the imperialization of Mesoamerican territories and the control of large reserves of resources such as water are disguised and presented as cooperation and partnership between interdependent parties, in which the United States arrogates to itself the unquestionable leadership -primus *inter pares-,* to guide international efforts to monitor and safeguard free access to water resources for "the most vulnerable populations" (White House, 2022, p. 6).

The critical situation of water reserves and their distribution is used to impose a predominant vision of the binomial between security and development, in which all the problems are the result of bad public policies and rampant corruption in the peripheral states, a reason that limits any possibility of development for these countries and with it, the explosion of violence. y The control and monitoring of water reserves and distribution is presented in terms of the security and development binomial, and is considered as one of the pillars of the *Global Water Strategy* in the White

House action plan for its implementation, as can be read in the document: Promoting sustainable management and protection of water resources and associated ecosystems to support economic growth, build resilience, mitigate the risk of instability or conflict, and increase cooperation (White House, 2022, p. 7).

However, the security-development binomial hides an entire strategy of pacification of populations and control of strategic resources, through a series of cooperation plans or agreements and privatization processes, under the aegis of the need for more efficient integrated resource management, which can only be achieved through public-private alliances. According to Mark Duffield:

> Under the influence of the merger of development and security, and the privatization of these responsibilities, cross-border connections and networks have been consolidated, and even new forms of collaboration have emerged. Actors, organizations and institutions that were once relatively autonomous now find new types of synergy, new mutual and overlapping interests. New institutions have been born and existing ones have changed their objectives and found new ways of interacting (2004, pp. 84-85).

These new types of synergy described by Duffield are found in euphemisms such as the "Water Management Community" which, as I pointed out earlier, is closer to the development of a military-industrial-university complex for water management in which converge both the private sector, government agencies, international organizations close to US geopolitical interests, and military apparatuses, whose fusion and collective work is the ideal response to the problems and conflicts related to water and its sanitation, resulting from the mismanagement of peripheral state governments and local communities. Their merger and collective work are the ideal response to water and sanitation problems and conflicts resulting from mismanagement by peripheral state governments and local communities. According to Duffield:

> By defining conflict as a social problem, i.e., by turning underdevelopment into a danger, new networks are allowed to mobilize in the name of security. War is no longer a

> state issue in the Clausewitzian manner, it is a problem of underdevelopment and political crisis and, as such, needs development and security professionals to find new ways of working together (2004, p. 76-77).

In the case of Mesoamerica, the PPP allowed the "synergy" between the public and private sectors to solve the demands caused by the backwardness and violence suffered by the region, which at the same time became an instrument of domination and reinforcement of U.S. control over the region. According to Carlos Fazio:

> As in Plan Colombia, one of the purposes of the US with the PPP was to intervene in the political-social conflict in Mexico, to impose and favor the oil transnationals (linked to the Bush administration), to facilitate the privatization of air and port terminals, electric energy, water and hydrocarbons, and to protect the landowners engaged in extensive agro-industrial and cattle ranching development, protect landowners bent on extensive agro-industrial and livestock development and, mainly, to seize without restrictions the enormous riches in biodiversity of the Lacandon jungle, the Chimalapas on the borders of Oaxaca and Chiapas, and the Mesoamerican Biological Corridor, which reaches as far as Panama (Fazio, 2018).

Fazio's description is critical to understanding the importance of the creation of development projects and their linkage to U.S. energy security. Two months after the creation of the PPP was enacted, on May 17, 2001, the George W. Bush administration adopted the National Energy Policy (NEP), which explicitly called for a stronger government role in helping U.S. energy companies overcome barriers to investing in foreign oil and natural gas projects. Among its main directives, the NEP suggested that the president "make energy security a priority in our trade and foreign policy" and assume overall responsibility for managing the country's energy diplomacy" (Klare, 2008:43).

By conceiving the region as a unified whole through this type of integration project, the aim was to exploit its shared economic potential, mainly in terms of its strategic resources, which

entities such as the Organisation for Economic Cooperation and Development (OECD) considered to be underutilized. According to the organization, Mesoamerica:

> To move beyond its current economic situation, the region should look to create competitive advantages through more effective exploitation of its privileged geographic location and its wealth of natural and cultural resources (OECD, 2006, p. 39).

The consolidation of dominion over the region, while advancing with the integration process and the construction of strategic infrastructure, came through the continuation of the PPP, now called the Mesoamerica Project, which came to include all of Mexico, Central America, Colombia and the Dominican Republic, thus approaching the construction of the Mesoamerica of the U.S. geopolitical imaginary. Within the framework of the project, imperial instruments of the United States, such as the Inter-American Development Bank (IADB), the Central American Bank for Economic Integration (CABEI) and the Development Bank for Latin America (CAF), are considered as financial partners of the countries for the construction of the infrastructure necessary for "regional integration".

The Mesoamerica Project came to reinforce the convergence between security and development to give continuity to the strategy of shielding and controlling the region. Two days after the Villahermosa Summit, on June 30, 2008, U.S. President George W. Bush created the Merida Initiative, which became a sort of Plan Colombia for Mexico and Central America, securing the Mesoamerican region as a strategic reserve, at a time when the United States was suffering the greatest economic collapse in its history.

The Mesoamerica Project-Merida Initiative binomial became the mechanism to ambush and shield the region to ensure the process of imperialization of the territories and control its strategic resources in the face of the collapse of the U.S. economy in 2008. For Jorge Beinstein,

> The US economy is presented as the generating center of [the financial, energy and economic crises, BGH], its energy voracity

> operates as the main catalyst of the turbulences in the oil and food markets, its parasitic hypertrophy (speculative, military, consumerist) feeds the world financial disorder. It is a long process of development of internal-external tendencies that plunged US society into decadence and, due to its enormous relative global weight, conditioned the evolution of the rest of the world (2009, pp. 28-29).

Conclusion

The promotion of integrated public-private management of Mesoamerica's water resources has sought nothing more than the imperialization of water, ensuring its unrestricted access and custody through its military apparatus, such as the Southern Command, while using its imperial architecture and agencies such as the World Bank, the Inter-American Development Bank and others to ensure that, according to John Saxe-Fernandez and Gian Carlo Delgado (2004):

> US capital to "manage and usufruct" water resources through "conservation" projects and/or privatization of water basins, aquifers, etc. Also, and as a complementary mechanism to solve the intense fresh water crisis that is beginning to be experienced, it is strategic for the interests of the multinationals to induce the partial or total privatization (concessions) of the world systems of distribution, storage and potabilization, especially those that satisfy the needs of the big cities (just where the big business is; p. 34).

This analysis exposes the political nature of water, since despite the progress that has been made in guaranteeing universal access to water, there is a huge gap in terms of actual access. In other words, access to drinking water is a political instrument at the service of those who control water resources and their means of distribution. Consequently, "resources, being scarce, should no longer be freely accessible to all, but only to a few, i.e., those who pay for access to them" (Arias, et al, 2019, p.5). The catastrophic future of water resources has not led the international community to advocate for water sovereignty that guarantees free and safe access to water as a human right and necessary for planetary life in general. On the contrary, the idea of water security conceived in official speeches as:

> The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (UN Water, 2013, p. 1).

This idea of water security has become the preferred solution of governments such as the United States and the agencies with which it articulates its international projection, such as the World Bank and the International Monetary Fund, to combat water shortages resulting from poor management by peripheral states. For this reason, the only way to ensure water security is through integrated management shared with the private sector. However, as Vandana Shiva rightly points out:

> Unfortunately, privatization leads to the acceleration of unsustainable water use and a deepening of the hydrological divide; it leads to corporate control of water supplies and to more speculation than fair distribution. As a result, people without purchasing power are denied their right to water, and thus their right to life (2007, p. 69).

This type of political instrumentalization is confirmed in the recommendations of the U.S. Office of the Director of National Intelligence in its 2012 report:

> The United States can benefit from an increased demand for agricultural exports as water scarcity increases in various parts of the world. This would be especially true if states expecting increased water scarcity rely upon open markets instead of seeking bilateral land-lease arrangements in other countries to achieve their food security (ODNI, 2012, p. VI).

In short, the political instrumentalization of the Mesoamerican water resource is a key element for understanding how U.S. imperialism operates in a plutogenic context of accelerated depletion of the planetary commons, considered as strategic resources and the struggle to control the remaining ones. Consequently, the war for water is a war against life.

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Chapter 4

The Approaching Water Crisis in the city of Calgary, Alberta, Canada: A Case Study

Krishna Kolen

Keywords: water crisis, water insecurity, Calgary, Alberta, Canada

Introduction

As climate change progresses and population growth continues, the city of Calgary will be faced with a water crisis that will impact its population of 1.3 million people (The City of Calgary, 2020). Climate change will likely cause earlier snowpack melt in the nearby mountains, more intense precipitation events, and hotter, drier, and longer summers which increases susceptibility to droughts and more frequent wildfires, and consequently flash flooding (The City of Calgary, 2020; Pomeroy & Fang, 2023; Westerling et al., 2006). River basins are expected to warm significantly, and annual precipitation is likely to transition towards more rainfall and less snowfall, however rainfall is expected to increase for all seasons except for summer when overall precipitation is expected to decline (Knowles et al., 2006; Pomeroy & Fang, 2023). Earlier snowmelt could prolong the fire season near Calgary, which could increase the risk of forest fires that would have impacts on Calgary's air and water quality (Evans et al., 2021; Pomeroy & Fang, 2023; Westerling et al., 2006). Climate change impacts are likely to make it more difficult for reservoirs to satisfy water demands of Calgarians and wildfire pollution will cause impacts to water quality (Evans et al., 2021; The City of Calgary, 2020; Westerling et al., 2006). Population growth will have impacts to local water security due to increased pressure on water supplies and increased stormwater runoff which will contribute to higher water supply contamination risks (The City of Calgary, 2020). With the population projected to double by 2064, there will be a need to achieve a 50% reduction in per capita

water use to provide Calgarians with a sustainable water supply, but cyclical climate change patterns indicate low river flow and higher temperature periods, which could lead to the demand for water exceeding supply allotments (CitySpaces Consulting Ltd., 2007). Calgarians are already large water consumers due to the dry climate and therefore climate change impacts are likely to contribute to increased water insecurity. Further future challenges to Calgary and its surrounding communities could be economic damages, water disputes with other provinces, and access to water for Indigenous communities (Boutillier, 2022; Lawrynuik, 2020).

It is significant to note that areas with high water availability, such as Calgary, can become water insecure due to increased flood risk, deteriorated water quality, and poor governance (Caretta et al., 2022). Water insecurity has emerged as a significant global challenge, and climate change impacts people in water-related ways (Caretta et al., 2022). It is affecting the overall availability of water across regions, including in areas with high water availability, such as Calgary (Caretta et al., 2022; The City of Calgary, 2020). There are high uncertainties of climate change impacts via water, which emphasizes the importance of case studies at different scales to understand how water will impact different communities (Caretta et al., 2022) This case study is significant to contributing to this research gap because it will attempt to discuss projections of how climate change will impact water availability and people in the region of Calgary, Alberta, Canada.

The current lack of research on local uncertainties of climate change impacts on water insecurity demonstrates the need and significance of this case study. As mentioned above, Calgary is a community with high water availability, but water insecurity is still likely to impact it due to a changing climate. Communities with high water availability are likely to experience water insecurity through increased flood risk, deteriorated water quality, poor governance, and other challenges. This case study will employ the use of a document review to assess the current literature related to the impacts of climate change on water security in the city of Calgary, Alberta, Canada. Objectives of

this chapter are to (1) Discuss how climate change may impact water in the city of Calgary and the water needs of Calgarians; and (2) Examine the likely impacts to local water security caused by population growth and increased stormwater runoff as well as potential further challenges of water insecurity, including economic damages, water disputes with other provinces, and access to water for local Indigenous communities. This case study aims to answer the following research questions:

- *How will climate change likely impact water availability, water security, and water needs in Calgary, Alberta, Canada?*
- *How will challenges such as population growth, increased stormwater runoff, economic damages, water disputes, and access to water for local Indigenous communities' impact local water security in Calgary, Alberta, Canada?*

Contextual Background

Calgary's water supply comes from the Elbow and Bow Rivers, which have headwaters in the Rocky Mountains (CitySpaces Consulting Ltd., 2007; Fang and Pomeroy, 2023). The greater Calgary area, including Cochrane, Airdrie, Bragg Creek, and Chestermere relies solely on the water from the Bow and Elbow rivers (CitySpaces Consulting Ltd., 2007). The waters flow eastward as part of the S. Saskatchewan River Basin, which eventually reaches the Arctic Ocean through Hudson's Bay (City Spaces Consulting Ltd., 2007).

Projected Climate Change in Calgary

Climate change is likely to impact the city of Calgary through earlier snowpack melt, more intense precipitation events, more frequent fires, and flash flooding. In the future, the region that includes Calgary is expecting to see a warming of river basins (Fang and Pomeroy, 2023; Westerling *et al.*, 2006). The river basin is expected to warm up significantly (by around 4.5°C) and is likely to receive 12-15% more precipitation annually under the business-as-usual climate change scenario (RCP8.5; Pomeroy & Fang, 2023). It is projected that annually precipitation will transition towards more rainfall and less snowfall, and rainfall is expected to increase for all seasons except for the summer, when

overall precipitation is expected to decline. Snowfall is expected to decrease in all seasons except for winter (Knowles *et al*., 2006; Pomeroy & Fang, 2023). Changing climates are also expected to cause a decline in snowpacks and an increase in glacier melt and wastage through reduced blowing snow transport, diminished sublimation losses (which is likely to occur due to blowing snow and intercepted snow), shorter snow-covered periods, and earlier snow depletion (Caretta *et al*., 2022; Pomeroy & Fang, 2023). Decline in snowpacks is also expected to occur due to warmer Chinook events, which may result in snow cover depletion from rapid snow melt and sublimation (Caretta *et al*., 2022; Pomeroy & Fang, 2023). The Bow River watershed contains a range of ecozones, so the response to snowmelt rates due to climate change are likely to vary due to complex interplay between air temperature, precipitation, snow redistribution, albedo decay, and seasonal variation in radiation fluxes (Knowles *et al*., 2006; Pomeroy & Fang, 2023). Climate change is predicted to cause shorter snow cover duration and earlier depletion, which is likely to cause an earlier onset of spring snowmelt freshet (Caretta *et al*., 2022; Pomeroy & Fang, 2023). Streamflow decline is also expected to occur earlier in the summer due to higher evapotranspiration loss, reduced redistribution of snow (causing faster snowpack depletion, earlier meltwater availability, reduced alpine summer snowmelt, and glacier melt (Caretta *et al*., 2022; Pomeroy & Fang, 2023). This is expected to occur in several snow-dominated basins and glacier melt-dominated basins in the Canadian Rockies where climate change is accompanied by deglaciation. Melting of glaciers could also result in substantial short-term increases in discharge volumes (Caretta *et al*., 2022; Pomeroy & Fang, 2023). Earlier snowmelt caused by reduced snow redistribution, earlier and faster snowmelt, higher evapotranspiration, and low late summer precipitation is likely to result in the recharge of subsurface moisture in the spring and lower subsurface moisture through the summer (Knowles *et al*., 2006; Pomeroy & Fang, 2023). This dryness in the summer months could increase the risk of forest fire and prolong the fire season (Pomeroy & Fang, 2023; Westerling *et al*., 2006). Other climate change impacts include warmer air temperatures and more frequent and intensive storm events in the spring and summer (Caretta *et al*., 2022; Knowles

et al., 2006; Pomeroy & Fang, 2023). Warmer air temperatures could develop favourable conditions for mountain pine beetle infestation and other forest diseases, while more frequent and intensive storm events in spring and summer could lead to a higher risk of flooding in the river basin and in downstream communities (Pomeroy & Fang, 2023).

Changing Water Needs of Calgarians

Two main drivers are likely to be attributed to the changing water needs of Calgarians: increasing population and the impacts of wildfire smoke and pollution on water quality. With climate change, the Calgary region is expected to see increasing temperatures, changing precipitation patterns, and declining river flows (CitySpaces Consulting Ltd., 2007; Knowles *et al.*, 2006; Pomeroy & Fang 2023; Westerling *et al.*, 2006). This will impact the water needs of the population, especially because the population of Calgary is projected to double by 2064 (CitySpaces Consulting Ltd., 2007). Currently, the province of Alberta, where Calgary is situated in, has a provincial water licensing system (CitySpaces Consulting Ltd., 2007). This means that municipalities are limited to maximum annual and daily withdrawals for water (CitySpaces Consulting Ltd., 2007; The City of Calgary, 2020). The water that is used by municipalities, such as Calgary, is also shared with high-demand industrial and agricultural users and industry within the watershed and is also passed into other provinces (CitySpaces Consulting Ltd., 2007; The City of Calgary, 2020). With growing populations, this will impact how water is used and allocated. Currently, in the face of population growth, Calgary has been successful in reducing per capita water use through system improvements and demand measures (CitySpaces Consulting Ltd., 2007; The City of Calgary, 2020). In the future, the city needs to reach at least a 50% reduction in per capita use by 2064 to provide a sustainable supply of water, but cyclical climate patterns and climate change indicate low river flow and higher temperature into the 2060s which could lead to water demand exceeding supply allotments set by the province (CitySpaces Consulting Ltd., 2007).

Calgarians are high consumers of water due to the dry climate of the region (CitySpaces Consulting Ltd., 2007; The City of Calgary,

2020). Currently, municipal water demands exhibit seasonal variation: high demand in the summer, especially when the weekly mean temperature exceeds 10°C or weekly precipitation accumulation is less than 30mm (CitySpaces Consulting Ltd., 2007; The City of Calgary, 2020). This is problematic because water is shared both up- and downstream, including with other communities, rural areas, industrial users, ranchers, farmers, ad irrigation districts (Caretta *et al.* 2022; CitySpaces Consulting Ltd., 2007; Sommerfield, 2012). The highest water consumption period occurs during the growing season, or in the summer, which results in a net loss due to outdoor water use (CitySpaces Consulting Ltd., 2007; The City of Calgary, 2020). The Bow River is the major supplier of municipal water in Calgary and peak summer water use has almost reached licensing limits at the current population (CitySpaces Consulting Ltd., 2007). If the population continues to grow, and eventually double by 2064 as projected, this could have impacts on water security and water use for Calgarians. If only 25% of water is conserved up to 2064, baseline water use increases by 75% (CitySpaces Consulting Ltd., 2007). This would mean that the summer demand would exceed the current daily withdrawal and will not leave sufficient amounts of water to balance the demand growth and supply availability with a growing population (CitySpaces Consulting Ltd., 2007). If 50% of water is conserved up to 2064, the city would be able to provide a sustainable water supply on an annual basis, however there could be exceedances during hot summer days in which demand exceeds supply (CitySpaces Consulting Ltd., 2007). Even with 50% conservation, low river flows are predicted, so demand could exceed the total river discharge that is licensed to the city of Calgary (CitySpaces Consulting Ltd., 2007). The challenge, in the case of increasing population and the resulting changing water needs of Calgarians, would be how to increase supply while following provincially regulated limits and a lack of any other nearby water source.

