CRITICAL INTRODUCTIONS TO GEOGRAPHY

Katie Meehan, Naho Mirumachi,
Alex Loftus, and Majed Akhter

Water

A Critical Introduction

WILEY Blackwell

Water: A Critical Introduction

Critical Introductions to Geography

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This book is the product of four people with very different backgrounds, interests, and life experiences. What unites us is a curiosity about the world, a relentless drive to question, and a responsibility to the people, places, and waters we have met along the way. We hope that this book serves as a launch pad for readers to do the same and see the world's waters around them a little differently.

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This book is dedicated to our students, past and present, who continue to create new worlds and teach us.

Part 1

Foundations

Chapter 1
The Hydrosocial Cycle

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.

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."

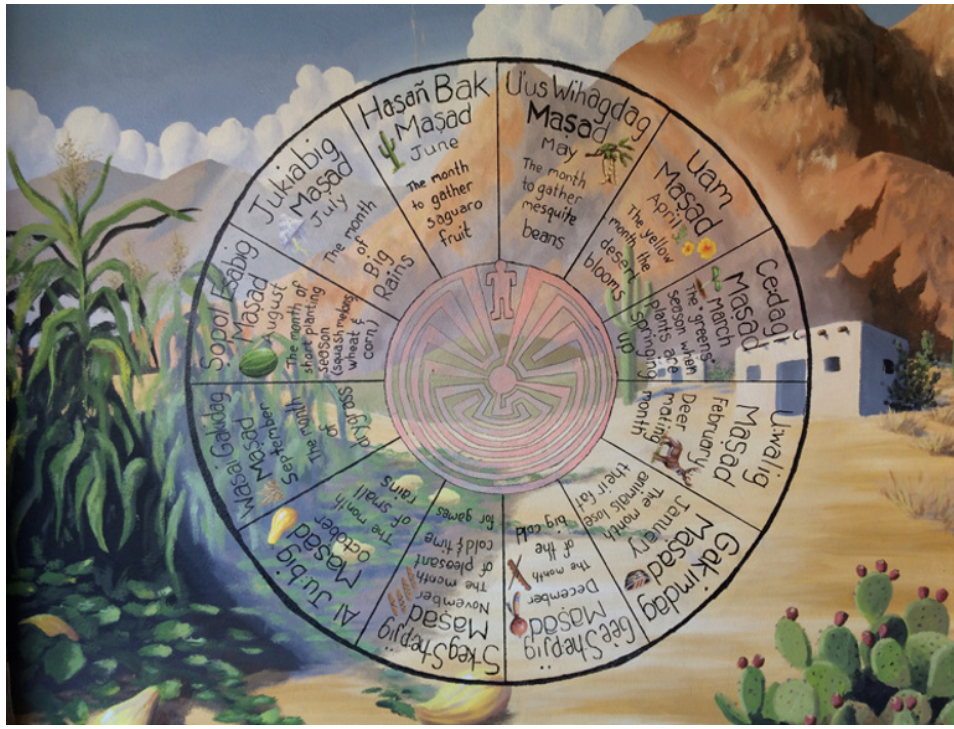

Figure 1.3 The O'odham calendar at Manzo Elementary School. Source: Katie Meehan (author).

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

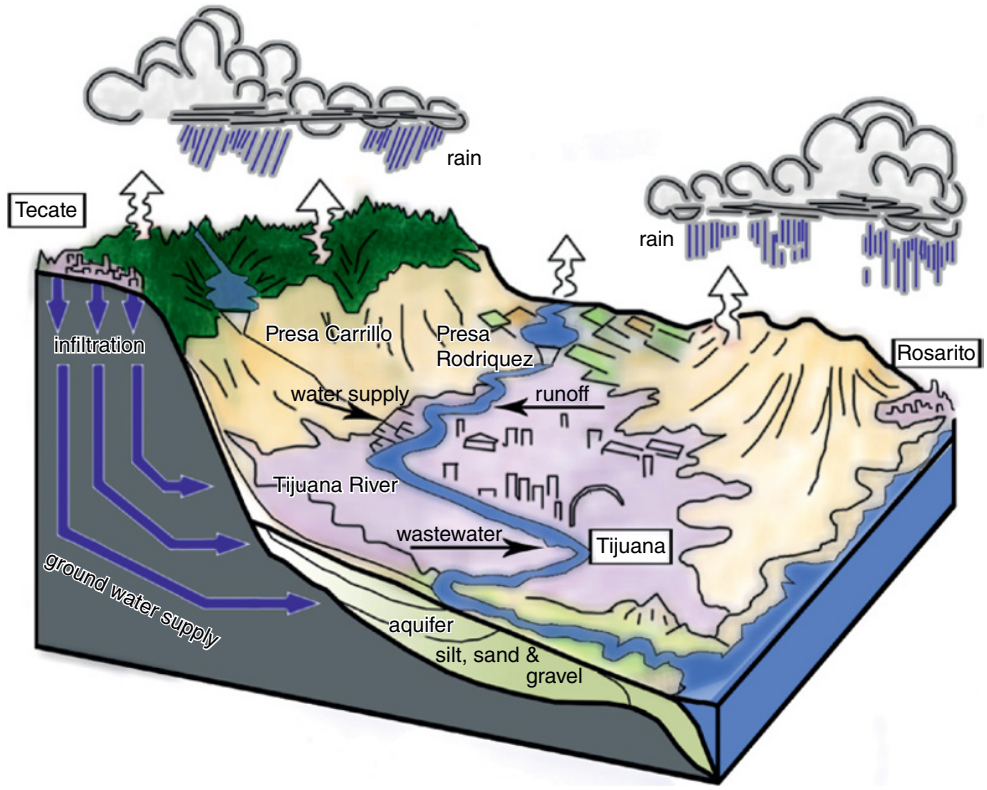

Figure 1.4 The Tijuana hydrosocial cycle. Water moves unevenly through the Tijuana urban region, fueled as much by "natural" forces (gravity, energy from the sun, ecological functions) as by "social" dynamics and institutions (law, science, urban planning). A hydrosocial perspective invites us to ask: 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).