Groundwater overdraft is water dispossession

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Abstract

The Coachella Valley sits at the geographic periphery of Los Angeles. Despite its physical and political marginality, the Coachella Valley is a key site of agricultural production in Southern California. Access to water is essential for ensuring the region's centrality in economic and social reproduction. Today, access to water for industrial production is primarily achieved through ongoing water dispossession. Using archival and policy documents, I analyze how United States settlers leveraged multiple mechanisms for water dispossession to expand the region's growth. Literature on water dispossession focuses on forms (water rights, grabbing, allocation, diversion, or contamination) that advance either settler colonialism *or* capitalism. This article demonstrates how successful white settlement in the Coachella Valley could only happen through Indigenous water dispossession. I identify an understudied form of water dispossession: groundwater overdraft. I illustrate that groundwater overdraft is not just a characteristic of early U.S. settler colonialism in the Coachella Valley; it is ongoing. In addition, the economic and environmental drawbacks to overdraft are resolved by expanding water dispossession. Analyzing groundwater overdraft as water dispossession, questions this premise. Illuminating the structural processes at play in water dispossession exposes the need to address dispossession, rather than simply overdraft, through both policy and cultural changes.

Keywords: dispossession, water, Colorado River, California, water access, water security, Coachella, groundwater, overdraft

Résumé

La vallée de Coachella se situe à la périphérie géographique de Los Angeles. Malgré sa marginalité physique et politique, c'est un site clé de la production agricole en Californie du Sud. L'accès à l'eau est essentiel pour assurer la centralité de la région dans la reproduction économique et sociale. Aujourd'hui, l'accès à l'eau pour la production industrielle passe principalement par une spoliation continue de l'eau. À l'aide de documents d'archives et de documents politiques, j'analyse comment les colons américains ont exploité de multiples mécanismes de dépossession de l'eau pour accroître la croissance de la région. La littérature sur la dépossession de l'eau se concentre sur les formes (droits à l'eau, accaparement, allocation, détournement ou contamination) qui font avancer soit le colonialisme de peuplement, soit le capitalisme. L'article montre comment une colonisation blanche réussie dans la vallée de Coachella ne pourrait se produire que grâce à la dépossession de l'eau par les autochtones. J'identifie une forme peu étudiée de dépossession de l'eau: le découvert des eaux souterraines. Ce n'est pas seulement une caractéristique des premiers colons américains dans la vallée de Coachella; c'est en cours. De plus, les inconvénients économiques et environnementaux du découvert sont résolus par l'expansion de la spoliation de l'eau. L'analyse du découvert des eaux souterraines comme une dépossession de l'eau remet en question cette prémisse. L'éclairage des processus structurels en jeu dans la

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dépossession de l'eau révèle la nécessité de s'attaquer à la dépossession, plutôt qu'au simple découvert, par le biais de changements politiques et culturels.
Mots clés: dépossession, eau, fleuve Colorado, Californie, accès à l'eau, sécurité de l'eau, Coachella, eaux souterraines, surexploitation de l'eau

Resumen

El Valle de Coachella se encuentra en la periferia geográfica de Los Ángeles. A pesar de su marginalidad física y política, el Valle de Coachella es un sitio clave de producción agrícola en el sur de California. El acceso al agua es esencial para asegurar la centralidad de la región en la reproducción económica y social. Hoy en día, el acceso al agua para la producción industrial se logra principalmente mediante la desposesión continua del agua. Utilizando documentos de archivo y de políticas, analizo cómo los colonos estadounidenses aprovecharon múltiples mecanismos de desposesión del agua para expandir el crecimiento de la región. La literatura sobre la desposesión del agua se centra en formas (derechos de agua, acaparamiento, asignación, desvío o contaminación) que promueven el colonialismo o el capitalismo. Este artículo demuestra cómo el asentamiento blanco exitoso en el Valle de Coachella solo podría ocurrir mediante la desposesión del agua de los indígenas. Identifico una forma de desposesión de agua poco estudiada: el sobreexplotación de aguas subterráneas. Ilustro que la sobreexplotación de aguas subterráneas no es sólo una característica del colonialismo estadounidense en el Valle de Coachella; continua. Además, los inconvenientes económicos y ambientales del sobregiro se resuelven ampliando la desposesión del agua. Analizar el sobreexplotación de aguas subterráneas como desposesión de agua, cuestiona esta premisa. Iluminar los procesos estructurales en juego en el desposesión de agua expone la necesidad de abordar el desposesión, en lugar de simplemente sobregirarlo, a través de cambios políticos y culturales.
Palabras clave: desposesión, agua, río Colorado, California, acceso al agua, seguridad hídrica, Coachella, aguas subterráneas, sobreexplotación del agua

1. Introduction

In recent years, national media reports in the USA on the two-decade megadrought causing shockingly low water-levels throughout the Colorado River Basin have grown in frequency and alarm (Fountain, 2021; 2022). However, in Southern California's Coachella Valley, where over 400,000 acre-feet (~490,000,000 cubic meters) of water per year from the Colorado River feeds robust agriculture and tourist industries, residents and advocates are forced to balance this regional water scarcity crisis with their immediate water-related health and safety needs (*Juntos por un Mejor Oasis v. Scott Lawson*, 2021; Olalde, 2020; Perez, 2021; Water Systems Consulting, Inc., 2021). An estimated 10,000-30,000 people in the Eastern Coachella Valley lack water security due to arsenic-contaminated groundwater (Ingrassia, 2020; Rumer, 2022). Many of these residents serve as the backbone of the half-a-billion-dollar agriculture industry (Coachella Valley Water District, 2019). They live in over one hundred trailer parks that dot a checkerboard of unincorporated Riverside County and tribal land. This duality between precarious residential water access and water-rich agriculture fields originates in the actualizing of federal land policy that drove water dispossession during early U.S. settler colonialism in the Coachella Valley.

The Coachella Valley is the homeland of the Cahuilla, who have lived in the region since time immemorial. U.S. federal land policies reduced the territory of the once estimated 5,000 to 6,000 pre-contact Cahuilla to five reservations in the late 1800s and early 1900s while at the same time encouraging Valley-wide white settlement (Shaw, 1999; Kray, 2009; Madrigal, 2005; Patencio & Boynton, 1943). Not only did these policies enable indigenous land dispossession by individual settlers, private companies, and public entities, but they also *required* water dispossession.

This article traces water dispossession from early U.S. settler colonialism in the Coachella Valley using archival and policy document analysis. It describes the multiple modes of water dispossession used by early white settlers to successfully maintain land ownership. The article demonstrates that water dispossession was not only necessary for growing the regional economy and individual wealth, but federally mandated. In doing so it expands the water dispossession literature by identifying groundwater overdraft as an understudied, managed, and systematic form of dispossession. The article begins with a literature review that parses through

the various modes of water dispossession that scholars have analyzed and offers a framework for understanding their interconnected roles in capitalism and (settler) colonialism. The next section provides background on the Coachella Valley and is followed by an account of the U.S. federal land policies that encouraged white settlement in the Coachella Valley. It articulates the multiple forms of water dispossession used by settlers, highlighting groundwater overdraft as a unique form of dispossession that is both ongoing and linked to local (Eastern Coachella Valley) and regional (Colorado River Basin) water scarcity issues. The article concludes by addressing why the analysis of overdraft as water dispossession is necessary for both theory and practice.