Another issue that is projected to impact the water needs of Calgarians is the impact of fires within the watershed. Fires are expected to increase in frequency and intensity with climate change (Evans *et al.,* 2021; Westerling *et al.*, 2006). Evidence of fire impacts in watersheds are biogeochemical effects to surface

water quality (Evans *et al.,* 2021). Biogeochemical effects can include runoff of nutrients and toxins, reductions in uptake by vegetation, and smoke (Evans *et al.,* 2021). Smoke, specifically, can impact water quality through fine particulate matter (PM2.5; Evans *et al.,* 2021). PM2.5 contains potassium (K^+) and calcium (Ca^{2+}), which are routinely measured in air and water quality analyses and can be used as indicators of PM2.5 from smoke in water bodies (Evans *et al.,* 2021). Evans *et al.* (2021) tested water bodies in Alberta after fires and found elevated K^+ levels in the water. Elevated K^+ levels is not itself a concern for drinking water or ecosystem processes, but the study suggests that it could be used as an indicator ion for other nutrients, toxins, and microbes present in wildfire smoke in water (Evans *et al.,* 2021). This is problematic for the water needs of Calgarians because PM2.5 can be harmful to human health and if it is present in drinking water, it would impact how water needs to be treated before it can be used by Calgarians.

Impacts to Local Water Security

Impacts to local water security are likely to manifest through economic and population growth, specifically through increased pressure on water supplies and increased stormwater runoff (resulting in higher water supply contamination risks). With current projections of water demand from population growth, the City of Calgary is concerned that they will not be able to provide the full amount of water demanded on a peak day by consumers by the mid 2030s, which will have major impacts to local water security (CitySpaces Consulting Ltd., 2007; The City of Calgary, 2020). To minimize the impacts, the city is investing in infrastructure upgrades and water conservation programming and emphasizes the need to consider multiple and growing water users and needs within the context of climate change so that the demand for water does not exceed the supply (CitySpaces Consulting Ltd., 2007; The City of Calgary, 2020). The main impacts to water security related to population growth and increased pressure on water supplies are water-intensive uses, climate change, and economic downturn, which would create competition for water resources and ability to pay for water services (CitySpaces Consulting Ltd., 2007; The City of Calgary, 2020).

Increased stormwater runoff is also a potential result of population growth that is likely to impact water security. Growing populations will increase stormwater runoff, which will in turn result in higher water supply contamination risks (CitySpaces Consulting Ltd., 2007; The City of Calgary, 2020). To reduce these risks, the city government has engaged with the urban development industry and other stakeholders due to the joint responsibility for stormwater management (CitySpaces Consulting Ltd., 2007; Sommerfield, 2012; The City of Calgary, 2020). Stormwater management encompasses understanding the needs of Calgarians as well as communities, industry, agriculture, and Indigenous groups up and downstream of the city and is used to work towards stormwater quality improvement to protect water security (Boutillier, 2022; Sommerfield, 2012; The City of Calgary, 2020). The city emphasizes the importance of working with water treatment plants upstream and that stormwater runoff from current and future land development is one of the top risks to the quality of water supply (The City of Calgary, 2020). This means that land use decisions need to include water supply and water quality considerations, which is critical to mitigate the impacts off population and economic pressures on water resources (The City of Calgary, 2020).

Further Challenges of Water Insecurity

Further challenges of water insecurity relate to economic damages. The two main industries in Alberta that are likely to be impacted by water insecurity are oil sands development and agriculture (Gibbins *et al.*, 2011; Sommerfield, 2012). Agriculture is completely dependent on water for its success, so it is particularly vulnerable to shifts in water supply because no water would result in no crop or livestock production (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Water is necessary for growing crops, raising animals, drinking, processing food products, and diluting chemicals such as fertilizers and climate change will likely impact water levels and seasonal temperatures, resulting in stress being placed on the agriculture industry (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Early snowmelt can result in over-saturated lands, which means that

farmers will be unable to seed crops at usual times and extreme weather as a result of climate change, including unexpected floods and droughts, can cause financial and environmental havoc for the agricultural industry (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Flooding can cause loss of farmland, risks to safety, and inaccessibility to roads and droughts can deplete soil moisture levels, reduce stream flows, lower lake and reservoir levels, and diminish groundwater supplies, all which can result in major financial losses (Caretta *et al.*, 2022; Sommerfield, 2012). There are local and global implications to this – if crops and livestock cannot be produced, farmers take large financial losses and products that are available will become more expensive, which will have impacts to domestic and global consumers (Caretta *et al.*, 2022; National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Another threat to water security by agriculture is water quality via contamination from livestock, excess nutrients, pathogens, pesticides, and herbicides (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). This can impact the agricultural community, neighbouring communities, and the environment, specifically through eutrophication which is a widespread problem affecting rural water resources and needs to be addressed to achieve water security (Gibbins *et al.*, 2011; National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Water quantity is also a water insecurity issue due to competition for water supply between the agricultural community, municipalities, and Indigenous communities (Boutillier, 2022; Gibbins *et al.*, 2011; Sommerfield, 2012). Other issues include agricultural infrastructure, which can contribute to soil erosion, and drainage of wetlands due to agriculture, which can result in changes to important environmental services including habitats to local species, natural flood management, and filtering water of pollutants (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012).

The pollution created by oil sands development is another economic challenge to water security (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Water

is used in *in situ* oil sands extraction, where steam is required to heat up oil in the ground to make it flow upwards into wells (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Water use, therefore, will increase as oil sands mining increases, and with population growth and demand for energy is predicted to increase, water demand from oil and gas companies will also increase (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). The major concerns related to oil and gas development are the environmental impacts of energy development and Indigenous water and land rights (Boutillier, 2022; Gibbins *et al*., 2011; National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Water quality is impacted because effluent from oil sands production ends up in tailings ponds, so there are risks of oil spills and toxins leaching into the earth bellow and around the ponds which can cause impacts to drinking water, fish populations and the communities that rely on them for food, and overall ecosystem health (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). There are also impacts to Indigenous communities downstream of oil and gas development and other communities within and outside of provincial borders (Boutillier, 2022; Gibbins *et al*., 2011; Sommerfield, 2012). Water quantity is also an issue because energy production requires large amounts of water and although companies cannot withdraw unlimited amounts of water, they have a relatively secure supply due to vague government regulations and water withdrawals not being comprehensively tracked in the energy sector (Gibbins *et al*., 2011; Sommerfield, 2012). When withdrawals are tracked in the energy sector, companies are reluctant to disclose numbers, and there is no law that requires them to (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). This has long term implications as not tracking water usage in the energy sector is detrimental to ensuring the security of Canada's water supplies and demonstrates the need for global perceptions of energy production and environmental protection to convince oil and gas producers to be moral (Gibbins *et al*., 2011; Sommerfield, 2012).

Methods

Study Location

The location of this case study is in Calgary, Alberta, Canada (51.0477 N, 114.0719 W; Fig. 1 and Fig. 3). Calgary is located in the Bow River Watershed (Figure 2: Bow River Basin Base Map; Bow River Basin Council, 2023).

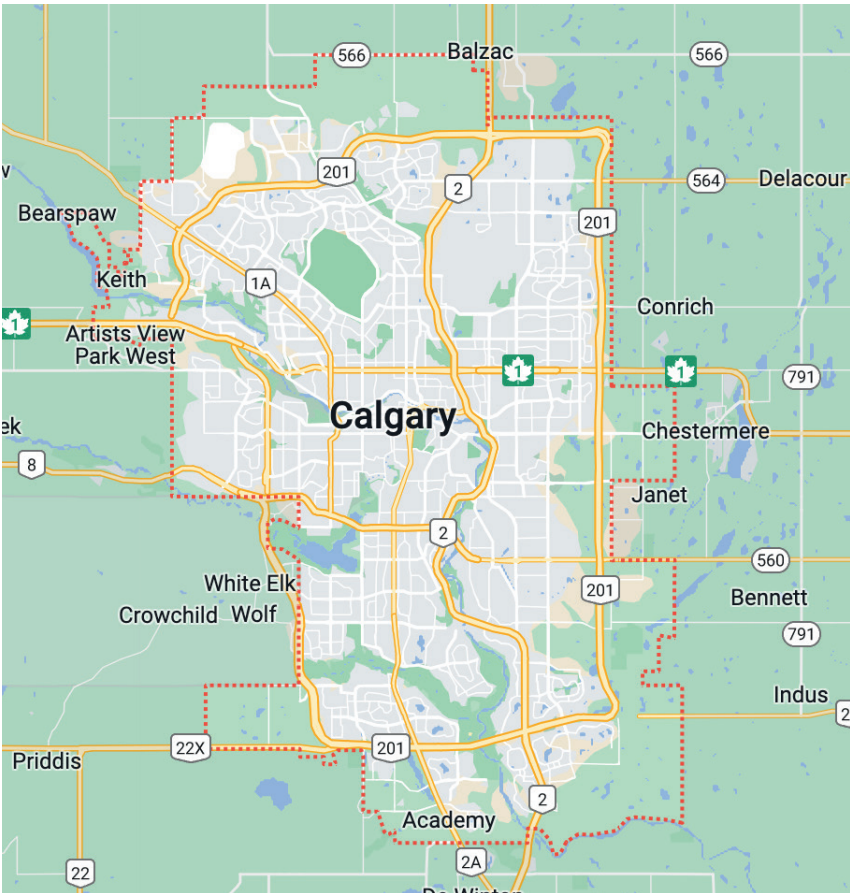

Figure 1: City boundaries of Calgary, Alberta, Canada. *Retrieved from:* **Google Maps.**

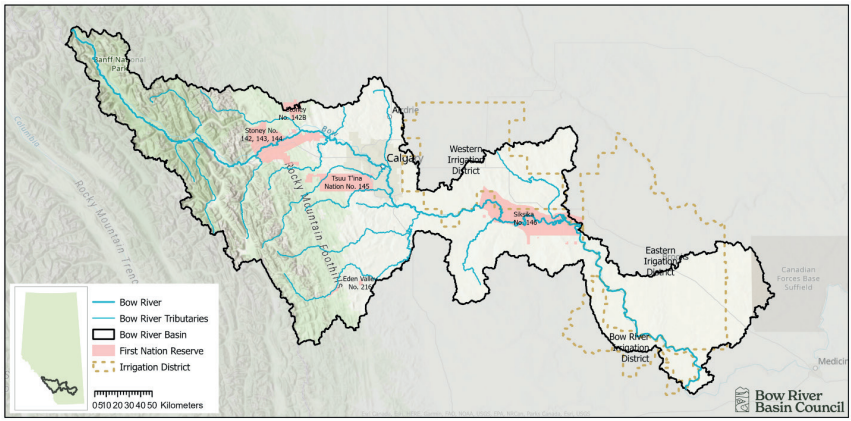

Figure 2: Bow River Basin Base Map. *Retrieved from:* **Bow River Basin Council (2023).**

Figure 3: Location of Calgary, Alberta, Canada on the map of North America. *Retrieved from:* **Google Maps.**

Research Methodology

The case study consisted of a document analysis to assess the projected climate change impacts on water security in and around Calgary. The document analysis included projected environmental impacts, impacts to the water needs of Calgarians, impacts to local water security, and further challenges of water insecurity. Documents included in the document analysis included peer-reviewed studies, grey literature (government publications, consulting firm publications), a chapter by the United Nations Intergovernmental Panel on Climate Change, and news articles.

Researcher Reflexivity

This topic is of relevance to me as a researcher because I was born and raised in Calgary. I have a personal connection to the city because I spent 18 years of my life living there. The impacts of climate change have also been of interest to me for a long time. The concentration of my Undergraduate degree was Changing Climates and Health and now my Master's research looks at the impacts of droughts and drought-induced poor air quality on health. The reason that I chose this topic for the chapter is because of my personal connection to Calgary and the fact that it was my first home and because of my interest in the changing climate.

Analysis & Discussion

Objective 1 was to discuss how climate change may impact water in the city of Calgary and the water needs of Calgarians. Predicted impacts of climate change that are likely to impact Calgary include more intense precipitation events, more frequent fires, and flash flooding. River basins that flow through Calgary are expected to warm and precipitation events are expected to increase for all seasons except for the summer (Knowles *et al*., 2006; Pomeroy & Fang, 2023; Westerling *et al.*, 2006). Snowpacks are projected to decline, and glacier melt is predicted to occur earlier in the season, which is likely to result in an earlier onset of spring freshet (Pomeroy & Fang, 2023). Flooding is likely early in the spring and streamflow decline is predicted earlier in the summer which could increase the risk of forest fires and prolong

the fire season (Pomeroy & Fang, 2023; Westerling *et al.*, 2006). The water crisis is predicted to have a multitude of impacts on Calgarians. Water needs of Calgarians are expected to change due to population growth (CitySpaces Consulting Ltd., 2007). Population growth and changing climates will impact how water is used and allocated based on increased demand for water and decreased supply (CitySpaces Consulting Ltd., 2007). Low river flow and higher temperatures, along with population growth and increased demand, could lead to water demand exceeding supply allotments set by the provincial government (CitySpaces Consulting Ltd., 2007). Increased forest fires are likely to have impacts to water quality, which can also have impacts on Calgarians. Nutrients, toxins, and microbes present in wildfire smoke can impact water quality and can be harmful to human health (Evans *et al.,* 2021; Westerling *et al.*, 2006). If particulate matter from smoke is found in drinking water, this could impact how water is treated before it can be used by Calgarians (Evans *et al.,* 2021).

Objective 2 was to examine the likely impacts to local water security caused by population growth and increased stormwater runoff as well as potential further challenges of water insecurity, including economic damages, water disputes with other provinces, and access to water for local Indigenous communities. The predicted water crisis is likely to have impacts to water security through increased pressures on water supplies and increased stormwater runoff, which is likely to result in higher water supply contamination risks (The City of Calgary, 2020). There are already concerns that the city will not be able to supply Calgarians with the full amount of water demanded on peak use days into the near future and competition for water resources is likely to result (The City of Calgary, 2020). Economic impacts are also likely to impact Calgarians due to the approaching water crisis, especially through the agriculture and oil and gas industries (Sommerfield, 2012). Climate change and water insecurity are likely to place stress on the agriculture industry both through floods and droughts (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Major financial implications could occur in the agriculture sector because if crops and livestock cannot be produced, farmers will experience large financial losses

and products that are available will become more expensive for domestic and global consumers (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Pollution caused by the oil and gas industry and potential over-use of water supplies is also predicted to impact Calgarians and neighbouring communities (specifically Indigenous communities who are fighting for water and land rights; Boutillier, 2022; National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). Decreased water quality caused by oil sand pollution cave impacts to drinking water, fish populations and the communities that rely on them for food, and overall ecosystem health (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012).

Connections between Water Security, Water Resource Management, & Water Conflicts

The City of Calgary (2020) currently employs six priority actions to achieve water security: (1) develop future water supply scenarios; (2) address water licensee limits on high demand days; (3) collaborate on a regional solution for water security; (4) advocate for a new upstream reservoir on the Bow River; (5) finalize the Drought Management Plan; and (6) finalize the Source Water Protection Plan and Policy.

Achieving priority (1) is significant because achieving effective long-term management of water security requires developing future water supply and demand planning scenarios that consider climate change impacts (National Round Table on the Environment and the Economy, 2010; The City of Calgary, 2020). Developing future water supply scenarios is necessary for guiding servicing decisions, infrastructure investments, programming, and policy. Priority (2) can contribute to creating options to increase the daily water diversion rate by addressing water licensee limits on high demand days. Achieving priority (3) is only possible through working collaboratively with organizations, stakeholders, and partners (National Round Table on the Environment and the Economy, 2010; The City of Calgary, 2020). It is necessary to create a shared understanding of water security issues and to create a long-term adaptive water supply strategy (National

Round Table on the Environment and the Economy, 2010; The City of Calgary, 2020). Advocating for a new upstream reservoir on the Bow River (priority (4)) contributes to water management practices and storage capacity for both extreme flood and drought situations, which is a priority for adapting to the uncertainties of climate change. This is a major component in flood mitigation and drought management. Finalizing the Drought Management Plan (priority (5)) is needed to ensure that the City can operate within shortage shocks and stresses. The Drought Management Plan will be used to assess drought risks and vulnerabilities under changing climate scenarios and inform improved drought management adaptation strategies and stakeholder engagement. The Source Water Protection Plan and Policy in priority (6) is necessary because it identifies the risk of contamination from wildfires and stormwater runoff from land development (The City of Calgary, 2020).

There are several avenues in which water security risks can be managed. Water supply can be managed using source water protection planning, with specific focus to wildfire and stormwater contamination which are the highest risks currently to source water protection (National Round Table on the Environment and the Economy, 2010; The City of Calgary, 2020). Source water protection planning in Calgary is currently related to land management outside of Calgary and consists of twelve implementation actions to reduce source water risks by building resiliency in water operations and contributing to water security. Water reuse can also be used to manage water supply by using rainwater and stormwater for internal plumbing and irrigation (National Round Table on the Environment and the Economy, 2010; The City of Calgary, 2020). Challenges with this include the need to proceed in a cost-effective manner and to reduce risks associated with public health, the environment, and cross contamination into water infrastructure (The City of Calgary, 2020).

Water demand can be managed using water efficiency planning, drought management, and drought forecasting models. Current water efficiency planning focuses on industrial, commercial, and institutional customers and outdoor water conservation

programming to manage peak day demand of water. Drought management is done through Drought Operational Guidelines which are used to improve preparedness and decision-making by assessing future drought risks and vulnerabilities under changing climate scenarios. Drought forecasting models incorporate future climate change and economic scenarios in order to analyze and optimize future demand management programs (The City of Calgary, 2020).

Another aspect of water resource management relates to systems operations. The City of Calgary (2020) currently utilizes a Water Long Range Plan (WLRP) and a Water Loss Strategy (WLS) as part of their system operations. The WLRP projects future water demands and identifies future water supply system requirements and associated investments. It focuses on major infrastructure such as treatment plants, pump stations, reservoirs, and transmission mains. The WLS focuses on leak detection testing on water infrastructure in the city to reduce water loss and any leaks that arere identified are scheduled for repair. The WLS helps the City of understand the use of potable treated water within the Water Utility infrastructure and to minimize the volume of non-revenue water, which is water that does not end up being delivered to consumers because of issues such as leaks (The City of Calgary, 2020).

The two main water conflicts that are likely to arise because of water insecurity in Calgary and the region around it relate to water disputes with other provinces and access to water by Indigenous communities. Water disputes are likely to occur due to different objectives and viewpoints between Indigenous communities, industry, environmental groups, and provincial and municipal governments (Boutillier, 2022; National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). This is especially of concern because no water originates in eastern Alberta, Saskatchewan, or western Manitoba (the two provinces east of Alberta), so the water from the Rocky Mountains supplies over 11 million people (Sommerfield, 2012). As populations increase and economic activity grows, the risk of water scarcity will likely intensify which is resulting in the need for transboundary agreements and jurisdictional concerns

between provinces. Somerfield (2012) explains that the Master Agreement on Apportionment, managed by the Prairie Province Water Board, lays out the allotment for water between the provinces of Alberta, Saskatchewan, and Manitoba, and dictates that Alberta must pass on 50% of the water flowing in the South Saskatchewan River to Saskatchewan and 50% of Saskatchewan's share must flow into Manitoba (Sommerfield, 2012). If water levels decrease, the potential for conflict between jurisdictions related to water supply is likely to increase (Sommerfield, 2012). Alberta uses First in Time First in Right (FITFIR) or the principle of prior appropriation for water allocation (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). In FITFIR, senior license holders will have first priority when it comes to water supply and are almost always entitled to withdraw their full allocation should they need to do so (National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012). This is problematic in drought periods because junior license holders may not be able to withdraw all their allocation in periods of water scarcity because senior license holders have priority and when the water supply is small, there will be less water left overall in the river, lake, or aquifer it is being drawn from. Senior license holders who do not need or use their entire allocation do have the option of selling part of their allocation to junior license holders for a high fee. This begs the questions of who is responsible for water, does this responsibility only remain inside provincial borders or does this responsibility extend outside of provincial borders, how to deal with the consequences of water flowing downstream, and whether provinces and territories should work separately or to work together on common strategies (Sommerfield, 2012). To answer these questions, the needs and viewpoints of multiple stakeholders (provincial governments, Indigenous communities, industry, environmental groups, and local residents) need to be reconciled (Boutillier, 2022; National Round Table on the Environment and the Economy, 2010; Sommerfield, 2012).

