Chapter 1
The Hydrosocial Cycle

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The Month of Big Rains

May is the last month of the school year in Tucson, Arizona, USA. At Manzo Elementary School, students lead us on a tour of their school gardens.[1] Under the desert sun, shade from fruit trees and the cool touch of goldfish ponds offer respite in this arid city. We stop near a rain tank (Figure 1.1). Chickens peck at bugs and sip water collected from the roof. A desert tortoise peeks out from under an agave plant. At Manzo, students learn science in the garden classrooms. They also develop community-building skills of empathy, leadership, mental wellbeing, and the care work involved in cultivation (Lohr et al. 2022). Manzo students are architects of life, transforming rain into vegetables, flowers, fruit, and eggs. At their weekly market, they sell garden products, manage customers, plan budgets, fix systems, and feed their neighborhood (Figure 1.2).

[1] The Manzo project is part of the Community and School Gardens Project (CSGP), a joint effort between the University of Arizona and the local Tucson Unified School District in over 70 Tucson-area schools: https://schoolgardens.arizona.edu/

Water: A Critical Introduction, First Edition. Katie Meehan, Naho Mirumachi, Alex Loftus, and Majed Akhter.
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Figure 1.1 The school gardens at Manzo Elementary School in Tucson, Arizona. Source: Courtesy of Community and School Gardens Program.

Figure 1.2 The Manzo farmer's market. Here, student leaders explain how they grow vegetables with harvested rainwater and sell their products in a community market. Source: Katie Meehan (author).

Can a desert support life? Outsiders tend to assume that a desert is a wasteland – a site of scarcity, a harsh landscape devoid of water and therefore life.[2] But in the Sonoran Desert, the Manzo students show us how life is infused in every raindrop. Plant flowering coincides with the North American monsoon season of July through September. Thunderhead clouds build pressure and water droplets, then break in dramatic displays of thunder, lightning, and heavy evening rain. Water floods streets and arroyos – trapping cars and washing out paved roads – and recharges rivers and aquifers. Plants bloom, sprout, seed, and germinate in a few crucial weeks. Most of the crops at Manzo are rainfed. Water from the municipal piped network (brought hundreds of miles from the Colorado River) is a backup source.

Water at Manzo is an example of the **hydrosocial cycle**, the view of water as inseparable from society. A hydrosocial approach argues that water is fundamentally *relational* (Loftus 2007). Water is the product of social, spatial, and ecological relations – a point of view that positions us (people) as *internal* to the production of the thing we call "water." The hydrosocial cycle asks questions like: How is water produced? Where is it sourced from and to whom does it flow? What work does water do? And what conditions does a water cycle create?

The hydrosocial thesis comes into focus at the end of the Manzo school tour, as we pause at a colorful mural (Figure 1.3). Our student guides explain that the mural is the traditional Tohono O'odham calendar for weather, agriculture, and ecological knowledge. Experts in dryland agriculture, the Tohono O'odham are Indigenous people of the Sonoran Desert (including Tucson), residing primarily in what is present-day Arizona (USA) and Sonora (Mexico).

Each month marks a water-related event or task. In April, cacti and flora bloom in spectacular colors, following a season of slow winter rains. May is the ideal time to collect beans from mesquite trees, which are dried and ground into flour. In June, the saguaro cactus called *ha:san* in Tohono O'odham bears fruit called *baidaj* which ripens in scorching temperatures. June is also the Tohono O'odham new year, called *ha:san baidaj* (or *bak*) *masad* (NAAF 2021). This celebration connects Tohono O'odham lifeways or *himdag* to the harvest of sweet, fuchsia-colored *baidaj*. By July – the month of big rains – the North American monsoon cracks open, unleashing torrents of hard rain and thunderclaps across a thirsty desert landscape. At its heart, the O'odham calendar depicts a *situated* worldview of water and society – the opposite of what scholar Donna Haraway (1988) calls the "view from nowhere" that characterizes modern science. Tohono O'odham Nation citizen and agriculturalist Nacho Littleagle Flores (CSGP 2022) explains how the calendar sustains O'odham culture, identity, and language, and incorporates biogeography, seasonal weather, human labor, and the intimate relations of water.

[2]Like any landscape, deserts are not innocent. As geographer Natalie Koch (2021, p. 87) argues, "[E]nvironmental imaginaries about deserts are geopolitics imaginaries, actively constituting and constituted by relationalities, identities, and potentialities across time and space."

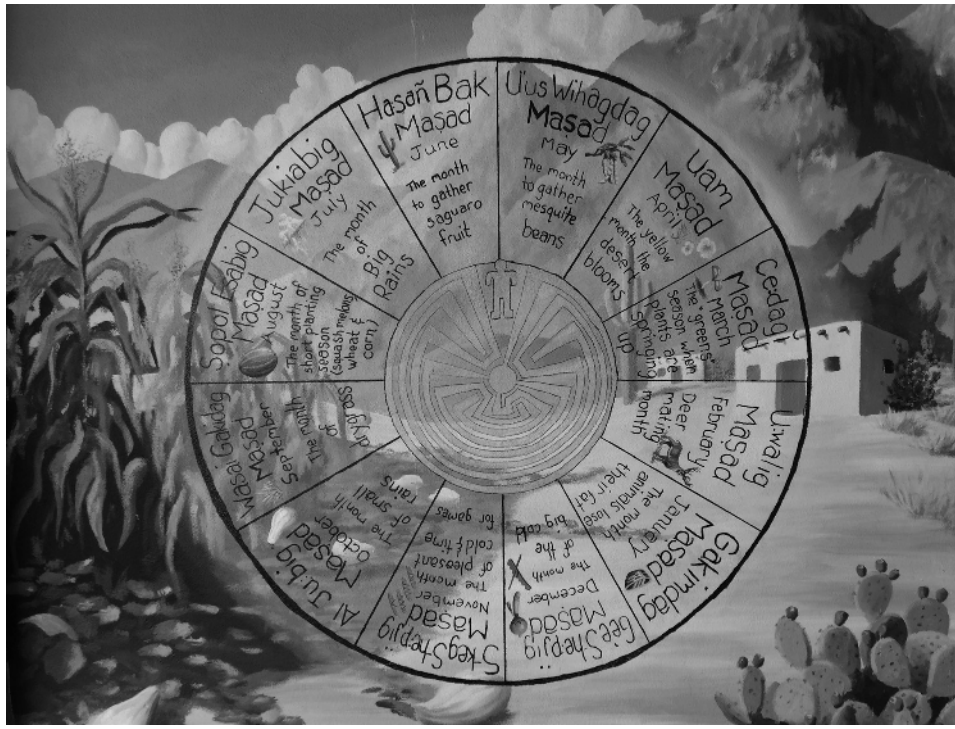

Figure 1.3 The O'odham calendar at Manzo Elementary School. Source: Katie Meehan (author).

A hydrosocial approach opens the sluice to a whole array of radical possibilities. In contrast to the hydrologic cycle, which "naturalizes" the nature and behavior of H_2O, the hydrosocial cycle challenges us to ask how "nature" – like a flooded field, a broken dike, a submerged city, a parched town, a thirsty household – comes to be. Why is Jakarta sinking? Why did New Orleans flood when Hurricane Katrina struck the US Gulf Coast in 2005? Why is the Middle East touted as the hot spot for water scarcity? What made "Day Zero" in South Africa such a terrible crisis? What explains the global rise in large dams? Who benefits from clean, safe piped water – and who does not? *Why?* Why is our world this way? And what can we do about it?