2. Water dispossession: A central process of capitalism and settler colonialism

Commonly expressed as depriving someone of a good that they previously possessed, scholars have demonstrated the centrality of dispossession to colonial and capitalist regimes. Forms of dispossession, theorized within capitalism, include primitive accumulation (enclosure) and its ongoing maintenance through accumulation by dispossession (privatization) (Castree, 2000; Gilmore, 2007; Hall, 2013; Harvey, 2004; Harvey & Marx, 2010; Robinson, 2020). In the Americas, settler colonial land dispossession provided the foundation for European industrial production and subsequent global capitalism. It involved the taking of Native land, bodies, and resources while destroying indigenous cultural and customary relationships between people and the more-than-human (Castellanos, 2017; Dorries *et al.*, 2022; Englert, 2020; Pulido, 2018; Schmidt, 2022). In both settler colonialism and capitalism, dispossession replaces existing cultural relationships between humans and between humans and the more-than-human with hierarchical differences (Federici, 2004; McCreary & Milligan, 2021; Mies, 1986; Pulido, 2016, 2017; Roberts, 2008).

Water dispossession involves the "loss of access to and control of the use, management and custodianship of water" (Hartwig *et al.*, 2020, p. 104873). Water and land (and their dispossession) are always intertwined. When communities lose access to and control of water, they also lose their ability to control and manage their local territory (Hidalgo *et al.*, 2017). As Andrew Curley (2021) presciently argues, water dispossession was as important as land dispossession to forming, maintaining, and expanding capitalism and settler colonial states. However, scholars have noted that due to water's fluid nature and renewability, its dispossession can often be obscured (Bakker, 2003; Dewan & Nustad, 2023; Swyngedouw, 2005).

Scholars have identified several forms of water dispossession including water privatization, grabbing, rights, allocation, settlements, and contamination (as a byproduct of accumulation) (Bakker, 2013; Curley, 2019, 2021; Perreault, 2013; Roberts, 2008; Swyngedouw, 2005). Forms of water dispossession roughly fall into three modes: discursive, legal, and physical (Figure 1 illustrates the relationship between modes and forms of water dispossession). Discursive modes of dispossession may precede both physical and legal modes, setting the stage for their easy acceptance through narratives that undermine and erase existing human-water relations (Dewan & Nustad, 2023). Forms of dispossession are often contingent on or entangled with one another. They may also provide pathways for the use or invention of subsequent forms. What follows is a brief description of water dispossession forms and their connections within the United States context.

Water grabbing, defined by Mehta *et al.* (2012) "as a situation where powerful actors are able to take control of, or reallocate to their own benefits, water resources already used by communities or feeding aquatic ecosystems on which their livelihoods are based" (p. 197), describes various forms of water dispossession. Water grabbing may involve capturing water physically and/or legally. Forms of dispossession defined as water grabbing include rights, allocation, settlement, and diversion. Water grabbing often serves as an initial step or precursor to other forms of water dispossession.

Water rights are used in the United States as a legal mechanism, which converts water into property. Water rights facilitate the privatization of water by giving individuals, companies, governments, and tribal organizations quantified amounts of water to use (Bakker, 2003, 2013; Bauer, 1997, 1998; Couret Branco & Damião Henriques, 2010; Curley, 2019; Roberts, 2008; Swyngedouw, 2005). Water privatization (or accumulation by dispossession) involves transforming communal water management, ownership, and organization into private ownership or control, often through government intervention (Diver *et al.*, 2019; Perreault 2013, 2014; Porten & Rob, 2013; Roberts, 2008; Swyngedouw, 2005). It also includes the privatization of water governance, which introduces market principles to water system management, and water

commodification, which expresses the value of water in economic terms. Once water is privatized and in use by industry, water dispossession can occur through contamination. Water contamination renders it unusable to downstream communities, becoming another form of enclosure as water is removed from the public sphere.

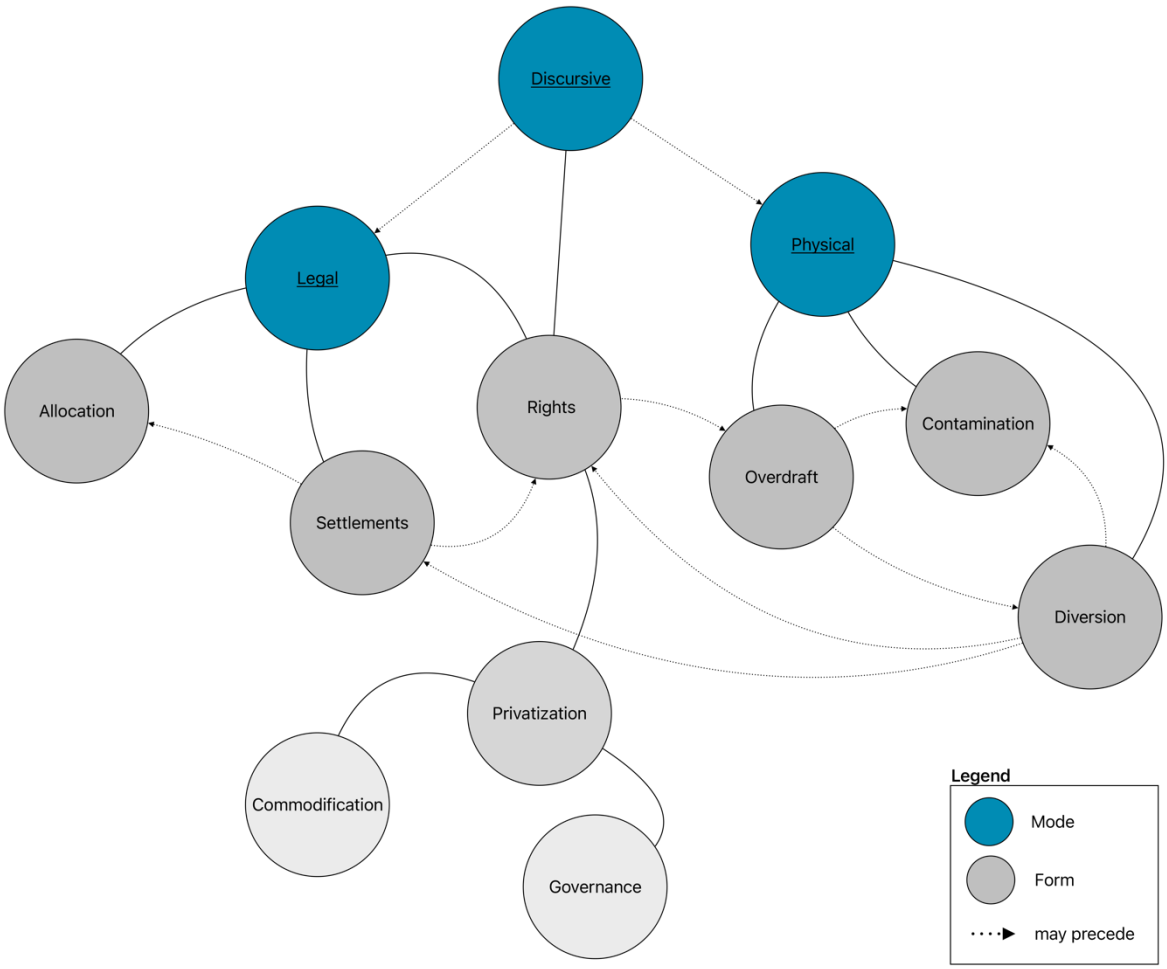


Figure 1: Water Dispossession Framework.

