Against Settler Sustainability:
California's Groundwater as a Vertical Frontier

Abstract

California has been heralded as a beacon of agricultural production and prosperity. Yet the current groundwater crisis is a warning of its impending collapse. In this paper, we argue that policies like California's Sustainable Groundwater Management Act (SGMA) reinscribe the settler state, even as they aim toward environmental sustainability. Drawing from Indigenous feminist scholarship on water and frontier processes, our methodology traces settler colonialism materially and discursively through the movement of water. First, we analyze hydraulic engineering discourses at the turn of the 20th century to illustrate how racial logics were key to producing irrigation - and the broader project of white settlement - as ostensibly benevolent processes of improvement. We then highlight how turn-of-the-century legislation was central to producing agriculture as a site of accumulation by dispossession through the production of settler forms of property and relations with land and water. Finally, we consider groundwater overdraft as a vertical frontier. Thinking with water as an analytic, we unsettle the nexus of relationships that inscribe settler water infrastructures as normative, demonstrating their role as frontier processes within a settler colonial present. Our analysis shows the necessity of dismantling settler modes of sustainability and centering and supporting Indigenous sovereignty.

Highlights

- Hydraulic infrastructures were/are central to the ongoing settler colonial production of private property and agricultural wealth in California.
- Reading water as an analytic (Barker, 2019), we demonstrate the discursive-material settler placemaking of California through the movement of water.
- Groundwater extraction infrastructures, in California's context of extreme groundwater overdraft, can be understood as vertical frontiers.
- Even solutions that rely on private property and settler governance propel the vertical frontier and sustain a settler colonial present.
- Our analysis shows the necessity of dismantling settler modes of sustainability and centering, instead centering Indigenous sovereignty and land rematriation.

Introduction

Groundwater is a vital resource, one that is increasingly understood to be in "crisis." This is particularly true in the settler state of California, where groundwater accounts for an average of thirty percent of the state's total water supply and an even larger proportion in drought years. In regions like the Pajaro Valley, located on California's Central Coast, groundwater reaches ninety-

eight percent of the total annual water use. It is perhaps unsurprising, then, that the Pajaro Valley basin is designated as one of 21 "critically overdrafted" groundwater basins across the state.[1]

Distinct but similarly dire conditions across California prompted the State Legislature to pass the 2014 Sustainable Groundwater Management Act (SGMA). Lauded as the first statewide regulation of groundwater, SGMA provides a roadmap for locally driven sustainable groundwater management policies, enforced at the state-level. SGMA calls for increased collaboration by local actors most impacted by groundwater overdraft, including what the legislation calls "disadvantaged communities," echoing the increasingly global calls for equitable and collaborative approaches to (ground)water management.

Yet in California, local actors include multi-billion-dollar national and global agro-economies. On average, 9.6 million acres of agricultural land are irrigated with roughly 34 million acre-feet of water annually (California Department of Water Resources, 2021), accounting for roughly 85% of the water that is moved across the state through a vast network of dams, canals, pipelines, and pumping stations (Arax, 2019; Worster, 1985). In 2019, over one-third of the vegetables and two-thirds of the fruits and nuts produced in the U.S. were grown in California. That same year, approximately 28 percent of the state's agricultural products were exported globally, generating 27.71 billion dollars in exports alone (California Department of Food and Agriculture, 2020). Given the centrality of groundwater to these lucrative agro-economies, we might ask, what is SGMA charged to sustain?

As scholars living and working on the Central Coast less than 20 miles away from the Pajaro Valley, and whose work variously draws from decolonial and Indigenous feminisms,

[1] This designation identifies basins where the "continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts" (Department of Water Resources (DWR), 1980: 3).

community-centered methodologies, and critical race and ethnic studies, we consider the ways in which even well-intended and urgently needed policies like SGMA reinscribe the settler colonial state and its entangled racial capitalist economies. Drawing from Indigenous feminist activism and scholarship (e.g., (Arvin et al., 2013; Barker, 2019; Byrd, 2011; Sherwood, 2019; Todd, 2017; Tuck and McKenzie, 2015; Yazzie and Baldy, 2018), we problematize SGMA as a solution to California's groundwater "crisis," demonstrating a longer history-present of what might be more aptly described as California's settler colonial groundwater status quo.[2]

Indigenous scholars have long established that colonialism is not part of the past, but rather persists and reinvents itself through time (Byrd et al., 2018; Davis and Todd, 2017; Kauanui, 2018; Whyte, 2018). Our methodology draws on this insight, tracing settler colonialism materially and discursively through the movement of water and connecting the expansion of white settlement in California to contemporary (ground)water infrastructure and management practices. To do so, we first analyze the writings of hydraulic engineers Joseph Nimmo and Elwood Mead, each deemed experts at the turn of the 20th century, to illustrate how racialized discourses were key to producing irrigation - and the broader project of white settlement - as ostensibly benevolent processes of improvement. We then highlight how legislation such as the 1877 Federal Desert Land Act and the 1887 Dawes Act was central to agricultural accumulation by dispossession through the production of settler forms of property and relations with land and water. Finally, we illustrate how these discursive, legal, and material water practices cohere the settler place-making of California.[3] Rather than providing a comprehensive history of water law or use, we aim to demonstrate the

[2] While this article draws from Indigenous and anti-colonial scholarship, it is not decolonial in and of itself. In Tuck and Yang's influential (2012: 1) articulation, decolonial work actively works toward "the repatriation of Indigenous land and life." This project aims to generate support of Indigenous-led decolonization and water justice by working to trace the continuities of settler colonial water work in California. We aim to disrupt settler temporalities that produce an innocent present (e.g., Rifkin, 2017) as well as settler discourses of environmentalism (Cronon, 1996), both of which can be seen as what Tuck and Yang call "moves to innocence."

[3] We thank one of our reviewers for re-articulating the centrality of this method in our paper.

production of now-mundane, normalized water systems as, in fact, ongoing frontier processes that are central to the ongoing project of settler colonialism.