The Hydrosocial Cycle

Imagine water in action. What do you see? Nearly every science textbook and school lesson begin with the classic image of the hydrologic cycle: a sweeping visual trace of water's planetary travels through clouds, oceans, lakes, rivers, aquifers, trees, and occasionally a crop field or town. The hydrologic cycle is a cornerstone of water science and expert knowledge. In most textbook versions, water moves seamlessly

against a temperate backdrop – a hint of its Northern origins (Linton 2008) – and flows without friction through different sites and states of being.

Water in the hydrologic cycle obeys a supposed "natural" rhythm and logic, neatly illustrated by arrows, names, and occasionally numbers. This water spends a long time underground, and comparatively, just seconds in the upper reaches of the atmosphere. Fueled by energy from the sun, water in the hydrologic cycle flows like a machine: a predictable substance that quietly follows the laws of physics and nature. Precipitation, infiltration, evaporation – these states of water are "scientific" and devoid of human influence or touch. Our task, as students and viewers, is to take notes. And then take a test.

Of course, water does obey rules. Rain falls, according to gravity and physics, even in the Arizona desert. But as the Manzo students remind us, water is more than a simplified scientific representation – which, even on its best days, captures knowledge about water that is important but partial, contingent, and produced (Haraway 1988). Critical scholars have shown us how the very categories of "nature," "technology," "wilderness," and "culture" are not stable and pre-given, but contingent products of human minds, social conventions, colonial histories, state institutions, and positions of privilege (Cronon 1996; Jasanoff 2004; Latour 1993; Ottinger et al. 2016). This critique is true of water. "Our starting point is that the hydrologic cycle is not merely a neutral scientific concept," argue Jamie Linton and Jessica Budds (2014, p. 171), "but can be regarded as a social construct with political consequences." This idea – that knowledge is produced, and no environment is apolitical (Robbins 2019) – anchors the journeys we take in this book.

In the mid-nineteenth century, for example, the US West and British Punjab regions were punctuated by large dams and massive irrigation projects of "desert reclamation" – a topic we explore in more depth in Chapters 2 and 6. These infrastructures were made possible by hydrologic studies and "truths" established by western science. This intellectual position was backed by the foreign capital and development muscle of American and British colonial rule – a confluence of science, capital, and power called the **technozone** (Akhter and Ormerod 2015). Experts deemed arid environments as "deficient" landscapes in need of development intervention to maximize their full potential as productive landscapes (Koch 2021). Drylands, the message went, must be tamed, properly managed by experts, and "scarce water" should not be wasted. In short, technozone thinking produced a scientific idea of water in desert regions that went hand in glove with large-scale infrastructure and development interventions. As we will analyze, this is not "neutral" knowledge but a political worldview.

The hydrologic cycle is a relatively recent invention. Jamie Linton (2010) explains how the hydrologic cycle emerged during an early twentieth-century struggle among scientists to define hydrology as a "pure natural science" and legitimate discipline, backed by quantitative force. In 1931, Robert E. Horton created the first scientific depiction of the hydrologic cycle, published in his landmark article and announced in

a public address, launching the field of hydrology.[3] "Hydrology is described as having origins in ancient philosophy" – a narrative promoted by Horton that supports the modernist idea that the water cycle was "just sitting there" awaiting discovery and simply needed a new discipline to illuminate it (Linton 2010). Taking a critical approach to history, Linton (2010, p. 109) excavates hydrology's origins "with the quantitative, basin-scale studies of French and English proto-hydrologists in the seventeenth century." Through this "new" scientific representation of water, Linton argues (2010, p. 105), the hydrologic cycle was "an intellectual move that allows us to quantify water and abstract it from cultural contexts that otherwise define its social nature(s)."

Horton was no stranger to these ambitions. In his hand-drawn version of the hydrologic cycle, water follows a precise order and quantitative logic. Any relations are severed: humans reside somewhere "external" or outside of water. Indeed, Horton's water cycle does not feature people at all! The effect of this representation was to "naturalize" water's circulation – as timeless, placeless, and devoid of human influence (Linton and Budds 2014; Schmidt 2014; Swyngedouw 2004). A seemingly innocent diagram, the hydrologic cycle has had major implications for how we understand people and nature:

> Because it is understood as the natural circulation of water on earth, the only possible way that people can involve themselves in the hydrologic cycle is to *alter* it, thus inevitably producing an antagonistic kind of relationship. Instead of allowing for the increasingly hybrid (socio-hydrological) nature of the circulation of water, the hydrologic cycle conditions an understanding that keeps water and people in separate, externally related spheres. (Linton 2010, p. 106)

A scientific field was born. Water, Horton argued, deserves a separate field of inquiry called hydrology, constituted by a certified body of experts (known as "hydrologists") who specialize in the "science of water" and bring technical knowledge and authority over its dynamics (Linton 2010, p. 171). This new framing of water dovetailed with national development agendas – think of the US West and British Punjab examples – and the restless movements of global capital, looking to invest in new infrastructure projects. By the mid-twentieth century, Linton (2010, p. 106) describes, "[T]he hydrologic cycle was quickly taken up by planning agencies of the US federal government as a means of envisioning the nation's water resources and rendering them to a 'calculable coherence' to use Heidegger's term." From Mexico to Pakistan, the science of hydrology supported national development agendas – cue the big dams (Chapter 6).

The hydrologic cycle is undoubtedly a major achievement. But this book is guided by a different notion: the hydrosocial cycle, the idea that water is inseparable from society and shapes – and is shaped by – our lives, places, practices, and geometries of

[3] Appropriately, the article was called "The Field, Scope, and Status of the Science of Hydrology" and was published in the flagship journal of the American Geophysical Union (Linton 2008, 2010).

power (Linton and Budds 2014). The hydrosocial cycle is a **heuristic**, a tool for thinking about relations that might otherwise remain hidden in mainstream accounts of water. As a tool, the hydrosocial cycle directs our inquiry into the very production of water flows, facts, narratives, and ideals. The hydrosocial cycle queries assumptions, challenges mythologies, and questions authority, even as it traces the material flows of water. We can ask important questions about the state of the world:

- What is water? How do social groups differentially construct water? How does water's **materiality** – its material properties – shape the ways people know and manage water?
- Where is water? Who experiences its scarcity or (over)abundance? Why? What does the spatiality of water reveal about its social and ecological relations?
- Whose knowledge about water counts? Under what circumstances? How do these knowledges articulate or refract vested interests or structures of power?
- How is water produced? What conditions make water "scarce" or "plentiful"? Who (or what) makes these conditions? What does water reveal about broader trends, politics, or power? Why is a drought (or a flood) never just a drought (or flood)?
- What causes water injustices? Why do they still occur, despite major advances in technology and management?
- What is the future of water? How can we manage water for more just and sustainable futures?