Access for Indigenous communities is another potential water conflict because current water allocation schemes do not recognize or incorporate Indigenous rights to water (Boutillier, 2022; National Round Table on the Environment and the Economy,

2010; Sommerfield, 2012). In the province of Alberta, First Nations communities are considered to have implied treaty rights to water, specifically for drinking water and for agricultural use (Boutillier, 2022). This is problematic because the courts have currently not yet considered whether there actually is an implied right to water under the treaties, although the courts are open to an assertion of these rights by First Nations (Boutillier, 2022). The implication can be problematic for water allocations because of the limited water use available in Southern Alberta and if Indigenous communities are not explicitly recognized to have water use rights, they may be ignored in dire situations. Future considerations here are how water allocation will change when these rights are recognized. Inclusion and consultation with Indigenous communities as an equal partner in determining water futures is critical (Boutillier, 2022; Sommerfield, 2012). Inclusion of Indigenous treaty rights and rights to water and land resources needs to occur in policy and decision-making processes in order to achieve successful water security and to local economies (Boutillier, 2022; Sommerfield, 2012).

Conclusions & Recommendations

The intent of this chapter was to answer the following research questions: (1) how will climate change likely impact water availability, water security, and water needs in Calgary, Alberta, Canada? (Objective 1) and (2) how will challenges such as population growth, increased stormwater runoff, economic damages, water disputes, and access to water for local Indigenous communities' impact local water security in Calgary, Alberta, Canada? (Objective 2).

Majoring findings related to *Question 1* are that Calgary is likely to experience more intense precipitation events, more frequent fires, and flash flooding because of a changing climate. The approaching water crisis is likely to have a variety of impacts on Calgarians and these impacts are likely to be magnified due to changing water needs of Calgarians caused by population growth. Population growth, specifically because of increased water demands and decreased water supplies, will impact how Calgarians use water and how it is allocated. Water demand is likely to exceed supply allotments set by provincial governments. Increased forest fires

as a result of climate change are likely to have impacts on water quality, subsequently impacting human health and how water is treated before it can be used. Main findings related to *Question 2* are related to concerns that there will not be enough water for Calgarians, industry, and Indigenous communities. There are concerns that the city will not be able to supply Calgarians with the full amount of water that is demanded, which is likely to result in competition for water resources. Economic impacts, specifically through the agriculture and oil and gas industries are expected through floods and droughts, financial losses, and increased cost of products domestically and globally. Pollution caused by these industries and potential over-use of water supplies are also likely to impact Calgarians and neighbouring communities. Indigenous groups, specifically, are likely to be impacted because water usage rights are implied in the treaties, but this does not necessarily translate to water allocation by the Alberta government to different sectors and communities.

There are several recommendations that can take place to contribute to water security in Calgary. Water usage can be reduced through conservation, for example, indoor water conservation, commercial water efficiency, lawn and garden conservation, water conservation for multi-family residents, and water management in parks and public areas (CitySpaces Consulting Ltd., 2007). Education for youth to understand why water conservation is important and increased civic awareness of the need to consider locally appropriate responses to climate change is necessary for planned mitigation and adaptation and to reduce future problems and risks of water insecurity (CitySpaces Consulting Ltd., 2007). Community planners should be involved in the decision-making process to help make progressive choices and to facilitate awareness and adaptation and it relates to climate change (CitySpaces Consulting Ltd., 2007). There is also significance in focusing on collaboration between multiple sectors including engineers, scientists, stakeholder groups, the public, Indigenous communities, and planners to create solutions that meet the needs of the entire population. Watershed management should be integrated into land use policies, plans, and decisions and collaborative work should take place with government, adjacent municipalities, residents, landowners, developers,

businesses, and Indigenous communities (Boutillier, 2022; The City of Calgary, 2020).

A major challenge that relates to water security is the governance of water and water scarcity is partly caused by how water sources are governed (Sommerfield, 2012). Water policy must become a priority and there is a need for better water pricing, integrated water and land use planning, and increased public awareness of water challenges to create proactive policy to water management (Sommerfield, 2012). Agricultural recommendations include changing methods to fertilizing lands, maintaining wetlands so that they can filter contaminants before they reach large bodies of water, changing irrigation practices, using non-potable water for irrigation, and growing low-water intensive crops (Sommerfield, 2012). Overall, there needs to be a rethinking of the value of water because it is necessary for economic, spiritual, cultural, ecological, and recreational purposes, environmental services, and for our survival (Sommerfield, 2012).

Several authors have identified the need for research and scientific data related to water security in Calgary. Research needs to take place to address hydrological impacts of low and medium emission scenarios for the region (Pomeroy & Fang, 2023). Studies of combined climate, glacier, forest, and soil changes on hydrological processes and basin response are needed for the larger Canadian Rockies sourced river basins and to better inform water resources and forest management adaptation to climate change (Pomeroy & Fang, 2023). Future research could also look at the contribution of wildfire smoke to the biogeochemistry of ecosystems and drinking water sources including a widespread assessment beyond the watersheds where wildfires occur because smoke can travel thousands of kilometres (Evans *et al*., 2021). More research needs to take place on the location and number of aquifers in Canada due to the current lack of knowledge about how much groundwater western Canada has (Sommerfield, 2012). Finally, there is a need to facilitate the easy access of consistent information to policy makers and researchers regarding water (Sommerfield, 2012).

Key recommendations from this study are to raise awareness about the impacts of climate change on Calgarians. Educating

Calgarians on the risks they face because of changing climates is what might motivate change and adaptation. Educating the public, and especially youth, is integral to creating a population that cares about our ecosystems and want to inflict positive change. Involving many stakeholders who are representative of the population and of equity-deserving communities is also significant to ensure that the needs and voices of the population are heard. Indigenous communities need their rights recognized and for their knowledge systems to be valued to create sustainable solutions that can help with adapting to climate change (Boutillier, 2022). More research needs to take place with different communities and at many different scales to see direct impacts of climate change, to understand how different actors impact each other, and to help develop adaptation strategies. Responses should be locally and culturally appropriate and research should take a strength-based, coupled-systems approach to produce results that can create meaningful change. Decision-makers also need to center science and consult multiple stakeholders in their decisions (for example, scientists, researchers, engineers, Indigenous communities, local residents, etc.).

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Chapter 5

Transboundary Dispute Resolution in the Colorado River Basin

Caitlin Wiley

Keywords: Transboundary river basin, river basin organization, U.S.-Mexico relations, Hydro-hegemony

Introduction

There are 310 transboundary river basins in the world which cover an estimated 47.1% of the planet's land surface and include 52% of the population within their boundaries (McCracken & Wolf, 2019). Many of these transboundary rivers provide critical freshwater for drinking, sanitation, household and industrial activities, and agricultural production. Historically, approximately 67% of all interactions between riparian states in transboundary river basins have been cooperative (Yoffe et al., 2003). Most of the conflictive interactions consisted of verbal exchanges expressing discord or hostility where tensions flared, and sabers rattled, but no more severe hostile actions were taken. States have very rarely come to blows over water, with Wolf (1998) identifying only seven true state-to-state conflicts fueled by water during the second half of the 20th century.

Despite this long history of transboundary cooperation around rivers, climate change is leading many countries to confront uncertainty about their water security. Water availability is shifting as weather events become more intense, droughts stretch for longer periods, and precipitation patterns deviate from historical patterns. Understanding how countries resolve disputes over shared water resources will be essential as climate change generates increased water stress, possibly leading to future water emergencies.

The Colorado River - Nearing a Water Emergency?

The Colorado River, which begins in the United States and flows southwest to its natural terminus in Mexico, is one such river that is potentially nearing a water emergency. The Colorado is one of the most important rivers in North America, providing drinking water for approximately 40 million people and irrigating 5.5 million acres of land (U.S. Bureau of Reclamation, 2012). Economically, it generates an estimated USD 1.4 trillion annually and supports 16 million jobs (James et al., 2014). It also nourishes the Colorado River delta wetland in northwestern Mexico, which is home to 400 unique species of birds (Paul, 2022) and several endangered fish species (Stern & Sheik, 2022). The delta was fragmented by water diversion upstream to meet the growing human demands and has been the subject of a massive restoration effort since 2014 (Gerlak, 2013; Vanderpool, 2018; Morton, 2022). Hydrologically, the river is under significant water stress due to overallocation and the effects of climate change. The legal agreements apportioning the river water allocated a specific million acre-feet amount of water to each stakeholder, rather than establishing a percentage annual streamflow that could be withdrawn. On the U.S. side, the river basin is further divided up into the Upper and Lower Colorado, with the Upper Basin states taking water directly from the river and the Lower Basin states only taking water from the reservoir at Lake Meade. The original legal agreements that set up this management system overestimated the river's average annual streamflow (Hundley, 1966; U.S. Bureau of Reclamation, 2012; Kuhn & Fleck, 2019; Stern & Sheikh, 2022; Paul, 2022), and as a result, more water is allocated to stakeholders on paper than flows through the river in an average year. In the past few decades, consumption of water from the Colorado River has exceeded average stream flows, with most of the water extracted being used for thirsty crops including cattle feed (Richter et al., 2020).

Figure 1. *Map of the Colorado River basin*

Note: Source: American Rivers, retrieved from https://www.americanrivers.org/river/colorado-river-2/. Reproduced with permission.

The problem of overallocation has been magnified since 2000 by a severe megadrought in southwestern North America. The megadrought has been attributed to anthropogenic climate change, which pushed "an otherwise moderate drought onto a trajectory comparable to the worst [southwestern North America] megadroughts since 800 CE" (Williams et al., 2020, p. 314). This combination of overallocation and drought has led the water level in the river to become dangerously low, and it now rarely flows to its natural terminus in Mexico (Gerlak et al., 2013).

In May 2023, the three U.S. lower Colorado River Basin states (California, Arizona, and Nevada) reached an agreement to save 3 million acre-feet of water by voluntarily reducing their water consumption through 2026 (Flavelle, 2023; The Colorado River Basin States Representatives of Arizona, California, and Nevada, 2023). To facilitate the agreement, the U.S. federal government committed to compensate the states for a portion of the water saved. While this agreement will avert an immediate crisis, the basin states, the U.S. federal government, and the Mexican federal government will need to work together on a more permanent solution. As water stress and tensions rise in the river basin, disputes over water rights in the region may intensify.

Understanding how past disputes have been resolved will shed light on the U.S.-Mexico relationship and provide insight into how the two countries might behave in the future. To better understand how the two have handled past disputes, this chapter will explore two historical flashpoints in the U.S.-Mexico relationship over the river: the Salinity Crisis (1961-1973), and the All-American Canal Dispute (1983-2009). These two episodes of high tensions concerned how the riparian states complied with the 1944 bilateral treaty agreement over the river. The resolutions of the two episodes differed greatly, as will be explained in this chapter. The following research questions will guide this chapter. What factors explain the difference in how the two disputes were resolved? What does this indicate about how the two riparian states might behave in the future? How should the two countries consider revising the structure of their river basin organization to better facilitate dispute resolution?

Through my analysis, I conclude that the two disputes were resolved in different ways due to the differing legal context surrounding them, the varying levels of political focus on each dispute, and the "shadow of the future." This last element, the shadow of the future, refers to an international relations theory that posits that when two parties expect their interactions to continue indefinitely, they are more likely to cooperate. This theory will be discussed later in the chapter and applied to the U.S.-Mexico relationship.

In the future, the U.S. and Mexico will seek cooperative solutions on the river largely due to the shadow of the future, along with their joint recognition of the importance of equity and environmental protection. Future disputes can be prevented by extending the provisions of the 1944 treaty with new minutes (specific agreements reached by the parties under the auspices of the treaty) covering watershed-level governance and groundwater governance. The lessons learned from the Colorado River case may be applied to other rivers managed by two states that have a significant power imbalance.

Contextual Background

The Colorado River: Legacies of both "mutual suspicion" and genuine bilateralism

The U.S. and Mexico have a long history of formalized diplomatic interactions over the Colorado River. At times, these relations have been complicated by a "historic legacy of mutual suspicion, socio-economic asymmetry, and water scarcity" (Mumme et al., 2012, p. 22). The U.S. is the stronger country economically, militarily, and politically, and as the hegemon in the relationship (per Zeitoun & Warner's (2006) definition of "hegemon"), it casts a long shadow over its southern neighbor.

Despite this power asymmetry, the two have experienced times of genuine bilateralism and equitable power sharing around water resources (Mumme, 2017; Bussey, 2018; Wilder et al., 2020). The U.S.-Mexico relationship has evolved from one of mutual distrust with only a limited role for Mexico toward what Rivera-Torres and Gerlak (2021) describe as "a more creative partnership demonstrated in recent binational agreements, namely Minutes 316, 317, 318, 319, and 323" (p. 567). These recent minutes[3] concern water-sharing arrangements between the U.S. and Mexico and provide additional flexibility in terms of how the provisions of the 1944 treaty can be fulfilled. Of special note is Minute 323, signed in 2017, which represents a significant effort to equitably manage water scarcity and allocate water for the environment (Bussey, 2018).

3 "Minutes" in this context are specific agreements reached by the parties under the auspices of the treaty. They extend and update the terms of the treaty, allowing the arrangement to evolve flexibly over time.

Institutional Capacity: The International Boundary and Water Commission

The U.S. and Mexico manage the Colorado through the International Boundary and Water Commission (IBWC). The IBWC traces its roots to the 1848 Treaty of Guadalupe Hidalgo, which created a commission to delineate the U.S.-Mexico border (IBWC, n.d.). In 1889, the two governments established the permanent International Boundary Commission to resolve periodic disputes over the border's location. Seven states in the American West with equities in the Colorado River then signed the 1922 Colorado River Compact. The compact allocated 7.5 million acre-feet each to the Upper and Lower Colorado River Basin. There were scientific indicators that the streamflow estimates informing the compact were from unusually wet years (Hundley, 1966), leading to the river being overallocated.

The modern IBWC was formally established in 1944 with the treaty on the "Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande" (hereafter referred to as "the treaty"). Institutionally, the IBWC consists of two sections: the IBWC representing the U.S., and its Mexican counterpart, the Comisión Nacional de Límites y Aguas (CILA). The IBWC and the CILA are separate but related political entities overseen by their respective country's foreign ministry. The two sections will be referred to in this paper jointly as the "IBWC," unless specifically discussing the CILA. The treaty gave the IBWC its mandate to manage the river and resolve disputes as they arise (Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, 1944, pp. 5-6).

To resolve questions over the implementation of the treaty, the IBWC was authorized to record future decisions in the form of minutes agreed to by both parties. As Wilder et al. (2020) note, this structure means that the "treaty thus functions flexibly and dynamically, encouraging stakeholders in both countries to work within its architecture to resolve disputes and address emerging challenges" (p. 193). At the time of this writing, 328 minutes have been published addressing a wide variety of topics.

Recently the IBWC has been criticized on both sides of the border due to its organizational structure, inability to adapt to changing circumstances, failure to effectively manage groundwater, and failure to incorporate environmental protection into its decision-making (Mumme, 2005). Suggested remedies include giving the IBWC a mandate for comprehensive watershed-level governance, supplying the organization with additional personnel and financial resources, and restructuring the two sections (Mumme, 2005). Despite these flaws, the IBWC is deeply entangled in water management and is legally mandated by the treaty. It will continue to serve as the forum for bilateral management of the river for the foreseeable future, evolving through additional treaty minutes.

Since the U.S. and Mexico signed the treaty, there have been two notable episodes of tensions over the river: the Salinity Crisis (1961-1973) and the All-American Canal Dispute (1983-2009). Both episodes tested the capacity of the IBWC and the treaty to resolve disputes when a novel problem arose. These episodes reveal interesting aspects of the power dynamic between the U.S. and Mexico and reached markedly different resolutions. These cases are therefore ideal for a deeper analysis. The following section will briefly outline the historical events of both cases, after which I will continue with the analysis.

Moments of Contestation: The Salinity Crisis and the All-American Canal

The 1944 treaty did not set water quality standards for the Colorado River water that flowed from the U.S. to Mexico, only establishing the quantity of water that the U.S. was obligated to deliver to its downstream neighbor. The Salinity Crisis began in 1961 when the U.S. unilaterally began dumping water with high salinity content from wells on the U.S. side of the border into the Colorado River before it flowed to Mexico. This caused salinity levels of the water flowing into Mexico to increase dramatically, negatively affecting crop production in the Mexicali Valley, and leading to protests from Mexico.

The U.S. initially dismissed the protests from the Mexican government over water quality (Wilder et al., 2020, p. 194) before

the two governments moved into a protracted period of diplomacy over the situation (Mumme, 2017). After years of deliberations spanning several administrations on both sides of the border, the U.S. did recognize the Mexican right to water with a minimum quality level and signed Minute 242 to enshrine that right in 1973. In 1974, the U.S. passed legislation in Congress to construct a desalination plant upstream of the border to improve water quality, going well above and beyond the commitments it made with Minute 242 (Mumme, 2017).

This dispute over the quality of water delivered to Mexico highlighted the two countries' differing interpretations of the treaty. Throughout the discussions, Mexico focused on parity and reciprocity in the bilateral relationship. The U.S., on the other hand, viewed its treaty obligations more narrowly – specifically, it maintained that the only requirement was that the U.S. ensure that the agreed amount of water physically flowed to Mexico (Mumme, 2017). One interesting note about the negotiations is that Mexico, the weaker state, pushed the discussion towards higher ideals of joint water governance (Mumme, 2017, p. 166). This is consistent with Cascão & Zeitoun's (2010) finding that by relying on their bargaining power, weaker riparian states "can in theory 'level the playing field'" through their ability to "influence the regional agendas and negotiations" (p. 30). The shifting international law context of the time also had an impact on the ultimate resolution in favor of Mexico, especially the 1966 Helsinki Accords' principle on "equitable and reasonable" uses of international waterways (Wilder et al., 2020, p. 194).

Ten years after the two parties signed Minute 242 and resolved the Salinity Crisis, the next major test of the treaty began. The 80-mile-long All-American Canal (AAC), which began operation in 1940, diverts 3 million acre-feet of water per year from the Colorado River to the Imperial Valley in California and runs entirely through U.S. territory (Imperial Irrigation District, n.d.). It was built to secure California's water supply and replace an older canal that ran partly through Mexican territory (Cortez-Lara et al., 2009). However, water seepage occurred at points within the U.S. where the canal was not lined with concrete, raising groundwater aquifer levels in the Mexicali Valley in

northwestern Mexico (Barrientos et al., 2006, p. 59). The seepage also reduced groundwater salinity on the Mexican side of the border, which improved its quality for irrigation (García Saillé et al., 2006, p. 96). The seepage thus enhanced both the quantity and quality of groundwater available for crop irrigation in the Mexicali Valley (Cortez-Lara et al., 2009).