The frontier - often imagined as a spatial marker of "progress" and manifest destiny - has long cohered U.S. settler colonial and imperial projects. Yet Jodi Byrd (Chickasaw Nation) and other Indigenous scholars have theorized frontiers as not only geographic boundaries but rather fragmented, flexible, and extractive *processes* (Byrd, 2015). Following Byrd, we contemporary conditions of groundwater overdraft and trace their continuities with historical processes of frontier-making through hydraulic infrastructure. In doing so, we theorize the ways in which reliance on groundwater - and solutions that remain on the same terms of property and settler governance - function as a vertical frontier.

Part of settler colonialism's power is in the way it produces practices and processes as "common-sense." Thus, we conclude our analysis by illuminating how mundane and even lauded policies like SGMA remain predicated on entangled technologies of frontier-making, racial capitalism, and settler colonialism.[4] Though these logics may be less explicit in SGMA's bureaucratic language, we highlight the continuities of historical hydraulic work and contemporary groundwater overdraft to show how settler colonialism continues to inform notions of sustainability today. We consider the necessity of moving away from settler modes of sustainability that will only sustain the same conditions that created our current groundwater crisis.

[4] Throughout this paper, when we reference settler colonialism, we also think with the racial capitalist economies that propel it. Following the work of Lisa Lowe (2015), Grace Hong (2012), Iyko Day (2016), and many others, we understand settler colonialism as constitutively entangled with racial capitalism (Robinson, 1983). While settler colonialism requires the dispossession of Indigenous nations to accumulate land, it also requires the production of racialized difference. As Jodi Melamed (2015: 77) explains, capitalism requires "loss, disposability, and the unequal differentiation of human value, and racism enshrines the inequalities that capitalism requires." Settler colonialism and racial capitalism, therefore, work together to produce white property and capital accumulation.

Indigenous Feminist Readings of Water in Settler Colonial Frontiers

> "...given the realities of catastrophic contamination and destruction, water shows us the intricacies and intimacies of imperial violence" (Barker, 2019: 6).

What stories does water tell? In particular, what do water infrastructure, policies, and practices in the U.S. reveal about the ongoing project of settler colonialism? Following the insights of Joanne Barker (Lenape, citizen of the Delaware Tribe of Indians), we surface some of the "intricacies and intimacies of imperial violence" by tracing the movement of water "as an analytic" (Barker, 2019: 6). Below, we highlight some of the Indigenous feminist theorizing that informs our conceptualization of water as central to the ongoing (re)making of settler colonial frontiers.

As many scholars, including Bang et al (2014) and Tuck and McKenzie (2015), remind us, whenever we are talking about land, we are also referring to the waters, airs, Indigenous nations, and more-than-human-beings that are inextricably connected to that land. While specific teachings about water vary across Indigenous cultures (Barker, 2019), water is still often understood beyond the bounds of Western epistemologies: as a relative with agency within networks of land-air-water-and-life, as a being in and of itself that deserves respect, care, and protection (Sepulveda, 2018; Yazzie and Baldy, 2018). In the words of Zoe Todd (2017), some of the most recent and broadly amplified struggles for decolonization, such as the movement to protect the Standing Rock Reservation from oil pipelines, demonstrate how Indigenous politics is indeed, "embedded in watery worlds" with our "water kin" (Todd, 2017: 1).

Western epistemologies, however, narrow water to a mere resource or scientific object (Barker, 2019; Linton, 2010; Todd, 2017), flattening and excluding water's constitutive relations with land, peoples, and multi-species networks. One of the key features of settler colonialism as an ideological, political, and economic project is not only the occupation of Indigenous lands by

white settlers as a mechanism to generate (stolen) wealth, but also the conceptual *separation* of land and water. Across California, the movement of water remains central to the transformation of once arid or inundated land into beacons of profitable agriculture. Thinking with water as an analytic, then, allows us to unsettle the nexus of relationships that inscribes these settler placemakings as normative (Tuck and McKenzie, 2015).

In the language of SGMA, "disadvantaged communities" - defined to include Indigenous nations - are ostensibly brought *into* local processes to shape the formation of groundwater sustainability plans. However, as Barker reminds us, "without an accounting of imperialism and colonialism, the "system of oppression" that is imagined reinforces the state as a settled structure" ((2019: 13). We aim to unsettle the "settled structure" of statewide groundwater governance by showing how water has been central to the (re)production of settler frontiers. In doing so, we hope to contribute to growing water justice approaches that center Indigenous self-determination.

Our methodology illustrates the ways in which discursive, legal and material hydraulic practices work together to uphold and propel the project of settler colonialism. Within the United States, notions of the frontier have been central to this political work (e.g., Turner, 1894). Critical Indigenous studies insists that the frontier is not simply the progression of the U.S.'s settlement across empty lands, but rather a series of violent international boundaries between the U.S. and Indigenous nations ((Byrd, 2015; Deloria, 1988; Hurtado, 1990; Karuka, 2019). Frontiers have also been theorized as colonial imaginations of a divide between the prosperity of private property and the deprivations of a presumed "wilderness" (Bhandar, 2018; Moreton-Robinson, 2015).

Frontiers are also sites of accumulation by dispossession, examples of Harvey's (2004) "spatial fix." Glen Coulthard (Yellowknives Dene, 2014) clarifies the colonial-capitalist relation within settler contexts as one of both dispossession and enclosure: a consistent process of

accumulation by dispossession. That is, the dispossession of Indigenous people from their territories opens new resources for privatization and produces labor markets for racialized laborers. In response to capitalism's consistent need for spatio-temporal fixes, the frontier, characterized by "geographical expansion and spatial reorganization" (Harvey, 2004: 63), becomes one such option.