Several key elements of hydrosocial thinking bracket this book. First, the hydrosocial cycle forces us into a **relational** state of mind. Why is this important? Water is fundamentally relational, the product of social, spatial, and ecological relations – a point of view that positions us (people) as fundamental to the production of water (Loftus 2007). For example, a relational view asks how the lack of universal piped water provision in Durban, South Africa, and San Francisco, California, are *manufactured* crises generated by social institutions, ideologies, and power relations (Deitz and Meehan 2019; Loftus 2007, 2009; Meehan et al. 2021). A relational point of view focuses our analysis on the *conditions* of water and its production – and how we, as people, are part of that production.

Second, while the relational aspects of water transcend space and time, an understanding of the hydrosocial cycle is necessarily attuned to **place**. A place-based perspective provides a sharper view into power and the production of spatial and social difference (Massey 2005), including racial, ethnic, classed, caste, and gender-based lines of difference and intersection. Consider the hydrosocial cycle of Tijuana, Mexico, a vibrant coastal desert city on the Mexico–United States border (Figure 1.4). Often stereotyped by images of narco-violence, NAFTA, and Nortec music, on closer look, Tijuana is a city rooted in struggles over water (Meehan 2014).

Water moves unevenly through Tijuana, shaped as much by infrastructure, power, and money as by the energy from the sun. Figure 1.4 depicts the hydrologic and political production of water in Tijuana (Meehan 2010). At the city's edge, reservoirs store

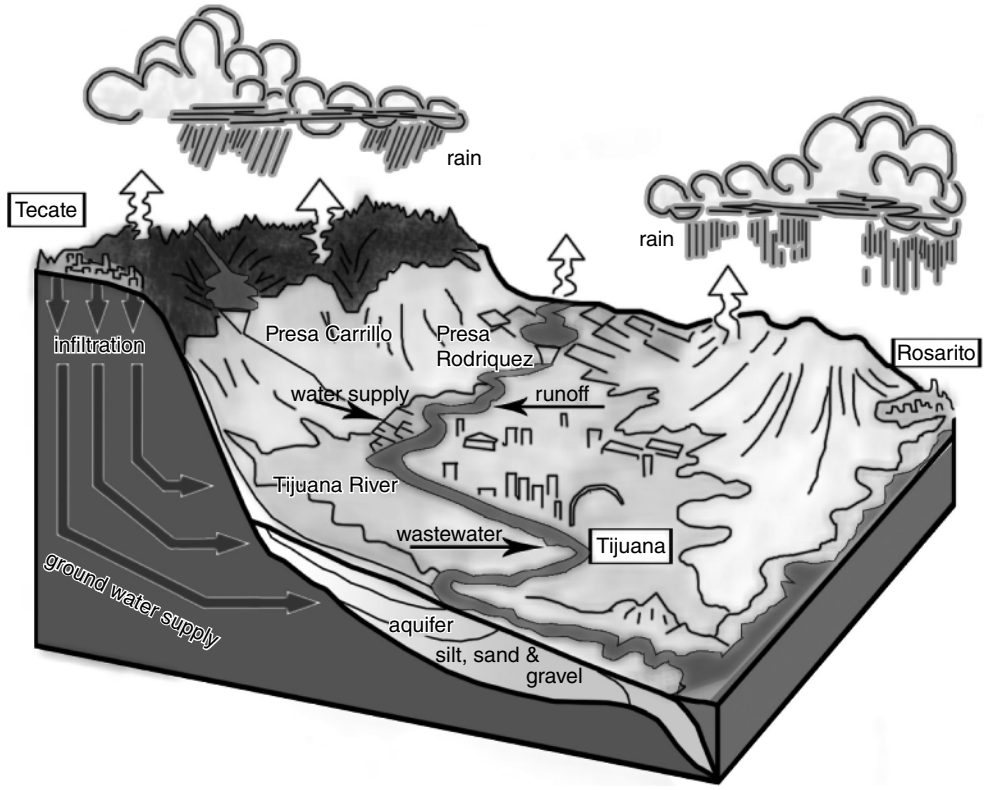

Figure 1.4 The Tijuana hydrosocial cycle. Water moves unevenly through the Tijuana urban region, fueled as much by "natural" forces (gravity, energy from the sun, ecological functions) as by "social" dynamics and institutions (law, science, urban planning). A hydrosocial perspective invites us to ask: what makes these conditions? Source: Katie Meehan, with help from Josh Gobel.

a precious water supply imported at great distances from the transboundary Colorado River. The reservoir supply is governed by a century-old international treaty and legal regimes that favor "beneficial use" for elite parties over long-term sustainability (Chapter 3). Tijuana has other vital inputs and outputs of water. Groundwater is a secondary source for Tijuana's industry and regional agriculture. The winter rains from the Pacific Ocean are a complicated water source. Big storms trigger street flooding and sewer overflows, causing problems for residents – especially those living in shacks in Tijuana's denuded canyons – and life in the Tijuana River estuary, a complex and beautiful ecosystem at the heart of the San Diego–Tijuana region. Rather than assume a "universal" movement of water through space, the Tijuana water cycle reflects the intersecting global and local dynamics of water in place.

Third, hydrosocial thinking attunes us to a critical and generative reading of the *politics* of water, by focusing on its **production**. "While the hydrologic cycle has the effect of separating water from its social context," argue Linton and Budds (2014,

p. 170), "the hydrosocial cycle deliberately attends to water's social and political nature." What does it mean to say that water is "produced"? A hydrosocial perspective does not dispute the existence of nature, reality, or established facts – boring! And by "critical" we do not imply "nihilistic" or "unproductive" or "critical for critique's sake" – doubly boring! Rather, a critical approach to water moves us past a reading of "external" human influence on the environment – because water is already relational, and therefore always political – and unlocks an urgent set of questions: how and why a waterscape is produced, and with what implications, where, and for whom?

In the following pages, we put our heuristic – the hydrosocial cycle – to work. Just like the original hydrologic cycle illustrations of gorgeous swirling vapors and globe-trotting reach, this book will follow water through different biomes, sites, controversies, and dimensions. We will discuss toilets, treaties, food crops, market logics, big dams, Pinochet, Pakistan, and sex. To build our approach, the remainder of this chapter presents four core arguments to structure this text. Think of them as the four joists that underpin the foundation of this book. They are:

1. Knowledge is power.
2. Scarcity is made.
3. Water is life.
4. Camp is everywhere.

Box 1.1 Make Your Own Hydrosocial Cycle

How does water flow in your neighborhood or region? Representations are a form of **visual discourse**: a system of order and power that uses imagery (not just words) to express a worldview. As observers and participants in the world, we – the authors of this book, and you, the reader – also produce discourse.

In a class assignment, students at the University of Oregon first listened to a news podcast story ("Valley of Contrasts" by journalist Antonia Cereijido) about water in Coachella Valley, California, the site of a retirement community and famous music festival. "Coachella is divided into two parts: the west side and the east side," Cereijido (2017) explains. "While the westsiders have pools, golf courses, and sprawling lawns – all which require a lot of water – there are parts of the east (such as mobile home parks) with up to ten times the safe level of arsenic in their water." Working in small groups, Oregon students listened to the podcast and teamed up to illustrate their version of how water flows through the valley (Figure 1.5). Just like the Horton water cycle, their illustrations are not "neutral" depictions, but a visual analysis and argument.