Enforced under settler colonial regimes, water rights in the United States are often accompanied by water allocation and privatization. Allocations in the U.S. establish set quantities of use for water rights holders, granted to both individuals and companies. In this sense, water rights and allocation in contemporary settler colonial societies enclose indigenous water use (Curley, 2019). It limits indigenous water use to set quantities, enclosing indigenous cultural traditions that emphasize communal use (Bakker, 2007, 2013; Hartwig *et al.*, 2020; Radonic, 2015). However, Indigenous water rights litigated and allocated in U.S. courts also allowed for a broadening of Indigenous self-determination and economic self-sufficiency (Radonic & Sheridan, 2017).

Settler colonial governments also use water settlements to dispossess water. In the United States, settlements are used to resolve conflicting claims and competition between tribal governments and local settler colonial jurisdictions (Curley, 2021; McCool, 2006). Through settlements, indigenous nations can gain their rights to water (Curley, 2019). However, the established water rights place conditions on use and quantity

through allocations. They limit indigenous water use to allocated inches, ensuring only enough to fulfill the productive purpose of the reservation.

Water settlements can legitimize contemporary and historic water grabbing. Settlements, while increasing the amount of allocated water for tribes (McCool, 2006), often legalize water diversions that preceded colonial governance (Curley, 2021). In the U.S. water settlements are shown to limit future growth for tribes and allow unrestricted expansion of settler cities (Curley, 2021; McCool, 2006). Settlements may bring temporary justice to present generations while leaving out future generations and tying tribes to economic development (mostly in large-scale agriculture) that is rapidly disappearing (McCool, 2006). Curley (2019) considers settlements in the United States to be "among the last enclosures of Indigenous resources on the continent" (p. 63). These enclosures physically restrict water access and change cultural understandings and governance within Indigenous water practices (Curley, 2021).

Although water dispossession is often analyzed either as a process of capital accumulation or colonial control, all forms of water dispossession are used for both. No matter the form water dispossession takes, it always creates spatial inequality. It guarantees that water security for some creates water insecurity for others (Hidalgo *et al.*, 2017; Roberts, 2008). In addition, because water insecurity has a socio-political and historical relationship, it reproduces differentiation and hierarchical relations of gender, race, and class (Hidalgo *et al.*, 2017; Roberts, 2008). This article adds to water dispossession literature using the case of the Coachella Valley. It adds groundwater overdraft to the various forms of water dispossession that scholars have identified throughout the Americas that intertwine expanded capitalist production and colonial settlement including the human right to water (Radonic, 2017), hydropower (Kelly, 2021), water rights (Curley, 2019; Radonic, 2015), settlements (Curley, 2021), and contamination (Leifsen, 2017; Wilson *et al.*, 2021). The case of the Coachella Valley documents how early settler colonialism intertwined with capital production to produce groundwater overdraft as a physical form of water dispossession.

3. The Coachella Valley

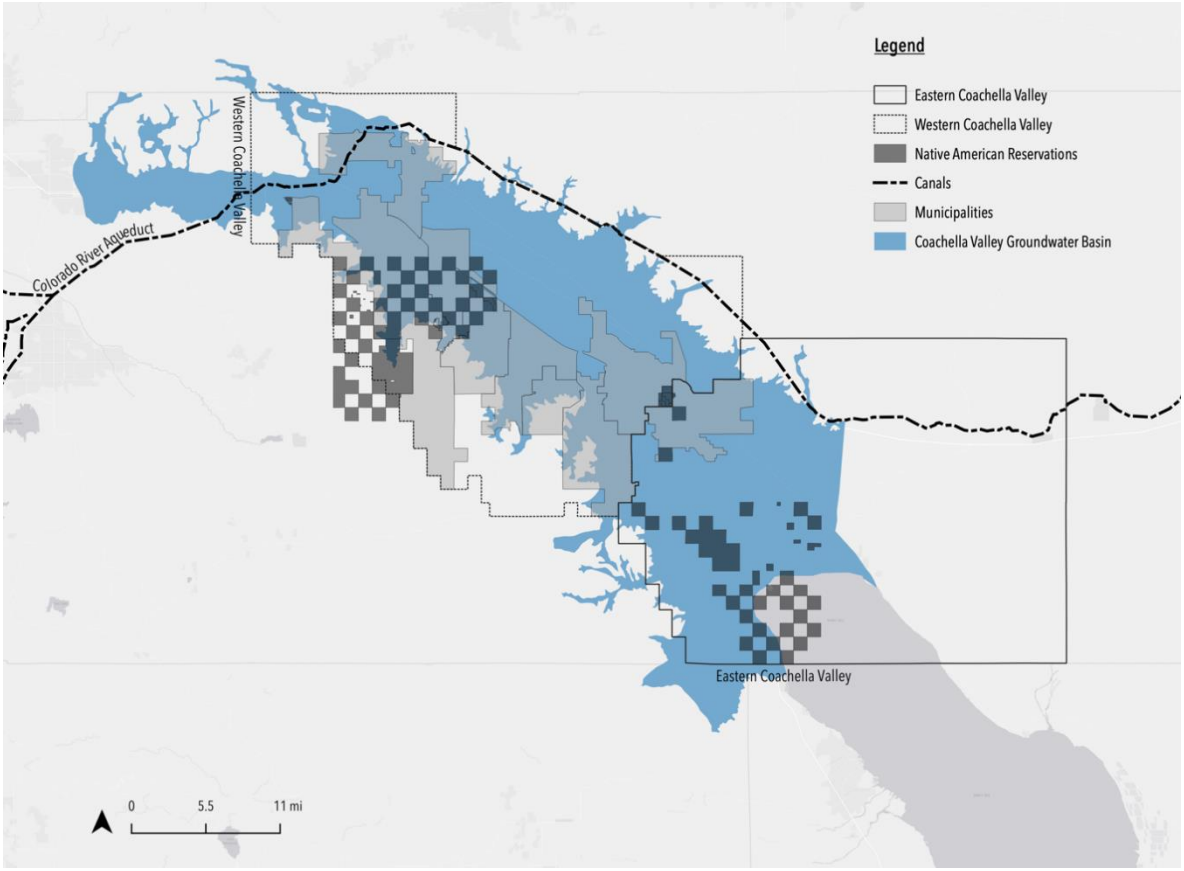
Southern California's Coachella Valley is naturally bounded by the San Jacinto, Santa Rosa, and San Bernardino Mountain ranges creating a catchment area for the Whitewater River Watershed system (see map 1). It contains over 1,200 square miles [~3,100 square kilometers] and includes nine incorporated cities, five tribal reservations, and unincorporated Riverside County land. The Riverside County General Plan divides the Valley jurisdictionally between East and West (County of Riverside, 2015, 2021). This jurisdictional boundary is upheld in the spatial imaginary of Valley residents and visitors.