In 1983, the U.S. unilaterally decided to line the canal with concrete to stop further water losses, a move that alarmed Mexico (Mumme & Lybecker, 2006). Before the lining project moved forward, García Saillé et al. (2006) estimated that it would reduce the total amount of water available in the Mexicali Valley by 14% (p. 78). It was also expected to increase the salinity of the groundwater in the Mexicali Valley, imposing considerable costs on Mexico:

> This increase in soluble salts will result in a loss of 9% of the area's production and an increase of 13% in energy costs, which in turn constitute 25% of the operational and maintenance costs of the hydroagricultural infrastructure of Irrigation District 014, leading to approximately 9% decrease in the area's agricultural production (García Saillé et al., 2006, p. 96).

Minute 242, which resolved the Salinity Crisis, included a clause requiring parties to consult each other before implementing projects that would affect surface or groundwater resources in the basin. Under this clause, the U.S. engaged with Mexican representatives about the canal lining plan. However, Cortez-Lara et al. (2009) note that "while the United States claims to have consulted Mexico extensively, Mexico has represented the process as cursory and insufficient" (p. 134). The Bush and Vicente presidential administrations discussed the canal lining project but did not resolve the situation before lawsuits brought by community groups halted further diplomatic communications (Cortez-Lara et al., 2009, p. 134).

In early 2006, a coalition of U.S. and Mexican community groups called the Consejo de Desarrollo Economico de Mexicali (CDEM) brought several lawsuits against the U.S. Bureau of Reclamation (BOR) in a Nevada District Court to halt the lining project. Ries

(2008) compiled a full history of the CDEM suits, and the legal implications of the rulings, in a detailed Note. In summary, the CDEM argued that the lining project would negatively affect Mexicali Valley residents and the environment since the seepage supported endangered wetlands in Mexico. Among the claims brought in the first lawsuit, *CDEM v. United States* (417 F. Supp. 2d 1176, 2006), were that the lining project would violate the water rights of Mexicali residents, the National Environmental Protection Act (NEPA), and the Endangered Species Act, along with several other U.S. statutes. The court dismissed these initial claims on lack of grounds and standing.

The CDEM then filed two additional amended suits that focused on the environmental protection provisions, *CDEM v. United States* (438 F. Supp. 2d 1194, 2006) and *CDEM v. United States* (438 F. Supp. 2d 1207, 2006). In the third lawsuit, the BOR argued that the suit related to a "non-justiciable political question" that could not be resolved by the court, that NEPA does not extend beyond the borders of the U.S., and that the BOR was only required to conduct environmental impact assessments within its jurisdiction (Conklin, 2006, pp. 177-178). Ultimately, the courts ruled against the CDEM, determining that NEPA does not apply to Mexican territory and the BOR need not conduct additional environmental impact assessments (Conklin, 2006). Shortly after the ruling on the third lawsuit in December of 2006, Congress intervened and directed that the project should proceed "without delay" (26 U.S.C. § 395(a)).

In their analysis of the outcome, Cortez-Lara et al. (2009) concluded that initiating formal legal proceedings in U.S. courts hurt the CDEM's chances by halting dispute resolution through the IBWC (p. 145). Once litigation began, IBWC actors were advised not to engage on the issue and left the legal resolution to the U.S. Department of Justice. Ries (2008) reached a similar conclusion, stating that this situation "provides a fitting example of why disputes over transboundary resources are best resolved through diplomacy by the executive and legislative branches, and not by courts in the course of litigation" (p. 518). Ries also notes that the IBWC did not resolve the disagreement before the lawsuits because it is "highly susceptible to domestic pressures and policy

positions" of the executive and legislature (p. 523). Once Congress determined that the lining project was a solely U.S. domestic concern, the U.S. section of the IBWC had no further leeway to negotiate with the CILA. Because of these pressures, there was no path for "parallel action," which are actions supported by both federal governments, to resolve the dispute (Ries, 2008, p. 524).

Rather than accepting this outcome, the Mexican federal government could have elevated the case to the International Court of Justice (ICJ) for resolution. International water law of the time might have been on Mexico's side. The downstream country could have argued the canal lining project jeopardized its equitable and reasonable use of water under the 1966 Helsinki Accord. It could also have referenced the principle that states that share water resources are obligated to not cause significant harm to one another, as outlined in the 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses. It is important to note that the UN Convention on Watercourses did not enter into force until 2014, but the principles may have supported Mexico's case.

Elevating the case to the ICJ might not have resulted in a different resolution. Adjudication through the ICJ is an extremely slow process, and years frequently pass before the court reaches a decision. If Mexico had pursued the case in the ICJ, the U.S. Congress would likely have directed that the lining project proceed in any case. The best Mexico could have hoped for in that situation would have been monetary compensation for damages, similar to the court's decision that Nicaragua should pay Costa Rica for lost environmental services in a 2015 ruling. These kinds of compensatory rulings are rare, and most cases brought before the ICJ are instead referred to the parties to negotiate a solution.

Mexico ultimately did not pursue the case in the ICJ, "electing not to jeopardize the broader binational relationship over the canal lining" (Rivera-Torres & Gerlak, 2021, p. 560). Notably, Mumme (2016) attributes the decision partly to Mexico being "unwilling to antagonize the USA at a time the NAFTA agreement was being negotiated and implemented" (p. 713). This may explain why Mexico did not press the issue of halting the AAC lining project.

Methods

The research questions of this chapter were answered using methods of comparative-historical analysis. The tradition of comparative-historical analysis utilizes a comparative method to gain insight into a research question. These comparative methods "compare cases to explore similarities and differences in an effort to highlight causal determinations" and rely on exploring multiple cases (Lange, 2012, p. 4). The method dives deeply into specific cases to gain a deeper understanding.

The investigation relied on reviewing existing primary documents, such as the 1944 treaty agreement, treaty minutes, and U.S. domestic laws. It also relied on secondary academic scholarship related to the Colorado River Basin and the U.S.-Mexico relationship.

The theoretical lens applied to these cases is the framework of hydro-hegemony, developed by Zeitoun & Warner (2006). This framework concerns power dynamics within river basins and conceptualizes interactions between states beyond the dichotomy of cooperation and conflict. The framework does so by incorporating intensities of conflict and recognizing that seemingly cooperative actions may be coercive in nature.

Hydro-hegemony considers asymmetries in four dimensions called "pillars" of power, which are: 1) geography, position on the river; 2) material power, meaning military and economic might needed for resource capture; 3) bargaining power, which is the capacity of actors to set agenda items; and 4) ideational power, defined as power over ideas and narratives (Cascão & Zeitoun, 2010, p. 31-32). States with more power in these pillars are referred to as "hegemons" or "hydro-hegemons," and "hegemony" is defined as "leadership buttressed by authority" (Zeitoun & Warner, 2006, p. 438). Hegemons can use their superior power to ensure favorable outcomes for themselves. However, hegemons need not harm non-hegemons in the process. The framework is further complicated by the recognition that "[f]rom its position of superior power, the hydro-hegemon may choose to enforce either a 'negative' form of dominant hydro-hegemony, or a positive form of hydro-hegemonic leadership, whereby all riparians benefit" (Zeitoun & Warner, 2006, p. 437).

Analysis and Discussion
Comparison of the Two Cases

The two cases described in the Contextual Background section exhibit a few key similarities and differences. First, they were both concerned with fulfilling the 1944 treaty's provisions. The Salinity Crisis, however, revolved around the quality of water flowing to Mexico, which was not addressed in the treaty text. Mexico successfully argued that the U.S. was not living up to the spirit of the treaty and made the dispute a question of equity. The AAC dispute was markedly different as the tensions arose over water that, by all rights, belonged to the U.S. The fact that Mexico benefitted from water seepage it did not technically own complicated things greatly. The only formal obligation that the U.S. had, in its view, was the agreement about prior notification. The U.S. decided that its engagement attempts with Mexico were sufficient, despite Mexico's disagreement. The narrow perception of the AAC situation as being a solely domestic concern for the U.S. was ultimately upheld by U.S. courts, which provided Congress with justification to take unilateral action.

In both scenarios, Mexico (the downstream, non-hegemon state) was the complainant. The U.S. (the upstream, more powerful hegemon) took actions in both situations that hurt its downstream neighbor, using its superior material power to ensure a favorable outcome for itself. Theoretically, the U.S. could have used its superior geographic position, material power, and political might to dominate Mexican interests and act with impunity in both situations. Despite this, the U.S. agreed to comply with Mexico's demands for desalinated water in the Salinity Crisis. This may have been an effort to maintain the U.S.'s reputation internationally and avoid the appearance of bullying its non-hegemonic neighbor. As with the previous set of comparisons, the existence of the 1944 treaty governing water delivery may have made the U.S. more inclined to invest in upholding the spirit of the treaty, if not the letter of the document. This contrasts with the AAC dispute, where the U.S. was under no legal obligation to consider the wishes of Mexican interests when securing water in its territory.

Finally, there were efforts made in both cases to resolve the dispute through the IBWC. The two sections of the IBWC came together during both disputes to exchange concerns and devise solutions. The main difference was that the resolution to the Salinity Crisis gained political traction and was executed through the treaty minutes process, whereas discussions over the AAC dispute stalled and were pre-empted by CDEM's lawsuits.

Reasons for Differing Outcomes

The signing of Minute 242 to resolve the Salinity Crisis was a landmark and a major victory for bilateralism that ultimately benefitted both parties. Theoretically, it should have brought the two parties closer to a more cooperative partnership. So why was it that only a few decades later, the U.S. decided to unilaterally act to secure its water claims, hurting Mexico in the process?

I argue that the differing natures of the outcomes of these two episodes can be understood through the theoretical lens of hydro-hegemony, and ultimately attributed to three factors: (1) the context of the Salinity Crisis being more legally within the bounds of the 1944 treaty; (2) the differing level of political focus on resolving the episodes domestically in the U.S. and Mexico; and (3) the "shadow of the future" in the U.S.-Mexico relationship.

First, the Salinity Crisis fit better within the bounds of the 1944 treaty, which Mexico used to its advantage. Hydro-hegemony predicts that a non-hegemon can compensate for a weaker riparian position and material power by leveraging ideational and bargaining power. They can do so by pushing the dialogue in a particular direction and citing established international agreements such as international law and treaties to bolster their claims. This aids non-hegemons in compensating for weaknesses in other pillars of power. The Salinity Crisis was an easier situation to resolve as the problem of poor water quality raised by Mexico fit more technically within the structure of the existing 1944 treaty. While the treaty did not specify the quality of the water flowing to Mexico, it did establish the delivery location and minimum quantity. It was not a stretch for Mexico to leverage its bargaining power, backed up by the treaty, to argue that the U.S. should improve water quality. The water that flowed across the border belonged to Mexico under the treaty, and the

U.S. was directly impacting Mexico's ability to make reasonable and equitable use of the water. Additionally, Mexico was able to use ideational power to change the dialogue around the dispute from one of a purely technical nature around what the treaty explicitly established, to one concerning equity between the two states. Mexico thus had the high ground in terms of bargaining and ideational power in this case, even if it did not possess superior material power and had a less favorable geographic position. By comparison, the seepage from the AAC dispute was unintentionally benefiting Mexico for decades. Mexico never had a formal claim to the seepage water under the treaty agreement. Besides the U.S.'s obligations to inform Mexico before acting and to not harm its southern neighbor, Mexico had little in the way of legal bases to bolster its bargaining power. Mexico chose not to use its ideational power in this situation to strongly pursue a claim when the U.S. decided to proceed with the canal lining project as other matters were more pressing at the time, as will be discussed later in this situation. This situation was much less closely linked to the spirit of the 1944 treaty, and so it was much easier for the U.S. to justify acting unilaterally in this case.

Second, the domestic political situation in the U.S. and Mexico was very different during these episodes. Although hydro-hegemony originally focused solely on interactions between states and describes states as "monolithic" actors, Zeitoun, Warner, and several other prominent scholars on hydro-hegemony have since recognized this as a flaw (Warner et al., 2017). States are not monolithic actors, and how actors within states contest their representatives' decisions is important. I argue that this should be taken one step further and that the domestic government situation within individual states also influences how that state interacts with others and should be considered within hydro-hegemony.

In the two cases examined, the domestic political situation in both countries certainly influences the outcomes. While the IBWC is charged with resolving disputes between the riparian states, it has little power to act without political support from its two sections' federal governments. Ries (2008) highlighted this deficiency by noting that once the U.S. government decided the lining project should proceed, there was nothing further the U.S.

section of the IBWC could do to negotiate. The IBWC can only act with the political will of the U.S. federal government behind its actions, and the CILA finds itself in the same position with the Mexican federal government. During the Salinity Crisis, finding a resolution to the issue was a top priority for both Mexican President Luís Echeverría and U.S. President Richard Nixon. Both politicians exerted political pressure to reach a suitable agreement (Wilder et al., 2020). This strong domestic political focus contrasts with the AAC Dispute, which was hardly a top priority for U.S. President George W. Bush and Mexican President Vicente Fox in 2006. The two did discuss the issue, leading to inter-agency meetings on the topic before the CDEM lawsuits halted further diplomatic negotiations (Cortez-Lara et al., 2009). In a joint speech after the two leaders met in March 2006, the issue of the AAC was mentioned only very briefly by President Fox after he listed a long series of other meeting topics. His only remarks on the AAC included a vague suggestion that the two leaders "reactivate the working commission in this area" to find a resolution (Bush & Fox, 2006). This meant that the two halves of the IBWC did not have a strong mandate from their respective governments to resolve the issue.

The third and final factor explaining why the two riparians resolved these disputes in differing ways relates to the international relations and game theory concept of the "shadow of the future" (Axelrod, 1984). In a classic Prisoner's Dilemma scenario, the present is much more important than the future, and the two actors have little incentive to cooperate. The prisoners in a one-off game instead will likely act selfishly to maximize their payoffs. However, Axelrod (1984) found that when two actors are frequently brought together under conditions where they remember the outcome of previous games and where the future is more important than the present (what they refer to as "enlarging" the shadow of the future), they are more likely to cooperate (p. 125-126). Bó (2005) tested the validity of Axelrod's theory using computerized Prisoner's Dilemma games. They did so by comparing a series of infinitely repeated games with a set of finitely repeated games to see which set yielded more cooperative results. Ultimately, Bó found that the infinitely repeated games resulted in more cooperation. This indicates that when the two

parties expected their interactions to continue indefinitely, they were more likely to cooperate.

Hydro-hegemony emphasizes that the hegemon can leverage power in most situations to ensure a positive outcome for itself, but that outcome need not be harmful to other states involved. The original imagining of hydro-hegemony allowed for positive or leadership hegemony, in which it benefits itself and other states in a river basin. A hegemon would pursue this sort of hegemony to ensure stability in the river basin, which is a potential goal envisioned by the framework (Zeitoun & Warner, 2006, p. 444). This compares with the opposite pole, which is the negative or dominant form of hegemony, in which the hegemon exerts its power over other states. Most relationships between riparian states fall somewhere along this spectrum of positive and negative hegemony. I argue that it is in the best interest of the hegemon to consider the long-term implications of its actions over water and how they will affect its ongoing relationships with neighboring states under the shadow of the future.

The shadow of the future taken with the hegemon seeking a positive form of hegemony would explain why the U.S. and Mexico reached the resolutions they did in both the Salinity Crisis and the AAC Dispute. In both scenarios, the U.S. and Mexico reasonably expect their interaction with one another to continue indefinitely. They are both interested in cooperating in areas including trade, immigration, travel, and shared resource management. In the Salinity Crisis, the U.S. could have acted selfishly, leaving Mexico to solve the problem of water quality on its own. Instead, the U.S. evaluated the cost of accommodating Mexico's requests and weighed it against potentially harming their bilateral relationship. The hegemon decided that the cost of building a desalination plant was a smaller risk than potentially injuring the relationship, and it acquiesced. The U.S. Mexico judged its potential loss from not pursuing the matter, especially when it had international law on its side, to be too great to let the matter drop.

In the AAC Dispute, the U.S. viewed the problem as a solely domestic concern, and a more minor one. As a result, it did not view its actions as either seriously harming its long-term relationship

with Mexico or disrupting the stability of the river basin. The treaty did not address the issue, and it was not a high priority for either country. For its part, Mexico could have fought more vigorously to halt the project. However, the non-hegemon judged the gains from halting the lining project to be worth less than the losses it might suffer in other areas of the relationship, such as trade relations, as suggested by Mumme (2016). Expecting its interactions with the U.S. to continue indefinitely, Mexico declined to pursue the matter further.

Conclusion and Recommendations

What does this interpretation of these cases indicate about how the U.S. and Mexico might behave in the future during disputes over the Colorado? For one thing, both the U.S. and Mexico have demonstrated that they are conscious of the shadow of the future in their relationship and want to maintain a long-term, positive bilateral relationship over the river. Their cooperation during the Salinity Crisis is strong evidence of this. The U.S. wants to exert a more positive form of hegemony in the river basin to ensure stability. However, when new challenges arise, the two struggle to resolve disputes that fall outside of the scope of the 1944 treaty, such as the AAC Dispute. In the future, they may face greater complications as water stress is further exacerbated by climate change. To manage the changing river, they might find themselves forced to unilaterally construct new infrastructure which has transboundary effects. When that happens, having a strong political mandate from their respective federal governments to resolve novel conflicts will ensure they prioritize dispute resolution through the IBWC. Additionally, expanding the provisions of the treaty through further minutes incorporating modern best practices of watershed-level governance and groundwater governance will help pre-empt, lessen, or contain novel future disputes.

Although the U.S. is the hegemon in the river basin, I predict that it will continue to seek a positive form of hegemony and will avoid taking actions that contradict Mexico's wishes in the future. This is especially true considering the modern tenets of transboundary water law encouraging the equitable and reasonable use of shared waters, and the responsibility to

avoid significant harm (McCaffrey, 2011). The U.S. will avoid a dominant form of hegemony in which it outright exerts its will in matters significantly concerning Mexico in the Colorado River basin and will instead seek diplomatic solutions. The U.S. taking unilateral action in the AAC Dispute is an anomaly, and its cooperative actions to resolve the Salinity Crisis more accurately represent its normal pattern of behavior historically. As explored in this chapter, the AAC Dispute was resolved unsatisfactorily for Mexico as the issue fell largely outside the existing treaty structure and IBWC institutional capacity. Mexico was unable to leverage bargaining and ideational power in that situation to level the playing field. It was also not a top priority for the leaders of both countries. When the CDEM stepped in with a legal challenge, the U.S. resorted to narrowly interpreting the provisions of the treaty and its domestic laws to frame the issue as a solely domestic concern. In the current transboundary political context, this is unlikely to occur again.

While not deeply explored in this chapter, Minute 323 of the 1944 treaty represents a strong sign that the U.S. and Mexico are aware of the need for continued close cooperation over the Colorado. Signed in 2017, Minute 323 is a groundbreaking accomplishment that allocates water for the environment, provides Mexico with more flexibility by allowing it to store some of its water in Lake Meade and withdraw it during times of need, and more equitably establishes how the two countries will cut water use in times of scarcity (Bussey, 2018). The two states recognize the water stress facing the river and are willing to maintain a positive, cooperative management relationship, as demonstrated by Minute 323. An avenue for further research is to conduct a more comprehensive review of the background that led to Minute 323. This would specifically entail examining how the Minute provisions related to equitable water allocation cuts and environmental protection were negotiated. Doing so will shed light on the modern priorities of both riparian states and will help to better understand their new working relationship moving forward.