We find Jodi Byrd's (2015) formulation of the frontier as a process particularly compelling because it tracks the work of frontiers as fragmented, flexible, and ongoing processes. Following Byrd, we thread together examples that demonstrate the expansion of frontier processes from an accumulation of existing land to the literal *production of* land - and making land 'productive' - through the addition or removal of water.[5] Our analysis demonstrates how racialized discourses and legislation underwrote the material remaking of place through late 19th and early 20th century water work. We illustrate that Indigenous dispossession was intimately tied to the remaking of water for settler agricultural practices and property ownership, showing connections between these historic processes and the ongoing production of vertical hydraulic frontiers through groundwater overdraft and seemingly progressive responses like SGMA.[6]

Water and the Propagation of Frontiers

Here, we analyze late 19th-century primary texts, legislation, and hydraulic practices that highlight the reproduction of the frontier through a white settler agriculturalist imaginary. We show the entanglements of water with settler world-making, in which lands, peoples, and relations

[5] To be sure, here and throughout the paper we critique settler desires for land as 'productive' in service of racial capital and colonial accumulation.

[6] This is not to negate the overt violence that was central to white settlement (see Madley, 2016). Instead, we interrogate ostensibly 'progressive' water management practices precisely because they disavow the same violent relationships to land, waterways, and Indigenous peoples that they normalize.

are re-configured to facilitate the ongoing production of the settler state. This section develops three themes: (1) racialized discourses and water in reclamation; (2) legislating accumulation by dispossession; and (3) water and settler place-making in California. Each of these examples provides unique insights into settler colonial world-making through hydraulic practices.

Discourses of reclamation

In the late 19th and early 20th centuries, reclamation discourses argued that white settlers could - and should - reclaim the land from its previous state of "wildness" by extracting profit from it (Igler, 2005; Worster, 1985).[7] The work of Elwood Mead and Joseph Nimmo, both recognized hydraulic engineering experts of their time, is a useful place to trace discourses of American imperialism through reclamation, and the centrality of hydraulic infrastructure to that work.[8] They show that the transformation of land through reclamation was never only an ecological process but also a profoundly racializing and gendering one. As we show, their writings also register a sense of both anxiety and settler benevolence in the propagation of the frontier.

Elwood Mead was an internationally recognized expert on hydraulic engineering at the turn of the 20th century, serving as the Chief Engineer of Hoover Dam and later as the Commissioner of the Bureau of Reclamation (Rook 2000). His early career developed in California, during which he experimented with developing irrigated colonies to induce white agricultural settlements. Joseph Nimmo is less well known, but in the late 19th century, he was considered a U.S. expert on irrigation. A civil engineer, government statistician, and eventual Chief of the Bureau of

[7]The idea of wilderness itself reflects a settler world view and division of people/nature, further erasing Indigenous sovereignty by characterizing land as otherwise untouched by humans (Cronon, 1996).

[8] In fact, Nimmo is one of the primary sources that Donald Worster uses in his canonical text, *Rivers of Empire,* to articulate American dreams of U.S. imperialism through hydraulic infrastructure. In our reading of both Nimmo and Mead, we aim not to single them out but rather to describe the prevalent logics of reclamation at the time.

Statistics, Nimmo also narrated settlement and westward expansion through settler discourses of progress.

In 1890, Nimmo wrote a series of articles in the popular publication *Frank Leslie's Illustrated Newspaper*, entitled "Uncle Sam's Farm: The Reclamation of the Arid Region of the United States by Means of Irrigation" (Nimmo, 1890). Labeled a "Thanksgiving Series," Nimmo's articles grapple with anxieties over the frontier's closure and articulate an agriculturalist vision of the West driven by irrigation to prosperity. Nimmo uses this imagination of prosperity to justify white settlement and land acquisition, racializing Indigenous people as "barbarians" in contrast. As he writes, "The Indian never was a proprietor of the soil, and to the present day he scorns the idea of property in the soil. Land ownership is an affront to the barbarian" (Nimmo, 1890: 41). He further frames "purchase and negotiation" as the "proper" form of relating to land and as such, stakes a white settler claim to the U.S. West (Nimmo, 1890: 41).

Writing almost 30 years after Nimmo, Mead's (1920) book, *Helping Men Own Farms,* similarly lays out the importance of irrigation. Rather than focusing on Indigeneity, however, he emphasizes the maintenance of whiteness in the U.S. West against the threats of racialized farm labor. He describes the "urgent need of creating in the country a sound community life, where healthy vigorous American children would flourish, and thus lessen the menace of growing industrial unrest in the cities and the creation of an alien oriental tenantry in the country" (Mead, 1920: 2). The urgency of his description arises from alarm at "only a sprinkling of the white race among the farm workers, the remainder being aliens - Japanese, Chinese, Hindoos (sic), Portuguese, Armenians, Italians, and Mexicans" (Mead, 1920: 130). For Mead, the solution was to enhance the ability of *white* Americans to own farms.

Numerous genealogies of critical race and anti-colonial scholarship have articulated the role of racialization within colonial contexts in justifying the supremacy of Western or settler law, relationships to land as property, and white/European, cis-gender, property-owning men as the proper and ideal citizen-human-subjects (Deloria, 1988; Lowe, 2015; Moreton-Robinson, 2015; TallBear, 2013; Wynter, 2003). The work of Mead, Nimmo, and other writers of the time reflects the complex co-constitutions of racialization and the production of "civilized" landscapes specifically.

Nimmo's writings show the way in which Indigenous peoples were positioned as inferior through their refusal of private property relations (Moreton-Robinson, 2015). If property entailed producing the white settler as a liberal subject, then the absence of property produced Indigeneity as a racialized other. As he writes,

> "The hopelessness of converting the Indian into an agriculturalist by the reservation plan is becoming more and more apparent, and it seems also to be certain that he will never become a worker, or a useful member of society, until, under proper protection, he is brought closely in contact with the influences of civilized life, and until he has ceased to be a mere encumberer of a large and fair portion of the national domain, which in the course of a few years will be reclaimed by the art of irrigation" (Nimmo, 1890: 42).