Advocates, government representatives, and journalists alike make comparisons between the Eastern Coachella Valley and its Western counterpart. They note the differences between the Eastern Coachella Valley's poverty rates, agricultural economy, Mexican immigrant and Mexican American population, and water scarcity with the Western's tourist-centric industry and amenities, whiter population (in Palm Springs, for example), and water abundance (Beckett, 2022; Olalde 2020). When it comes to water use and access, these differences are not just illustrative, they are grounded in the lived experiences of Eastern Coachella Valley residents.

An estimated 10,000 people in the Eastern Coachella Valley rely on private wells to access water (Rumer, 2022). At the same time, over 64,000 acres [~26,000 hectares] of farmland in the Eastern Coachella Valley is irrigated by infrastructure conveying Colorado River water through the Coachella Branch of the All-American Canal (Coachella Valley Water District, 2019). Crops on this land are tended to by a largely Mexican immigrant labor force.[2] Fifty-eight percent of the Eastern Coachella Valley's Oasis, Thermal, and Vista Santa Rosa communities work in agriculture (U.S. Census Bureau, 2019a). In these communities, 37% of residents lack complete plumbing (Manson, Steven *et al.*, 2020; U.S. Census Bureau, 2019b). Moreover, their access to potable water is compromised by arsenic found in groundwater throughout the Eastern Coachella Valley at

[2] Ninety-two percent of residents in the Eastern Coachella Valley identify as Hispanic (U.S. Census Bureau, 2019c). Out of the 41% who are foreign-born, 98% were non-citizens and 95% came from Mexico (U.S. Census Bureau, 2019d). In addition, 80% of the population have income levels below the average median income, 28% of whom live below the poverty line (U.S. Census Bureau, 2019e).

levels that exceed the Environmental Protection Agency's maximum contaminant level of 10 parts per billion (California State Water Resources Control Board, 2022; State Water Resources Control Board, 2022). Arsenic contamination in these communities means that households face daily water insecurity, while agricultural fields, golf courses, and resorts receive piped water through the region's largest public water district, Coachella Valley Water District (CVWD).



Map 1: The Coachella Valley (California Department of Water Resources, 2022a, 2022b; County of Riverside, 2021; Manson, Steven *et al.*, 2020)

Despite these jurisdictional, political, and imaginary boundaries, the region pulls groundwater from a single source: the Coachella Valley Groundwater Basin. The basin extends across the entire valley floor and is subdivided into four subbasins based on fault barriers, constrictions in the basin profile, permeability variance, and barriers to the lateral movement of groundwater (Water Systems Consulting, Inc., 2021). However, groundwater interflow occurs throughout the basin. In 1964, California's Department of Water Resources estimated that in the first 1,000 feet [305 m] below the ground surface the Coachella Valley Groundwater Basin contained approximately 39.2 million acre-feet [~48 billion cubic feet, 3.64 m^2] (28.8 – or 35 billion cubic feet – of which were in the Indio subbasin). However, today, the Coachella Valley Groundwater Basin is in a continuous state of overdraft.

Overdraft describes the condition of annual groundwater extraction occurring at a faster rate than the annual rate of natural recharge. It can lead to land subsidence, seawater intrusion, groundwater depletion, chronic lowering of groundwater levels, and aquifer collapse. Groundwater is one of four primary water sources in the Coachella Valley (which also includes allocations from the Colorado River and the California State Water

Project as well as local recycled water) managed across six public water agencies.[3] In the Coachella Valley, ecological and economic crisis are held at bay through artificial aquifer replenishment using water from the Colorado River.

4. Land policies enabling dispossession in the Coachella Valley

Contemporary water use and management in the Coachella Valley follow practices set during early U.S. settler colonialism, which include overdraft, industrial prioritization, and racialized water access. State and settler implementation of the Land Ordinance of 1785, the 1851 California Private Land Act, the 1862 Pacific Railroad Act, Presidential Executive Orders from 1875 to 1902, and the Desert Land Act dispossessed Cahuilla of land and water. Under these regulations, Cahuilla land was dispossessed by the U.S. government, surveyed and carved into a checkerboard, and granted and sold to non-Indigenous private companies and individuals. Implemented under U.S. law, these new boundaries, first, legally, then physically, corralled Cahuilla into progressively uninhabitable spaces. However, long-term settlement was only viable when water dispossession accompanied land grabbing and distribution.

Pre-contact Cahuilla relied on mobility, adaptation, and innovation to support their livelihoods within natural and continuously changing water conditions. In the Western Coachella Valley, the Agua Caliente Band of Cahuilla Indians (as they are now known) lived between the canyons in the San Jacinto Mountains in the summer and on the Valley floor in the winter (Shaw, 1999; Patencio & Boynton, 1943). Springs, streams, and hot springs provided seasonally available potable water sources. They built stone-lined irrigation channels from the streams to water their crops and used *ollas* and woven Tule mats to store water (Agua Caliente Cultural Museum, n.d.; *History of Tahquitz Irrigation by Cahuilla Indians 1880*, 2011; Lebacho, 1909; Patencio & Boynton, 1943). Agua Caliente member, Jose Lebacho, in a testimony from 1909, described how he built the Tahquitz irrigation ditch prior to settler arrival:

> I had built the ditch out of Tahquitz Canyon some years before the U.S. mail was first carried through there on horse back. The stage station was built about fifteen or twenty years after I had built the Tahquitz ditch. The ditch was built to get good water to drink and to irrigate with. All the water we had before we built the Tahquitz ditch, was from the hot sulphur spring, to drink or to irrigate with. I took the water out of Tahquitz creek and made a ditch following reasonably close to the foot of the mountain and made the ditch so that it passed a little north of the hot springs. No white man did anything to help me build the ditch. (Lebacho, 1909, p.1)

In the Eastern Coachella Valley, surface water was comparatively sparse. However, the Desert Cahuilla, living along the lower end of the Valley's alluvial fans, found groundwater below outcroppings of Palm trees (Lando & Modesto, 1977; Patencio & Boynton, 1943; Smith, n.d.). The Desert Cahuilla created water access by bringing it up from the ground using hand-dug wells (Lando & Modesto, 1977; Patencio & Boynton, 1943; Smith, n.d.). Women collecting water walked into them: "one side had steps going down to the water. Then often that one side was dug out slant-ways for the animals to go down to drink" (Patencio & Boynton, 1943, p. 58).

Across the desert landscape, water access required Cahuilla ingenuity to ensure reliability. However, Desert Cahuilla hand-dug wells in the Eastern Coachella Valley proved water availability to settlers unfamiliar with the perceived dry landscape. By appropriating indigenous water access practices, settlers leveraged federal land policies to acquire and occupy land in the Coachella Valley. The U.S. acquired California from Mexico with the signing of 1848's Treaty of Guadalupe Hidalgo. Subsequently, the federal government passed the California Private Land Act on March 3, 1851 and implemented the Land Ordinance of 1785 to divide and take ownership of its new territory. The California Private Land Act made all land in California public domain that lacked an established claim granted under the Spanish or Mexican governments (1851, March 3 – California

[3] Groundwater is accessed through wells maintained by individual households, small water systems, and each of the six public water systems.