We invite you to put down this book and pick up a pen or pencil. Find a flip-chart, a notebook, a whiteboard, a tablet, or even a sidewalk. Think of a place

Figure 1.5 Hydrosocial flows in the Coachella Valley. Illustration by students (Fiona De Los Ríos and Holly Moulton) at the University of Oregon. After listening to the "Valley of Contrasts" podcast, students discussed the story in class and created their own interpretation of the Coachella hydrosocial cycle. Source: Katie Meehan (author).

like your hometown, or perhaps, a place cited in current events or a lecture. How does water flow in this place? Who and what are its sources and destinations? What shapes these physical and material circulations? What landscape features are critical or important? What impedes, diverts, or transforms water's flow? With what effects or results? Does water obey the rules of physics – like the alchemy of rainfall, the mechanics of evaporation – or are there other, perhaps more social elements and forces at work? Draw and discuss your findings. Every image will be unique, because (i) water has certain universal properties but its flow is dependent on places, which are unique; and (ii) drawings will depend on you – the artist and analyst. Ask yourself: What does a hydrosocial cycle allow us to "see" about water and society?

Knowledge is Power

A key tenet of the hydrosocial cycle is that knowledge is power. In other words, scientific knowledge, expertise, and authority shape how water is understood, managed, and legitimized. In La Ligua basin in Chile, Jessica Budds (2009a) explores how routine groundwater assessments by hydrologists became fraught politicized tools

used by the water authority, the National Water Directorate (DGA). These assessments shape water rights and access for farmers in uneven ways. Far from science playing a neutral role in water management, the story of La Ligua reveals how social power saturates the nexus of science and decision-making, influencing which (and whose) ideas are adopted into practice.

Knowledge is not innocent or neutral but is a human construction that shapes (and is shaped by) the world. Drawing on the field of science and technology studies, Sheila Jasanoff (2004) argues that scientific knowledge is **coproduced** by social practice and spatial orders. In short, science and politics are a two-way street, as the world seeps into science from the outset of knowledge creation.

François Molle (2008) expands on this approach to explain why certain flagship ideas manifest as practice in international water policy. Molle examines the emergence of Integrated Water Resource Management (best known by its acronym, **IWRM**), a prominent concept that promotes a coordinated and cross-sectoral approach to managing water. While IWRM was welcomed as an antidote to the perceived "chaos" of uncoordinated water management, Molle argues that IWRM, like any hegemonic concept, tends to obscure the political nature of natural resource management. "Ideas are never neutral and reflect the particular societal settings in which they emerge, the world views and interests of those who have the power to set the terms of the debate, to legitimate particular options and discard others, and to include or exclude particular social groups" (Molle 2008, p. 131). For Molle, the global IWRM bandwagon operates not due to "genius" insight but because of the social conditions which brought IWRM into existence in the first place. For us, a critical focus sparks even more questions: Whose water knowledge counts? Why? To what effect or end?

A productive way forward is to consider how expert or scientific **discourse** about water is more than a set of constructed facts or words. Scientific discourse reflects a categorization and system of power. Social power shapes our realities, knowledge, and claims about water – it even produces the ways in which truth is *made true*, what philosopher Michel Foucault (2020 [1975]) calls "regimes of truth." Rutgerd Boelens draws on this theory to explore the rationalities in different kinds of Andean water knowledge, including "scientific" knowledge and other knowledge systems categorized as "local" or less salubrious to water management. From the vantage point of Western science, the pecking order of knowledge sits in a hierarchy:

> Rules, rights, and duties attached to water flows and hydraulic infrastructure are closely linked to systems of meanings, symbols, and values, involving institutions and networks of human, non-human, and supernatural actors and power that influence water control. This domain – often erroneously associated with only "social" and not with, for example, technology – is essentialized in romantic representations and contested or ignored in natural sciences. (Boelens 2014, p. 240)

Discourses have the effect of designating "legitimate" knowledge, truths, and frames of reference (Boelens 2014, p. 235) at the expense of creating (subordinate) categories

of "local" (or vernacular) knowledge (Klenk et al. 2017). In this way, the hydrologic cycle works to (i) separate "legitimate" forms of water knowledge, rights, and access from "illegitimate" forms; (ii) naturalize policy models as scientific and reinforce elite and state control over water resources (Boelens and Vos 2012). Struggles over water are not limited to physical allocation, they include struggling over truth regimes and defining the very order of things (Boelens 2014, p. 235).

How do ideas about water (and people) travel? Who comes up with influential policy principles and what makes them stick? Why are some policy models so seductive, pervasive, and powerful? Our knowledge about water is profoundly shaped by **expert networks** and hegemonic policy narratives (Conca 2005). A good idea is not enough, argues Ken Conca (2005), an idea needs a networked cadre of elites, organizations, and institutional structures that grease the tracks for policy ideas to circulate globally, gain authority, and reproduce in settings beyond their origins. Michael Goldman (2007) illustrates this argument with his account of how the World Bank seized the "pro-poor" narrative of "water for all" and mobilized it into a policy prescription for water privatization. Goldman (2007, p. 788) shows how this policy idea stretched beyond the Bank, as it "requires active participation and contributions from actors in corporations, NGOs, think tanks, state agencies, and the media, across the global North and South." In this case, the expert networks converged to create a "global consensus" on reforming water "for all," with privatization as its answer.

Mary Galvin (2015) offers an equally compelling analysis of community-led total sanitation (CLTS) – a prominent technique in the water, sanitation, and hygiene (**WaSH**) sector, implemented in over 56 countries. In the appropriately titled article "Talking Shit," Galvin investigates the ideology that underpins CLTS and chronicles the expert networks that enabled its "thrilling success" in the WaSH sector.

> What is particularly distinctive about CLTS is that it forces participants to confront their "shit" by using this word, visiting places where people openly defecate and tracing the fecal to oral transmission route to the glass of water on the table. (Galvin 2015, p. 10)

We discuss further how disgust and shame-based methods create social damage in Chapter 8 (see also Brewis et al. 2019a). Galvin, meanwhile, dissects organizational pathways taken by UNICEF, WaterAid, and the UN Special Rapporteur on the Right to Water and Sanitation that have put CLTS in motion. "Communities may be driving," argues Galvin (2015, p. 17), "but the roads have been built by these organizations."

Of course, in our uneven world, not all knowledge gets to *be* mobile or count equally. As Diné geographer Andrew Curley (2019a, 2021b) argues, quantification is central to the logic and mechanics of water law in the US West – a logic informed by

the hydrologic sciences. In the Colorado River basin, US water law literally "divides up the river" into segmented, quantified units – divorced from their context and place, stripped of time and kin (human and non-human), and pegged to settler-defined geographical units. This logic stands in contrast to the worldview of water held by many Indigenous communities (see Further Reading section). Curley (2021b, p. 21) argues that Indian water settlements, a type of legal agreement between Native Nations and the US federal government, are forms of colonial enclosure, "built on a lineage of law that replaces and perpetuates settler-colonial dispossession." In reproducing law, we reproduce these hegemonic systems of knowledge.

In sum, a critical approach to water does not take knowledge at face value, but asks: How is knowledge about water produced? By whom? What kinds of knowledge are designated as "legitimate" or gain authority – and which do not? Why? What work does knowledge do?

