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Indigenous Water Justice: Theory, Gaps, and Opportunities for Application

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Indigenous Water Justice: Theory, Gaps, and Opportunities for Application

By

Ruby Howard

An undergraduate honors thesis submitted in partial fulfillment of the requirements for the

degree of

Bachelor of Science

in

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Environmental Science and Management

Thesis Advisor

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2023

Indigenous Water Justice: Theory, Gaps, and Opportunities for Application

An Undergraduate Honors Thesis

Ruby Howard

Introduction	2
Global Water Insecurity	2
Water Justice as a Theory and Movement	4
Evolution from Environmental Justice	4
Gaps in Environmental Justice for Indigenous People	5
Traditional Water Justice	6
Research Question	7
Methods	8
Body	9
Indigenous Water Injustices	9
Health Impacts	9
Injustices of Major Interest	10
Failing or Lack of Water Infrastructure	10
Water Pollution	11
Pipelines	12
Climate Change	12
International Locations of Major Interest	13
Australia	13
Canada	13
South America	14
Unique Dimensions of Indigenous Water Justice	14
Context of Colonization and Unique Histories	14
Legal and Political Standing	16
Expanded Scope of Water Uses and Values	16
Different Definitions of Health	17
Conclusion & Recommendations	17
Conclusion	17
Opportunities for Future Research & Recommendations	18

Reference List	20
Appendix	25
1. Applying Indigenous Water Justice Principles to the Warm Springs Case Study	25
History and Ongoing Water Issues of Warm Springs	25
Indigenous Water Justice Approach to Crisis in Warm Springs	29

Introduction

In this thesis, I review the existing literature on water injustices facing Indigenous people in the United States and globally, and how Indigenous water justice builds off of traditional water justice theory to reflect a wider scope of Indigenous worldviews, histories, experiences, and cultures.¹ I begin with background on global water insecurity and water justice, including how water justice evolved from its parent movement, environmental justice, to provide a grounding in how Indigenous water justice differs from the movements before it. The body section is split into two parts: ‘Indigenous Water Injustices’ and ‘Unique Dimensions of Indigenous Water Justice’. ‘Indigenous Water Injustices’ explores the literature on the impacts of water insecurity on Indigenous communities: what they are, where they are happening, and the individual and community health impacts. ‘Unique Dimensions of Indigenous Water Justice’ synthesizes the literature on how Indigenous water justice has evolved from traditional water justice to address the unique injustices and impacts that Indigenous communities face. It also outlines how this evolution has taken into account the history of colonization, distinct legal and political standing, expanded scope of water uses, and different definitions of health that often characterize these communities. Finally, the thesis concludes with recommendations for future research and management based on the literature, and an exploration of an opportunity for the application of Indigenous water justice principles in Warm Springs, Oregon.

Global Water Insecurity

Water is power, and those who can make decisions about water can significantly shape people’s lives. Water is also extremely complex, and has social, economic, political, institutional, cultural, spiritual, and ecological aspects, and if it is only controlled by a narrow group of people, there will also be a narrow reflection of these values (Sultana, 2018; Meehan et al., 2020). Therefore, it is dangerous that participation in decision-making on water management and governance is highly skewed towards certain groups that are overwhelmingly white and male (Zwarteveen & Boelens, 2014). Natural water scarcity is rarely to blame for water insecurity, which is more

¹ This thesis uses the United Nations (UN) definition of Indigenous, which is: “Practicing unique traditions, they retain social, cultural, economic and political characteristics that are distinct from those of the dominant societies in which they live. Spread across the world from the Arctic to the South Pacific, they are the descendants - according to a common definition - of those who inhabited a country or a geographical region at the time when people of different cultures or ethnic origins arrived” (UN, n.d., p.1).

commonly engineered by legal, political, and economic structures (Meehan et al., 2020; Eichelberger, 2016; Correia, 2022).

Due to the disparities in who is making water management decisions, access to water is unequal, and water is not universally accessible, affordable, safe, and reliable (Zwarteveen & Boelens, 2014; Sultana, 2018; Brooks et al., 2017; Meehan et al., 2020). In fact, over a billion people globally do not have access to reliable, safe, clean water (Sultana, 2018). Between 2013 and 2017, more than 470,000 U.S. households lacked piped water or had dangerous infrastructure (Meehan et al., 2020). People with unstable housing like those experiencing homelessness, renters, immigrants, or migrant workers, are at higher risk for water insecurity (Meehan et al., 2020). Sewage systems and water treatment plants are inequitably distributed throughout communities, leaving many in 'plumbing poverty' (Deitz & Meehan 2019). Water is often contaminated with pesticides, waterborne diseases, pharmaceuticals, industrial waste, and heavy metals. In the U.S., water is expensive, and many low-income families have to put high proportions of their disposable incomes (between 5% and 26.9%) towards paying for water (Meehan et al., 2020).

Water insecurity has devastating health impacts (Meehan et al., 2020; Schimpf & Cude, 2020; Deitz & Meehan, 2019; Anderson et al., 2013; Johnson, 2002). Poor water quality can cause waterborne diseases, or illnesses from water contaminants like lead or pesticides, resulting in over 500,000 people dying each year globally (Sultana, 2018). Lack of plentiful water can cause dehydration, or malnutrition if communities rely on water to produce or harvest their own food (Meehan et al., 2020; Schimpf & Cude, 2020). Inadequate water access also has detrimental effects on mental health, including emotional distress, depression, anxiety, and psychosocial distress in the form of shame, affronts to human dignity, or fear (Meehan et al., 2020; Schimpf & Cude, 2020; Hanrahan et al., 2014; Hartwig et al., 2022; Anderson et al., 2013; Johnson, 2002). During the COVID-19 pandemic, the 3 billion people who didn't have access to hand-washing facilities were at greater risk of contracting and spreading the virus (Staddon et al., 2020).

These issues impact many groups of people across the globe, and they are especially apparent in Indigenous communities. Current water policies and management practices have done little to address this problem. Consequently, many scholars are calling for the application of a theory and set of principles known as water justice. However, Indigenous people have pointed out that water justice literature does not focus enough on Indigenous issues, often neglecting the issues specific to their communities when implemented in a management setting. This thesis describes the existing literature on Indigenous water justice perspectives and makes recommendations for how these perspectives can be better integrated into water management.

Water Justice as a Theory and Movement

Evolution from Environmental Justice

To truly understand water justice, it is necessary to examine the history and basic theories of environmental justice. Because water justice evolved from the movement of environmental justice, it still holds some of the same gaps and oversights of its parent movement.

Environmental justice is protection from environmental ills and adverse health impacts for all people regardless of race, income, or other socioeconomic factors, and the pursuit of accountability and remediation (Gilio-Whitaker, 2019; Bullard, 1993a; Bullard, 1993b)

Environmental justice officially emerged as a movement and area of academic interest in the early 1980s in the U.S. after a landfill for a class of toxic compounds, polychlorinated biphenyl (PCB), was proposed in Warren County, North Carolina. This decision was met with widespread protest due to contamination concerns and the suspicion that siting decisions were racially motivated (Gilio-Whitaker, 2019; EPA, 2023). Additional grassroots resistance movements to environmental ills and research on race and exposure propelled environmental justice into the mainstream, resulting in the creation of various U.S. government programs, publications, and the landmark Executive Order 12898 which integrated environmental justice into federal agency operations (Gilio-Whitaker, 2019; Bullard, 1993a.; Bullard, 1993b). After the U.S.-based movement grew quickly in the 1980s, international environmental justice scholars and activists along with issues like the global distribution of waste, pollution from manufacturing, and climate change gained prominence (Mohai et al., 2009).