Private Land Act, Ch 40, p. 631-634, 2016). In the Coachella Valley, with no previous title holders, the California Private Land Act created a *legal* maneuver for federal dispossession of Cahuilla land. *Physical* land dispossession would begin two decades later as the Southern Pacific Railway made its way through the Valley.

To properly dispose of and control land acquired under the California Private Land Act, the U.S. government implemented the Land Ordinance of 1785. The ordinance required orthogonal and regulated land surveys to dispose and develop Western territories (United States Continental Congress, King, R., Johnson, W. S. & Continental Congress Broadside Collection, 1785). U.S. surveyors arrived in the Coachella Valley in 1855. They implemented the ordinance by abstracting land into maps, a key mechanism of colonial governments for claiming power and dispossessing land (Anderson, 2006; Barraclough, 2011; Blomley, 1998, 2003; Porter, 2010). They divided the region into eighteen, full and partial, numbered townships – each six square miles [15.5 km^2]. They then carved townships into thirty-six one-mile squares (or 640 acres) (Shaw, 1999; Kray, 2009; La Croze, 1856; Lando & Modesto, 1977; United States Continental Congress, King, R., Johnson, W. S. & Continental Congress Broadside Collection, 1785). Maps rendered the Valley vast and vacant, cartographically and discursively erasing Indigenous land and water practices. Coachella Valley survey maps replaced the unique, highly mobile relationships Cahuilla had with land and water with static markings of an Indian village or *rancheria* (Bremner, 2022). Only eleven sections within eight different townships marked an Indian village; five sections depicted an Indian well or spring. Illustrated as vacant land, the federal surveys readied Coachella Valley's townships for a first phase of land disposition in 1862 that would expand settler occupation and industrial production.

The 1862 Pacific Railroad Act regulated the U.S. federal government's legal transfer of Cahuilla occupied, public domain land into private hands. The Act (and its subsequent amendments) granted land to the railroad companies responsible for building the Northern Pacific, Atlantic and Pacific, and Southern Pacific Railways for construction use, rail right-of-way, and recouping construction costs (Act of July 1, 1862 (Pacific Railroad Act), 1862). Earlier surveys routed the Southern Pacific Railway through the center of the Coachella Valley, marking present-day Indio as the halfway point between Yuma, Arizona, and Los Angeles, California (Mendenhall, 1909; Preuss *et al.*, ca. 1855). When construction completed on the Southern Pacific Railway lines in the Coachella Valley, the federal government granted the Southern Pacific Railroad Company, unbeknownst to the Cahuilla, all odd-numbered sections within ten to twenty miles on either side of the railroad line in accordance with the Act (Act of July 1, 1862 (Pacific Railroad Act), 1862; Lec & Gabbert, n.d.). The land grant to the Southern Pacific Railroad Company covered almost the entire region.

The land grant transformed the Coachella Valley into a checkerboard of private (odd-numbered) and public (even-numbered) square miles. However, the odd-numbered land was granted with stipulations requiring the Company to sell the land at a market price. The Southern Pacific Railroad Company's land sales in the Western Coachella Valley brought the first white settlers, land speculators, and physical land and water dispossession to the region. Attracted by the Agua Caliente's irrigation ditches and conversion of the hot spring's mineral water into potable water, settlers began buying land in the 1880s adjacent to their village on the valley floor (Lec & Gabbert, n.d; McManus, 1957).

While settlers physically invaded Cahuilla land after buying property rights to odd-numbered sections of the checkerboard, a series of presidential executive orders and federal acts dispossessed and further reduced Southern California Indigenous land. On May 15, 1876, President Grant signed an executive order reserving six square-mile sections for Cahuilla villages in the Coachella Valley (United States President & United States Office of Indian Affairs, 1902). At the time of the President's executive order, Desert Cahuilla villages in the Eastern Coachella Valley included Indian Wells, Indio, Martinez, Augustine, LaMesa, and Alamo, in addition to Torros and Cabezons, which were named in the executive order (Lando & Modesto, 1977; Smith, n.d.). However, a presidential executive order in 1877 expanded the Agua Caliente reservation to 60,000 acres [24,300 ha]. And later, the Act for the Relief of Mission Indians in 1891 added 24,000 acres [9,700 ha] to the Torres and Martinez reservations (An Act…, 1891; Torres-Martinez Desert Cahuilla Indians Claims Settlement Act, 1996; S. Doc. No. 54, 1898; S. Exec. Doc. No. 15, 1885; Southern California Tribal Chairmen's Association, 2022; United States President & United States Office of Indian Affairs, 1902). The 1887 Dawes Act further degraded Cahuilla land relations by requiring individual allotments for tribal members, instituting private property norms over communal land ownership on reservations (An Act…, 1887). However, continued

Cahuilla resistance to the Dawes Act kept reservation land in communal ownership well into the twentieth century (Pete, 1928a, 1928b). In the end, these policies designated five reservations as trust land, Cahuilla as wards of the federal government, and racialized the checkerboard of public/private land into Indian and white settler land (Bremner, 2022).

Reservation delineation in the Coachella Valley dispossessed Cahuilla of their relationship to and management of land. Reservations also limited Cahuilla water access by restricting their ability to move and adapt to changing water conditions. As a result, Cahuilla water insecurity grew. For example, within a decade of white settlement, federal agents reporting in 1898, found the Torres tribe occupying a single section with an artesian well that was "choked with sand" requiring "a cost of several thousand dollars" to return the flow to the well (S. Doc. No. 54, 1898). After using the reservation system to set aside land for Cahuilla villages, the Desert Land Act opened remaining public land for settler acquisition. Designed for Western territory land reclamation, the 1877 Desert Land Act gave the land poor the opportunity to own 640 acres [259 ha] of land, equal to one section of a township (Act for Sale of Desert Lands, 1877). However, land ownership was contingent on settlers' ability to irrigate the land.

5. Settlement and dispossession in the Coachella Valley

Incoming settlers to the region understood that long-term settlement in the Coachella Valley required access to water. This was best expressed by one of Western Coachella Valley's first settlers, John McCallum, who, according to accounts from his daughter, "knew that if the desert was to bloom and grow, that water, water and more water was the only answer" (McManus, 1957, p. 36). White settlers from the East Coast and Midwest were unaccustomed to the Coachella Valley's landscape that lacked the abundant rainfall and perennial river systems present in their home states. Without river systems to easily divert, settlers instead dispossessed Cahuilla of their water access and water infrastructure.

Settlers used multiple types of water dispossession, which varied between the Western and Eastern regions. Water dispossession in the Western Coachella Valley required a combination of water rights, grabbing, settlements, allocations, and pollution (Bremner, 2022). As settlers bought Southern Pacific Railroad Company land around the Agua Caliente village in the late 1880s, they applied for water rights to the Agua Caliente's primary water sources: Whitewater River, Tahquitz Creek, and Andreas Creek (Bauer, 1918; *History of Tahquitz Irrigation by Cahuilla Indians 1880,* 2011; McManus, 1957). In doing so, they ignored existing Cahuilla water use, diversions, and infrastructure accompanying those water sources (Kelsey, 1906).