Scarcity is Made

For desert cities, like Tucson and Tijuana, the notion that water is a "scarce" resource is a common refrain in many influential documents, textbooks, and policy principles. But what if, following Erik Swyngedouw (2004, 2009), we started with the idea that scarcity is relational and constructed? That a lack of available water – or clean, accessible, secure, safe water – is not an inherent feature or pregiven reality, but the *outcome* of uneven conditions, logics, and practices? How do we account for the fact that water – the molecule H_2O – is one of the most abundant elements on planet Earth and yet out of reach for so many? What explains resource scarcity?

The narratives of many "scarcity" debates can be traced to Thomas Malthus, an English economist and demographer in the late eighteenth century, whose ideas influenced generations of key thinkers, including Charles Darwin. In his book *An Essay on the Principle of Population*, first published in 1798, Malthus (1992) introduced the concept of population growth causing environmental degradation. Malthus predicted that the human population would outgrow the available food (and water) supply, using the artfully simple logic – he called it "logical empiricism": that (i) people reproduce geometrically (exponentially) and yet, (ii) food supply reproduces in an arithmetic (linear) progression. Too many people, not enough food.

Malthus didn't stop there. Indeed, he argued the human population will expand to the limits of subsistence and only through techniques of "vice" (including war and violence), "misery" (including famine, illness, and drought), and "moral restraint" (i.e. abstinence and Protestant morality) could the world check excessive population growth and avoid environmental destruction. Welfare or charity

(embodied by the Poor Laws) was a useless exercise, creating more "dependency" by subjects on the state. Malthus's own words offer a window into his worldviews on race, gender, and class:[4]

> The Poor Laws of England tend to depress the general condition of the poor . . . they may be said, therefore, to create the poor which they maintain. (p. 100)
>
> It can scarcely be doubted that, in modern Europe, a much larger proportion of women pass a considerable part of their lives in the exercise of virtue than in past times and among uncivilized nations. (pp. 43–44)
>
> In some of the southern countries where every impulse may be almost immediately indulged, the passion sinks into mere animal desire, is soon weakened and extinguished by excess. (p. 212)

With the winds of privilege at his back, Malthus's ideas about people and the environment spread like wildfire. His ideas are found, for example, in popular World Bank claims that the "world is running out of freshwater." They lurk in "population bomb" arguments and other accounts that smack of environmental determinism (see Robbins 2019 for explanation and critique).

What does this "scarcity" argument overlook or leave out? Let's go back to Tijuana. Water in Tijuana can easily be labeled as "scarce" – but this claim requires surgical attention and critical analysis. Tijuana is a desert city, but the provision of water to homes and businesses is mediated by infrastructure, social institutions, law and legal status, and money. For example, *maquiladoras* (export-oriented manufacturing plants) are thirsty customers that never run out of municipal water; yet informal housing settlements (*colonias*) are routinely denied piped water service and sewerage based on their tenure status, and unhoused (homeless) people are reliant on precarious or polluted water sources (Meehan 2013).

For the beneficiaries of Colorado River water, including Tijuana, scarcity is felt unevenly (see Figure 6.3 in Chapter 6 for the map). In Southern California, the Imperial Valley is one of the system's major recipients; the valley gobbles the bulk of regional water allocation rights to grow sod for lawns, parks, and sports fields. The service districts of Los Angeles and San Diego are also well watered. Tijuana, as a major metropolitan area and economic engine, sucks up the bulk of Mexico's allocated Colorado River water through a complex pipeline system that flows west over the Sierra Madres mountains and delivers water to its reservoirs, after which it is unevenly distributed to city residents. Some users can afford to pump groundwater, at a considerable cost. South of the international border, in the Colorado River Delta region of Mexico, small-scale and subsistence farmers eked out an agricultural livelihood on the escaped flows from irrigation system leaks (at least, before the Imperial Valley engineers sealed the leaks). In parts of the Delta, Indigenous users have been marginalized in terms of water access and rights allocation (Muehlmann 2013). Now, the mighty

[4] For a brilliant and blistering critique of Malthusian thinking, see Harvey (1974). For key updates, see Robbins (2019) and Robbins and Smith (2017).

flows of the Colorado River often never make it to the sea, ending in a sad trickle in a desiccated wetland.

This story asks a deeper question: What produces water scarcity? Our example does not deny the reality of aridity, or the fact that deserts receive less rain than their temperate counterparts, or the fact that the Tijuana metro region is urbanizing rapidly and placing new pressures on the existing water supply.

A critical approach invites us to ask important questions about conditions. Scarcity is *produced*, not ready-made. As Tijuana illustrates, what is "scarce" – and to whom, where, and why, across the Colorado basin – is an outcome of relations. And so, we invite you to put Malthusian thinking in the dustbin. In its place, we invite you to think with the people of Standing Rock, who offer a far more interesting and critical thesis (the third plank of this book): water is life.

Water is Life

Early in 2016, the people of the Standing Rock Sioux Tribe mobilized to prevent a crude oil pipeline called "The Black Snake" from crossing their unceded lands and threatening the Missouri River, a major water source along the tribe's eastern boundary, located in the Upper Midwest region of the United States (Figure 1.6). The Black Snake is the Dakota Access Pipeline (DAPL), a US$3.8 billion, 1 172-mile underground pipeline that runs 570 000 barrels of oil every day across four US states, two major rivers, and over two hundred creeks and streams.

Early on, Indigenous youth organized camps and led protests, galvanized by calls to "ReZpect Our Water" and defend Indigenous sovereignty (Curley 2019a). By late September, more than three hundred Native Nations and allies joined the movement, creating a #NoDAPL movement and planting their flags in solidarity at Oceti Sakowin Camp, the largest of several protest camps (Figure 1.7). *Oceti sakowin* is translated as the seven council fires of the Lakota, Dakota, and Nakota Nations, known by some as the Great Sioux Nation. Not only the name of the largest camp, *oceti sakowin* is also the unity of the *oyate* or people of this geography.[5] The Standing Rock Sioux were no strangers to their roles as Water Protectors. "#NoDAPL [w]as not a departure from so much as it was a continuation – a movement within a larger movement, but also a movement within a moment – of long traditions of Indigenous resistance deeply grounded in place and history" (Estes and Dhillon 2019). At its peak, the #NoDAPL struggles included thousands of Water Protectors, galvanized by the phrase *mni wiconi* or "water is life."

The physical geography of the DAPL is massive. Operative since July 2014, it carries light sweet crude oil from six sites in the Bakken and Three Forks oil-producing regions of North Dakota, through South Dakota and Iowa, to a terminal in southern

[5] The name of the camp, Oceti Sakowin, shows the power of bringing Lakota people together, including Standing Rock but also people of Pine Ridge and Rosebud, who share the worldview of *mni wiconi*.