Currently, environmental justice brings together the civil rights and environmentalism movements, to recognize that the same systems that harm the environment harm its people, and that environmental regulations or governmental agencies like the Environmental Protection Agency (EPA) in the U.S. have not benefited low-income and people of color communities who bear the highest burden of environmental degradation (Bullard, 1993a; Bullard, 1993b; Grijalva, 2011). It also recognizes that the people most exposed to pollution are not only contributing the least to the problem but are also the least likely to be able to react, adapt, and recover from the pollution. This is due to poverty, limited political power, institutional neglect, crumbling infrastructure and housing, high unemployment, poor schools and inadequate school systems (Bullard, 1993a.; Bullard, 1993b). While the movement is still heavily centered in the U.S., there is a significant environmental justice movement internationally, and a strong focus on the adjacent climate justice movement (Mohai et al., 2009). Most scholars suggest that environmental justice should include three spheres: recognition, participation, and distribution (McLean, 2007; Hartwig et al., 2022; Schlosberg, 2004). In this interpretation, for something to be considered environmentally ‘just’, there must be recognition of the cultural, historical, and experiential differences of affected communities, participation in management and policy decisions, and equal distribution of resources. Many scholars, activists, and organizations argue

that, without fully meeting the requirements of all three spheres, environmental justice policies or solutions are incomplete (Schlosberg, 2004).

Gaps in Environmental Justice for Indigenous People

Indigenous groups within the U.S. have faced assaults on their human, environmental, and sovereign rights since European settlers arrived in North America in the late 15th century, and this legacy of colonization continues to perpetuate injustice today (Gilio-Whitaker, 2019; Cantzler & Huynh, 2016; Vickery & Hunter, 2016). Deprivation of traditional lands, resources, and relational responsibilities through forced relocation and the reservation system, and the resulting loss of Indigenous cultural lifeways emanating from land (i.e. ceremonial and religious practices, traditional food, medicinal knowledge) has caused devastating health and social impacts since European contact. Common injustices include loss of traditional resources from pollution, climate change, dams, industrial facilities, or extractive activities; targeting for unwanted land uses like dump sites, nuclear facilities, military weapon testing facilities, or extractive industries like mining; or predatory contracts with extractive industries; among many other issues (Gilio-Whitaker, 2019; Cantzler & Huynh, 2016; Vickery & Hunter, 2016). In part due to these environmental injustices, between 2008 and 2010, Native Americans died at a rate roughly 30% higher than other racial groups (Gilio-Whitaker, 2019).

In the book, *As Long as Grass Grows: The Indigenous Fight for Environmental Justice, from Colonization to Standing Rock*, Gilio-Whitaker states that “For a conception of environmental justice to be relevant to a group of people, it must fit within conceptual boundaries that are meaningful to them” (Gilio-Whitaker, 2019, p. 24). Given that environmental justice often collapses all affected communities into one monolithic group based on shared racial minority status, it fails to account for and address the differences of Indigenous people, and the unique injustices that result from those differences (Gilio-Whitaker, 2019; McGregor, 2009). Indigenous people often do not fit under environmental justice’s racial minority umbrella, because they have different perspectives evolving from unique histories, cultures, political standing, and experiences of colonization and ongoing oppression that make the environmental issues they face, and necessary solutions, different from other environmental justice issues (Gilio-Whitaker, 2019; Cantzler & Huynh, 2016; Hernandez, 2019; Vickery & Hunter, 2016). For example, recognized tribes within the U.S. are owed certain rights through treaties and executive orders, and often have more legal autonomy than other communities seeking environmental justice restitution. This unique political and legal situation makes Indigenous environmental injustices underrecognized by a framework that equates political power with the ability to avoid environmental ills (Gilio-Whitaker, 2019; Hernandez, 2019; Vickery & Hunter, 2016). In addition, environmental justice is firmly rooted in Western science that separates humans from nature, and uses this framework to assess risk and impact, thus neglecting Indigenous ways of knowing, strong place attachment, human and nature relationships, and definitions of health,

social wellbeing, risk and comfort that do not conform to Western standards (Hernandez, 2019; Vickery & Hunter, 2016).

Due to this method of categorizing people, health, and risk, traditional ways of conceptualizing environmental justice are often not attuned to the ways in which environmental degradation could impact Indigenous peoples. This has led to less research focused on the struggles of Indigenous communities to control and protect their environment (Gilio-Whitaker, 2019; Cantzler & Huynh, 2016; Hernandez, 2019; Vickery & Hunter, 2016). As researchers rarely engage Indigenous voices, environmental justice places a strong focus on distribution of resources at the expense of recognizing Indigenous worldviews, root causes of unequal distribution of environmental ills, and participation of Indigenous people in decision-making, resulting in environmental justice policies and governmental institutions that have significant oversights (Gilio-Whitaker, 2019; Hernandez, 2019). For example, the EPA's first report on environmental justice included several issues facing Indigenous Americans, but it also admitted that its programs were poorly incorporating Indigenous cultural considerations, including forgetting to include subsistence practices that increase risk of toxic exposure into health-risk analyses (Grijalva, 2011). The U.S. federal government has continued to fall short in collaborating with tribes and representing their values in environmental programs. When Indigenous concerns are mentioned, the language is rarely legally binding and littered with disclaimers (Gilio-Whitaker, 2019). Overall, if something cannot be identified as an environmental justice issue, then it cannot be addressed using an environmental justice framework or policy, resulting in continuing injustice and health disparities (Pellow, 2016; Vickery & Hunter, 2016).

While the environmental justice literature focuses heavily on U.S. issues, Indigenous people globally have had similar experiences of colonization, relocation and genocide, and have reported comparable impacts, meaning their issues are also neglected by traditional environmental justice. Additionally, environmental justice theory is largely shaped by U.S.-based researchers, authors, activists and policymakers, and thus does a poor job addressing issues specific to international communities that might not align with American understandings of culture, lifestyle, religion, or political systems. Despite the lack of recognition of Indigenous environmental injustices in both the U.S. and abroad, Indigenous people have long been leaders in the environmental justice movement, and this is especially apparent when examining the Indigenous water justice literature (Hernandez, 2019; Vickery & Hunter, 2016).

Traditional Water Justice

Water has unique qualities, including its necessity for all life, its spatial and temporal uneven distribution, and the goods and services it provides. These unique qualities mean water yields significant power to those who control it, and devastating consequences for those without it (Sultana, 2018; Neal et al., 2014; Jackson et al., 2013). In addition, the proliferation of water

injustices in realms of management and physical access, make a targeted, justice-centered management approach vital (Neal et al., 2014). Water justice offers a more holistic and equitable solution for water insecurity, that is better equipped to account for water's unique qualities, than more common command and control water management systems (Zwarteveen & Boelens, 2014; Schimpf & Cude, 2020; Neal et al., 2014).

Water justice builds on environmental justice because it seeks equal distribution of water ills and benefits, recognition and participation of all groups of people in water-related decision-making, and safe and universal access to water, regardless of a person's ability to pay (Zwarteveen & Boelens, 2014; Sultana, 2018; McLean, 2007; Harris et al., 2015). Water justice goes beyond traditional questions of distribution to address the underlying social systems and institutions that dictate who controls and benefits from water, and who experiences water insecurity (Zwarteveen & Boelens, 2014; Sultana, 2018; Harris et al., 2015; Neal et al., 2014). Most water justice scholars have pointed to a few distinct ways in which water justice recognizes water as a resource that deviates from how resources are viewed under environmental justice. For example, many authors have suggested water cannot be separated from the unique historical and cultural contexts of the place it is in, and that there can be 'objective' truth when it comes to water, and instead, conceptions of injustice should be based on the 'situated knowledge' of the people being impacted (Zwarteveen & Boelens, 2014; Sultana, 2018; Harris et al., 2015). Furthermore, water justice scholars have increasingly broken down the boundaries between humans, nature, and society, and have recognized that while nature plays a role in water access, it is far more common for human systems to have produced outcomes of scarcity (Zwarteveen & Boelens, 2014; Correia, 2022). In general, water justice acknowledges that water has material, social, cultural, political, and economic qualities, and that problems can arise in all realms. It provides a framework that recognizes water access problems as justice problems and provides solutions to reform water allocation and management to achieve equity.