After legal dispossession, they enabled physical dispossession. They sabotaged the Agua Caliente's irrigation ditch, which brought water to the Valley floor from Tahquitz Creek, and diverted it to their own land (Lebacho, 1909). They used Cahuilla labor to create new diversions from Whitewater River. Settlers had claimed "upstream" land surrounding the Agua Caliente village. In 1906, federal agents reported, "[a]t the Palm Springs reservation, sometimes called Aguacaliente number 2, there is a small stream of water, the right to which is claimed by outside parties. It would seem that the Indian rights are prior and should be supported" (Kelsey, 1906, p. 22). These diversions left the Agua Caliente as the last to receive water from both Whitewater River and Tahquitz Creek. As a result, at times, Agua Caliente did not receive any water from the shared ditch; at other times, they found "dead chickens, cats, and other refuse in the ditch, the water of which we have to drink and use for cooking purposes" (Patencio, 1914, p. 3). Physical and legal water grabbing created water scarcity for the tribe. It dispossessed the Agua Caliente of their customary water use by decreasing their water supply through diversion and contamination (*7-page,* 1915*;* Indian Defense Association of Santa Barbara, 1924; Patencio, 1914).

Fighting for their water sources, they entreated the federal government to recover their water access (Dady, 1935; Indian Defense Association of Santa Barbara, 1924; Patencio, 1914). Indian agents resorted to litigation to gain quantified water allocations for the Agua Caliente under U.S. law (Bauer, 1918; Office of Indian Affairs, 1911). Unfortunately, settlers ignored tribal water allocations and indigenous water scarcity remained (*11-page,*1940). However, the dispossessed water was not enough to support white settler agriculture

production. Seasonal flooding washed out and clogged the Whitewater River's diversions (McManus, 1957). A ten-year drought in 1894, which ceased water flow in the channel, caused early land and water companies to collapse and settler exodus (*7-page*, 1915; *The Indian Land Zoning Controversy in Palm Springs*, 1976). Following this, settlers in the Western Coachella Valley reoriented their land and water use in the early 1900s towards tourism-led urban development, which prompted further water dispossession of the Tahquitz and Andreas Creeks and the mineral hot springs (Bremner, 2022).

Where agricultural production was unattainable in the Western Coachella Valley, it flourished in the Eastern Coachella Valley, where Desert Cahuilla's hand-dug wells demonstrated groundwater availability to settlers seeking land ownership. Homesteading under the Desert Land Act began with a land claim in 1885 on section 23 near present-day Indio (Coachella Valley Water District, 1968). The Eastern Coachella Valley's high water table allowed settlers to reclaim land under the stipulations of the Desert Land Act by accessing the region's groundwater through hydraulic wells (City of Coachella, 2019; Mendenhall, 1909). By 1902 settlers and private companies had drilled over 100 wells (City of Coachella, 2019; Crider, 2018). Five years later, the number of wells quadrupled to 400 (Mendenhall, 1909). At hearings for the Committee on Irrigation of Arid Lands in 1920, Coachella Valley's representative described the region as "almost all patented land. They have artesian water in there. It is limited in amount, but they get enough to patent all of their lands, whether they have enough to irrigate or not." (*Hearings…*, 1920, pp. 52-53). Wells supplied water for profitable agriculture production. Valley farmers grew dates, alfalfa, wheat, cantaloupes, melons, sugar beets, and sweet potatoes for export (City of Coachella, 2019). By 1918, agricultural cultivation had expanded to 8,000 acres [3,200 hectares] (Coachella Valley Water District, 1968). The success of the Valley's irrigated lands increased improved land value (*Hearings…*, 1920; Mendenhall, 1909). Its agriculture became a national priority.

Rapid expansion in agricultural production, irrigation, and groundwater pumping quickly depleted the region's groundwater supply. In 1856, a U.S. surveyor noted that the area's water table was only 10 to 12 feet [~three to three and a half meters] below the surface (Lando & Modesto, 1977). Wasteful settler irrigation practices, including leaving wells uncapped, letting water flow uncontrolled, poorly constructing reservoirs and ditches, and wasting water through evaporation, exacerbated aquifer depletion (Mendenhall, 1909). In 1909, Federal agents reported that well depth measurements taken between April 1905 and April 1907 showed that in the Coachella Valley water basin "in nearly every well the water plane has lowered or the yield has lessened" (Mendenhall, 1909, p. 35). At the Toro Indian reservation water flow had decreased by five miner's inches during that time period.

Aquifer depletion required settlers to dig deeper artesian wells or rely on gas and oil-powered pumps to access groundwater as artesian pressure, flow, and water plane declined. In 1909, federal agents recorded that gas, wind, compressed air, and artesian pressure were used to raise water to the surface for well depths ranging from an 18-foot [~five and a half meters] hand-dug well on the Toro Indian Reserve to artesian wells with depths reaching over 1,000 feet [~300 meters]. Early settlers recounted how the depleted water supply required transforming the mechanics of their well access:

> As wells were drilled in the lower valley, our wells around Indio went down. My family brought in a sand bucket and drilled a larger well and installed a pump. This happened to all wells in this end of the valley. As land developed further down the valley, the farther down we had to go for water. (Coachella Valley Water District, 1968, p. 55)

Expansive settler well drilling and irrigation practices physically dispossessed the Desert Cahuilla of water access through groundwater overdraft., creating life and livelihood-threatening water scarcity. Trapped in place by federal land dispossession and reservation policies, Desert Cahuilla could no longer depend on mobility nor the ingenuity of hand-dug wells to adapt to changing water conditions. The federal government

helped by drilling wells to increase their water access to eleven wells in 1905 (all located at the Torres Reservation) (Mendenhall, 1909).

Even with government assistance, white settlers water access far exceeded Cahuilla, creating both water scarcity and unevenness in access. Desert Cahuilla accessed well water at a 50-person to one well ratio in 1910, while settlers accessed water at a five-person to one well ratio (Jackson and Kinney, 1883; Mendenhall, 1909; U.S. Census Bureau, 1910). Inequity between settler and indigenous water access was exacerbated by the capital-intensive well drilling required due to settler aquifer depletion. In 1924, an inspector for the Department of Interior found seven groundwater pumping plants on the Cabezon, Torres, and Martinez reservations (Palmer, 1924). The water supply was found to be insufficient for their needs and "the Indians are asking for more" (Palmer, 1924, p. 2). However, calculating the cost of irrigating reservation land at US$750,000 and the amount of water needed, the inspector recommended inaction:

> The water requirements would be 50,000 acre feet per annum, so the valley would be using more than twice the water which it is now receiving or can expect to receive at any time until the All-American Canal is built. Therefore, unless there is immediate prospect of the building of the canal, it is useless to consider the development of any of those large allotments, and the only program which the irrigation Office of the Indian Service has in mind is the development of the present wells as far as it appears to be feasible to do so (Palmer, 1924, p. 2).

Settler groundwater pumping left Cahuilla with insufficient water for agricultural production. Without agricultural products to sell, Cahuilla were unable to raise the necessary capital to improve their water access without federal government assistance. Instead, it forced their entrance into the labor market on adjacent agricultural fields. A 1930 report documented that:

> One of the Indians, unable to farm an acre of his own land, now operates a large Ranch for a white man on land contiguous to, or overlapping the reservation, and is paid 100 a month for this expert service (*Preliminary Report*, 1930, p. 2).

Overdraft in the Coachella Valley created Indigenous water scarcity and an uneven and racialized agriculture industry. It resulted in white land having a higher value, access to water, and being agriculturally productive through indigenous labor while Indian land had little value, was fallowed, and dry.