Nimmo's characterization of Indigenous people as "barbarian" must be understood not as incidental, but instead normalizing relationships to land (i.e., property) that give primacy to white settlers. Mead's writing, in contrast, shows a different valence of racialization: while Nimmo describes settler claims to property as a civilizing force, Mead is concerned about the threat of "Oriental farmers or other aliens" (5) buying land that, for him, *should* be owned by white farmers: "the finest type of American citizen this nation had produced" (Mead 5). But both Nimmo and Mead position Indigenous peoples and racialized groups "in sorry contrast" (Mead 1920 5) to

white settlers, showing the work of racial capitalism in producing racialized difference in order to rationalize the severe inequalities that capital requires (Melamed, 2015).

Both also show the work of water in consolidating a range of affective dimensions, encoding anxieties and desires around the emergence of the U.S. state and the liberal subject. Scholars have articulated the affective valences of the "closure of the frontier" at the turn of the 19th century (Cronon, 1987; Turner, 1894): if the frontier had been central to the development of American identity and individual Americans' subject formation, what did this mean for the settler nation's future? Nimmo and Mead each grapple with these concerns, showing the entangled anxieties and desires to which hydraulic frontiers responded.

For instance, Nimmo argues that bringing water to the West is a necessary step for the forces of civilization that "neither savage nor nomad can resist" (Nimmo, 1890: 13). According to Nimmo, even the rugged cowboy, a paramount icon of the frontier, will be "forced to the confession" that agriculture is the future of the American tradition: an inevitable if not desirable process (Nimmo, 1890: 13). His narration of the frontier as an evolutionary procession from "savage" to "cowboy" to "agriculturalist" imagines a temporal break between overt anti-Indigenous violence and a purportedly peaceful, "wise and beneficent" project of irrigated agriculture (Nimmo, 1890: 7). Yet irrigation was not a clean break from previous forms of settlement. Instead, it provided new methods to extract value from the land, extending settler colonial violence by securing white settlement through seemingly less violent means.

Similarly, Mead's writing is propelled by an overarching sense of anxiety over the impact of racialized groups on the US West. As he writes, "if the self-respecting intelligent American farm workers are driven from this country and replaced by people who have no social pride and no interest in public questions, then the rural voter of the future will be a national danger" (Mead,

1920: 133). For him, the antidote to this "national danger" is to increase irrigation in arid regions, incentivizing small, family-run farms, and restricting farm ownership to white families. In a 1929 article, he proudly reports that "about 80% of all water users on the Federal irrigations projects were born in America" (Mead, 1929: 129). While Nimmo positions irrigation as a benevolent act, an "influence of civilized life," Mead similarly situates irrigation as necessary to create "good roads, good schools, and good government" and "the hopeful independent spirit that marked the early life of this State" (Mead, 1920: 134).

As Arvin et al. (2013: 14) describe, Indigenous feminists show "the consistency and thus naturalization of heteropatriarchy and heteropaternalism" as a "relentless" feature of settler colonialism. As they write, heteropatriarchy shapes not only "proper" forms of sexuality and family, but also produces "a citizenry that will support and bolster the nation-state" (Arvin et al., 2013: 14). And, indeed, heteronormative gender and sexuality are central to both Nimmo and Mead's visions. For Mead, proper farm labor required binary gender roles and the nuclear family. As he wrote, for instance, "The fitness of the wife should probably have the same attention as the experience and character of the husband…the cheer and courage of the wife and mother is such a large factor in success that more must be done to fit her for her part in the enterprise" (Mead, 1920: 183–184).

Similarly, Nimmo's articles reproduce tropes that are simultaneously gendered and racialized, such that the emasculation of Indigenous men is core to their racialization as inferior. As he writes, "the Indian daily loses his self-respect while eating the bread of charity, which is invariably destructive of the very fibre of manhood in Indian and white man alike" (Nimmo, 1890: 42). Nimmo's accusation of disinterest in plowing registers a refusal to participate in Western systems of production, which he reads as laziness or idleness and extends to a racialized and

gendered sense of inferiority. Yet in this passage we also see a hint that white men could also be emasculated through taking the bread of charity, echoing the latent anxieties over the solidity of white masculinity at the closure of the frontier. From Nimmo and Mead's writing we see both the reproductive and emotional labor of women, and the simultaneous stabilization of settler masculinity.

Both Mead and Nimmo premise racial, gendered and sexualized distinctions on differential relationships to property and labor. Yet private property - and agricultural fields on which to labor - did not always-already exist, either discursively or materially. Instead, land as property had to be made: the movement of water literally produced the arable land that was then parceled into private property (Dillon, 2021). In the following section, we review legislation that propelled the production of private property through hydraulic infrastructure.

Legislating Accumulation by Dispossession

Though hydraulic engineers and political leaders like Nimmo and Mead framed reclamation as a benevolent project, it was in fact a process of accumulation by dispossession, which necessitated both the violent displacement of Indigenous peoples and the devaluation of racialized labor to facilitate white settlement and capital accumulation (Coulthard, 2014; Day, 2016; Wolfe, 2016). In California specifically, reclamation not only irrigated dry lands, but drained the wetlands and shallow lakes that originally characterized the Central Valley. Legally and legislatively, both irrigation and draining became part of the formal policy mechanisms that shifted public lands into private property to be sold and taxed.

In this section, we focus on the 1877 Federal Desert Land Act and the 1887 Dawes Act. While the former incentivized irrigation, and the latter privatized Indigenous lands, they worked

together to produce ongoing frontiers of settler expansion and agricultural production. Even if the international frontier had already reached the Pacific, producing newly tillable land through the development of dams, canals, and complex drainage systems and through narrow definitions of Indigeneity, became ways that frontier processes could continue to function at the edges of wetlands, deserts, and reservation lands as a kind of "spatial fix" (Harvey, 2004).

The 1877 Federal Desert Land Act, sponsored by California Senator Aaron Sargent, amended the 1862 Homestead Act and allowed for the discounted sale of public desert lands to white settlers in exchange for irrigating that land It also expanded the maximum land allowable from 160 acres to 640 acres and didn't include a residency requirement, which resulted in extensive land fraud including, for instance, claims filed by "dummy men" hired by large landowners (Ganoe, 1937). Alongside a series of federal and state Swampland Acts, the Desert Land Act was responsible for patenting vast tracts of land - including, for instance, California's Imperial Valley.