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Chapter 6

Contamination of Country: The cultural significance of water and how forever chemicals are creating an intergenerational emergency for Aboriginal communities in Australia.

Samantha Strachan

Keywords: PFAS, Aboriginal, Indigenous, Connection to Country, Wreck Bay, cultural significance

Disclaimer:

This paper was written based on secondary sources and without official endorsement from the Wreck Bay Aboriginal Community. I apologize for any errors that may be made in this article.

Introduction

Per- and poly-fluoroalkyl substances (PFAS) are a group of chemical compounds that have garnered significant attention due to their widespread use and potential adverse effects on human health and the environment. PFAS have been extensively used in various industrial and consumer products due to their unique properties, including heat, water, and oil resistance. One of the major applications of PFAS has been in aqueous film-forming foams (AFFF), which are commonly used in firefighting and fire suppression operations. The use of PFAS in AFFF has unfortunately led to contamination in numerous communities around Australia and has created a long-acting emergency that not only impacts human health and the natural environment but also damages a source of spirit and culture for Indigenous peoples. This chapter focuses on the specific impacts of PFAS contamination on the cultural practices and connection to land for Aboriginal people, with a particular emphasis on the community of Wreck Bay.

Located near my hometown of Woollamia, Wreck Bay is a coastal community that has experienced firsthand the consequences of PFAS groundwater contamination. The contamination poses health risks and profoundly impacts the ancient connection to Country, which forms the core of Aboriginal cultural identity (AIATSIS, 2022). For Aboriginal people, the land and water hold deep spiritual and cultural significance, forming the basis of their cultural practices, traditions, and kinship systems. The cultural significance of water has not been well-recognized in Australia's history or present, resulting in an emergency that will last generations into the future.

It is important to note that I am not an Aboriginal person. I am a white, cisgender woman of non-Indigenous descent. My ancestry traces back to colonizers who arrived in Australia during the 1800s. This chapter represents my efforts to learn about the land on which I grew up and serves as a modest act of solidarity with the people who have cared for the land for countless generations prior to my ancestors' arrival. This topic holds personal relevance to me as I was raised on Jerrinja Wandi Wandian Country, situated near Booderee National Park, and I had classmates connected to the Wreck Bay Community. While my high school fostered a culture of acknowledging and appreciating Aboriginal and Torres Strait Islander people, I do not recall local history being taught explicitly. I recognize that it is important for Aboriginal people to lead and guide research on their own communities. I am fully aware that this paper does not reflect that perspective and is solely the viewpoint of a white person who grew up adjacent to Wreck Bay. The intention of this paper is to share secondary content with a global audience to contribute to broader awareness. Any future research on this topic should be initiated and led by the members of the Wreck Bay Community.

While this chapter is not focused on a climate-change-related water emergency, it is interrogating the impact of an anthropogenic pollutant, creating a water emergency that will have similar health and cultural impacts for future generations. This chapter explores the impacts of PFAS contamination on the Wreck Bay community and compares the experience to findings from a separate study with a community in Katherine in the Northern Territory. By

examining this case study, we can better understand the broader implications of PFAS contamination on the cultural practices and connection to land for Aboriginal people across different regions. In addition to highlighting the impacts, this chapter will also present recommendations for addressing PFAS contamination and mitigating its effects on Aboriginal communities in Australia. By delving into the multifaceted impacts of PFAS contamination on Aboriginal communities, this chapter aims to shed light on the urgent need for nationwide recognition of the cultural significance of water, for comprehensive and culturally sensitive approaches to address the challenges posed by PFAS contamination and to protect the cultural heritage and wellbeing of Aboriginal peoples across Australia.

A note on language:

I have chosen to use the term 'Aboriginal' as a general descriptor for Aboriginal and Torres Strait Islander people in Australia. I have made this choice based on the regular usage of 'Aboriginal' by the Wreck Bay Aboriginal Community and Booderee National Park. As encouraged by Land (2015) it is important to note that my use of this term is from a critical standpoint only, and I acknowledge that cultural identity and terminology can vary significantly. Furthermore, I recognise that the term 'Aboriginal' has colonial origins that can imply very different and traumatic experiences. Nonetheless, I have opted to use it to effectively communicate this issue to a global audience. When discussing the specific topic of care of Country, I will use the term 'Traditional Owner', while 'Indigenous' will be used as a more inclusive term in accordance with the definition outlined in the United Nations Declaration on the Rights of Indigenous Peoples. It is also worth mentioning that other terms such as 'First Nations' may appear in my references to external sources.

The Human Right to Safe Water

Access to safe drinking water is an international human right under Article 11(1) of the International Covenant on Economic, Social and Cultural Rights (ICESCR) (OHCHR, 2023a) and has

been recognised as international law since 2010 (UN Water, 2023). Other human rights treaties with explicit reference to safe water include the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), the Convention on the Rights of the Child (CRC), the Convention on the Rights of Persons with Disabilities (CRPD) (OHCHR, 2023b) and Australia is party to all of these (AG, 2023).

In 2023, "two billion people lack guaranteed access to drinking water" (MRGI, 2023, p. 13). Not due to lack of availability or scarcity of water, though, most of these people tend to live near waterbodies, rivers and aquifers that are polluted and unsafe to drink. International NGOs like Minority Rights Group International (MRGI) condemn "economies and cultures that disregard the water cycle and which waste, pollute or destroy water", generating false scarcity in places with "abundant ground and surface water" (Minority Rights Group International, 2023, p. 7).

Governments are responsible for upholding the human right to safe water. The first and former Special Rapporteur on the human rights to safe drinking water and sanitation, Catarina de Albuquerque, stressed that "States have an obligation to realise the human rights to water" (de Albuquerque, 2014, p. 5) and UN Water (2023) stipulates that "governments must take a human rights-based approach (HRBA) to water and sanitation…so that no one gets left behind".

Often, marginalized groups are at greater risk of not being able to access safe water. International NGOs recognize that Indigenous Peoples face disproportionate discrimination and injustices (MRGI, 2023), and UN Water says that minority groups like this are often "overlooked" when it comes to the governing and management of water (UN Water, 2023). Indigenous Peoples worldwide suffer "systematic marginalization" and often with a lack of free, prior and informed consent as stipulated in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (MRGI, 2023, p. 13).

The HRBA means incorporating human rights principles in every project. These principles are equality, non-discrimination,

participation and inclusion, access to information, accountability and sustainability (Human Right 2 Water, 2021, p. 6). There are five dimensions within the HRBA specific to water and sanitation: availability, accessibility, quality and safety, acceptability and affordability (Borja-Vega & Kloeve, 2018). The quality and safety dimension stipulates that water must "meet quality standards for human consumption and for personal and domestic hygiene. This implies that water must be free of microorganisms, chemical substances, and radiological hazards that constitute a threat to a person's health over a lifetime of consumption" (Borja-Vega & Kloeve, 2018). This chapter's case study examines how the quality and safety of water in Wreck Bay has created a slow emergency impacting health and cultural practices over generations and finishes with suggestions of how a human rights-based approach might be used in some suggested ways forward.

The Cultural Significance of Water to Indigenous Peoples

Indigenous Peoples worldwide have strong cultural connections to water and waterways (MRGI, 2023). As recognized by the former Aboriginal and Torres Strait Islander Social Justice Commissioner, Tom Calma, in the Australian Human Rights Commission's (AHRC) 2008 Native Title Report, these connections are "protected under international law which provides for the right to practice, revitalise, teach and develop culture, customs and spiritual practices and to utilize natural resources" (AHRC, 2008, p. 174). For Aboriginal People, water is part of 'Country', and 'Country' is at the heart of their identity. 'Country' is everything: lands, waters, sky, animals, plants, people, and the stories and ceremony that connects them all (GANSW, 2023, p. 20). The AHRC acknowledges that "Access to cultural water is vital for the wellbeing of Indigenous peoples and their ability to care for country" (AHRC, 2008, p. 3). Indigenous peoples worldwide and within Australia are not homogenous entities. However, Altman & Branchut (2008, cited by AHRC, 2008b, p. 172) recognise that one commonality is that "Indigenous relationships with water are holistic; combining land, water, culture, society and economy" (AHRC, 2008b, p. 172). In Australia, Aboriginal people distinguish themselves between freshwater and saltwater peoples: "the

management of sea country is as equally important as freshwater to Indigenous peoples, with the sea seen as an extension of the land incorporating rights and cultural responsibilities" (AHRC, 2008b, p. 173).

The 2008 Native Title Report stipulates that "Indigenous Peoples obtain and maintain our spiritual and cultural identity, life and livelihoods from our lands, waters and resources", and this can be through sites and stories associated with water and resources in rivers and the sea, Indigenous cultural knowledge and heritage associated with water, cultural activities such as hunting, fishing and ceremony (AHRC, 2008b, pp. 171-172). The spiritual connection with water is often identified through creation stories (McAvoy, 2006, cited in AHRC, 2008b, p. 172). However, a cultural and spiritual emergency is created when connections or linkages with land and waters are disrupted. This disruption may include displacement, loss of traditional sources of food and medicine, health impacts, weakened economic development opportunities and, most critically, loss of identity (AHRC, 2008a; MRGI, 2023).

While Australia is party to many international instruments that protect the human right to safe water (including the Sustainable Development Goals[4]) and the Indigenous right to enjoy cultural practices, the 2008 Native Title Report, the AHRC reported that Australia had the "least formal recognition of Indigenous water rights" compared to countries with similar histories of colonization like New Zealand, Canada and the United States (Durette, 2008 cited in AHRC, 2008b, p. 179).

One of the recommendations in the 2008 Native Title Report was for governments to "fully recognize the significance of water to Indigenous peoples and incorporate their distinct rights, including as water users, to water, the environment, economic development, participation and engagement into the Water Act 2007. In particular, the Water Act should be amended to include a distinct category that provides for "Indigenous cultural water use' and access entitlements." (AHRC, 2008b, p. 209) however, more than a decade later, as of 2023, this has not been adopted.

4 SDG Six is for 'clean water and sanitation' and is to 'ensure availability and sustainable management of water and sanitation for all' (UN DESA, 2023).

New South Wales appears to be demonstrating greater recognition, with the 'Water Management Act 2000' being the first Australian water legislation to incorporate Indigenous values. It directs consultation on "(iii) benefits to culture and heritage, and (iv) benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land water' (s. 3: Objects, cited in Commonwealth of Australia, 2021). The NSW Government also acknowledges the significance of 'Country' in its CWC Framework, with 'Healthy Country' being the overarching outcome. It is described as a "healthy ecology" that includes pollutant-free water, and "interference with natural water systems is minimal" (GANSW, 2023, p. 49). The CWC Framework recognises that "in many instances, 'Healthy Country' will require healing". The lands and waters around the Wreck Bay community are a perfect example of Country that requires healing, and this can be done by supporting Aboriginal communities to "practice their obligations to care for Country" (GANSW, 2023, p. 48).

The 2008 Native Title report also recognised that climate change will create "loss and degradation of the lands, waters and natural resources they have relied upon for generations" and "poses a major threat to the physical health of Indigenous communities and our ability to sustain our traditional life, languages, cultures and knowledge" (AHRC, 2008a, p. 1). This chapter aims to demonstrate that in addition to climate change, 'forever chemicals' that have polluted watersheds and rivers have the same long-term impacts and have created an emergency that will have detrimental cultural and health impacts for generations to come.

Contextual Background

Made of carbon and fluorine atoms, the family of chemicals known as PFAS originated in the 1940s (Banwell et al., 2021, p. 2) and has been widely used in Australia since the 1950s. These chemicals gained popularity due to their ability to repel grease, oil, and water, as well as their high heat resistance. They were widely used in various applications such as Scotchgard, non-stick pans like Teflon, furniture and firefighting foam. However, the indestructibility of PFAS has resulted in the widespread presence

of PFAS globally, with traces found in the blood of all Australians (Australian National University (ANU), 2021) as well as in polar bears in the Arctic (Boisvert et al., 2019), and on Mount Everest (Miner et al., 2021). Produced by 3M for more than 50 years, PFAS is a family of more than 9000 synthetic chemicals (CDC, 2023). One prominent member of this family is *perfluorooctane sulfonate* (PFOS), commonly used in AFFF in Australia since the 1970s at airports and Defense bases.

PFAS does not degrade easily, can be ingested by humans and animals and tends to accumulate in the body, resulting in high concentrations even with small daily exposures (Jervis Bay PFAS Contamination Class Action, n.d.). The New South Wales Environmental Protection Agency's (EPA) official statement is, "There is currently no consistent evidence that exposure to PFAS causes adverse human health effects. However, based on the evidence from animal studies, potential adverse health effects cannot be excluded" (NSW EPA, 2017). A recent study commissioned by the Australian Federal Government (the Australian Government) and conducted by the Australian National University (ANU) stated that "Human exposure to per- and poly-fluoroalkyl substances (PFAS) is an issue of global public health importance." (Banwell et al., 2021, p. 2).

By 2000, when 3M announced its voluntary exit from the PFAS market, these synthetic 'forever chemicals' had already contaminated more than 95% of the global human population (Fellner & Begley, 2018), creating a global emergency. Recent lawsuits have exposed 3M to potential legal liabilities amounting to billions of dollars, including costs associated with remediation and claims related to personal injury, medical monitoring, and property damage.

In 2009, PFAS was listed for restriction under Annex B of the Stockholm Convention, which aims to "protect human health and the environment from Persistent Organic Pollutants (POPs)… chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on human health and the environment" (Stockholm Convention

on Persistent Organic Pollutants, n.d.). More than 170 countries have committed to phasing out PFAS (Fellner & Begley, 2018).

The Health Impacts of PFAS

The challenge with PFAS lies in their resistance to breaking down; they are "highly inert – thermally, chemically and biologically" (Banwell et al., 2019, p. 12). Due to their persistence, they tend to accumulate in the environment, including waterways and human and animal bodies. In living organisms, PFAS accumulates in organs with a rich blood supply, such as the liver, kidneys, and lungs (Banwell et al., 2019, p. 12). Emerging research indicates that this bioaccumulation is connected to various health concerns.

PFAS has long been suspected of being endocrine disruptors, meaning they can interfere with hormone functions in the body, but research on their impacts is still relatively new and limited in scope. In a prospective study published in 2018, researchers found a correlation between higher levels of PFAS in the plasma of individuals and a higher likelihood of weight regain after a "diet-induced weight loss trial", which was especially prevalent among women (Liu et al., 2018)but whether PFASs may interfere with body weight regulation in humans is largely unknown. This study aimed to examine the associations of PFAS exposure with changes in body weight and resting metabolic rate (RMR. This evidence suggested that the accumulation of "certain environmental compounds", or PFAS, could impact or slow the metabolic rate, leading to weight gain. Another study indicated that PFAS exposure "may increase diabetes risk in midlife women" (Park et al., 2022). Additionally, a study in 2020 suggested a possible association between elevated PFAS concentrations and the severity of COVID-19 (Grandjean et al., 2020). Other recent studies have identified "additional health outcomes associated with exposure to PFAS, including decreased renal function and increase[d] risk of renal cancer; and inverse immune outcomes in children, such as reduced vaccine derived immunity against specific vaccine preventable infections" (Stanifer, Stapleton, Souma, Wittmer, Zhao, Boulware, 2018; Sunderland, Hu, Dassuncao, Tokranov, Wagner, Allen, 2019; Rappazzo, Coffman, Hines, 2017; cited by (Banwell et al., 2021,

p. 2). Other governments in Europe and the United States (US) have recognised health impacts associated with PFAS, including liver damage, thyroid disease, obesity, fertility issues, cancer, hormone interference and developmental impacts on children (Fellner, 2023b).

PFAS in Australia

Australia ratified the Stockholm Convention in 2004 (DAFF, 2020), with an estimated cost of approximately $39 million (Fellner & Begley, 2018). However, from the 1970s until 2004, the Australian Department of Defence and civilian firefighting services used an AFFF containing PFOS and PFOA (Perfluorooctanoic Acid) to reduce heat and extinguish fires (Jervis Bay PFAS Contamination Class Action, n.d.). Despite the phased-out use of PFOS and PFOA in AFFF, their environmental stability has resulted in ongoing contamination of groundwater, sediment and soil in areas local to firefighting activities (Banwell et al., 2019, p. 13). This contamination has created a health emergency in relation to the consumption of animal products from affected regions, including livestock raised on contaminated land and fish and crustaceans sourced from contaminated waterways.

In 2016 the Australian Government Department of Health commissioned a study (the PFAS Health Study) from the Australian National University (ANU) National Centre for Epidemiology and Population Health (NCEPH) to investigate the "exposure levels and potential health effects of PFAS in areas of known contamination in the communities of Williamtown, NSW South Wales (NSW), Oakey in Queensland (QLD), and Katherine in the Northern Territory (NT), Australia (Australian National University (ANU), 2021). The PFAS Health Study is one of the first and most comprehensive research projects on this topic in Australia. It involved a systematic literature review, focus groups with members from the subject communities, blood specimen testing, and data linkage. The literature review examined more than 200 scientific studies covering almost 150 health outcomes. The researchers ascertained that there was sufficient evidence connecting PFOA and PFOS with higher cholesterol (hypercholesterolaemia) (Banwell et al., 2019, p. 12) and "limited

evidence" of connection with higher levels of uric acid in the blood, kidney and testicular cancers as well as lower levels of antibodies following certain vaccinations (Banwell et al., 2019, p. 12). However, following the PFAS Health Study, the Australian Government is adhering to the findings and the official statement of the final report, stating that there is 'limited evidence' regarding the harm PFAS exposure can cause to human health. This stance is likely held to avoid accepting liability.\

Australia's first PFAS National Environment Management Plan (NEMP) was published in 2018, providing a "risk-based framework for the environmental regulation of PFAS-contaminated…sites" and offered "as an adaptive plan [that could] respond to emerging research and knowledge" (DCCEEW, 2022a). A second version of the PFAS NEMP was endorsed in 2019, and a third version is currently in development, with public consultation closing in February 2023 (DCCEEW, 2022b).

When the Stockholm Convention lists a new chemical, Australia must follow several steps, including a treaty-making process and implementation of management measures to ensure Australia complies with international obligations. Australia is still reviewing the uses of PFOS, PFOA and related compounds that fall under these listings (HEPA, 2020, p. 10). However, Australia has faced criticism for its delayed ban on the most toxic PFAS chemical, PFOS, resulting in multiple class-action lawsuits against the Australian Government. One of the communities involved in a class-action lawsuit is the Wreck Bay Aboriginal Community, which claims that the contamination of sacred waterways has enacted a cultural emergency that has impacted customs and practices passed down from generation to generation.

Methods

The objective of this chapter is to examine how PFAS contamination has created a water emergency in Australia, disturbing the connection to Country for Aboriginal people, focusing on the Wreck Bay Aboriginal Community as a case study. This chapter aims to consider the long-term consequences of contamination on both health and cultural practices, the Australian Government's response and the Community's experiences.

This chapter expands on a previous project that involved a personal reflection on a local water (in)security issue close to my home community. This expanded chapter is based solely on secondary data sources and is only supported by personal familiarity with the location. Given the limitations of this project, primary data collection was not conducted.