Settler groundwater overdraft in the Coachella Valley dispossessed local Indigenous of water and required expanding the geographic scale of water dispossession. Instead of adjusting irrigation and groundwater pumping practices that would reduce water use and waste, settlers organized politically to form the Coachella Valley County Water District (CVCWD) to help grow agricultural production by protecting their current water sources and dispossessing additional ones (Coachella Valley Water District, 1968; Crider, 2018). Regionally, CVCWD filed for all unappropriated water rights to the Whitewater River System in 1918. This resulted in an adjudication, and subsequent settlement and allocation, that further dispossessed the Agua Caliente tribe of water; leaving them with only enough to water between 40 and 50 cultivatable acres [16 to 20 hectares] (out of the reservation's 10,000 cultivatable acres [4,000 hectares]) (Department of Public Works Division of Water Rights, 1928; Indian Defense Association of Santa Barbara, 1924). At the same time, the District joined Imperial Valley's water-grabbing pursuit of the Colorado River. Representatives successfully entreated the federal government to build a Coachella Branch to the All-American Canal conveying Colorado River water to the Coachella Valley with water rights stipulated under the Colorado Compact of 1922 (*Hearings*, 1920). The Colorado Compact of 1922 and its implemented diversions, including the Coachella Branch of the All-American Canal, dispossessed (and continues to dispossess) Indigenous tribes whose historical use of the Colorado River preceded settlement and the Colorado Compact of 1922 (Curley, 2021; Wilson *et al.*, 2021).

By 1928, wells on tribal land in the Eastern Coachella Valley had run dry from regional overdraft. As representatives from the Coachella Valley worked at the federal level to dispossess Colorado River water through appropriation, Desert Cahuilla in the Eastern Coachella Valley requested the U.S. government help alleviate their water scarcity and thus their dispossession-caused impoverishment:

> We, the Indians of Coachella Valley in Riverside County, California, we are making this petition for want of more water on the reservations, the wells that were drilled many year are now gone dry, many Indians on the reservations have no water now, at Cabazon reservation, the Indians that raised onions this season lost there well because that could not pay for the power bill on account of losing money on the crop the power been cut off next year the Indians won't be able to farm anymore. (Pete *et al.*, 1928)

Two years after their entreaty, they had received little assistance, instead, government agents found their wells "too shallow for the present water level, or equipped with machinery which, in some cases is broken, and in other cases produces [an inadequate] flow" (*Preliminary Report*, 1930, p. 2). The Desert Cahuilla were experiencing a "total starvation for water" (*Preliminary Report*, 1930, p. 2).

Expanded groundwater pumping from the aquifer, prior to Colorado River arrival, further depleted it to a point close to collapse. In CVCWD's 1948 annual fiscal report, the Chief Engineer and Manger, J.H. Snyder warned that overdraft created the "threat of real disaster due to absolute failure of water in wells" (Crider, 2018, p. 41). And yet, with regional knowledge that settlement and related agricultural practices were causing aquifer depletion and water basin overdraft, settlement and pumping increased as farmers waited for the arrival of water from the Colorado River. Snyder reported that although 25,000 acres [10,000 hectares] were under cultivation the region had a "water supply adequate for only 9,000 to 11,000 acres," [3,600 to 4,400 hectares] (Crider, 2018, p. 41).

Water from the Colorado River would arrive to agricultural land in the Coachella Valley in 1948 (Crider, 2018). That same year, a journalist from the *Palm Springs Villager*, found little improvement to water access on the Torres Martinez Reservation. Tribal member Eleanor Levy was quoted saying, "we have no water and we have no machinery and so we have no farms" (Morris, 1948, p. 1). All that remained of the tribe's water access was a shared tin cup for a single, "one-cylinder pump that moves barely enough water to provide the base household needs of the fifty-odd Indians" (Morris, 1948, p. 1). As agricultural production grew throughout the Valley on non-tribal land, continuous groundwater overdraft had dispossessed Cahuilla water access, practices, and use leaving the tribal members who remained on their original homeland impoverished.

The CVCWD, today known as the Coachella Valley Water District (CVWD), has third priority rights[4] to the Colorado River to serve their 137,000 acre [55,000 hectare] territory (Boulder Canyon Project Agreement, 1931; Coachella Valley Water District, 2019). Although tribal land is included in Improvement District 1, the Coachella Valley land delineated for Colorado River water use, CVCWD initially refused to serve water to tribal lands (*Comments of Bureau of Indian Affairs*, 1957). It took congressional intervention for tribal lands in the Coachella Valley to finally receive water from the Colorado River over a decade after the Coachella Canal conveyed the water to the region (An Act to provide for the construction of an irrigation distribution system and drainage works for restricted Indian lands within the Coachella Valley County Water District in Riverside County, California, and for other purposes, 1958; Saund, 1958). Unfortunately, water access came too little too late. The delay in water and infrastructure provision resulted in public water infrastructure access challenges that are ongoing today (Bremner, 2022).

[4] Coachella Valley water allocation was finalized in 2003 with the Quantification Settlement Agreement between the Coachella Valley Water District, Imperial Irrigation District, the Metropolitan Water District, San Diego County Water Authority, the State of California, and the United States, Department of Interior. The Quantification Settlement Agreement establishes the amount of water received by each district from California's allocation of the Colorado River under the 1931 Seven Party Agreement (Crider, 2018). Under this agreement, CVWD has third priority position water rights to the first 3.85 million AFY allocated to California along with and following the Imperial Irrigation District (Water Systems Consulting, Inc., 2021).

Today, the Coachella Valley's groundwater is in a state of perpetual overdraft. CVWD estimates an annual cumulative overdraft of 5.5 million acre-feet [6.8 billion cubic meters] (Native American Rights Fund, 2017). Across the Coachella Valley, city and county governments are approving new water-intensive, leisure-oriented developments (Bremner, 2022). Their approvals are based on the CVWD's water supply calculations that rely on imported water. Sustaining the region and its capacity for growth is only possible because of the water received from the Colorado River and the State Water Project for industrial and recharge use (Water Systems Consulting, Inc., 2021). However, artificial aquifer recharge using imported water provides a false sense of water abundance in the region. The Agua Caliente have engaged CVWD and the Desert Water Authority in a multi-year litigation, arguing to protect their groundwater rights under U.S. law and that artificial recharge from the Colorado River degrades groundwater quality (Bass, 2018; Native American Rights Fund, 2017). At the same time, long-standing, low-income communities, many of whom live on tribal land, lack access to safe potable water and public water infrastructure.

6. Overdraft as water dispossession

Why does it matter that we understand groundwater overdraft as water dispossession? Is it not enough to simply understand the economic and environmental future of regions if overdraft were to continue; a future that points towards aquifer depletion (Bessire, 2021, 2022)? What does dispossession offer us in understanding overdraft and its potential solutions? In the last two sections, I analyzed policy and archival documents, describing how federal, regional, and local land and water policies implemented in the Coachella Valley for U.S. settlement and capital production led to Cahuilla water dispossession and differential water access. I documented the processes that created groundwater overdraft in the Coachella Valley and argued that overdraft is water dispossession (see figure 2). In this section, I describe the theoretical and practice-based importance of analyzing overdraft as dispossession.