In practical settings, water justice can be applied to the management or allocation of a water resource, conflict over water, sustainable water use, equitable water use, water rights, and discourses around water (Zwarteveen & Boelens, 2014; Sultana, 2018; Neal et al., 2014; McLean, 2007). Water justice scholars have indicated that water justice cannot remain just a philosophical theory to enact change, but rather it must be transdisciplinary cooperation between water users, policymakers, activists, scientists, and those experiencing water injustice (Zwarteveen & Boelens, 2014).

While water justice builds off of environmental justice and fills many of its gaps, many Indigenous water justice scholars have highlighted the many ways these gaps have re-emerged and have suggested a variety of ways to 'Indigenize' water justice to account for unique Indigenous relationships to water, uses of water, and historical and present experiences of water injustice.

Research Question

This thesis investigates how Indigenous water justice builds off of traditional water justice theory to reflect a wider scope of Indigenous worldviews, histories, experiences, and cultures to better enact equitable water distribution for Indigenous communities.

I outline the dominant narratives in the existing literature on Indigenous water justice, including the most common documented injustices, unique dimensions of Indigenous water justice in the context of scope of water use, legal and political frameworks, and context of colonization, and the most common author recommendations for integrating Indigenous perspectives into water justice theory and practical applications. I conclude with an examination of how Indigenized water justice principles could be applied to water management, and the areas where further research is needed before Indigenous water justice can be scaled up.

Methods

This is a thematic literature review, where findings are organized based on themes that emerged from the literature, rather than systematic categorization. Two major databases were used to find an initial body of literature to review: Google Scholar and Web of Science. After the initial articles were collected, they were analyzed to determine if they were eligible for inclusion in this review. To be included in the review, articles had to center around Indigenous water justice. The articles are from multiple states within the U.S., and countries, including Australia and Canada. Articles could focus on any water issue (climate change, pipelines, plumbing, pollution, etc.), as long as the issue was analyzed through a water justice lens and focused specifically on Indigenous issues or Indigenous water justice principles. Articles that did not explicitly focus on Indigenous issues, but mentioned them as part of a larger research question, were included if they were discussed in the context of water justice.

Out of the initial selection of papers pulled from both databases, 43 were included in the review. These papers come from a wide range of time periods, from 1989 to 2022, with over half published after 2017. They include both peer-reviewed journal articles and chapters of books on the topic. They represent a wide variety of journals from the fields of social science, environmental science, environmental management, law, and public health, among many others.

An important thing to note is that when referring to an 'Indigenous water justice scholar' I am not suggesting that the authors themselves are necessarily Indigenous, just that they focus on Indigenous issues. It is impossible to determine if all the authors are Indigenous, however many of them are.

As water is central to Indigenous worldviews, life-ways, and experiences of health and well-being, it is often difficult to draw distinct lines between water justice and wider environmental justice literature. Although most of the papers in this literature review explicitly focused on water justice, there are some that focused on environmental justice in title but dedicated a significant portion of the content to exploring water injustices, gaps in traditional water justice, or Indigenous water justice principles. These are mostly included in the ‘Indigenous Water Injustices’ section.

Body

Indigenous Water Injustices

The first half of the literature review is focused on synthesizing the present-day Indigenous water injustices, including the impacts of water insecurity, most well-represented in the literature. I also summarize the major geographical locations where this literature originates. Not only does most of the current literature focus heavily on examples of water injustices but examining the array of injustices represented in the literature will provide context for the ways in which author’s suggest to ‘indigenize’ environmental justice that I explore later in the review.

The literature on Indigenous water justice described a wide variety of injustices from multiple sources that Indigenous communities face today, as well as some of the most harmful impacts. Authors generally agreed that current injustices root back to colonization, a connection which I explore later in this review. They also outlined threats from the destruction of nature, disinvestment, extractive industries, and aging infrastructure exacerbated by unmet treaties, ineffective policies, and lack of research on Indigenous lands that contributed to a host of water issues on Indigenous lands. These water issues included sedimentation, eutrophication, pesticides, groundwater withdrawal, bacterial pollution, hazardous waste pollution, crumbling infrastructure, and toxic chemicals (Jackson, 2018; Lewis et al., 2017; Cummins et al., 2010; Kozich et al., 2018). Broadly, these issues impacted access to water supply and water infrastructure, aquatic species important for food or culture, ranching and agricultural businesses, and tribal sovereignty and rights associated with water resources, fishing, hunting, and gathering (Cozzetto et al., 2014). Some authors explored how, as a consequence of the remote locations of many reservations residents are subjected to hazards like severe climates, perilous geography, disease-carrying insects and rodents, and dangerous industry like mining or military bases, which can have a direct impact on water or can compound the already high risk of living in a water-insecure community (Mitchell, 2016). Authors also made connections between how systems of colonization, displacement, and political oppression translate to reduced power in changing their situations. Generally, Indigenous people have less economic and political means to mitigate impacts of these activities, and are not included in management discussions, and therefore have

longer-term exposure to water insecurity and risk of negative health outcomes (Jackson, 2018; Cozzetto et al., 2014).

Health Impacts

Many authors focused heavily on the health impacts that result from water injustices on Indigenous lands and highlighted the inequitable health outcomes that many Indigenous people experience. Indigenous people in the U.S. have high rates of diabetes, cancer, heart disease, obesity, and mental health issues like substance abuse or depression (Mitchell, 2019; Boyd, 2011). A lot of these issues are either directly caused by or greatly exacerbated by water insecurity. For example, some studies explained how people who didn't have access to clean drinking water often drank sodas because they knew they were clean and they were cheaper or more readily available, which could increase their risk of diabetes, cancer, and obesity (Mitchell, 2019; Hanrahan et al., 2014). Also, nonexistent or poor-quality water infrastructure can lead to contamination and disease (Mitchell, 2020). Interestingly, authors often focused more heavily on the emotional and psychological impacts of water insecurity than the physical impacts. Many authors detailed how there are significant emotional impacts associated with losing traditional water sources, being water insecure, or worrying about health impacts of water pollution. A small sample of these issues included shame around unclean homes and head lice outbreaks, fear and anxiety around where they would get their next load of water, sadness from the loss of important cultural resources, and depression from not being able to adequately provide for one's family (Eichelberger, 2016; Hanrahan et al., 2014; Duignan et al., 2022; Johnson, 2002; Mitchell, 2016, 2019). There is also ongoing concern that chronic exposure to water contaminants, such as arsenic, is impairing neurological functioning in Indigenous elders, leading to a loss of cultural knowledge and history due to the tradition of oral storytelling in Indigenous communities (Gilio-Whitaker, 2019).

Injustices of Major Interest

The literature on Indigenous water injustices was grouped around a few major problems or repeated case studies, including lack of sufficient plumbing or water infrastructure, pollution from manufacturing or extractive industry, pipelines, and water impacts of climate change. Multiple authors suggested that the case studies outlined in the following section were representative of the issues faced by Indigenous people on a much wider scale and were not isolated instances of water insecurity.