By incentivizing settlers to build irrigation systems and drain wetlands, this legislation in effect created new frontiers at the edges of wetlands, lakes, and deserts. This process was explicitly seen as a "spatial fix," providing a potential outlet for labor surpluses from the Industrial East. For instance, William Smythe, a major East Coast proponent of irrigation, wrote in 1905: "No other part of the Republic can possibly compete with [the West] as an outlet for surplus population….It is here that the Nation is to find the means of relief from many of the perils that encompass it" (Smythe, 1905: 327, quoted in Worster, 1985: 122). Smythe was a proponent of centralizing of capital because he believed its superior efficiency would better position the U.S. as a growing imperial power. However, he was concerned about the potential human surplus that might result. The irrigated West provided a solution: "redundant Americans could simply head west and find an irrigated farm, returning to the soil as earlier generations had done, and win their stake in life"

(Worster, 1985: 122). Smythe was not alone: Mead also saw irrigation as a way to "lessen the menace of growing industrial unrest in the cities" (Mead, 1920: 2).

In addition to reclamation legislation, the 1887 Dawes Act was also central to the transformation of land through irrigation and agriculture. In essence, the Dawes Act subdivided reservation lands into privately owned allotments premised on transforming Indigenous relationships with land into European forms of agriculture and private property. While federal definitions of Indigeneity have shifted, including frameworks based tribal affiliation or matrilineal or patrilineal descent, the Dawes Act in part relied on ideas of blood quantum to define Indigeneity, itself a settler-defined, racialized metric that contradicts complex notions of Indigenous kinship (Spruhan 2007; Simpson, 2014; TallBear, 2013). The Dawes Act excluded many Indigenous peoples from claiming allotted land. As a result, Indigenous peoples lost control of two thirds (100 million acres) of the land and connected surface and groundwater basins they held in 1887 (Aoki and Haynie, 2000). Jodi Byrd (2015) has articulated the ways in which the Dawes Act also worked as a frontier process, opening lands around the edges of reservations for white settlement as the US frontier was reaching the Pacific. As we will see in the next section, the Dawes Act also became a crucial part of California's ability to amass the land necessary for the 1960 State Water Project.

Drawing on such assumptions of land use, a 1908 Supreme Court case, *Winters v. U.S.*, provided that the reservation of public land for Indigenous reservations also implicitly reserved sufficient water to carry out the reservation's purpose: namely, agriculture. Water rights were therefore allotted based on irrigable acreage (Curley, 2019a). However, most of these rights remained "on paper" and Indigenous peoples were still excluded from claiming surface water sources.

Ultimately, these pieces of legislation released more land (and water rights) for white settlers to own through imagery of the promise (and benevolence, as discussed above) of agriculture. While irrigation and draining created new frontiers of arable land, the Dawes Act worked to make more land available for the human "surpluses" of the settler state; both processes became another way of propagating frontier processes after Turner's frontier met the Pacific. Fragmented and flexible, the frontier was no longer an exclusively Western-moving boundary, but instead extended accumulation through dispossession around the edges of wetlands, deserts, and reservation lands.

Water and the Settler Place-Making of California

The importance of water to emergent property regimes was not only legal and discursive, but also material. After the U.S. annexed California and much of the Southwest at the end of the Mexican-American war in 1848, vast tracts of land were deemed public property (Almaguer, 2008). The Gold Rush first catalyzed large-scale white settlement and wealth accumulation in California. Within a few decades, however, people saw that the real gold was within the land and, more specifically, in the transformation of land for agriculture (Igler, 2005).[9] The movement of water through hydraulic infrastructures became a key mode of transferring that land into private ownership by draining the Central Valley's large lakes, leveling earth using equipment specifically developed for that purpose such as the Fresno Scraper, and excavating thousands of miles of ditches and canals (Igler, 2005; Worster, 1985). California would continue to build dams, canals, and pumping stations over the next 50 years.

[9] As Nimmo narrates, "Thus a wealth of soil was discovered far in excess of the wealth of mine, and within the last year the important fact has dawned upon the country that the reclamation of the agricultural lands of the arid region opens up the last, and perhaps the most important chapter in the history of the subjugation of wild lands to the uses of civilized man upon this continent" (Nimmo, 1890: 14).

Just after statehood, U.S. representatives negotiated 18 treaties with Indigenous groups that would have set aside 7.5 million square acres of land for reservations. Yet, under pressure from California state officials, the U.S. Congress never ratified the treaties, instead keeping them secret for decades. Therefore, even though the Dawes Act fractionated land and disrupted tribal governance, it also - in California - "actually represented one opportunity to have rights recognized to a small part of one's homeland" by offering individual ownership of allotments (Middleton-Manning, 2018: 19).

As scholar Beth Rose Middleton Manning describes, many of those allotments were subsequently leased, sold, or lost to white ownership through a range of means including outright cancellation or 'condemning' of allotments without compensation (Palmer, 2011; Poindexter, 1994). As she shows,

> "Maidu allotment lands in particular...eventually became the headwaters of the massive California SWP [State Water Project], and other Indian allotments around the state were flooded for other reservoirs and the Federal Water Project, including Wintu lands now under Shasta Lake and Pit River lands now flooded by the system of dams and reservoirs along the Pit River" (Middleton-Manning, 2018: 19).[10]

To pay for these irrigation projects, the government used the proceeds from the sale of "public" lands to fill an "arid land reclamation fund," used exclusively to build dams, reservoirs, and other hydraulic infrastructure (Middleton-Manning et al., 2018: 176). In other words, legislation that claimed Indigenous lands as 'public' U.S. lands and then sold that land created the revenue for hydraulic engineering projects that enabled both irrigation and draining.