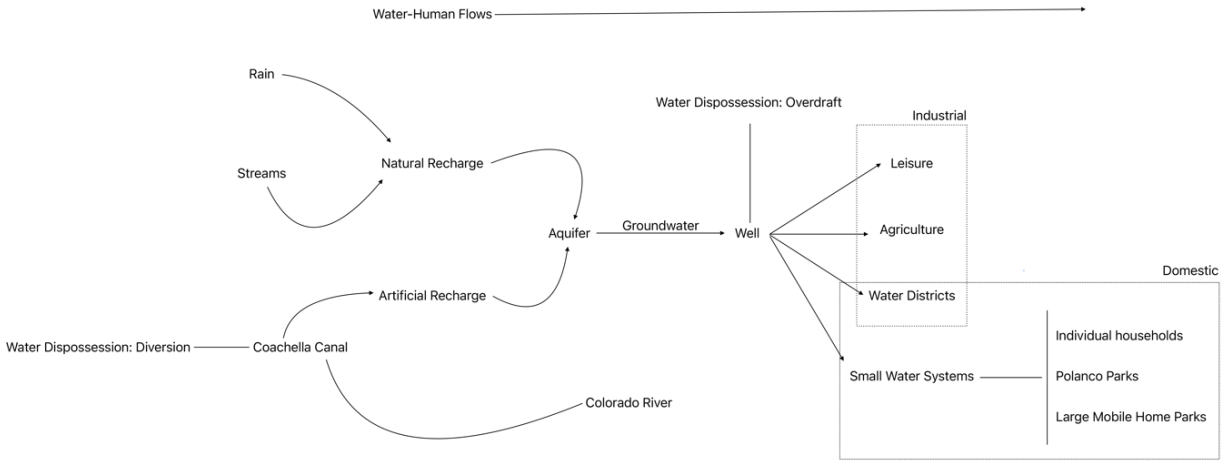


Figure 2: Overdraft and dispossession in the Coachella Valley.

Groundwater overdraft is more than the simple calculation of annual groundwater extraction exceeding annual natural replenishment. In the Coachella Valley, analyzing groundwater overdraft as water dispossession reveals the interlocking of capitalism and settler colonialism through water and land policies. Tracing overdraft as dispossession in the Coachella Valley daylights the structural processes, actors, and policies behind groundwater extraction. It shows that these processes are ongoing, connecting past overdraft to contemporary overdraft, while providing hints towards the spatial future of overdraft and dispossession.

Analyzing overdraft as dispossession showed that U.S. settlement in the Coachella Valley did not only dispossess Cahuilla of land, but, importantly, also of water access. However, overdraft dispossesses much more than just water access. Water scarcity from overdraft led to Cahuilla cultural dispossession. Water disappeared throughout the region as overdraft lowered the groundwater table. Springs vanished and the Cahuilla practice of hand digging wells was no longer possible. Water scarcity inhibited Cahuilla seasonal mobility between water sources and their agricultural practices. As a result, water dispossession forced Cahuilla into the labor market and away from their relationships to the more-than-human.

Groundwater overdraft also dispossesses the more-than-human. Overdraft changed the nature of water in the Coachella Valley. It altered the water cycle. Natural replenishment is never reached due to unbalanced extraction, thus also dispossessing plant and animal life that depends on that cycle. It changes the water itself by degrading the water quality as artificial aquifer recharge pumps the basin with lesser-quality water from the Colorado River. In addition, overdraft changes the underground structure of aquifers (Bessire, 2022), causing subsidence and altering the ground levels above depleted aquifers.

Groundwater overdraft lacks the physical and legal visibility of other water dispossession techniques, such as diversion. Instead, it materializes as a natural consequence of settlement, industrial production, and urban growth. Often, overdraft that is driven by settlement growth and industrial production is viewed as solvable in one of three ways: by strengthening water regulations (Walsh, 2019) and thus existing water rights, by moving industry (Bessire, 2021), or by moving water (Water Systems Consulting, Inc., 2021). These inadequate solutions include acceptance of aquifer depletion as the cost of doing business and the continued dispossession of water from other places through new diversions or through new overdraft. Addressing groundwater overdraft through a lens that naturalizes extraction creates policies that maintain the status quo for water and land use – continued growth and dispossession.

Analyzing groundwater overdraft as dispossession, as I have done in the Coachella Valley, documents how these solutions expand water dispossession to other places through additional forms of dispossession. In the Coachella Valley, overdraft led to continued water dispossession by expanding water rights that appropriated and diverted local (Whitewater River) and regional waterways (Colorado River). These additional forms of water dispossession allowed settlement and industrial production (both agricultural and recreational) to grow, practically unabated. Today, because of water received from the Colorado River and the State Water Project, the region's governing bodies continue to approve new residential and industrial developments as the regional water supply is deemed sufficient for growth. However, this growth fails to address existing and historical water access issues on Cahuilla land and relies on existing and planning future water dispossession vis a vis new, regional diversions (Water Systems Consulting, Inc., 2021).

Analyzing groundwater overdraft as water dispossession points us to very different solutions that go beyond water regulations cloaked as conservation. Instead, a dispossession lens asks us to consider the structural processes at play in local groundwater overdraft; in the case of the Coachella Valley, ongoing settler colonialism and dynamic capitalist production. Overdraft as dispossession requires policy maneuvers for management and restoration that prevent further dispossession. Overdraft as dispossession challenges our expectations around the normalcy and desire for continued growth (of urbanization, capital, production). And overdraft as dispossession requires cultural changes to Western ontologies of human-water relationships.

7. Conclusion

Early U.S. settler well drilling and groundwater pumping in the Eastern Coachella Valley was regulated by federal policies that encouraged water extraction and dispossession. Until the 2014 passage of the Sustainable Groundwater Management Act, groundwater pumping in California remained largely unregulated as a commons (Walsh, 2019). Overdraft is not limited to the Coachella Valley, nor are the intertwined processes that demand it. Groundwater overdraft is widespread throughout California, the United States, and the world (Bessire, 2021; Walsh, 2019).

Water dispossession by overdraft is normalized today with policies that support using imported water, continued and expansive urbanization, and accepting overdraft as the cost of doing business. However, revealing groundwater overdraft as managed water dispossession points to the land and water policies enabling

dispossession. An analysis of overdraft as dispossession requires examining the structural processes and institutional policies that drive groundwater extraction and thus considering the policy solutions necessary to prevent further dispossession (locally and regionally).

Tracing the application of early U.S. settler colonial land policies in the Coachella Valley exposes the designed entanglement between land and water dispossession. In the Coachella Valley water dispossession was a necessity for long-term settler land ownership. And, it was written into federal land policy, the Desert Land Act. Regulations and processes undergirding capitalist and settler colonial expansion that led to groundwater overdraft in the Coachella Valley were also implemented and managed by actors across the Western United States and U.S./Mexico borderlands (Banister, 2011; Curley, 2019; Radonic & Sheridan, 2017; Sheridan, 2006). Settlers across the region employed various forms of water dispossession including water rights, allocation, grabbing, and pollution. In the Coachella Valley, settler groundwater overdraft dispossessed Desert Cahuilla water access leaving a path of ongoing water dispossession and uneven water access that continues today.

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