The secondary data collection process heavily relied on news articles related to the Wreck Bay community using the following specific keywords:

"Jervis Bay"; "Wreck Bay"; "Booderee"; "water"; "pfas"; "water security"; "contamination"; "caring for Country"; "connection to Country"; and "Australia"

A broader search was conducted to gather background information on PFAS and its global impact using databases such as JSTOR, ProQuest and Google Scholar to review relevant academic research. Sources mentioned in news articles were cross-referenced with official Australian Government websites and research reports to validate the information found. Sources were included if they specifically discussed the Wreck Bay Community concerning PFAS contamination, if they addressed connection to Country concerning contamination, or if they focused on the impacts of PFAS contamination on Aboriginal communities in Australia. These criteria were used to ensure the relevance and applicability of sources for this study.

Discussion

Wreck Bay Aboriginal Community

Located on the South Coast of New South Wales, approximately three hours from Sydney, Jervis Bay is a renowned tourist destination and weekend getaway due to its serene waters, natural surroundings, and recreational activities such as diving, boating, and swimming. At the southern end of Jervis Bay lies the Bherwerre Peninsula, where the small Aboriginal community of Wreck Bay faces Summercloud Bay and is nestled within Booderee National Park.

The Bherwerre Peninsula holds thousands of years of Aboriginal history, with over 100 recorded sites, including a shell-midden site dating back 6000 years, reflecting the community's strong fishing culture (Our History, n.d.). Due to a misplaced lighthouse in the 19th century, many ships crashed on the southern end of Bherwerre Peninsula, giving the name 'Wreck Bay'. In 1911, a naval college was established for the Royal Australian Navy, including a training school and airstrip just 2 kilometres from Wreck Bay. Mary Creek, a popular swimming and fishing spot, flows from the airstrip towards Summercloud Bay. Booderee National Park, which is jointly managed by the Wreck Bay Aboriginal Community, attracts over 1 million visitors annually (Fellner, 2023c). In the local Dhurga language, 'Booderee' translates to "bay of plenty" or "plenty of fish" (Booderee National Park, n.d.-a). Booderee is Aboriginal land, and the Koori people of Wreck Bay are the Traditional Owners. They are saltwater people, and seafood has always been part of their diet (Discover Booderee, n.d.).

Originally established as an Aboriginal Mission, managed by religious institutions for housing and conversion, the management was transferred to the Wreck Bay Aboriginal Community Council in 1986 under the Land Grant Act (Where We Are, n.d.). According to the 2021 census, the population of Wreck Bay was 152 (Australian Bureau of Statistics, 2021), although there are 315 registered community members, many of whom reside in surrounding suburbs (Where We Are, n.d.) due to limited housing availability in Wreck Bay (Fellner, 2023c). The suburb of Wreck Bay (covering an area of 403 hectares) sits within and is adjacent to 6312 hectares of Booderee National Park, all within Jervis Bay Territory, which operates as a separate entity governed by the Australian Government instead of the state of New South Wales (Where We Are, n.d.). This distinction means that the Wreck Bay Aboriginal Community (WBAC) residents have no local or state representation but can vote in Federal elections (Jervis Bay Wild, n.d.). The Jervis Bay Territory also includes other jurisdictions such as the Australian Department of Defence's Naval Training College, HMAS Creswell and a Range Facility (Where We Are, n.d.). Additionally, Lake Windermere, which supplies drinking water to Wreck Bay, is situated within the Territory, right next

to the only Aboriginal-owned and managed botanic garden in Australia (Booderee National Park, n.d.-b). All the waters within Jervis Bay are within and subject to the control of the Naval Waters Act 1918, allowing for naval exercises (Jervis Bay – A Snap Shot! | WBACC Website, n.d.).

Pfas Contamination In Wreck Bay

In 1997, the use of AFFF containing PFOS was discontinued in Jervis Bay by Defence. However, in 2017, PFAS site investigations across the Shoalhaven region detected contamination in surface water, groundwater and sediment "exceeding health-based recommendations for drinking water" (Jervis Bay PFAS Contamination Class Action, n.d.). Multiple locations, including Jervis Bay Territory and Wreck Bay, were affected by this contamination. The decades of use of AFFF had created "devastation for thousands of residents across Australia", but on the South Coast of NSW, a cultural and spiritual water emergency had been created; as Fellner (2023c) puts it, "nowhere has it landed a crueller blow than at Wreck Bay, where the sacred spiritual connection to the land and waters has underpinned the community for millennia".

The site investigations revealed PFAS contamination in various sites around the Bherwerre Peninsula, including HMAS Creswell, the Jervis Bay Rifle Range, Summercloud Creek, and Captain's Lagoon. The most severe pollution was found in Mary's Creek, with contamination levels nearly ten times higher than the safe limit for recreational use (Fellner, 2018). Lake Windermere also showed PFAS contamination (Malone & Clifford, 2018). While the Defence report suggests that the contamination is "well below levels that would be of concern to human health", the local community understandably remains sceptical and concerned (Malone & Clifford, 2018).

Aboriginal life expectancy is significantly lower compared to non-Aboriginal Australians (Australian Institute of Health and Welfare, 2022). Although the health issues faced by elders from WBACC, such as cancer, cannot be directly linked to PFAS, the possibility cannot be dismissed either. They recall a time when

they would play in a claypit next to the airstrip, using the clay for its medicinal properties and in ceremonies (Fellner, 2023c). They would also drink water directly from the creeks that ran past the Rifle Range. However, in 2016, "the water (in Marys Creek) was deemed to pose such a risk to human health that the creek was declared closed" (Malone & Clifford, 2018).

According to community member James Williams, the community can no longer "access the seafood they had been catching and eating for thousands of years, and they were too scared to drink the water" (cited by Clifford, 2020b). "We used to go and fish every day and get prawns, mussels, pipis and bush food". The community asked Defence to supply them with seafood and bottled water, but Defence declined, implying that the community's cultural practices have only been "suspended" and that even though contaminants were found in their water supply, Defence still "considered water from the drinking catchment safe" (Clifford, 2020b).

Long-time Wreck Bay Aboriginal Community residents remember growing up swimming in the Creek and foraging for food and plant medicine from the bush surrounding their community. They ate local seafood, including bream, mullet, grouper, flathead and pippies (Fellner, 2023c). Whilst swimming in Mary Creek, Defence was likely burning off chemicals such as aviation fuel, diesel, or paint and then dousing it in AFFF (Fellner, 2023c), which was then moving downstream towards them.

Mary's Creek was tested by the Defence and found to have levels of PFAS that were more than 90 times the safe level for drinking water (6.6 micrograms/Litre)[5] and three times the limit for recreational waters, decades after it had stopped being used. (Fellner, 2023c). Signs have been erected along the creek warning people against swimming or consuming seafood and other locations nearby Summercloud Creek and Captains Lagoon (Fellner, 2023c). The clay in the claypit was also tested and found to have .101 micrograms per Litre, again much more than the

5 According to the Australian Drinking Water Guidelines, the acceptable levels of PFOS and PFHxs (perfluorohexanesulfonic acid) combined in drinking water are less than 0.07 micrograms per litre (µg/L), and less than 0.56 µg/L of PFOA (Sydney Water, 2023).

official 'safe' limit. (Fellner, 2023c). Lake Windermere, the water source for Wreck Bay, was also tested and found to contain PFOS, although Defence claims that it tested within the safe limit of .0001 µg/L, which aligns with Australian guidelines, but not internationally as the US EPA recommends a limit of .00004 µg/L (Fellner, 2023c).

In 2021, seeking justice for the cultural water emergency, members of WBAC initiated a class action against the Department of Defence for the chemical contamination of soil and groundwater in and around Jervis Bay Territory. The claim suggests that the contamination was from firefighting foam on HMAS Creswell and Jervis Bay Range Facility that contained PFAS. It is argued that "as a consequence, [the PFAS contamination] has impacted the value of the surrounding land, and affected cultural practices" (Jervis Bay PFAS Contamination Class Action, n.d.).

Interventions At Wreck Bay

When the contamination was first discovered, signs were erected on popular tourist beaches within Booderee National Park warning visitors not to eat any fish or seafood caught. However, Defence was cautious about claiming responsibility. They claimed there were "no consistent links between PFAS and diseases…and that advice to limit exposure was given as a precaution" (Malone & Clifford, 2018). A spokesperson for Defence said, "It's not up to Defence and it's not appropriate for Defence to give health advice to visitors to the National Park, or members of the community" (Chris Birrer, defence spokesperson, as cited by Malone & Clifford, 2018).

The Wreck Bay Community "regard the inland waters, rivers, wetlands and sea as something intimately attached to their homes and properties" (Traditional Owners File Class Action against the Commonwealth over Contamination of Indigenous Land at Wreck Bay, n.d.). So, the advice against fishing or consuming fish from the waterways within the Territory impacts a way of life practiced by the Aboriginal community for thousands of years. "We can't go and hunt and gather anymore, we can't teach our younger generation coming through about our culture, like I

learnt as a kid" (James Williams, cited by Drewitt-Smith, 2021).

In late 2020, Defence announced a trial with a company that offers nano-remediation technology alleging to break down PFAS in the environment (see Figure 4; Clifford, 2020a). The trial with Photon Energy "involves injecting iron nanoparticles suspended in water into a small area of PFAS-contaminated groundwater and then applying a low direct current to the groundwater through electrodes inserted into the ground. Groundwater can then be treated in place without any requirement to pump or transport it" (PFAS Removal Technology Trial and Updates for the Jervis Bay Range Facility and HMAS Creswell Area. Response Provided to Journalist., 2022). Outcomes from this trial are expected in 2023 (Defence, 2023); however, nothing further has been released at the time of writing. It was also recently announced that $15.8 million would be spent to decommission Lake Windermere as a water supply to Wreck Bay and to connect the community to the Shoalhaven Water supply instead (Fellner, 2023c). However, it was stressed that this is due to ageing infrastructure rather than contamination (Fellner, 2023c).

The Department of Defence has a Remediation Action Plan for the area, which includes the following activities: redirecting clean water before it becomes contaminated, capturing and treating contaminated water at the boundary of the naval base and then releasing it back to maintain natural water levels; and removing contaminated soil (Defence, 2023). Clifford (2023) reported that detailed designs are almost complete for a longer-term solution; however, Defence has not provided a timeline on how long it might take. Concerningly, the Department of Defence's PFAS Management Area Plan for the Jervis Bay Range Facility and HMAS Creswell, while acknowledging the exposure risks for the Wreck Bay Aboriginal Community, only makes passing reference to the cultural significance of the land concerning past and present practices of foraging bush food and crustaceans and fishing off the shoreline (Department of Defence, 2020a, p. 27). It does not appear to centre this significance in the management plan. Similarly, the Australian Government's PFAS NEMP 2.0 only makes one reference to Indigenous cultural practices, defining them as 'social values' that influence the "consequence(s)

of harm" (HEPA, 2020, p. 23). This lack of acknowledgement in plans of management appears to minimise the extent of the harm and impact specifically for Aboriginal communities like Wreck Bay, where the contamination is more than just a health hazard for people but also the sickness of the Country which is intrinsically linked with identity, spirit and culture as well.

Experiences In Other Communities in Australia

One of the communities included in the PFAS Health Study was Katherine, NT, which has a significant First Nations population. In the qualitative focus groups, the researchers from ANU aimed to capture residents' experiences and sentiments regarding the contamination. The researchers found that the feedback from Katherine contrasted with the other two communities in the study. While the findings from Katherine are not representative of the Wreck Bay community, they provide valuable insight into how PFAS contamination can impact social well-being and psychosocial health (Cline, Orom, Child, Hernandez & Black, 2015, cited by Banwell et al., 2021, p. 2). The PFAS Health Study revealed that the communities expressed "concerns about health, financial impacts, distrust of government agencies and stigmatisation" (Banwell et al., 2021, p. 13). It is crucial to emphasise here that Aboriginal communities in Australia are not homogenous, and there are significant cultural differences between the Jawoyn, Dagoman and Wardaman people of Katherine and the saltwater Koori people of Wreck Bay 3000 kilometres away. However, some parallels can be drawn, particularly one expressed by Aboriginal and Torres Strait communities across the continent: their connection to 'Country' (AIATSIS, 2022).

'*Country*' is challenging to define as it encompasses multiple meanings. The NSW Government's *Connecting with Country Framework* (GANSW, 2023, p. 20) states that "there is no universal way of defining Country". Rose (1992, cited by Fatima et al., 2023, p. 2) describes it as "the lands Indigenous people have a traditional attachment or relationship with". It is everything. It is "land, air, water and stories of 'Dreaming" (GANSW, 2023; Ganesharajah, 2009; Tonkinson, 2011; cited by Kingsley et al., 2013, p. 682)applying holistic notions of health and developing

less rigid definitions of wellbeing. The following article draws on qualitative research on Victorian Aboriginal peoples' relationship to their traditional land (known as Country and "water… weaves not only through Water Country, but also feeds Earth and Sky systems" (GANSW, 2023, p. 64). Connection to Country intertwines identity, culture (McKnight, 1999, Weir, 2012; cited by Kingsley et al., 2013, p. 682), and wellbeing (Fatima et al., 2023).

Due to the fundamental differences in care for and connection to Country between the people of Katherine and those of Oakey or Williamstown, the PFAS Health Study presented the results separately (Banwell et al., 2019, p. 6). Fatima et al. (2023, p. 2) highlighted the reciprocal benefits between Country and Aboriginal people as reflected in the sayings "healthy country, healthy people" or "if you look after the country, the country will look after you" (citing Griffiths & Kinnane, 2011). This reciprocal relationship is evident in the findings of the PFAS Health Study, where participants from Katherine expressed concern for the health of Country and linked it to their own health concerns (Banwell, 2021, p. 8). Banwell et al. (2019, p. 12) described this as the "interdependent relationship between Indigenous people and their ancestral lands and seas" (citing Burgess, Johnston, Berry, McDonnell, Yibartuk & Gunabarra, 2009).

Connection to Country includes Indigenous food sovereignty (Fatima et al., 2023, p. 4). For the people of Katherine, the impact of PFAS contamination was notable in their ability to gather food from the bush and rivers. The restriction on fish consumption, which held "cultural and economic significance" (Banwell et al., 2021, p. 12), forced them to rely on more costly food sources and bottled water from supermarkets. This "loss of access to indigenous food" is significant as it affects their ability to carry on with cultural practices. Banwell et al. (2021, p. 10) reported high levels of "suspicion and mistrust" towards both the Departments of Health and Defence, as questions went unanswered and participants received insufficient or contradictory information. This mistrust was mixed with miscommunication and a sceptical but stressful consumption of information from "scientific reports, local knowledge and everyday experiences" (Banwell et al., 2021,

p. 7). However, the "contradictory evidence on the internet and elsewhere" generally led to further "confusion" rather than clarity, potentially leading to community tensions (Banwell et al., 2021, p. 15).

Communication emerged as a significant issue in all the communities involved in the PFAS Health Study. Some community members in Katherine were uncertain about drinking water safety, the contamination levels in various food sources, their exposure to PFAS, and the potential contamination from swimming and drinking water in Katherine Gorge (Banwell et al., 2019, p. 22). Although the drinking water in Katherine met Australian standards, poor communication led many community members to resort to buying and consuming bottled water due to fear of contamination, Banwell et al. also reported confusion among participants about the flow and direction of water in Katherine (2019, p. 24). Participants expressed greater confidence in their knowledge of the local watercourses compared to Defence, resulting in scepticism about the accuracy of Defence's assessment of the community's safety and their exposure to PFAS. (Banwell et al., 2019, p. 25).

Impacts On Cultural Practices and Connection To Country

It is useful to reflect on the findings from the PFAS Health Study and compare them with the experiences of the Wreck Bay Community, particularly if further research is conducted. In the PFAS Health Study focus groups conducted in Katherine, it was found that the community expressed a strong attachment to their Country and the Katherine River through their cultural practices and unique diet, and they were resistant to the idea of moving from their location (Banwell et al., 2019, pp. 35–36). The community also expressed resentment towards being advised against fishing or swimming in the river and desired greater transparency and clear information from the government's response (Banwell, 2021, p. 11). The PFAS Health Study report emphasised the importance of the "relationship with Country", referring to its "spiritual, cultural, [and] traditional significance", and Banwell et al. also referred to similarities with other Aboriginal groups

that had experienced "loss of traditional foods from culturally significant sites such as rivers" (Hoover, 2018, cited by Banwell et al., 2021, p. 14).

"First Nations participants felt that their unique dietary and cultural practices were not factored into risk assessments and communication" (Banwell et al., 2021, p. 14). This account also aligns with experiences reported by residents of Wreck Bay. The people of Booderee also have distinct dietary and cultural practices impacted by groundwater and seawater contamination. Fatima et al. (2023, p. 4) noted that connection to Country encompasses "Indigenous food sovereignty activities such as harvesting". Therefore, the contamination of Country, including rivers [and seawater], affects the food sovereignty and livelihood of both the Katherine and Wreck Bay communities, as it hampers their ability to pass down local knowledge to the next generation on the use of bush medicine, including the use of clay and the collection of seafood (Fellner, 2023c). Both Katherine Gorge, a popular international tourist destination, and Mary Creek hold cultural significance for the respective communities of Katherine and Wreck Bay. In both communities, the water emergency resulted in restrictions on the consumption of fish and food from waterways, altering thousands of years of practice. Official advice for Mary Creek is to abstain from eating any seafood, and adults are advised to limit their consumption to only 15 servings per year from Flat Rock Creek and Captains Lagoon (Fellner, 2023c).

Adequate communication is essential in remediation efforts. However, poor communication, characterised by insufficient or contradictory information and unanswered or avoided questions, has fostered "high levels of suspicion and mistrust" towards the Departments of Defence and Health. According to Banwell et al. (2021, p. 14), "there had been minimal attempts by government agencies to develop communications designed specifically for these communities". It is not clear whether this is also the case for Wreck Bay. While much of the communication appears to be community-specific, it is unclear if any cultural consultation regarding the communication methods has occurred. The First Nations people interviewed by Banwell et al. (2021, p. 14) "requested information on the impact of PFAS on traditional practices such as hunting,

eating bush foods and fishing". This request is similar to those made by Wreck Bay people, who have sought reimbursement or replacement for their traditional diet or further information on how the contamination impacts their cultural fishing practices.

Moving Forward

In 2020, in recognition of the emergency across the country, the Australian Government paid $212 million in damages to the three communities from the PFAS Health Study (Roe et al., 2023). During that time, more than 90 additional sites across Australia were also identified as having PFAS contamination (Fellner & Begley, 2018). In February 2023, the Australian Prime Minister, Anthony Albanese, publicly apologised for the use of PFAS and its subsequent contamination of communities throughout the country (Clifford, 2023). This was the first public apology issued by the Australian Government on this topic (Green Career, 2023). The Assistant Minister for Defence, Matt Thistlethwaite, met with Wreck Bay Community members in Jervis Bay to offer a public apology and present the remediation plan developed by Defence (Clifford, 2023).

On 25 May 2023, the Australian Department of Defence agreed to a $22 million settlement to go to the Wreck Bay Aboriginal Community for the PFAS contamination and harm to land and impacts on cultural practices. However, the settlement was made with no acceptance of liability from the State (Fellner, 2023f). The amount was perceived as inadequate to compensate for the "thousands of years of culture they had lost", as reported by Fellner (2023g), who quoted (2023f) one of the community members responding to the outcome:

"You call this the forever contaminant, we're the forever people" – George Brown.