Failing or Lack of Water Infrastructure

Authors consistently brought up water infrastructure issues, especially lack of piped drinking water and lack of plumbing, common in Indigenous communities. Lack of piped water is one of the most common water insecurities faced by Indigenous people, and in the U.S., it is estimated that between 6.5% and 9% of Indigenous homes lack safe water sources compared to only 1% of

the general population (Mitchell, 2020). If communities do not have access to piped water, or do not trust the source, they often turn to natural sources that could be contaminated and unsafe to consume (Eichelberger, 2019). In illustrating the lack of water infrastructure in Indigenous communities, authors repeatedly mentioned villages in Northern Alaska. One author wrote multiple papers on these villages, each time adding new context and updates on the evolving situation. Upwards of 30 Indigenous villages in Northern Alaska have never had access to piped water or are facing degrading water and wastewater treatment infrastructure due to flooding and erosion from climate change. These households have had to haul at least 10 gallons of treated water over multiple trips per day, which is time consuming and causes chronic pain for many residents (Mitchell, 2019; Eichelberger, 2016, 2018, 2019). Residents reported having to choose between buying water or paying bills, rationing and reducing consumption of water to have enough to wash clothes and dishes, waiting so long to wash their hair that their head started to hurt, experiencing frequent service disruptions, and drinking untreated natural sources that could be unsafe. Residents in these villages also do not have indoor plumbing and have to dump their waste into a river. Because of these issues, tribes are considering relocation which would potentially cause them to lose their native languages, traditions, and culture (Mitchell, 2019; Eichelberger, 2018).

Some authors explored the connections of rurality and indigeneity, and resulting geographic, economic, and political marginalization, through examples of failing water infrastructure (Meehan et al., 2020; Schimpf & Cude, 2020; Boyd, 2011; McLean, 2007; Eichelberger, 2018). When colonizers created the reservation system, they disconnected Indigenous peoples from their native lands and resources, and pushed them into isolation (Gilio-Whitaker, 2019). For this reason, Indigenous people possess intersecting identities of indigeneity and rurality, both of which are seen as outside modernity and devalued, together and in combination (Pellow, 2016). As the previous example of Northern Alaska demonstrates, many rural communities lack water infrastructure altogether (Mitchell, 2019; Eichelberger, 2016, 2018, 2019). For those that have infrastructure, often their systems have limited capacity to withstand drought and other natural disasters (Schimpf & Cude, 2020). Degraded infrastructure is common in rural areas, but due to low incomes and political marginalization, there are limited resources to fix it (Meehan et al., 2020; Schimpf & Cude, 2020; Eichelberger, 2018). In addition, transporting water into remote rural areas is very expensive which often causes people to compensate by drinking water from unsafe natural sources, using untreated water, paying for bottled water, rationing water, or drinking sugary beverages in substitute (Hanrahan et al., 2014; Cozzetto et al., 2014; McLean, 2007). The Alaska example also exemplifies a wider issue in geographically isolated reservations: 'plumbing poverty'. Indigenous households are 3.7 times more likely to lack complete plumbing and the combination of geographic isolation and Indigenous identity seem to interact to create high-risk levels. Improper management of waste can lead to various diseases and negative health outcomes (Deitz & Meehan, 2019).

Water Pollution

Authors gave multiple examples of pollution degrading Indigenous water sources, from extractive and manufacturing industries, agriculture, and from crumbling infrastructure - sometimes even crumbling water infrastructure. Multiple authors spoke about how common pollution from uranium mining is on Indigenous lands (Mitchell, 2019; Lewis et al., 2017; Gilio-Whitaker, 2019). These sites leak mining chemicals that contaminate soil and water, which causes increased rates of kidney disease, hypertension, and other diseases in communities nearby. Exposure risk is compounded by poor infrastructure that allows higher rates of contaminants to enter drinking water sources (Lewis et al., 2017). Pollution from organic waste, either from agriculture or leaking wastewater treatment infrastructure is also common. The Kickapoo Tribe in Kansas' water supply is highly contaminated from agriculture (Cummins et al., 2010; Mitchell, 2016), and the Crow people of Montana have been dealing with health impacts and declining animal populations linked to a leaking sewage lagoon since the 1970s, despite notifying the Bureau of Indian Affairs (McLean, 2007; Mitchell, 2016). Some authors discussed the prevalence of wells in rural areas, and how decreased regulation of these water sources could lead to higher exposure to water pollutants for Indigenous people. Throughout the U.S., 90% of people reliant on domestic wells have unsafe water (Meehan et al., 2020). Twenty percent of Oregonians use private wells with no government regulations for safety, mostly in rural areas where Indigenous communities are more prevalent (Schimpf & Cude, 2020).

Pipelines

A cornerstone of many authors' arguments that Indigenous people have not attained water justice in the U.S. was based on the treatment of Indigenous water protectors during the resistance movement at Standing Rock. The Dakota Access Pipeline (DAPL) resistance at Standing Rock is a famous example of environmental violence where water protectors standing up against a proposed pipeline that could contaminate their water and violate their treaty rights were met with a paramilitary police response and violence (Gilio-Whitaker, 2019; Mitchell, 2019; Robison et al., 2018). This event represents an instance of environmental violence, where Indigenous people attempting to protect a sacred and life-giving resource were met with extreme tactics, despite many arguments that they had legal standing to protest (Gilio-Whitaker, 2019). Many authors have suggested this event illustrates the need for Indigenous perspectives to be integrated into water justice conversations and federal policies so that their concerns are taken seriously the next time a project like DAPL is proposed on Indigenous lands. There are also various studies from Canada that outline how often pipelines are placed on Indigenous lands, and how these pipelines are prone to leaking into important water sources. They also suggest that Indigenous Canadians have had little success in fighting pipeline placement or mitigating impacts after they leak (Datta & Hurlbert, 2019, 2022).

Climate Change

Multiple authors highlighted the connections between climate change and increasing water insecurity in Indigenous communities. They also framed climate change as a justice issue by describing how Indigenous communities are on the frontlines of these crises, despite contributing little to the causes of climate change (Gilio-Whitaker, 2019; Cozzetto et al., 2014). Rising temperatures in freshwater sources are causing dangerous algal blooms, lakes are draining as permafrost thaws and allows the ground to hold more water, melting permafrost is resulting in higher erosion and turbidity rates and an increase in boil notices and waterborne diseases, flooding is overwhelming water treatment centers, estuaries are flooding and becoming more acidic, and in arid regions, lakes and rivers drying up (Goldhar et al., 2013; Cozzetto et al., 2014; Bischoff-Mattson et al., 2018). Indigenous first foods are being impacted by the same climate-caused water injustices affecting people. For example, in the Northwest of the U.S., salmon populations are declining from a combination of low river flow from climate change and water diversions, dams, and flooding in nesting areas (Johnson, 2002; Mitchell, 2016; Cozzetto et al., 2014; Gilio-Whitaker, 2019). The Ojibwe Tribe of the Great Lakes is experiencing a loss of their wild rice, Manoomin, due to higher temperatures increasing rates of disease and invasive species (Cozzetto et al., 2014). Authors suggested that food insecurity is one of the many ripple effects of water insecurity that is fundamentally changing Indigenous communities' ability to maintain their health, well-being, and connection to their cultures.

International Locations of Major Interest

Despite the vast diversity of Indigenous communities throughout the world, their deep connection with and responsibility to nature and shared experiences of colonization or oppression make it possible to apply a similar Indigenous water justice lens to the injustices they face, even though most of the official water justice research originates in the U.S. This is important because water injustice is not just a problem for Indigenous people in the U.S. as it is also a significant issue for Indigenous people worldwide. While authors examining U.S. issues focused mostly on Alaskan villages, the Kickapoo Tribe in Kansas, the Crow Tribe in Montana, the Standing Rock Sioux in North Dakota, and various Pacific Northwest and Great Lakes Tribes, authors detailing injustices globally focused on Canada, Australia, and South America.