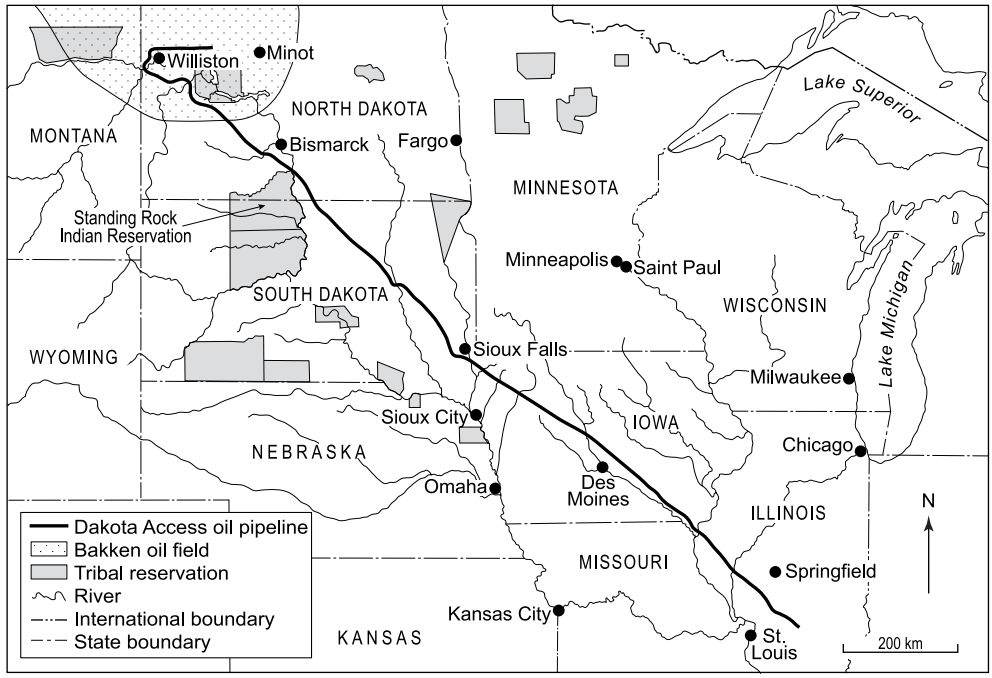

Figure 1.6 The Black Snake. This map illustrates the geography of the Dakota Access Pipeline as it routes oil across the Standing Rock Sioux Reservation, traditional Oceti Sakowin Lands, and the northern Great Plains to a distribution center in Illinois, near the Mississippi River. Source: The Authors, cartography by Philip Stickler.

Figure 1.7 The Oceti Sakowin Camp at Standing Rock. Source: Courtesy of Teresa Montoya.

Illinois, where it links to refineries in the Midwest and Gulf Coast (Mazer et al. 2019, p. 356). The Bakken and Three Forks production areas are part of a deposit that runs all the way north into Montana and the Canadian provinces of Saskatchewan and Manitoba. DAPL fuels a carbon-dependent empire, transnational in finance and commodity flows (Mazer et al. 2019). A rupture of "sweet crude" jeopardizes the drinking water of millions of people and other-than-humans who depend on clean rivers and aquifers for life.

The history of the Black Snake rests on shady grounds. The DAPL violates the Fort Laramie Treaties of 1851 and 1868 (Mazer et al. 2019), treaties made between Lakota, Dakota, Nakota, Arapaho, Crow, and other Native Nations and the US federal government. In neither of these agreements with the US federal government did the Oceti Sakowin cede the land in question surrounding the DAPL route. Since this time, in its rush to seize resources and secure access to land, the United States has repeatedly violated the terms of the Fort Laramie Treaties, including the occupation of sovereign lands, which currently represent a fraction of what is stipulated in the treaty (Mazer et al. 2019, p. 358). Along with #NoDAPL protests, the Standing Rock Sioux Tribe sued the US Army Corps of Engineers, the federal water agency that had approved key permits and authorized DAPL construction.

What does it mean to say that **water is life**? At its core, the concept reflects a relational worldview of water, land, and society – the heart of hydrosocial thinking. In the compilation *Standing with Standing Rock: Voices from the #NoDAPL Movement*, Nick Estes and Jaskiran Dhillon (2019, pp. 2–3) expand on this worldview:

> [W]ater, in general, is not a thing that is quantifiable according to possessive logics. *Mni Sose* is a relative: the *Mni Oyate*, the Water Nation. She is alive. Nothing owns her. Thus, the popular Lakotayapi assertion "*Mni Wiconi*": water is life or, more accurately, water is alive. You do not sell your relative, Water Protectors vow. To be a good relative mandates protecting *Mni Oyate* from the DAPL's inevitable contamination. This is the practice of *Wotakuye* (kinship), a recognition of the place-based, decolonial practice of being in relation to the land and water.

You do not sell your relatives. Relational thinking, in this case, demands a different set of logics, analytics, and practices than a settler colonial mindset. "Land is much more than a site for cultural and spiritual practice, it is also space for social reproduction," explains Andrew Curley (2019a, p. 164), "Without land, life is not possible." Water, too, is part of **social reproduction**: the material social practices, infrastructures, and ecologies that make life possible – for work, play, and freedom. In this way, water is part of the "messy, fleshy" materiality to sustain life, within and beyond the planetary order of **capitalism** (Katz 2001). The notion that "water is life" advances this critique of hegemonic planetary order one step further. Elders from the Yukon First Nations, for example, argue that "Water is a living entity, with the 'person-life' quality of agency referred to as 'spirit'" (Wilson and Inkster 2018, p. 524). "From this perspective water not only enables human life by meeting physical needs, but water *is* life or alive."

In Western understandings – such as Horton's hydrologic cycle – water is often described as a resource, a thing to be abstracted, measured, quantified, valued in commensurable terms, and put to "beneficial" use by law. Rivers running to the sea untapped are considered "wasted" in California water law, for example (Cantor 2017). For some Indigenous communities, such hegemonic thinking runs counter to their fundamental **ontology** of water, as Anishinaabe scholar Deborah McGregor (2014, p. 496) explains:

> Water, in the dominant Western Euro-Canadian context, is conceptualized as a resource, a commodity to be bought and sold. Federal and provincial governments therefore make decisions about water based on a worldview, philosophy and set of values which stands in direct contrast to the views of First Nations people.

Ontology is a word to describe what the world *is* (and how we see it), which is linked to how we *know* the world (**epistemology**). Ontology is collective, not singular. Ontologies are collective systems of identification and classification that serve as models of relationality, points of reference for contrasting worldviews, and wellsprings of identity and knowledge about the world. Put simply, ontology describes what a thing – like water – is and how, why, and where it fits in the order of the universe.

To say that water is life, then, implies an ontology of water that relates internally to society. "Water is life" implies a politics of kinship and respect, and water is "part of extended networks of kinship or kin relations" (Wilson and Inkster 2018, p. 525). An example from a Tlingit salmon ceremony puts these relations into practice. "By returning the fish bones to the water, a salmon ceremony is an act of respect for fish and water," explain Nicole Wilson and Jodi Inkster (2018, p. 525). "Reciprocity is therefore about engaging with water according to protocols to ensure mutual survival. In other words, if you take care of the water, it will take care of you."