Today, state governments are eager to resolve existing *Winters* water claims because they date to the initial creation of the reservation. In most cases, this gives Indigenous nations' water

[10] Completed in the mid-20th century, the State Water Project dams major rivers in northern California and channels that water to the agriculture of the Central Valley and the population centers of Los Angeles and southern California.

rights claims seniority under appropriative rights systems. Settlement of these claims has become the primary mechanism for Indigenous nations to actualize their "paper" rights. Yet, as Andrew Curley (2019a: 60) importantly highlights, *Winters* claims are also "colonial mechanisms meant to minimize Indigenous water rights." For example, the 1963 Supreme Court decision of *Arizona v California,* calculated water rights for five Indigenous nations relying on the Colorado river based on the irrigable acreage within the reservations. In 1977, the Court returned to consider the case again, because the 1963 calculations were smaller than the true amount of irrigable acreage and the Tribes, therefore, were entitled to almost 300,000 more acre-feet of water per year (Florio, 1983). The majority opinion concluded that, though they had the power to step in, they would choose *not* to, prioritizing finality over equitability. This shows that water settlements, though often the only practicable modes for Indigenous nations to claim water rights within settler legal frameworks, also constrain and minimize Indigenous water rights. As such, Curley situates water settlements as "part of one of the last great enclosures on the continent" (Curley, 2019b: 2).

Since then, the applicability of the *Winters* doctrine to groundwater has been an open question. In 2017, however, the Ninth Circuit Court of Appeals ruled in favor of the Agua Caliente Tribe of Cahuilla Indians in a suit they brought against two California state water agencies (Zablan, 2018). The Agua Caliente reservation is in the Coachella Valley, a hot and arid environment reliant on groundwater. The aquifer has long been overdrafted, so in recent years, water management agencies have recharged it with surface water from the State Water Project and the Colorado River. This surface water's lower quality degraded the entire Coachella Groundwater Basin, and the Agua Caliente Tribe sued to protect it from further contamination. The Court decided that groundwater underlying the reservation was governed by the *Winters* doctrine, but this decision's impact on groundwater rights in the rest of the state remains to be seen.

The disruption of environmental functioning through settler reclamation projects likewise remains part of the ongoing dispossession of Indigenous peoples. Both irrigation and wetland draining made traditional Indigenous lifeways even more inaccessible, forcing survivors to reservations or into exploitative labor relations with settler economies (Hurtado, 1990). This disruption continues into the present day. Charles Sepulveda (Tongva and Acjachemen, 2018), for instance, describes the "domestication" of the Santa Ana River, the largest riparian system in Southern California, through channelization and concrete overlays. Today, the river contains primarily summer runoff and municipal wastewater. Centering Acjachemen and Tongva understandings of lands and waters, Sepulveda (2018: 39) theorizes the parallels between "Western dynamic[s] of submission" of lands and waters and the colonial logics of heteropatriarchal domestication of Indigenous women.

Ultimately, these examples show the work of water within the propagation of frontiers as flexible, fragmented processes of accumulation by dispossession. Hydraulic engineering practices were not only the legal prerequisites for white property ownership; they also created frontiers of land on which California's lucrative agricultural economies remain fiercely defended today.

Tracing water as an analytic, as Barker suggests, shows the systems of power at work in both the flexibility of accumulation through dispossession and the racialized devaluation of Indigenous groups. Further, tracing the work of water highlights the entangled anxieties, hopes, and ideas of benevolence that propelled Nimmo and Mead's racialized discourses; legislation such as the Dawes Act and Desert Land Act; and settler placemaking of California itself. If the closure of the frontier produced anxieties over the future of the emergent U.S. settler colonial state, then the forms of benevolence generated through irrigation discourses served as a recuperative response. Yet these forms of irrigated hope and benevolence also required the dispossession and

disruption of Indigenous lives and lifeways as well as the racialization and exploitation of farm labor.

Following the weaponization of water also connects these frontier processes to contemporary ground(water) policy and practice in California. In what follows, we return to SGMA as a contemporary response to groundwater scarcity in order to show that similar engines of anxiety and hope, set within the settler colonial present, continue to produce new frontier processes of accumulation by dispossession.

What does SGMA Sustain? Groundwater as a Vertical Frontier

Thus far, we have traced the role of water in the historic but ongoing production of racial capitalist agricultural economies, at once a symbol and material effect of settler colonial imaginations of progress. Water was crucial to extending and elaborating modes of settler frontier making through accumulation by dispossession. From this vantage point, new technologies that expand groundwater extraction – and profit from its increasing insecurities – demonstrate the fragmented continuity of water in frontier-making. Here, we expand on groundwater extraction as a vertical frontier by highlighting the continuities between the 19th century hydraulic frontier-making projects that produced contemporary groundwater scarcity and 21st century innovations that aim to maintain and even expand this system's reach.

Across California's Central Valley, along major trucking routes that transport the region's agricultural products across the state and nation, signs like "California's Future Depends on Water: Build Dams Now" position water as central to a California future of economic and agricultural abundance. With phrases like "Is growing food a waste of water?" or "Save California's WATER: build more dam storage," written in large, bright writing flashy enough to catch a speeding driver's

eye, these signs frame expanding hydraulic infrastructure as a common-sense solution to the arid region's reliance on overdrafted groundwater basins. Funded by "Families Protecting the Valley," who condemn both the emergence of predatory water markets and water conservationists for exacerbating the plight of farms hard-hit by the water crisis, these signs also speak to water's centrality in maintaining precarious agricultural economies (Keulertz et al., 2018). Just as Nimmo and Mead proposed agriculture as a superior way relating to land, these signs play on common-sense understandings of agriculture as not only a necessary but beneficial use of water.

Groundwater has long been used in California to meet water budgets and, therefore, has been a central feature of settler colonialism through its ability to produce lucrative agricultural economies. Today, extracting groundwater from increasing depths has become a vertical "spatial fix"[11] to go beyond existing resource limitations and extract new forms of profit, even amidst widespread acknowledgement of dire groundwater over-extraction across the state (Department of Water Resources (DWR), 2014; Keats and Tu, 2015; Niles and Wagner, 2017). In the urgency to maintain agricultural output, farmers are drilling deeper and more expensive wells each year and planting higher-value (yet water-intensive) crops like nuts to pay off the resultant debt (Arax, 2019).