Australia

Indigenous water insecurity in Australia has been well documented. In Australian Indigenous communities, 17% of the population relies on water quality that does not meet national health standards, 38% of communities have regular water testing, 33% have regular water restrictions, and 14% do not have maintained water supply systems (McLean, 2007) The Australian government has historically managed water with little regard for Indigenous interests and there is a history of colonization and displacement interrupting use of traditional water sources similar to that of the U.S. (Bischoff-Mattson et al., 2018; Lyons & Barber, 2021). There was a large body of participatory research examining Aboriginal water insecurity in Australia, that details the

social, cultural, emotional, and physical impacts this water insecurity has had on people. This type of survey or interview-based research is lacking in Indigenous water justice literature from other parts of the world, despite the importance of talking directly to communities highlighted in the principles of water justice.

Canada

There were many studies on water injustices faced by remote Indigenous communities in Canada, especially those focused on access to water infrastructure and resulting health impacts. In Canada, thousands of people living on reserves do not have running water or flush toilets, leading to high rates of influenza, whooping cough, shigellosis, and impetigo (Duignan et al., 2022). Those that do have water experience frequent contamination and long-term boil notices (Boyd, 2011; Duignan et al., 2022; Cummins et al., 2010; Anderson et al., 2013). Multiple authors detailed the water crisis in Black Tickle, Labrador, Canada. Here, there are no piped water systems or water trucks to deliver clean water to residents. Before 2004, the community relied solely on brooks and ponds for water, but this water was contaminated. Now, they must pay \$2 per liter of water and haul it to their homes (Mitchell, 2016; Anderson et al., 2013). Because of the high price, they compensate by using expensive bottled water, unmonitored shallow community wells or natural ponds (which often dry up), or by drinking soda (Mitchell, 2016; Anderson et al., 2013; Hanrahan et al., 2014; Goldhar et al., 2013).

South America

A few authors highlighted the water injustices faced by Indigenous people in South America, though not as many as in Canada or Australia. All the water injustices in these regions captured in the literature included in this review were spurred by agriculture, which is largely unregulated in these areas. Andean Indigenous people are trying to maintain their water rights in Ecuador where the government is propping up a flower-growing industry that is seizing Indigenous lands and using immense amounts of water to grow flowers for international export (Hidalgo et al., 2017). The Enxet and Sanapaná people in South America's Chaco region are facing severe water pollution from cattle ranching. Fecal contamination has made the water unsafe to drink, and residents can't afford filters, so they've resorted to stretching fabric over buckets as makeshift filters (Correia, 2022). Indigenous communities in Cotopaxi Ecuador are facing increasing water shortages and desertification due to intense irrigation on surrounding broccoli farms (Partridge, 2016).

Unique Dimensions of Indigenous Water Justice

Indigenous scholars who study both environmental and water justice have long suggested that traditional or 'mainstream' iterations of their respective movements inadequately address Indigenous issues or properly integrate Indigenous perspectives and ways of understanding the world into their frameworks. They have suggested this leaves Indigenous issues dangerously

underrepresented or misrepresented in the literature and resulting political or legal applications. Within the water justice literature, authors who focus on Indigenous issues have thoroughly exposed the gaps in traditional water justice literature and current applications for Indigenous people, and have proposed various ways to fill those gaps. In this section I explore the major themes in Indigenous water justice that exemplify its diversion from traditional water justice.

Context of Colonization and Unique Histories

Authors consistently outlined a wide variety of water injustices faced by both Indigenous people in the U.S. and abroad today, that play a significant role in determining community health outcomes (Meehan et al., 2020; Mitchell, 2019; Boyd, 2011; Eichelberger, 2019; Jackson, 2018; Johnson, 2002). However, most Indigenous water justice scholars have argued that water injustices root back to colonization, and current injustices can't be separated from the impacted communities' experiences with colonization and the reservation system in the U.S. Authors suggested that not only are many of the water injustices faced by Indigenous communities direct consequences of colonization, but they are continually reinforced by current legal, political, and economic systems that were also consequences of colonization (Meehan et al., 2020; Mitchell, 2019; Duignan et al., 2022; Robison et al., 2018; Correia, 2022; Jackson, 2018). After European contact, Indigenous populations dropped drastically from genocide, disease, and displacement. Their political power and ensuing control over their own water resources were significantly reduced (Mitchell, 2019; Colby et al., 2005). For the first time, private property and the reservation system created fixed boundaries that limited movement and prevented tribes from accessing traditional water sources and other water-based foods, greatly reducing both water and food security (Meehan et al., 2020; Mitchell, 2019; Jackson, 2018; Johnson, 2002; Cozzetto et al., 2014; Correia, 2022). Water became a huge part of the mining, agricultural, and industrial development of the U.S., and powerful industry groups were able to pressure those imposing new property-rights regimes to mold them to industry interests, creating a situation where industry had significant control over resources and the ability to use up or pollute them without major consequence. This often came at the expense of important Indigenous water resources (Jackson, 2018; Mitchell, 2016; Hidalgo et al., 2017).

As well as describing colonization as a water injustice, many authors also commented that the event of colonization and experience of ongoing colonial systems has shaped Indigenous water justice as a theory and political or management tool. Authors suggested that there are unique dimensions of Indigenous water justice to account for the unique experiences, histories, cultures, and political situations of Indigenous people, that set it apart from traditional water justice (McLean, 2007). Water injustice has a long history within Indigenous communities, because it has been occurring and dictating health outcomes since European colonization (Mitchell, 2019; Eichelberger, 2018; Hartwig et al., 2022; Jackson, 2018; Cummins et al., 2010; Cozzetto et al., 2014; Kozich et al., 2018). Indigenous water justice accounts for this history and recognizes that water justice struggles are particularly complex in places where settler nations and institutions

have caused environmental degradation (Hartwig et al., 2022). In water justice literature, the term ‘water colonialism’, defined by Hartwig et al. as describing “the situations of past, present and ongoing acts, institutions, decision-making processes, physical interventions, discourses, narratives and paradigms that continue to marginalize and exclude Indigenous Peoples”, is used to describe the unique Indigenous experience (2022). Because of this history and ongoing oppression, Indigenous communities are usually more politically, socially, and economically marginalized which makes them both more vulnerable to injustice in the first place, and less prepared to react (Mitchell, 2019). These authors suggested that it is impossible to examine any water justice issue in an Indigenous community without examining it in the context of colonization.

Legal and Political Standing

A large portion of Indigenous water justice literature described the unique system of water rights and laws that Indigenous nations within the U.S. operate under, which make the injustices they face legally complex (Moore, 1989; Chandler, 1994; Cozzetto et al., 2014; Kozich et al., 2018). The authors focused on a few major sources of resource rights that Indigenous groups in the U.S. share. For example, after colonization, tribes gave up expansive tracts of land in exchange for treaties that guaranteed them reservations, and the right to hunt, fish and gather traditional foods outside of reservation boundaries (Johnson, 2002). U.S. tribes also have federally reserved water rights from the 1908 *Winters vs The U.S.* court case, which recognized the responsibility of the U.S. government to provide reservations with adequate water (Moore, 1989; Chandler, 1994; Jackson, 2018; Cozzetto et al., 2014; Gilio-Whitaker, 2019). Under the Clean Water Act, federally recognized tribes can be treated as states due to Section 303 of the 1987 Amendments (Chandler, 1994). Multiple authors discussed the various International non-binding resolutions like the U.N. Declaration on the Rights of Indigenous Peoples (UNDRIP) and the Kyoto Declaration that assert the rights of Indigenous peoples to have full authority over their natural resources, including water, and their rights to enough water for basic needs, sanitation, social, spiritual, cultural and economic purposes (Robison et al., 2018; Hartwig et al., 2022; Jackson, 2018). Indigenous people in the U.S. are rights holders, not stakeholders, and unlike many other groups they have a legal right to water (Moore, 1989; Chandler, 1994; Colby et al, 2005). However, authors stressed that this does not mean that their rights are guaranteed to be respected, or that the current legal framework does a good job protecting the aspects of water that are important to Indigenous people or the quality of water (Jackson, 2018; Chandler, 1994; McGregor, 2009).