> In other words, for Indigenous peoples' water (and land) are understood not simply as a physical asset, but as a way of knowing (epistemology) and being (ontology) embedded in a universe of relations between human and non-human beings that can guide forms of governance and resistance. Through this lens, respect for water can be understood as a politics of kinship that is inextricably linked to Indigenous understandings of water and water governance. (Wilson and Inkster 2018, p. 527)

Conflicts between different regimes of water governance inform **ontological politics**: the friction and lived implications of different worldviews. In the Canadian North, settler ontologies and forms of governance permeate every element of water management, from the co-management boards (shaped by land claims) to the baseline declaration that "water belongs to the Government" in the Yukon Waters Act (Wilson and Inkster 2018). To be clear, the stakes of ontological politics involve erasure and violence. "Although both colonialism and settler colonialism are based on domination

by an external power, only settler colonialism seeks to replace Indigenous peoples with a settler society," explain Wilson and Inskter (2018). Settler colonialism is fundamentally about access to territory, in this case, land *and* water. And "invasion" in the context of settler colonialism "is a structure not an event" and therefore never ends (Wolfe 2006).

What lessons can we learn from Standing Rock and other sites of struggle? First, the ontological politics of water is not mere wordplay. Water protectors at Standing Rock endured police attack dogs, pepper spray, concussion grenades, and high-frequency noise devices. Police used high-pressure water cannons on protestors in freezing winter weather. By October of 2016, there had been over 140 arrests. For Estes and Dhillon, state violence against Water Protectors reveals high stakes at play. "Water Protectors became criminal precisely because they were generating and upholding a different kind of law contrary to settler law (one that places relations with nonhumans, the land, and water equal to, or sometimes surpassing, human-made laws), while also reminding the United States of its own obligations to uphold its own treaties – its original agreements – with the Oceti Sakowin" (Estes and Dhillon 2019, p. 2).

Second, Standing Rock shows us a critical praxis of water is alive and resurgent. Far beyond the prairies, the message "Water is Life" rippled across the globe. "No one could have predicted the movement would spread like wildfire across Turtle Island and the world, moving millions to rise up, speak out, and take action," observe Estes and Dhillon (2019, p. 1). "Few could have imagined it would happen in their lifetimes, except for, perhaps, the visionaries themselves who kept the dream alive; and yet it happened, in the isolated, rural geography of dirt roads, farmlands, and the lush shorelines of the *Mni Sose*, the Missouri River." Water protection is bound up with questions of sovereignty, territory, and justice. Whose (and what) future gets to count? For Estes and Dhillon, "The good people of the earth have always been the vanguards of history and radical social change. Such was the case at Standing Rock: everyday people taking control of their lives" (2019, p. 4).

Finally, Standing Rock signals a different kind of **futurity** in the making (Curley and Smith 2022; Daigle 2018). *Mni Wiconi* "simultaneously speaks to the past, present, and future – catapulting us into a moment of critical, radical reflection about the colonial wounds and wounding in the spaces between calls to save planet Earth and the everyday sociopolitcal realities facing Indigenous peoples" (Estes and Dhillon 2019, p. 3). Good relations are born and reborn every day.

"Water *does* connect us," writes Diné anthropologist Teresa Montoya (in Mari Birkett and Montoya 2019). "This understanding goes beyond environmentalist assertions of justice, not because they are wrong but because they are incomplete. It is why, time and time again, our relatives have felt so implored to defend this being." Montoya bends our focus from the individual – a privileged site of Western epistemology – and toward a collective, relational approach to water and society. "When you ask, where do I carry this knowledge," she muses, "I contemplate instead, where does *it* carry us?"

Camp is Everywhere

Standing Rock compels us to ask hard, critical questions – for life, not just for school. By now, you might be asking: What exactly *is* a critical introduction to water? What does a specifically geographic take bring to the water table? And why should we care?

A critical perspective is our entry point to water. Critique is a tricky and beautiful thing – it is a skill, sharpened at the edges by practice, reading, listening, debate, curiosity, doubt, risk, and self-reflection. Critique is a **praxis**, indivisible from what philosopher Hannah Arendt (1998) calls "everyday political action" and our capacity to wrestle with ideas through the active life (*vita activa*). Critique is not only words on a page, but also the practices, knowledge, and action taken by folks with the Standing Rock camp.

We break a few rules in this book. First, we refuse to give you a test. A critical approach to water, as we try to model in this book, is learning for life – not just the exam. On a heating planet, marked by melting glaciers, species extinction, polluted water, state violence, struggling families, and widening social inequality, no exam will be sufficient to meet the task of urgent critical praxis. With this book, we hope to equip you with the tools to learn long after class is dismissed. We will try our best to make it memorable and fun.

Second, we refuse disciplinary silos and easy narratives – we go for the hard story. For us, a critical perspective is a stance rooted in skepticism: a wariness of institutionalized power and seductive narratives that tra-la-la around the globe. Skepticism is not cynicism or a life without hope. Skepticism is a superpower. Skepticism allows us to slow down, see past the hype, and think about the long arc of a narrative: such as ideas that the "law" delivers water justice, or that the "market" is the best allocator of water resources. With these superpowers, we can ask the important questions: How did we get here? What produces a water crisis? Who (or where) benefits from things like water treaties, infrastructures, or technologies – and who (human and otherwise) does not? Why does water remain "hidden" in our breakfast and dinner? What makes these conditions – and why? And what do we do about it?

Who are "we"? At the heart of this book are four people – teachers, writers, editors, and friends – whose situated knowledges, voices, and unique life experiences shape the ideas and stories presented here. Despite the "we" used in the book – the plural, first-person pronoun – our "we" voice is more like a piece of felt than a singular perspective. In this book, we have felted together our situated insights and areas of expertise, informed by our unique subject positions and a mutual training in geography.[6]

Standing Rock is an invitation to camp. Lessons learned on the Dakota prairies enter our classrooms and everyday lives. Camp is planetary and frames this book.

[6] Disciplines are freighted with questions of power and knowledge production, which we actively explore in this book. Geography, for example, carries a deep history of colonial science that still shapes our present-day community and praxis. For us, a geographic approach offers far more than a love of maps; it gives us the tools to explore the "why" and "how" of social and spatial interconnections between water and society.

Camp is a form of struggle – using Arendt's term, a form of situated praxis and critique. In *Standing with Standing Rock*, Teresa Montoya and Tomoki Birkett (Birkett and Montoya 2019, p. 270) illustrate the power of "camp" through a beautiful exchange of letters. Reflecting on water development in the American West, including its extractive history and transhemispheric reach, Montoya recalls a story by LaDonna Bravebull Allard. A camp founder and movement leader, LaDonna Allard discusses a tributary of the Missouri River, not far from the Standing Rock camps.

> In her telling, Allard emphasizes that the true name for the Cannonball River is *Inyan Wakangapi Wakpa*, which means "River That Makes Sacred Stones." This name refers to a once active whirlpool whose movement shaped "large, spherical sandstone formations" in the river's bed. Back in the 1950s, however, the US [Army] Corps of Engineers severed this flow when they flooded the area for the construction of Oahe Dam. The project resulted in a loss of 150 000 acres for the Cheyenne River Indian Reservation. But the greater loss was not quantifiable or limited to one Nation or another. Allard writes, "They killed a portion of our sacred river. I was a young girl when the floods came and desecrated our burial sites and Sundance grounds. Our people are in that water. This river holds the story of my entire life."

Co-author and colleague Tomoki Birkett (p. 274) writes back,

> The movement to protect the water at Standing Rock spirals out in so many directions, through seeping groundwater, as evaporated atmosphere, through ocean currents. As you wrote, having enduring relations, despite losses and through victories, has sustained Indigenous practices of decolonization for hundreds of years. In interviews since the camps at Standing Rock were emptied, leaders of the NoDAPL movement have emphasized this continuity. Holy Elk Lafferty has said, "For me it's been a continuum. It has never stopped. We're all continuing to fight. Now, camp is the globe. Camp is everywhere."