Now, as policy makers and the broader public acknowledge the groundwater crisis, money is being poured into improving technologies to sense and predict remaining untapped groundwater aquifers (e.g., Fairbairn et al., 2020). If, historically, processes of frontier-making opened new resources for extraction and produced new social structures through which capital could circulate,

[11] We use the terms horizontal and vertical as spatial heuristics, but don't mean to imply that surface water and its infrastructures only function horizontally or that groundwater infrastructure only functions vertically. We understand vertical frontier-making processes to include the same multi-faceted aspects as the historical examples we've analyzed.

we can similarly understand the emphasis on groundwater extraction technologies today as a vertical extension of frontier-making practices.

In 2014, California's Sustainable Groundwater Management Act - the state's first comprehensive groundwater legislation - recognized the critical condition of California groundwater basins, perhaps signalling the "closure" of this long-profitable vertical frontier. Yet SGMA shows the ways that settler colonial logics reinvent themselves even *through* crises. Even though SGMA explicitly aims to remedy unsustainable groundwater extraction, it also further sustains colonial practices of large-scale agriculture and water use.

For instance, a key lauded feature of the policy is its emphasis on local decision-making and equitability, tasking communities implement plans for local groundwater management. It specifically mandates consultation with "disadvantaged communities," a category which includes racialized farmworkers and Indigenous nations. In doing so, SGMA undermine Indigenous sovereignty by defining them as marginalized subjects of the settler state (Byrd, 2011; Coulthard, 2014). As other scholars have shown, the category of "disadvantaged community" can also function to symbolically include low-income communities and Indigenous nations while reifying governance structures that systematically exclude them (Dobbin and Lubell, 2019; MacLeod and Méndez-Barrientos, 2019).

Thus, SGMA works to produce a sense of benevolence by performing inclusion while undermining Indigenous sovereignty and perpetuating basic aspects of procedural injustice. It also prioritizes data collection and technical solutions, rather than holistic changes to relationships to land or water. SGMA explicitly does not override existing water rights and upholds existing colonial economies and relationships to land. Therefore, further infrastructure development becomes one of the law's primary tools to sustain current groundwater levels in already over-

extracted areas. To expand on this analysis, we consider the impacts of SGMA's mandate in the Pajaro Valley, a region just south of where we live and work where vertical frontier-making is particularly clear.

On California's Central Coast, fertile soils and a range of microclimates generate a multi-billion-dollar economy through the production of berries, lettuces, celery, spinach, broccoli, and other high-value crops (Hanson et al., 2014). In the Pajaro Valley, 98% of water use is groundwater; users annually pump almost twice as much as the groundwater basin's sustainable yield (Rudestam and Langridge, 2014). It is not a surprise, then, that this region is also among the state's critically overdrafted groundwater basins (Department of Water Resources (DWR), 1980, 2014). Decades of groundwater over-extraction have accelerated coastal seawater intrusion, a process in which seawater moves inland and contaminates aquifers. This includes the drinking water supplies of local communities, some of whom are low-income communities of color whose underpaid labor underwrites these lucrative economies (Rudestam et al., 2018).

As a result, local municipalities, farm owners, and state agencies are developing hydraulic technologies to maintain both agricultural yields and groundwater supply. The Pajaro Valley Water Management Agency (PVWMA) is investing in multi-million-dollar infrastructure designed, in part, to deliver recycled and alternative water supplies to nearby farmland. This includes a major pump and pipeline system that siphons freshwater from a slough upstream. A tangent pipeline brings recycled water from a residential area; recycled water, slough water, and a small percentage of groundwater are mixed and then pumped through 21 miles of pipeline, irrigating strawberry fields covering rolling sand dunes (Hanson et al., 2014; Pajaro Valley Water Management Agency, 2014). This project maintains the vertical frontier of groundwater availability; it provides necessary water to avoid further depleting groundwater supplies or requiring farmers to fallow

fields. Instead, it pulls water horizontally through a complex system of pipes to maintain groundwater supply across the valley and maintain capital accumulation on highly profitable farmlands.

Not only are people investing in groundwater infrastructure, but they are also investing in the uncertainty of groundwater itself. Heightened speculation - and the potential to profit off water uncertainties - is the most recent iteration of hyper-accumulative logics within an already collapsing system. As Fairbairn et al. (2020) articulate in a case study of Harvard's recent land acquisition in the Cuyama Valley, the financialization of water means that investors can profit from the *uncertainty* of groundwater levels through investment products such as groundwater futures. Here, not only does groundwater itself serve as a "fix" to maintain agricultural profitability, but *knowledge* about untapped groundwater also represents a new zone of capital accumulation. It also serves as the foundation for increasing technological investments, innovation, and the movement of capital through industries of scientific measurement, drilling, and extraction (Bakker, 2010; Fairbairn et al., 2020).

Investments in water futures also highlights the various affective dimensions that propel these vertical frontiers. Fairbairn et al. (2020) describe the "pleasures" that are central to the speculative economies of high-risk investments, in which investors gamble to extract more profit through groundwater futures, perhaps hearkening to the feelings of hope or progress articulated by Nimmo and Mead. In contrast, profound anxieties about water scarcity and drought, much like anxieties over the frontier's closure in the 19th century, continue to motivate legislation like SGMA and investments in groundwater extraction technologies.

If, as we argue, SGMA sustains agricultural *economies* rather than sustaining groundwater, it also sustains these economies' racialized labor systems. Even as Nimmo and Mead framed the

importance of water within the maintenance of white settler superiority, groundwater extraction today propels an industry that has always required the racialized exploitation of farmworkers, including Japanese, Chinese, Filipinx, Hmong, Mexican, Central American, Laotian, Vietnamese, and Indigenous peoples, in different periods of the state's history (Almaguer, 2008; Bardacke, 2012; De Ruiz, 1993; Hurtado, 1990).[12] From the 19th century to today, racialization through relationships to water and land remains a key tool of settler colonial frontier making.