Expanded Scope of Water Uses and Values

Most authors described how Indigenous water justice has a wider scope than traditional water justice because of the wider role that water plays in Indigenous culture, identity, and livelihoods (Jackson et al., 2013; Mitchell, 2016, 2019). There is diversity within Indigenous history, language, culture, spirituality, social organization, and tribal governance, so Indigenous water

justice must be situational and account for the specific place and culture that is being examined (Mitchell, 2019; Hanrahan et al., 2014; Cozzetto et al., 2014; Kozich et al., 2018). Despite this diversity, within the literature it was clear that overall: water is central to the identity, well-being, spirituality, livelihoods, and culture of Indigenous people, and their understanding of water is based on intimate knowledge, respect, place attachment, and relationships. Water is a matter of cultural survival, it is a fundamental life-giving force with spiritual significance and sentience (Gilio-Whitaker, 2019; Boyd, 2001; Robison et al., 2018; McLean, 2007; Hartwig et al., 2022; Jackson, 2018; Johnson, 2002; Cummins et al., 2010; McGregor, 2009; Cozzetto et al., 2014; Hidalgo et al., 2017; Jackson et al., 2013; Correia, 2022; Anderson et al., 2013; Lyons & Barber, 2021; Eichelberger, 2018, 2019; Mitchell, 2016, 2019, 2020). Attempts to classify water as solely a resource or water security only in terms of treated water access erase the cultural significance of water (Eichelberger, 2019, 2018). Authors also detailed how many tribes have custodial duties of water, and how caring for and respecting water is a sacred responsibility (Mitchell, 2019; Robison et al., 2018; Jackson, 2018; Johnson, 2002; Cozzetto et al., 2014; Jackson et al., 2013; Correia, 2022; Bischoff-Mattson et al., 2018; Lyons & Barber, 2021).

Severing the reciprocal relationship between water and people threatens people's well-being, identities, culture, and could be considered a type of cultural genocide (Hartwig et al. 2022, Jackson 2018, Correia 2022). However, because Western views of water hold it as a commodity to be bought, sold, and controlled, and often view Indigenous water management systems as 'unscientific' or 'ill-defined', these values often go unrecognized in traditional water management practices (McLean 2007, Jackson 2018, Kozich et al. 2018, Finn & Jackson 2011, Mitchell 2019, Robison et al. 2018, Jackson et al. 2013).

Different Definitions of Health

There are many documented impacts to health, as outlined above. However, multiple authors touched on how Indigenous people also often have different definitions of health or what constitutes a culturally appropriate water source. Due to these expanded definitions, Indigenous water justice is concerned with a wider array of 'health impacts' than those represented in traditional water justice literature. Food security, ceremonial use, reciprocal relationships, knowledge transmission, community cohesion, and physical health all play into Indigenous definitions of health (Donatuto et al., 2011; Mitchell, 2016). Loss of access to traditional resources, even if not harming one's physical body, is still detrimental to Indigenous health (Donatuto et al., 2011; Mitchell, 2016). For many, drinking from traditional water sources or subsistence activities like hunting and fishing are as much a part of health as having clean, uncontaminated water, and if water is polluted it is hard to choose between which aspect of health to prioritize (Eichelberger, 2018; Robison et al., 2018; Hanrahan et al., 2014; Lewis et al., 2017). Current risk assessments common in water justice literature, local water management programs, and U.S. government programs do not incorporate this view of health, and thus miss

the potential scope of impacts of water issues (Donatuto et al., 2011; Cummins et al., 2010; Finn & Jackson, 2011).

Conclusion & Recommendations

Conclusion

Indigenous people are particularly at risk of water scarcity in the U.S. and abroad, and face high rates of nonexistent or failing water infrastructure, water pollution, pipeline proposals that threaten water resources, and water-related climate change impacts. They also are often unequipped, politically and economically, to react and adapt to these impacts. For a long time, environmental justice has been used as a framework to address water issues, but due to the unique qualities of water, water justice emerged. As an offshoot of environmental justice, water justice carries some of the same gaps, especially for Indigenous people. Broadly, the issues are rooted in collapsing all racial minorities into one monolithic group and ignoring key differences between Indigenous and non-Indigenous people. Issues that have been identified by Indigenous water justice scholars include failing to account for histories of colonization and forced relocation, ignoring their political standing as legal rights holders, failing to examine how intersecting identities like indigeneity and rurality can create synergistic effects, failing to recognize different definitions of health and failing to account for unique ways of interacting with, valuing, relating to or using water in different cultural, spiritual and health practices. Unfortunately, even water justice principles aren't commonly applied in management settings. However, in their current state, they would likely not adequately address Indigenous issues due to these gaps. Because water is necessary for life and provides power to those who control it, these gaps in literature and principles, if reflected in management, can lead to engineered scarcity that has devastating physical and emotional consequences for Indigenous people. It is necessary to work towards a more justice-centered approach to water management in order to address the water scarcity that plagues over one billion people worldwide.

Opportunities for Future Research & Recommendations

From this body of literature, a few areas for additional research emerged. Much of the environmental justice and water justice literature describes the importance of recognition justice - or making sure that unique histories, experiences, cultures, and ways of knowing, or values, are incorporated into definitions of justice and potential solutions. In order to meet requirements of recognition justice and thus usher in better distributive justice, the ways in which Indigenous people value water must be thoroughly explored. While Indigenous communities often have similar worldviews and perspectives on environmental issues due to shared histories and ongoing injustices rooted in colonialism, and similar viewpoints rooted in traditional ecological knowledge and the ideas of reciprocity, relationships between nonliving and living, human and

nonhuman beings, and custodial relationships, the diversity of experiences of different nations cannot be condensed into one monolithic group (Gilio-Whitaker, 2019). Despite this, the current body of participatory research, where researchers directly ask Indigenous people about the issues they are facing, is heavily skewed towards areas like Australia, Alaska and parts of Canada, and does not equally represent the diversity of Indigenous experiences (Jackson & Barber, 2013; Bischoff-Mattson et al., 2018; Lyons & Barber, 2021; Jackson, 2006; Maclean, 2015). Without understanding these perspectives, local water managers and policymakers will not be successful in creating policies that will be realistic and attainable for a specific community and attentive to that community's needs and wants. More participatory research should be conducted in the U.S., especially in Oregon as the state is underrepresented in the literature despite many tribes facing water insecurity. Current literature on Indigenous water issues in Oregon focuses on dams and salmon, however, there are other types of injustices occurring. One community in Oregon that would benefit from a participatory study is the Confederated Tribes of the Warm Springs, who have faced disinvestment in their water systems for years, culminating in a series of water shut offs and boil notices that left residents water insecure for many months. For more information on the situation in Warm Springs, and opportunities for management, see Appendix 1. Without asking people directly about the issues they are experiencing and the ways they are impacting their health, culture, and well-being, things that the water justice framework currently does not have the ability to account for can be missed. With a renewed research focus on representation, managers will have more resources to promote more equitable distribution. Another opportunity for research is participatory studies exploring intersecting identities. There is a growing selection of research on rural Indigenous water issues, however, the body of scholarly work remains small. Additional research on people with these identities, as well as other intersecting identities like Indigeneity and poverty, gender, or education level for example, could help shed light on potential synergistic impacts.