Camp is everywhere. We invite you on this journey. Step with us, into the whirlpool.

Summary and What's Next

This chapter introduced the central thesis of this book: the hydrosocial cycle, the idea that water is inseparable from society, and that water shapes – and is shaped by – social practices and geometries of power. We use the hydrosocial cycle as a tool to reveal hydrosocial relations often hidden in mainstream accounts of water. To build our approach, we introduced four core arguments that structure this text: (i) knowledge is power; (ii) scarcity is made; (iii) water is life; and (iv) camp (praxis) is everywhere. These "planks" provide the foundation for our central argument and you will see them resurface in future chapters. We situated ourselves within this book and extended an invitation to learn for life, not just for the exam. Moving forward, the next chapter takes on hydrosocial relations that have permeated every corner of the globe: the relations of water, power, and empire.

Further Reading

The hydrosocial cycle

Budds, J. (2009). Contested H_2O: Science, Policy, and Politics in Water Resources Management in Chile. *Geoforum* 40 (1): 418–430.

Linton, J. (2008). Is the Hydrologic Cycle Sustainable? A Historical-Geographical Critique of a Modern Concept. *Annals of the Association of American Geographers* 98 (3): 630–649.

Linton, J. (2010). *What Is Water? The History of a Modern Abstraction*. Vancouver, BC: UBC Press.

Linton, J. and Budds, J. (2014). The Hydrosocial Cycle: Defining and Mobilizing a Relational-Dialectical Approach to Water. *Geoforum* 57 (1): 170–180.

Schmidt, J.J. (2014). Historicising the Hydrosocial Cycle. *Water Alternatives* 7 (1): 220–234.

Swyngedouw, E. (2009). The Political Economy and Political Ecology of the Hydro-social Cycle. *Journal of Contemporary Water Research & Education* 142 (1): 56–60.

Indigenous sovereignty and water

Arsenault, R., Diver, S., McGregor, D., Witham, A., and Bourassa, C. (2018). Shifting the Framework of Canadian Water Governance through Indigenous Research Methods: Acknowledging the Past with an Eye on the Future. *Water* 10 (1): 49.

Chief, K. (2018). Emerging Voices of Tribal Perspectives in Water Resources. *Journal of Contemporary Water Research & Education* 163 (1): 1–5.

Chief, K., Meadow, A., and Whyte, K. (2016). Engaging Southwestern Tribes in Sustainable Water Resources Topics and Management. *Water* 8 (8): 1–21.

Curley, A. (2019). "Our Winters' Rights": Challenging Colonial Water Law. *Global Environmental Politics* 19 (3): 57–76.

Curley, A. (2021). Unsettling Indian Water Settlements: The Little Colorado River, the San Juan River, and Colonial Enclosures. *Antipode* 53 (3): 705–723.

Daigle, M. (2018). Resurging through Kishiichiwan: The Spatial Politics of Indigenous Water Relations. *Decolonization: Indigeneity, Education & Society* 7 (1): 159–172.

Gergan, M.D. (2017). Living with Earthquakes and Angry Deities at the Himalayan Borderlands. *Annals of the American Association of Geographers* 107 (2): 490–498.

Estes, N. (2019). *Our History is the Future: Standing Rock Versus the Dakota Access Pipeline and the Long Tradition of Indigenous Resistance*. London: Verso.

Estes, N. and Dhillon, J. ed. (2019). *Standing with Standing Rock: Voices from the #NoDAPL Movement*. Minneapolis, MN: University of Minnesota Press.

McGregor, D. (2014). Traditional Knowledge and Water Governance: The Ethic of Responsibility. *AlterNative: An International Journal of Indigenous Peoples* 10 (5): 493–507.

Poelina, A., Taylor, K.S., and Perdrisat, I. (2019). Martuwarra Fitzroy River Council: An Indigenous Cultural Approach to Collaborative Water Governance. *Australasian Journal of Environmental Management* 26 (3): 236–254.

Poelina, A. (producer) and McDuffie, M. (director). (2021). *A Voice for Martuwarra*. Madjulla, Inc. Broome, Australia. https://vimeo.com/424782302 (accessed 12 July 2022).

Prieto, M. (2021). Indigenous Resurgence, Identity Politics, and the Anticommodification of Nature: The Chilean Water Market and the Atacameño People. *Annals of the American Association of Geographers* 12 (2): 487–504.

Wilson, N.J. (2014). Indigenous Water Governance: Insights from the Hydrosocial Relations of the Koyukon Athabascan Village of Ruby, *Alaska. Geoforum* 57 (1): 1–11.

Wilson, N.J. and Inkster, J. (2018). Respecting Water: Indigenous Water Governance, Ontologies, and the Politics of Kinship on the Ground. *Environment and Planning E: Nature and Space* 1 (4): 516–538.

Wilson, N.J., Montoya, T., Arsenault, R., and Curley, A. (2021). Governing Water Insecurity: Navigating Indigenous Water Rights and Regulatory Politics in Settler Colonial States. *Water International* 46 (6): 783–801.

Expert networks

Conca, K. (2005). *Governing Water: Contentious Transnational Politics and Global Institution Building*. Cambridge, MA: The MIT Press (see chapter 5 "Expert Networks: The Elusive Quest for Integrated Water Resources Management").

Galvin, M. (2015). Talking Shit: Is Community-Led Total Sanitation a Radical and Revolutionary Approach to Sanitation? *WIREs*: *Water* 2 (1): 9–20.

Goldman, M. (2007). How "Water for All!" Policy became Hegemonic: The Power of the World Bank and its Transnational Policy Networks. *Geoforum* 38 (5): 786–800.

Molle, F. (2008). Nirvana Concepts, Narratives and Policy Models: Insights from the Water Sector. *Water Alternatives* 1 (1): 131–156.

On drylands and deserts

Abbey, E. (1968). Water. In: *Desert Solitaire: A Season in the Wilderness*, 112–127. New York: McGraw-Hill.

Koch, N. (2021). The Political Lives of Deserts. *Annals of the American Association of Geographers* 111 (1): 87–104.

On water justice

Boelens, R., Perreault, T., and Vos, J. ed. (2018). *Water Justice*. Cambridge, UK: Cambridge University Press.

Perreault, T. (2014). What Kind of Governance for What Kind of Equity? Towards a Theorization of Justice in Water Governance. *Water International* 39 (2): 233–245.

Pulido, L. (2016). Flint, Environmental Racism, and Racial Capitalism. *Capitalism Nature Socialism* 27 (3): 1–16.

Ranganathan, M. and Balazs, C. (2015). Water Marginalization at the Urban Fringe: Environmental Justice and Urban Political Ecology across the North-South Divide. *Urban Geography* 36 (3): 403–423.

Sultana, F. (2018). Water Justice: Why It Matters and How to Achieve It. *Water International* 43 (4): 483–493.

Zwarteveen, M.Z., and Boelens, R. (2014). Defining, Researching and Struggling for Water Justice: Some Conceptual Building Blocks for Research and Action. *Water International* 39 (2): 143–158.