Conceptualizing groundwater as a vertical frontier of accumulation by dispossession shows that groundwater scarcity and contamination are not external problems that can be fixed with further technological innovation or inclusion. Instead, scarcity and contamination are central to existing forms of groundwater management and capital accumulation in spite of the colonial climate crisis. This shift in perspective is necessary not only in California but across the globe, as groundwater reserves are pumped at unsustainable rates to fill shortages in surface water in the face of a growing colonial climate crisis (Alley and Alley, 2017).

Conclusion: Against Settler Sustainability

> "While resource extraction of this magnitude is not new to Indigenous people, the frequency and magnitude of resistance to it is historically unique (Yazzie, 2016), as is the role of water as an ideological and ontological centerpiece within this resistance" (Yazzie and Baldy, 2018: 8).

The materiality of water is fundamental not only to the creation and destruction of ecosystems, but also to the daily lives that are possible within them. Through the power to make

[12] In 2020, while the largest number of fires ever recorded burned over 4.2 million acres across California (Cal Fire, 2021), farmworkers, already navigating the disproportionate risks of the COVID-19 pandemic, still labored in the fields to maintain the nation's food supply (Vanek Smith and Garcia, 2020). Beneath blackened skies, farmworkers continued this strenuous work without adequate safety gear in air quality conditions deemed hazardous for regular activities (Doubek, 2020).

water present or absent, modern hydraulic infrastructures reproduce white settler colonial hydrosocial systems (Linton and Budds, 2014). Hydraulic infrastructures transformed arid lands and wetlands into lucrative agricultural industries and spaces of white settlement, while intensified groundwater extraction retools these frontiers vertically. Water infrastructures also produce subjectivities, futurities, and visions of what is possible or even desirable. While anxieties over the late 19th-century "closure" of the frontier transmuted frontier-making processes through irrigation projects, the contemporary groundwater crisis propels the production of vertical frontiers, expanding hydraulic technologies and creating novel markets for capital accumulation through speculation. Thus, just as settler colonialism constantly reinvents itself, frontier processes also continue to propagate through and beyond purported closures: they have an embodied and emotional momentum that consistently turns even imagined solutions back to the colonial conditions from which the very same problems emerged (Stein et al., 2017).

As we've discussed, SGMA addresses groundwater shortages through ostensibly recuperative and benevolent frameworks like sustainability, yet it maintains existing surface and groundwater rights, which themselves are already overallocated. Further, although SGMA's language prioritizes equity, the institutional and procedural norms of groundwater governance in fact uphold policy structures that marginalize racialized, and low-income communities, and pull Indigenous sovereignty within the domain of the settler state.

In other words, while SGMA seeks to mitigate groundwater overdraft and develop strategies toward groundwater sustainability, its notions of sustainability and equity do not upset the ongoing frontier-making that relies on the exploitation of racially stratified labor forces and groundwater overdraft. Instead, 'sustainability' is operationalized to sustain existing agricultural production through enhanced hydraulic infrastructure, rather than dismantling unsustainable ways

of relating to peoples, waters, and lands. As such, SGMA re-invests in a colonial future and obscure alternatives, while California's large-scale agricultural economy remains a deeply racialized, exploitative, and ecologically detrimental industry. More broadly, without dismantling the settler state and the economic, legal, and social structures it normalizes, hopes for a sustainable future or desires for more equitable water access will instead uphold a colonial present.[13]

So, what can be done? We believe it's important to be cautious of hope within potential solutions to groundwater scarcity. As we outlined through this article, settler colonialism fundamentally shapes worlds and understandings of the past, present and visions of the future. We must actively work against settler temporalities that produce the present as innocent, disconnected from the violences of the past (Rifkin, 2017). Even though practices of dispossession are distinct and shift across time, their logics are consistent, and we have traced their connections to implicate persistent structures of racial-colonial capitalism.

Further, given the specifities of subject formation by and through distinct relationships with and to the settler state, it is useful to interrogate the parts of our identities that are invested in racial-colonial capitalism and thus our differential responsibilities and capacities to dismantle this system. This work requires a rigorous engagement with the expansive work of Indigenous and allied thinkers/organizers that center analyses of coloniality in approaches to water justice (Barker, 2019; Estes, 2017; Middleton-Manning, 2018; Sherwood, 2019; Todd, 2017; Wilson, 2014; Yazzie, 2013).

It also requires centering Indigenous self-determination and land rematriation. In California, examples include the land rematriation work of the Sogorea Te' Land Trust in the Bay

[13] On the registers of hope and desire, Tuck and Yang (2012: 1) write, decolonial desires "can similarly be entangled in resettlement, reoccupation, and reinhabitation that actually further settler colonialism." Decolonial education scholars such as Stein et al. (2017) have similarly described the desires for security that propel colonial worlds.

Area (e.g., Wires and LaRose, 2019), or the Winnemem Wintu's struggle to stop a proposed raise of Shasta Dam (Middleton-Manning et al., 2018). In the area where we live and work, the Amah Mutsun Tribal Band have worked for years to return Amah Mutsun stewardship to the land of the Monterey Bay, and the Pajaro River specifically, through the Amah Mutsun Land Trust (French, 2021; Lightfoot and Lopez, 2013). In addition, this work requires understanding water and coloniality as global phenomena, connecting the specificities of settler colonialism to other forms of colonialism and imperialism (al-Shalalfeh et al., 2018; Jaber, 2019; McLean, 2017; Rusca et al., 2019; Wright et al., 2020). Ultimately, the work involved in addressing water within settler colonialism is not to look for easy ways out, or solutions that merely address the symptoms, but instead to learn, unlearn, and dismantle the architectures and worldviews that settler colonialism works so hard to produce as inescapable.

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