The authors included in this review provided a few key recommendations for how to integrate Indigenous perspectives into water justice to usher in better recognition, participation, and distributive water justice for Indigenous people. Overall, they suggested that for true justice to be achieved, there needs to be an integration of Indigenous water values, needs, and perspectives into water justice frameworks and water management practices (Jackson, 2018; Jackson et al., 2013; Bischoff-Mattson et al., 2018; Robison et al., 2018; McLean, 2007; Hartwig et al., 2022; Maclean, 2015). Using the idea of the three spheres of justice, this would look like recognizing the differences in Indigenous experiences and values, respecting the inherent rights of Indigenous people to have autonomy over internal water management and participate in wider water decision-making, and prioritizing equitable distribution of culturally-appropriate water that meets Indigenous definitions of health and is sufficient to fill all of their needs, both physical and metaphysical. They also highlighted the need to connect the research to tangible shifts in management. Indigenous water values should be integrated into federal and state infrastructure decisions, funding allocation, and laws impacting resource management, to ensure that water

distribution meets the actual needs of Indigenous communities (Robison et al., 2018). There are many communities currently facing injustices, Warm Springs, Oregon included, that could benefit from integrating the Indigenous water justice principles. While there is ample discussion in discrete academic circles about these principles, they have yet to be applied on a wider scale. Making the leap between scholarly discourse and widespread implementation is vital. Water managers could start by shifting their focus from distribution to recognition and participation. This might look like hiring more Indigenous people to water utilities or water boards, electing Indigenous officials, and utilizing or conducting participatory studies of how Indigenous people's water is impacted in a certain region and integrating what is learned into the management approach. If more of these practices are implemented in real water management settings, research could be done to determine the most effective practices and implementation techniques that can then be applied by other managers. After Indigenous water values and uses are integrated into water justice frameworks, and these frameworks are adopted by water managers on a larger scale, water justice can become a tool actually equipped to provide equitable water outcomes for Indigenous communities.

Indigenous communities are often some of the most water-insecure, and while a promising framework, water justice often does not account for the experiences, histories, and worldviews of the Indigenous people, leaving gaps in its ability to bring about community-centered change. Indigenous water justice offers a more tailored approach, that if better researched and scaled, has great potential to promote true water justice that meets the needs of the people facing insecurity and brings about long-term change in water access.

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Appendix

1. Applying Indigenous Water Justice Principles to the Warm Springs Case Study

History and Ongoing Water Issues of Warm Springs

For thousands of years before European colonization, diverse groups of people lived within the Columbia River basin, each with different languages, cultures, and lifeways (Tananáwit, 2020). Two of these tribes were The Warm Springs, who lived along the Deschutes and John Day rivers, and the Wasco who lived along the Columbia and Hood Rivers. They hunted for game, gathered roots and berries and fished for salmon, which played important roles in food, weddings, funerals, and religious ceremonies (WSCAT, n.d.; CTWS, n.d.; Odell, 2004). Both the Warm Springs and Wasco Tribes were known for building intricate scaffolding over waterfalls in the Columbia to catch migrating salmon (Tananáwit, 2020; CTWS, n.d.). The Northern Paiute Tribe lived in the more arid region of the Northern Great Basin of Southeastern Oregon and migrated further and more frequently than the other two tribes throughout the high plains of what is now Oregon, Nevada and Idaho. The Northern Paiutes relied on hunting, gathering and to a lesser degree, fishing, and each band occupied a specific territory centered on a water body like a lake or wetland (Tananáwit, 2020; WSCAT, n.d.). For all three tribes, certain water bodies and the resources they provided played a central role in their lives.

In the 1800s, European trappers arrived on the Pacific coast from Russia, Canada and The Netherlands in search of beaver and otter skins (Tananáwit, 2020; CTWS, n.d.). In 1843, waves of settlers started arriving in these tribe's territories, bringing disease and stealing land and resources from the Native people (WSCAT, n.d.). By 1852, 12,000 settlers were crossing Wasco and Warm Spring territories each year (CTWS, n.d.). Diseases brought by Europeans during this period killed approximately 80-90% of the Native people in the ancestral homelands of the Wasco and Warm Springs Tribes (WSCAT, n.d.). These diseases included smallpox, scarlet fever, whooping cough, dysentery, typhoid, measles, and a malaria-like disease that was especially deadly (WSCAT, n.d.). Government propaganda instilled fear of Native peoples in the settlers, causing them to inflict violence on these groups (Tananáwit, 2020).

In 1855 the Warm Springs and Wasco Tribes signed a treaty with the Superintendent of Indian Affairs Joel Palmer, where they ceded approximately 10 million acres of land in exchange for 640,000 acres of land in North Central Oregon, and the right to fish, hunt, gather food, and graze livestock, and \$200,000 (McConnell, 2006; Cook, 2020; Tananáwit, 2020; WSCAT, n.d.; CTWS, n.d.; Cliff, 1942). This was approximately 1/20th of their original territory (WSCAT, n.d.). After signing the treaty in 1855, the members of the Wasco and Warm Spring Tribes moved onto the reservation (Tananáwit, 2020). The Northern Paiute Tribe refused to sign the treaty and were

targeted by a U.S. Army campaign to force them to comply. After defeat in the Bannock War of 1878, 38 Paiutes moved from the Yakama reservation to the Warm Springs Reservation between 1879 and 1884 (Tananáwit, 2020; WSCAT, n.d.; CTWS, n.d.; Cliff, 1942).

The reservation was a vastly different terrain than they were used to, especially for the Warm Springs and Wasco people as it was 300 miles away from their ancestral homes along the Columbia River (Tananáwit, 2020). Most of the reservation has a dry climate, with about 10 and 15 inches annually of rain and snow respectively, much different than the wet Columbia basin (Cliff, 1942; Robison, 1976). For all the tribes, residing in the fixed boundaries of the reservation was difficult as their lives were molded on the ability to move around to trade, hunt, gather and fish, and the reservation did not provide many of these traditional resources, especially salmon (McConell, 2006; Tananáwit, 2020; WSCAT, n.d.; CTWS, n.d.). While tribal members reserved their right to fish in traditional territories, due to colonization, increasing resource extraction and human activity, fish populations were declining in these territories and traditional fishing sites were often far away (McConell, 2006; WSCAT, n.d.). One important site was located 70 miles from the reservation and required a difficult four-day trip to get there (McConell, 2006). In 1867, another state official visited the reservation, stating that they were there for the tribe to sign an agreement that they would carry identification when leaving the reservation for their own protection. The tribe agreed to this; however they actually signed a treaty stating that they agreed to sell their off-reservation rights to erect houses, fish, hunt, gather food and graze livestock. Tribal leaders insisted that they were deceived, and that the treaty was null because there were no tribal witnesses present when it was signed. Despite the treaty provisions never being officially enforced, it has been used as a political tool against the Warm Springs government ever since its signing (McConell, 2006). People on the reservation continued to deal with boundary disputes, poor farming conditions, and the trauma of children being forcibly removed from their parents and sent to boarding schools for assimilation for many years (WSCAT, n.d.; Tananáwit, 2020). In 1934 Congress passed the Indian Reorganization Act to bolster tribal governments and make it possible for them to manage their own affairs, and made federal funding for tribes available (WSCAT, n.d.; CTWS, n.d.). The three tribes accepted the terms of the IRA and in 1937 they officially became the Confederated Tribes of the Warm Springs (C.T.W.S.) (WSCAT, n.d.; CTWS, n.d.).

But even after being removed from their homelands, The C.T.W.S. continued to face assaults on their cultural water resources which were a direct threat to their status as a recognized nation and legal rights-holders. In 1858, a tribal agent requested \$3,000 to buy land and build housing next to the river for tribal members to use while fishing at important sites, but the request was ignored. Eventually in 1917, Congress appropriated \$5,000 to buy tracts of land in these areas for fishing grounds for the C.T.W.S. However, in 1939 the Bonneville Dam was completed, which caused water levels to rise and inundate these important fishing sites (McConell, 2006). Later in 1957 the Dalles Dam was built, further disrupting fishing sites like Celilo Village, which was set

aside for the C.T.W.S. by the U.S. Government in 1929 (WSCAT, n.d.). The government purchased several in-liu sites, but these did not offer the same strong cultural ties as the lost sites (McConell, 2006). In March of 1999 an American Transport Truck carrying 10,300 gallons of gasoline lost control on Oregon State Route 26, causing most of the gasoline to be released into Beaver Butte Creek which runs within reservation boundaries (Pawlak, 2009). This killed thousands of juvenile Chinook salmon, steelhead and other fish within a four mile stretch below the spill, and killed many macroinvertebrates, indirectly reducing the creek's quality as rearing habitat (Pawlak, 2009).