Across Australia, the total liability value from the Australian Government's use of AFFF was $344 million as of May 2023 (Fellner, 2023a). An investigation into the PFAS Health Study found that officials from the Australian Government asked researchers to "remove references about potential community concern over elevated rates of cancer found in towns contaminated

with "forever chemicals" (Fellner, 2023e) as clear evidence of a linkage between elevated cancer rates and the prevalence of PFAS was not found by the research team. However, the study authors did not adopt these suggested changes (Fellner, 2023e).

Besides the trial, other 'management actions' suggested include source management (on-site containment, off-site removal and destruction of contaminated soil); pathway management (stream diversion, capture and treatment and upgrades to sewer system); receptor management (i.e. access and use guidelines for the creeks and lagoons in the Territory) and recommendations around the consumption of seafood and other animals (Department of Defence, 2020b).

The Department of Climate Change, Energy, the Environment and Waste is working on Australia's obligations under the Stockholm Convention. This process has triggered actions that include policy management options for the import, export, use and disposal of PFAS (Per- and Poly-Fluoroalkyl Substances (PFASs), n.d.). As of July 2022, Defence has spent $580 million on PFAS remediation across Australia since 2016 (see Figure 5) and has another $117.5 budgeted for 2022/23.

Wreck Bay's settlement in May 2023 was only for "harm to land and cultural practice". Justice Lee, who was responsible for overseeing the settlement, noted that the claim does not "relat[e] to any degree of personal injury" (cited by Fellner, 2023e), which implies that the State has admitted no culpability for impact on personal health and that there is still scope to pursue damages, with adequate proof.

There are concerns that the statute of limitations may be reached sooner than evidence can be gathered for a class action to be launched for personal injury, which Justice Lee warned of: "I'm very conscious of the fact that so many times in history there's only been a very slow understanding of how bad a contaminant has been to the health of people" (cited by Fellner, 2023g). It was reported by the Sydney Morning Herald that "it could take decades or even generations to prove causation, the highest level of scientific certainty, even if probable links to health effects were apparent much earlier" (Fellner, 2023e). This fact is likely very

concerning for all those who live in PFAS-affected locations, not just Wreck Bay. The cumulative impacts of PFAS on the body require long-term study and examination to gather solid evidence and linkages to health concerns.

Conclusions And Recommendations

Following the exploration of the water emergency caused by PFAS contamination in both Wreck Bay and Katherine, several recommendations emerge, influenced by Banwell et al. (2019 & 2021). Firstly, the Australian Government, particularly Defence and Health, must provide greater acknowledgement of Country as a foundational aspect for Aboriginal communities. This recognition should serve as the basis for all subsequent recommendations. Secondly, communication with affected communities should be transparent and culturally sensitive. Understanding the significance of Country and its meaning for Aboriginal community groups is crucial when providing information about risks and planning for remediation. The third recommendation is to involve communities in the design and implementation of remediation efforts. Traditional Owners possess ancient knowledge of the land and should be consulted when devising plans to remove and divert waterways. Fourthly, the statute of limitations should be extended to account for the yet unknown and unconfirmed health impacts of PFAS. Given that PFAS is labelled a 'forever chemical', exceptions should be made to allow time to uncover long-term impacts. Finally, longitudinal health studies should be conducted involving both Aboriginal and non-Aboriginal communities across Australia to assess how PFAS may be affecting health over time. In line with the UN Water's call to not leave anyone behind (UN Water, 2023), all of these recommendations should approached from a human-rights-based framework.

As previously discussed, 'Country' holds significant importance to Aboriginal people in Australia, encompassing both abstract and physical aspects such as land and water care and the consumption and use of native food and bush medicine. However, recognition of the importance of 'Country' and the necessity to centre it within any actions or plans varies between Federal and State Government actors (e.g. the Australian Government's Committee on Aboriginal and Torres Strait Islander Water Interests and

the NSW Government's *Connecting with Country Framework* (GANSW, 2023)*)*. The results of the historical exclusion of Indigenous peoples in policy are becoming more evident as communities continue to face threats to their way of life. To have a genuine human-rights-based approach to addressing PFAS contamination, especially around the principles of equality and non-discrimination, the Australian Federal Department of Defence should follow the direction of the NSW Government by recognising the cultural significance of water and Country and centring this significance in any updated PFAS Management Plans.

To meet the HRBA principles of access to information and accountability, the Australian Government should improve communication with communities on important issues such as PFAS contamination. In an era of information overload, departments must be innovative to ensure that crucial information cuts through to the intended audience. Banwell et al. (2021) stress that "greater effort [is] needed to ensure Indigenous populations are fully informed and consulted with" (Banwell et al., 2021, p. 14). Greater effort includes understanding the meaning of Country to its people and ensuring that communicators and facilitators possess cultural awareness. Effective communication should involve early engagement and provide safe and neutral spaces for community members to express concerns and share experiences (Banwell et al., 2021, p. 14). The safety of spaces for feedback is critical, given the existing mistrust of government representatives.

Although Defence has acknowledged responsibility for the contamination and is allocating resources for remediation, the suggested actions still appear invasive and disruptive to the landscape. Concerning seafood, the response from Defence regarding Aboriginal cultural practices and the community's ability to safely fish and sustain themselves is disheartening. Their response raises the question of whether access to seafood is viewed as a basic human need or a luxury food. To align with the HRBA principles of inclusion and participation, communities should be consulted before any new activities take place on Country and given the opportunity to co-design plans to heal

Country. Given the extensive historical development and activity resulting from colonialism, it is essential to avoid repeating past mistakes by attempting remediation without consulting the Traditional Owners. Banwell et al. (2021) reinforce this point by citing Kwiatkowski et al. (2009) and calling to "strengthen [First Nations communities] capacity to "identify, understand and control impacts associated with development"". Similarly, another recommendation in the 2008 Native Title Report was for governments to "recognise[s] and respect[s] the importance in Indigenous traditional ecological knowledge and management of biodiversity and conservation, including water" (AHRC, 2008b, p. 209). Co-designing a response can ensure community buy-in, greater control, and mitigate "negative mental health effects" (Council on Environmental Quality, 2007, cited by Banwell et al., 2021).

As noted by Justice Lee, the statute of limitations for community members to make claims for harm to health may expire soon. However, the linkages between PFAS and health outcomes are still limited, with firm evidence limited to cholesterol and uric levels from the PFAS Health Study. Given that PFAS is a 'forever chemical,' legal provisions should account for the potential discovery of health outcomes over a longer period. Extending the statute of limitations would support the HRBA principles of accountability and sustainability for multiple generations that are to be impacted by contamination.

Finally, while this paper provides a limited exploration of the reported impacts of PFAS contamination, a more comprehensive and in-depth analysis could be undertaken to explore how contamination affects the connection to Country. This analysis could also encompass other Aboriginal communities and consider other types of contaminants and their impact on the health of people, the health of Country, and the remediation efforts to maintain these. Banwell et al. (2021, p. 13) also encourage further qualitative "community environmental health research" as it "give(s) voice to individuals and community-based organisations and characterise(s) the community in a full and complex fashion" (citing Brown 2003). According to Banwell et al. (2021, p. 3), "little scholarly attention has been paid to the psychosocial

health effects of living in PFAS-contaminated areas due in part to the relatively recent acknowledgement of its potential environmental impacts by the Australian government". There is little research on psychosocial health effects and even less on the cultural impacts on Aboriginal communities, highlighting a need for further research with specific communities like Wreck Bay, which would also contribute to sustainable HRBA outcomes.

This chapter is solely based on secondary information, and the Wreck Bay community did not invite me, a white woman descendant of colonisers, to undertake this research. Any oversights and errors in this paper are my own. To conclude, I wish to express my sincere and deepest apologies for the injustices of my ancestors and the founders of the country of my citizenship, for the harms both past and present still felt today. I extend my condolences for the sorry business that has occurred and will occur due to the contamination spoken about in this chapter, and acknowledge the ongoing illnesses caused by living in the current colony.

As someone who regularly visited Booderee as a child and adult and grew up on land that would have been inhabited by the ancestors of those currently residing at Wreck Bay, I wish to express my deepest gratitude for the thousands of years of care for Country, for waters, for sea and sky, taken by the first peoples. I recognise and respect your dignity, wisdom, and perseverance.

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Glossary

PFAS	Per- and poly-fluoroalkyl Substances
PFOS	Perfluorooctane Sulfonic Acid
PFOA	Perfluorooctanoic Acid
PFHxS	Perfluorohexanesulfonic Acid
POP	Persistent Organic Pollutant
AFFF	Aqueous Film Forming Foam
NSW	New South Wales
NT	Northern Territory
QLD	Queensland

Chapter 7

Climate Change and Evolution of Dutch Water Authorities: Public Goods, Democratization, Cross-Sectoral Policy and Scale

Soemano Zeijlmans

Keywords: Netherlands, Water Management, Institutional Reform, Public Interest, Water Quality

Introduction

Climate change is intensifying extreme weather and the risk of water emergencies. Extreme weather events that cause highly impactful droughts and floods have become more severe, and more likely, and such risks are expected to increase as the climate keeps warming (Caretta et al., 2022). Sea level rise presents a pressing danger to regions with low-lying coastal zones and those that economically depend on them. In addition to water quantity, water quality is threatened. Population centres, industries, and agricultural activities are important sources of water pollution (Mateo-Sagasta & Marjani Zadeh, 2018; Moss, 2007), which affects human health (Schwarzenbach et al., 2010). As a result, countries are facing an urgent need to adapt to challenges related to water quality and quantity to avoid water emergencies.

Within Europe, the Netherlands3 is a unique case in terms of water security and climate change. More than a quarter of all its land is below sea level due to a process of land reclamation that started in the 14th century. Most of the country's territory is in the low-lying, highly populated delta of the Rhine/Waal, Meuse, Eems and Schelde rivers, among others. Some of its ecosystems, such as heathlands, grasslands and raised bogs, are already being affected by climate change (Witte et al., 2012). The country has many users and potential polluters of water:

3 This book chapter deals with the European Netherlands only.

more than half of surface area is used for agriculture (Statistics Netherlands, 2020), much of the country's over 17 million people live below or close to sea level, and there is significant industrial activity. As a result, adaptation to climate change-induced water challenges and ensuring water quality are of vital importance to the Netherlands.

It is interesting to study how the Netherlands manages water risks, not only because it is a country particularly vulnerable to water challenges, but also because of the unique and democratic way in which the country manages them[4] Within academia and civil society, debate exists about the potential and limitations of democratic institutions in taking adequate climate action (Fiorino, 2018; Fredriksson & Neumayer, 2013; Povitkina, 2018) The Netherlands has not only taken efforts to adapt to climate change and address water quality, but it has done so in a way that protected and even increased the democratic functioning of its dedicated layer of government responsible for water management: the Water Authorities.

This chapter investigates how the Dutch Water Authorities have adapted their work to handle climate-induced risks of water emergencies and the urgency of ensuring water quality while transitioning to a more democratic mode of government. This book chapter argues that, since 1992, the Dutch Water Authorities have undergone four interrelated transitions that made this possible:

1. They have transitioned from primarily serving the private interests of the stakeholders represented in their administration, to working on water quality and quantity as a public good, due to the increasingly public nature of current water challenges like climate adaptation.

2. This shift towards working on water as a public good has been accompanied by a democratization of the Water Authorities, which enabled and was necessitated by their new work on providing public goods.

4 This book chapter does not make claims about whether the measures taken are adequate from a technical or economic point of view.

3. The first two changes have prompted Water Authorities to collaborate more frequently with other stakeholders, such as municipalities, and to be involved in more policy domains, such as spatial planning and agriculture.

4. Working in the public interests and working in new policy domains went hand-in-hand with a scale increase and professionalisation of the organisations.

This book chapter is organized as follows: First, a contextual background section describes the role and functioning of the Water Authorities as important institutions in Dutch water management. Then, the four transitions described above will be covered in more detail in the analysis section. The final and concluding section discusses the interrelatedness of these transitions.

Contextual Background: Water Authorities

In the Netherlands, the Water Authorities[5] are a cornerstone of surface water management. They are a decentralised form of government, independent from municipalities and provinces, whose sole task is water management. Their inception dates to the 13th century when they were established to ensure water safety and prevent flood risks in local regions. While Water Authorities have the reputation of being the oldest democratic institutions of the Netherlands, the 'democracy' of the Water Authorities was different from what would be considered democratic today. Originally, only owners of agricultural land were given votes based on the size of their property. Women were not represented, and tenant-farmers or other inhabitants were also excluded (Brouwer, 2006). Instead of holding direct elections, the operational structure of the Water Authorities was guided by the principle of interest-payment-control.[6] This principle posited that those stakeholders to whom water management was most important contributed the most financially and should therefore have more power in the decision-making process.[7]

5 Dutch: *waterschappen*. Some are called a *hoogheemraadschap*. In English, they are also often called Water Boards.

6 Dutch: trits/beginsel 'belang-betaling-zeggenschap'

7 The rationale here was that a large cattle farmer has a higher interest in the water level than someone living on the same land, but not owning land.

In 2023, the Water Authorities have evolved into (mostly) directly elected democratic bodies, a sharp contrast to their earlier composition. Every four years, every person with the right to vote elects the members of the Water Authority's general board[8] by voting for a political party (or another association that participates) (Rijksoverheid, n.d.). Several members of the general board are not elected but appointed by agricultural organisations and nature organisations (Unie van Waterschappen, n.d.-a). Water Authorities also have an executive assembly[9] of approximately five people tasked with preparing and executing policy. The government-appointed chair of both the general board and the executive assembly is called the *dijkgraaf* (Rijksoverheid, n.d.).

The Water Authorities have three main responsibilities. Firstly, the Water Authorities are responsible for avoiding flooding by strengthening dykes and giving sufficient room for water to flow. Secondly, they ensure that surface waters are clean by cleaning wastewater and avoiding pollutants. Thirdly, they aim to make sure that there is sufficient water available, for example by storing water during droughts (Unie van Waterschappen, n.d.-b). This three-fold task is summarized as safe, sufficient, and clean.[10]

As a layer of government responsible for managing surface water, the Water Authorities have an important role in the water-related aspects of climate adaptation and protecting water quality. The Water Authorities' modi operandi have seen shifts, albeit still rooted in the primary mandate of safe, sufficient, and clean water. However, their work has become more focused on providing public goods, their democratic structure has adapted, and they operate with more stakeholders in more policy domains, in a more professional way on a larger scale. The subsequent chapters of this book will explore this evolution in depth, providing an understanding of the four transitions that have shaped the contemporary Dutch Water Authorities.

8 Dutch: algemeen bestuur
9 Dutch: dagelijks bestuur
10 Dutch: veilig, voldoende, schoon

Method

This research delves into the evolution of the Water Authorities by creating a narrative based on qualitative document analysis. The primary data for this book chapter are five policy advice documents that were mandated by the Dutch government to inform political decisions about the structure and functioning of these bodies. They have been written by ad-hoc or permanent advisory bodies that consist of experts on this topic. As such, they do not only provide valuable insights into the functioning and role of the Water Authorities, but they also discuss the changing social, political, and environmental context in which they perform their roles. The documents examined were published between 2009 and 2020 and are used to analyze this evolution in the late 20th and 21st centuries, up to 2023. The section on democratization will also cover some earlier history for context. An overview of the primary documents used is provided in Table 1.

As a form of triangulation, the documents are complemented by news reports by public broadcaster NOS to contextualise the societal debate about Water Authorities, as well as to reference matter-of-fact statements, such as announcements of a law having passed parliament. These news reports were selected by searching for "*waterschappen*" (Water Authorities) and "*geborgde zetels*" (appointed seats) using the search function on NOS.nl. Context is also provided by several academic articles that have been written about the Water Authorities.

The four transitions that I identified as relevant for the topic of this book are presented in the next section; each transition is covered in a separate subsection. Any quotes have been translated from the original text in Dutch, and footnotes present the original Dutch terms.

Table 1

Policy advice documents used in this book chapter in chronological order

Author (Dutch)	Author (English translation)	Name of the document (Dutch)	Name of the document (English translation)	Year	Citation
Commissie van Advies inzake de Waterstaatswetgeving (CAW)	Advisory Commission regarding Water Management Legislation	*Belangenrepresentatie in het waterschapsbestuur*	*Interest Representation in the Water Authorities*	2009	(CAW, 2009)
Tappeiner et al.	-	*De grondwettelijke positie van het waterschap*	*The Constitutional Position of Water Authorities*	2010	(Tappeiner et al., 2010)
Adviescommissie Water (AW)	Water Advisory Commission	*Advies doelmatig waterbeheer*	*Advice Regarding Expedient Water Management*	2010	(AW, 2010)
Adviescommissie Water (AW)	Water Advisory Commission	*Advies Waterschapsbestuur*	*Advice Regarding Water Authorities*	2015	(AW, 2015)
Advies-commissie Geborgde Zetels bij Waterschaps-besturen (AGZW)	Advisory Commission for Appointed Seats in Water Authorities	*Geborgd gewogen: Advies over de geborgde zetels in waterschapsbesturen*	*Appointed Evaluated: Advice regarding appointed seats in Water Authorities*	2020	(AGZW, 2020)

Analysis and Discussion

Transition 1: Towards Water Management as a Public Good

The first transition marks one from managing water in the private interests of the actors with a high degree of control in the Water Authorities, to managing water as a public good. The report by AGZW (2020) describes that the task of the Water Authorities of providing safe, sufficient and clean water has not changed, but the context of their work has. Climate change has created a new dimension for the work of Water Authorities because "the Netherlands has to adapt to […] sea level rise, higher river

discharges, flooding, and longer periods of drought" (AGZW, 2020, p. 3). This new context means that water management touches less upon the private interests of those stakeholders with appointed seats (agriculture, industry and natural areas), and more upon water management as a public good. For example, climate change necessitates new public goods, such as drainage and water storage infrastructure, to prevent urban flooding. This is different from providing sufficient water and flood protection to farmland, which is a private interest of the landowner and/or tenant farmer. As such, "the position of 'partial' interests in Water Authorities has diminished in meaning" (AGZW, 2020, p. 4), which is reflected in their observation that elected general board members representing inhabitants do not promote the interests of inhabitants as a separate interest group, but manage water as a public good (AGZW, 2020, p. 5).

The change from working for private interest to working for the public interest is not just created by the need for climate adaptation, but also by national and European legislation for water management and aquatic biodiversity. The Water Framework Directive (WFD) prescribes steps that European Union member states should take to protect the quantity and quality of surface water and groundwater by 2015. The WFD has changed water quality management to be more connected to sources of pollution and, as a result, Water Authorities became more outward-facing to address sources of pollution, despite their limited authority on the topic (AGZW, 2020, pp. 3–4). These actions in the public interest went against the private interests that were historically represented in the Water Authorities, as agriculture and industry are main polluters.[11] The Second National Water Plan of the Netherlands (2016-2022) emphasizes addressing pollutants from agriculture, healthcare facilities, and the pharmaceutical industry (AW, 2010; Rijksoverheid, 2015). This expanded on the focus placed on reducing these pollutants in the First National Water Plan (2009-2015), albeit to a lesser extent (Rijksoverheid, 2009).

11 For example, reducing pollution is often not in the interest of the main polluters that are being represented, and higher water levels to reduce soil subsidence makes using heavy machinery on agricultural land more difficult.