In 2018, and again in 2019 the water delivery system on the reservation failed due to pressure brakes in multiple community water lines and broken water pumps (Kohn, 2023; Althouse, 2022). This comes after many years of under-investment in water infrastructure and the 40-year-old water system in Warm Springs (Cook, 2021; Land, 2022; AP Staff, 2022; Cook, 2020; Althouse, 2022). Many of the pipes were made from terracotta and were expected to fail many years ago. The 2019 failure left 3,800 residents without safe drinking water for months, as well as businesses, a health clinic and senior housing (Cook, 2020; Kohn, 2023). The EPA sent a violation notice to the tribe but finding permanent funding to fix the issue proved difficult (EPA, 2022; Cook, 2019).

In October of 2020, 60% of Warm Springs residents did not have regular and consistent access to clean water for residential use (Gorman, 2020). Since the initial infrastructure breakdown in 2019, the reservation has been dealing with regular boil water orders for any water used for drinking, making ice, washing dishes, brushing teeth and preparing food, that make access to safe water much more difficult (KTVZ, 2022; Cook, 2020; Kohn, 2023; Gorman, 2020). One boil notice in 2019 lasted 10 weeks, and another in mid 2020 lasted 7 weeks (Kohn, 2023). Some parts of the reservation were on boil notice for three months (Cook, 2020). Not all residents are able to shower, wash dishes, do laundry or provide water for livestock (Gorman, 2020). Residents must line up to get bottled water, use portable toilets, and shower, which had dangerous health implications during the height of the COVID-19 pandemic (Douglas, 2020; Cook, 2022; Flaccus et al., 2021; KTVZ, 2022; Cook, 2020; Kohn, 2023). After the initial line break, there have been additional infrastructure failures due to temporary repairs, and loss of water pressure (Cook, 2020).

In March of 2022, an underground fire at the water treatment plant completely shut down the plant yet again, causing approximately \$75,000 in damage (Land, 2022; AP Staff, 2022; Kohn, 2023; AP, 2022). An emergency water conservation notice was issued, and the plant was shut down for two weeks (AP Staff, 2022; Kohn, 2023; AP, 2022). After repairs were conducted, a precautionary boil notice was in place for another week (KTVZ, 2022). This happened right before a sacred feast celebrating first foods, 'root fest', was set to take place, which includes celebrations to give thanks for clean water (Cook, 2022).

Even when residents have access to water in their homes, the history of disruptions has made them distrust the water, leading some to continue using bottled water or water from natural sources. Residents report being surprised when they wake up and have running water in their house. They also report financial burdens from booking hotel rooms, buying water, eating out in restaurants and getting transportation to facilities to shower and do laundry when water access is disrupted (Flaccus et al., 2021; Cook, 2022).

The tribe has relied on donations from community members and partnerships with organizations like Friends of the Columbia River Gorge, Warm Springs Community Action Team, Don't Shoot Portland and MRG Foundation (Cook, 2022; Cook, 2020; Gorman, 2020; KTVZ, 2022; Douglas, 2020). As of January of this year, The Emergency Management Water Distribution Center in Warm Springs has distributed nearly 5 million gallons of donated water in the past two years (Kohn, 2023). For many months, the tribal council was trying to negotiate who was responsible for basic services and infrastructure on the reservation (Cook, 2020). There were discussions about charging residents for water to pay for infrastructure, but aside from many residents not having the money to pay, the idea was also deeply unpopular as it goes against their cultural beliefs, with one resident stating “How do you sell something you never owned? The Creator has given it to us” (Flaccus et al., 2021; Cook, 2019; Cook, 2022). Because the U.S. gained around 10 million acres for just \$200,000 in exchange for providing certain governmental services to the tribe, and the water treatment plant was built by the Bureau of Indian Affairs, many feel that it should be the federal government's responsibility to fix the problems with the water infrastructure (EPA, 2022; Cook, 2020). Some state funding and \$1 million in federal grants were made available, but they were unsure of where money for a permanent solution was going to come from, which was a significant barrier (Cook, 2019; Land, 2022).

After the Bipartisan Infrastructure Bill was passed, which includes \$11 billion for projects to serve tribal nations and \$3.5 billion for sanitation projects, the tribe secured \$23.8 million in funding for a new water treatment plant (EPA, 2022; Cook, 2021; Land, 2022; AP Staff, 2022; Flaccus et al., 2021; Cook, 2020; Kohn, 2023). \$13,601,000 comes from the Indian Health Service and \$10,262,000 comes from the EPA (EPA, 2022). The design process for the new facility is in progress, and officials are hoping to have a set of building plans and contracts by the end of 2023. Tribes are also seeking funding to keep the current plant in working order until the new one can be built, which could take 30-36 months or more (AP Staff, 2022; Kohn, 2023). While tribal members are hopeful for the new plant, they also are clear that this will not make up for decades of neglect from the US government (EPA, 2022; Flaccus et al., 2021).

Indigenous Water Justice Approach to Crisis in Warm Springs

From an Indigenous water justice lens, it is impossible to examine the current crisis in isolation from the history of the tribe. The water injustices faced by the Confederated Tribes of the Warm

Springs goes back to colonization, when the three tribes were forced to move from their traditional territories and water resources that were important for fulfilling basic, cultural and spiritual needs and move onto reservations and abide by strict property boundaries for the first time in history. Before colonization, if tribes were able to move around and reside by the rivers for a few months out of the year they could catch enough salmon to sustain them through the winter (McConnell, 2006). Disconnection from these water bodies at later attempts to revoke off-reservation rights, would lead to the need to change their diets, usually to foods high in sugar and fat, which led to an increase of disease on the reservation. Some scholars might also suggest that the geographic isolation of the reservation would contribute to later issues with water infrastructure and lack of political movement to address the issue.

The construction of dams and lack of regard for important fishing sites not only demonstrates the disrespect officials had for the Warm Springs people, but also how their priority water uses - leaving water instream to promote salmon runs - were unaccounted for or disregarded. Managers using an Indigenous water justice lens would have discussed these projects with Indigenous people, learned about their values, and then integrated the cost of losing salmon into the cost benefit analyses of these projects. Current infrastructure issues would be recognized as a fundamental breach of water justice's principle of equitable access to water regardless of ability to pay. They would also be linked to the history of colonization and forced relocation of the C.T.W.S.. Scholars would likely highlight the unique political standing of C.T.W.S. as a federally recognized tribe and point out the added layer of injustice of the U.S. government agreeing to provide adequate water resources to them and then not holding up that promise. While some scholars might applaud the fact that funding for a new plant has been attained under the Infrastructure Bill, others might argue that by funding the project without providing resources or a plan for how it will be maintained over the next forty years, history might repeat itself. They might also point out that the lack of a maintenance plan and funds, potentially resulting in a fee-based system later, highlights an oversight of a value of the tribe - not paying for resources that they don't view to be property. A water justice scholar might suggest regular meetings between tribal members and water managers to build trust and help managers understand the water issues and uses that are most important to the tribe. They would argue that for true justice to be achieved, tribal members would need to be responsible for decision making on the management and distribution of their water. A true Indigenous water justice solution in Warm Springs would be one crafted by its people and is not molded off a European standard that doesn't account for their worldview and water uses and priorities.