Transition 2: Democratisation of the Water Authorities

In game theory, actors are typically not expected to abandon their private interests to protect the public interest. How, then, did Water Authorities evolve to be equipped to work on public goods? The answer lies in a democratization of the Water Authorities that happened simultaneously with the shift in working toward the public interest. Here, it is important to note that the method of electing and appointing Water Authority general board members is determined by the national government, not the Water Authorities themselves. This makes institutional reform easier, as the Water Authority boards themselves do not vote about such reforms.

Widening of Representation up to 1995

Historically, the representation in the Water Authorities was determined by the principle of interest-payment-control, not one person, one vote. The rationale behind this principle is that the Water Authorities are a "functional body that makes administrative considerations", which suits a governance style in which "all direct interests are represented" (AW, 2015, p. 6, emphasis added).[12] Functional management that is based on interest and financial contribution is also rationalised in the policy advice by Utrecht University that considers it is "not only explicable but also acceptable" in a delta and the "battle against water" (Tappeiner et al., 2010, p. 19).

The Water Authority boards used to consist almost exclusively of agricultural landowners, as they benefited most from water management, and paid most towards the activities of the Water Authorities. Therefore, it was thought that they should have the highest say in its governance structure. During the 20th century, building owners became represented in the Water Authorities, both due to their interest in water management and because of financial difficulties faced by the Water Authorities. After the arrival of the Surface Water Pollution Act[13] in 1969, the represented categories were expanded to include domestic and industrial polluters. Board members, however, were hardly ever appointed through general elections, and instead were appointed

12 Direct meaning those interests that are most affected by water management decisions.

13 Dutch: Wet verontreiniging oppervlaktewateren (Wvo)

by other public bodies or, in the case of industrial polluters, by the Chamber of Commerce[14] (CAW, 2009).

A government memorandum in 1977 argued for a broad representation of elected inhabitants as a category in the boards of Water Authorities where this was relevant, such as in urban areas. While the official argument was that inhabitants also have an interest in water management, the CAW (2009) argues that this should mainly be seen as a solution for the poor financial situation of the Water Authorities, as the move would also broaden their tax base. Inhabitants became represented because of the Water Authority Act[15] of 1992 that led to the first (often direct) elections for inhabitants taking place in 1995. The other interest categories (agriculture, industries, nature) were now appointed by sector organisations, the Chamber of Commerce and nature organisations (Aa en Maas Water Authority, 2022).

Electoral Reform and Democratic Mandate post 1995

In the 21st century, the Water Authorities continued their democratic reforms. 2008 marked the first year that elections took place using a list system, in which inhabitants could vote for political parties or other associations in the elections as opposed to voting for individuals. In 2014, the process for Water Authority elections became part of the Electoral Act, which gave elections for Water Authorities the same legal status as those for the European Parliament, House of Representatives, provincial councils, and municipal council.[16] As a result, the Water Authority elections from 2015 onwards have taken place in person, rather than through mail, often at the same time as other elections. The jointly organised elections caused a drastically higher turnout for the elections, as people were likely to go to a voting booth anyway. Other reasons for higher voter turnout include the drought of 2018 and climate change, both of which sparked debate about the importance of water management (AGZW, 2020).

Abolition of the Water Authorities?

It should be noted, however, that the democratisation of the Water Authorities should not be taken for granted. Not only were many stakeholders back in 2008 sceptical about the need for political parties in a technocratic body like the Water Authorities

14 Dutch: Kamer van Koophandel (KvK)
15 Dutch: Waterschapswet
16 Dutch: Europees Parlement, Tweede Kamer, Provinciale Staten, gemeenteraden

(AGZW, 2020), but the very existence of the Water Authorities was threatened. In fact, during the elections for the House of Representatives in 2010, most political parties included plans to abolish the Water Authorities, justifying the move as a way to reduce excessive administrative activities. The financial crisis had created a need for budget cuts in government spending, and government working groups were looking for ways to implement spending cuts through administrative downsizing. Within government, it was seriously considered to abolish both provinces and Water Authorities, and divide their tasks between the national government and municipalities, or transform the Water Authorities to executive agencies of the provinces (Tappeiner et al., 2010). The municipalities and provinces, too, were in favour of their abolition or transformation (NOS, 2010).

These reforms did not happen because of several reasons. Firstly, a government-mandated study by Utrecht University considered it necessary to change the constitution before the Water Authorities could be abolished or transformed into executive agencies. Secondly, the system of Water Authorities was in line with requirements from the WFD, and making water management a responsibility of municipalities and provinces could result in a violation of this directive WFD (Tappeiner et al., 2010). Lastly, there was criticism against the plan itself from the Water Advisory Commission. The Commission stated that the discussion should primarily focus on the importance of water management and policy, and the method of organisation should be based on that mission rather than considerations of budgeting or administrative downsizing. According to the Water Advisory Commission, this can be rationalised because of the importance of water safety and quality in the Netherlands (AW, 2010).

Abolition of Appointed Seats

Despite elected inhabitants making up the majority of representatives in the general board of the Water Authorities beyond 1992, the Authorities were still seen as a functional body of government instead of a representative one such as municipal councils. The Advisory Commission regarding Water Management Legislation described the represented inhabitants as “representing the so-called interest of general tasks”, with no remarkable difference from other interest categories (CAW, 2009, p. 3). According to the Water Advisory Commission, “it suits to have an administration in which all direct interests are

represented", because of the interests that all four represented groups have in the Water Authorities (inhabitants, agriculture, industry, nature) (AW, 2015, p. 6). Thus, both the Advisory Commission regarding Water Management Legislation and the Water Advisory Commission defended the existence of appointed seats in 2009 and 2015, respectively.[17]

Within the Netherlands, however, there was criticism on the appointed seats because it was considered undemocratic that some interest groups had appointed seats, even though they voted on topics with a political nature (NOS, 2019).[18] The first mandated policy advice document that was sceptical of the appointed seats was published in 2020 by the ad-hoc Advisory Commission for Appointed Seats in Water Authorities. This commission was created by the Ministry of Infrastructure and Water Management to research if any developments, such as climate change, would warrant a change in the desired governance of water authorities. The commission recommended abolishing the system of appointed seats in the Water Authorities. In line with section 1 of this chapter, they argued that Water Authorities are working more in the public interest because of climate change, and that the elected representatives of inhabitants also consider the specific interests of agriculture and industry within the functional mandate of the Water Authorities.[19] They found that, at the time, 14% of elected inhabitants were affiliated with agricultural interests, increasing agricultural stakeholders' influence further (AGZW, 2020).

Because of this report, the Dutch green party GroenLinks proposed a law to abolish the system of appointed seats. According to their Member of Parliament Laura Bromet, "the Water Authorities have many more tasks than before because of climate change, and because of that have become more political" (Bromet, 2020, as cited in Jonker, 2020). After amending and voting on the bill in the House of Representatives and voting in the Senate, the

17 The Advisory Commission regarding Water Management Legislation preferred to call them "reserved seats" because they argued that these seats created a balanced representation of interests. According to them, "appointed seats" sounded unnecessarily undemocratic (CAW, 2009, p. 18)

18 The most prominent example is the water level: agrarians (with appointed seats) are in favour of a low water level as this benefits cattle grazing, whereas one of the biggest elected parties (Water Natuurlijk), wants a high water level as it reduces land subsidence (NOS, 2019).

19 This was exemplified during the Water Authority elections on 22 March 2023, in which the new party Farmer-Citizen Movement (BoerBurgerBeweging) won 118 out of 518 total seats in Water Authority general boards (NOS, 2023).

Dutch legislature approved a new system in which the number of appointed seats was approximately halved to two seats for agriculture and two seats for nature, and none for industry (NOS, 2022).[20]

Transition 3: Increased Collaboration and Cross-sectoral Work

The increased public nature of the role of the Water Authorities and their democratisation led to a third transition: Water Authorities were forced to collaborate with other public bodies and external stakeholders and were required to work on policy outside their usual domain.

Climate adaptation and water quality standards necessitated, first and foremost, that Water Authorities entered the policy domain of spatial planning (AGZW, 2020; Bruinsma et al., 2011). For example, drier summers like the one in 2018 require areas that can retain more freshwater, heavier rainstorms require more floodplains, and sea level rise requires land use change, too (AGZW, 2020). Water quality, too, requires spatial policy. Nature-friendly lakeshores and riverbanks, which improve water quality, has made the Water Authority itself an increased user of land, often at the expense of agricultural lands (AGZW, 2020). These are considerably larger scale spatial activities than maintaining dykes, the water level, and cleaning wastewater.

The Water Authorities also engage in nature and environmental policy, such as advocating for natural water retention areas and addressing point-sources of pollution. They are also active in the agricultural domain, working on fertilizer and pesticide management advocacy (AGZW, 2020; AW, 2010). Some Water Authorities are even active in energy provision by providing hydropower or biogas from wastewater (AW, 2010).[21]

Despite the Water Authorities' expanded scope of work, their legal instruments have not changed or barely changed. Water

20 Before this new system, the number of appointed seats differed per Water Authority.

21 The transition to cross-sectoral work is not considered a success by all. Wuijts et al. (2023)countries worldwide are facing a challenge to achieve this ambition by 2030. This paper focuses on the legal and governance challenges faced in the European context with regard to achieving water quality ambitions, using experiences from the Netherlands as a case study. Although many EU Member States (MS argues that water management in the Netherlands is not cross-sectoral enough.

Authorities cannot block any spatial or non-spatial decisions from other layers of government that are irresponsible from their perspective (AGZW, 2020), and the administrative boundaries of municipalities and provinces usually are not restricted to one ecosystem (Tappeiner et al., 2010). As a result, Water Authorities are required to enter into dialogue with these other authorities to reach their goals (AGZW, 2020; AW, 2010; Tappeiner et al., 2010) and publish their spatial goals in a so-called "blue environmental vision" document (AGZW, 2020, p. 4). At the same time, Water Authorities are collaborating increasingly with non-governmental stakeholders (AW, 2010; Grotenbreg & Altamirano, 2019).

According to the Advisory Commission for Appointed Seats in Water Authorities, the new system of democratic election benefits this collaboration. For the layers of government that the Water Authorities collaborate with, the relatable functioning of the Water Authorities is an advantage, and the "political" Water Authority administration are able to collaborate well with the representatives and public officials of other layers of government (AGZW, 2020). This is, at least in part, because the spatial policy domain is less technocratic than that of conventional water management (Schwartz, 2004). The contact between different government bodies also benefits the public support of the measures that the Water Authorities wish to take (AW, 2010).

Transition 4: Professionalization and Scale Increase

The transition towards governing water as a public good (transition 1) and increased collaboration and cross-sectoral work (transition 3) went hand-in-hand with a professionalisation and scale increase of the Water Authorities (AW, 2015, p. 5). The new context of water challenges in the Netherlands made scaling up and professionalising "indispensable" (AGZW, 2020, p. 3).

Firstly, the Water Authorities became larger organisations with new expertise. The new dimensions and cross-sectoral activities of the work of the Water Authorities required new, specific skill sets within the organisations. For example, the Water Authorities need to hire ecology experts to monitor and safeguard surface water quality under the WFD, and climate adaptation experts to ensure safety from flooding in the context of climate change. Because Water Authorities entered the spatial policy domain, attracting employees with knowledge of spatial planning became key to achieve its spatial ambitions (AGZW, 2020).

Secondly, the number of Water Authorities was reduced from hundreds in 1990 to a mere 21 in 2023. As water authorities became larger, professional organisations, they were able to benefit from economies of scale by having fewer, geographically larger Water Authorities. Additionally, many of the new challenges that Water Authorities are facing extend beyond the jurisdictional boundaries of Water Authorities, such as sea level rise, drought management, and salination (AGZW, 2020, p. 4). Having fewer Water Authorities reduces the costs of coordinating action among the different organisations.

While having fewer water authorities creates economies of scale, having large, professional organisations with sector-specific expertise creates costs that are borne by the taxpayer. As inhabitants pay the vast majority of the taxes levied by the Water Authorities (AGZW, 2020), their expenditures are legitimised by the increased democratic functioning of the Water Authorities: inhabitants always form the majority in the general board (AW, 2015, p. 5; CAW, 2009, p. 27).

Conclusions and Recommendations

The Water Authority Law of 1992, the electoral reforms and the (partial) abolition of appointed seats were important milestones in the democratisation of the Water Authorities. Their new, more democratic functioning enabled the Water Authorities to work more effectively on providing public goods, including water-related aspects of climate adaptation and water quality. This relationship goes both ways: because of the increasingly public responsibility of the Water Authorities, there has been an increase in public pressure to democratise the institutions so they can work on these topics.

Work on climate adaptation and an ecological transition necessitated that Water Authorities entered different policy domains, such as spatial planning, environment, and agriculture. The Water Authorities' activities in these new policy areas have, to a large extent, been made possible by their democratisation, as this gave them the legitimacy and familiarity to work with other bodies of government that carry authority in these policy domains.

The democratisation of the Water Authorities also gave legitimacy to the taxpayer-funded organisations to scale-up

and professionalize. A professionalisation was needed because their work on public goods required hiring new experts in fields like ecology and climate adaptation and working in the spatial planning domain required experts in this field. The larger size of the organisation, and environmental challenges that extended beyond jurisdictional borders, have created a need for Water Authorities to merge into fewer, larger bodies.

The interrelatedness between these four transitions is summarized in Figure 1.

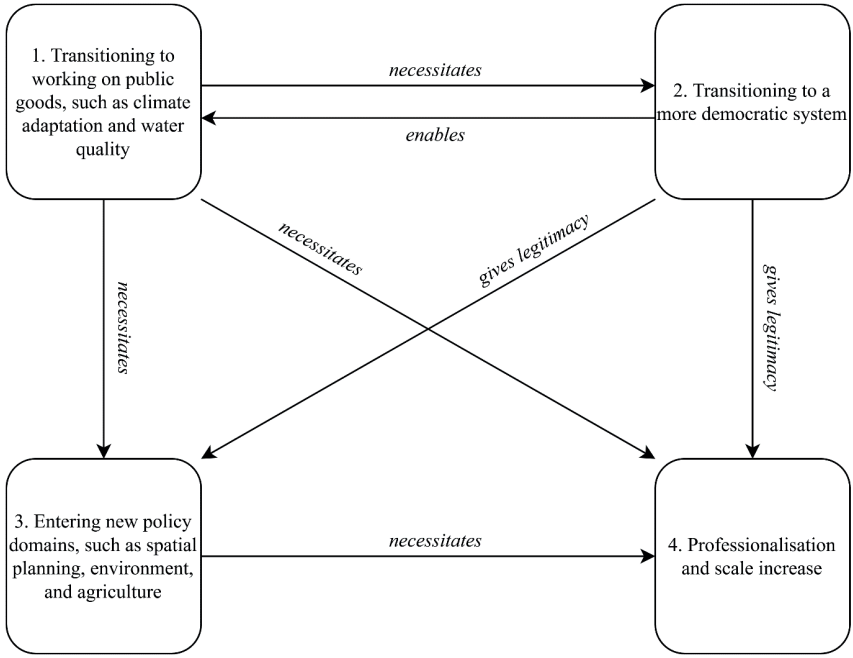

Figure 1
The interrelatedness of the four transitions of the Water Authorities

The case of the four transitions of the Water Authorities in the Netherlands is an interesting case to study in climate adaptation and water risk management, as it shows a case in which environmental pressure can advance democratic institutions, and in which democratic institutions make climate adaptation possible. It is also in interesting case because it highlights the need to adapt institutions to working in spatial, agricultural, and environmental policy domains to adapt to water-related aspects of climate change, at least in some contexts.

It should be noted, however, that the democratic transition of the Water Authorities is a recent one. Little is known about the empirical success of Water Authorities in effectively mitigating the risk of climate-induced water emergencies, as well as their empirical ability to reconcile the specific interests of important stakeholders (such as agriculture) with the public interest. Anecdotally, the Amstel, Gooi en Vecht Water Authority has in 2023 been accused of neglecting its core tasks at the expense of working on water innovation (RTV Utrecht, 2023)dat het waterbeleid regelt in het waterschap Amstel, Gooi en Vecht (AGV. Future research should empirically and longitudinally study the performance of Water Authorities with regards to water security and climate adaptation.

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Bryan has a PhD in Latin American Studies with emphasis in Latin American Thought. He also has a master's degree in Latin American Studies in Culture and Development as well as a B.A. in International Relations with emphasis in Foreign Policy and Diplomacy. His research has focused on topics such as Critical Studies of Development and Climate Change; Security and Geopolitics; International and Latin American Politics. He has worked as coordinator of a master's Program in Latin American Studies at the National University of Costa Rica; professor in public and private universities in Costa Rica; and as associate researcher in national and international research centers. He also worked on an educational and research project on socio-environmental issues called Escuela de la Tierra, while collaborating in the promotion of environmental education for a Wildlife Refuge in southern Costa Rica.

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Krishna grew up in Calgary, Alberta and now lives in Saskatoon for her post-secondary education. She is a Master of Arts student in the Department of Geography and Planning at the University of Saskatchewan. Krishna completed her Undergraduate degree

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Clara is a Ph.D. student, instructor, and coordinator of two MA programmes: Development Studies & Diplomacy and Responsible Management and Sustainable Economic Development. She holds an MA. in Environment, Development, and Peace with a specialization in Sustainable Natural Resource Management from the University for Peace (Costa Rica). Clara has over 12 years of experience living and working in Costa Rica on projects related to water, agriculture, and gender in rural communities. Her doctoral research is on water justice, river rights, community health, and environmental peacebuilding.

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Samantha is a current student at the University for Peace finalising her Master of Arts in Environment, Development and Peace specialising in Environmental Security and Governance. With a background in human geography, local economic development, and systems change, Samantha's passion and expertise focuses on the nexus between humans and their environment. Throughout her career, Samantha has gained extensive experience in project management, community engagement, capacity and strategy development while working in change management consulting and local government. She has previously facilitated partnerships with startups, government agencies, advocacy groups, universities, research institutions, small businesses and community organisations. In her previous roles, Samantha has successfully delivered a diverse portfolio of projects producing advocacy strategies, grant guidelines,

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Olivia is the Head of the Environment, Development and Peace Department, and Associate professor at the University for Peace. She holds a Ph.D. in Natural Resources and Environmental Management from the Natural Resources Institute at the University of Manitoba (Canada). She also holds an MSc. in Biology from the Universidad de Costa Rica and a BSc. in Biology from the University of Calgary (Canada). In the last decade, Olivia's research program has focused on food sovereignty, agroecology, climate & environmental justice, and gender. Specifically, she works with Indigenous people, women, small-scale farmers, and youth on these topics. Her research is driven by social and environmental justice, and she uses relevant methodologies (e.g., Indigenous, feminist) to achieve these goals. She has over 30 peer-reviewed articles, book chapters, and new articles and is the editor of 3 books. She has co-produced videos for Bribri Indigenous development with identity and her most recent book project supported Huetar Indigenous Elders author and publish their cultural knowledge and practices.

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Caitlin is a master's student in Global Environmental Policy at American University in Washington, D.C. Her research topics of interest include climate change, natural resource governance, transboundary water management, ocean policy, domestic U.S. and international environmental law, and environmental policies in the Americas. Ms. Wiley holds a bachelor's degree in Global and International Studies and Spanish from Western Michigan University in Kalamazoo, Michigan. She has extensive personal experience in Latin America, having lived and studied in Argentina, Brazil, and Costa Rica. Her studies in Brazil were supported by a U.S. Department of Defense prestigious David L. Boren Scholarship, and she received many academic scholarships

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