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# Water Regimes and Infrastructures: A Transhistorical Archaeology of the Desaguadero River, Bolivia

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*This article uses tensions over the construction of a flow-regulation infrastructure built to control outflow from Lake Titicaca into the Desaguadero River, on the border between Peru and Bolivia, as a case study to explore the ways that relationships to water emerge and are contested. We argue that a nuanced understanding of tensions arising from this infrastructure requires us to recognize the long-term history of how the river accumulated practices, meanings and materials. Adapting the work of Arturo Escobar, we use the concept of ‘water regime’ to think about how engagements with the river are based in different spatiotemporal frameworks that have developed transhistorically and come into tension around the materiality and dynamism of the river itself.*

Two objects, both created around 2004 in the small, riverside community of Iruhito in Bolivia, illustrate a broader tension in the nature of the Desaguadero river and its relationships to people and politics (Fig. 1). The first is a poster promoting a momentous international summit of ‘Uru’ communities that occurred in March of 2004 in Iruhito (Fig. 2). The ethnonym ‘Uru’ has been used for communities in Bolivia and Peru that historically have lived their lives in and through the water. In the sixteenth century, these communities constituted roughly 25 per cent of the population in the Aymara- and Quechua-dominated *altiplano*; however today there are only a handful of remaining communities of ‘people of the water’ (*Qut suñi*, as they call themselves), of which Iruhito is one (Fig. 3) (Bastien 2012; Julien 1987; Sáenz 2006). The poster depicts several individuals sailing on the river in reed boats. The text (our translation, emphasis in the original) reads:

**PAN-ANDEAN MEETING**

**URU – QUT SUÑI – QASH SHONI**

their name has been taken ...  
their culture has been taken ...  
their lands have been taken ...  
they’ve been called savages ...  
they’ve been oppressed for 500 years ...

**now they take history in their hands  
the Qut Suñi–Qash Shoni culture is reborn**

The second object, a ruined, barracks-like structure in the centre of the community (Fig. 4), was constructed and used by a team of engineers and workers who dredged a 65 km channel in the Desaguadero river as part of a multinational, United Nations Environment Programme (UNEP) and Organization of American States (OAS) financed effort to create a flow-regulation infrastructure in the upper Desaguadero river (Fig. 5). This effort also included the creation of a dam at the outlet in Desaguadero where Lake Titicaca flows into the river. The team that dredged the channel used the structure in Iruhito as a base of operations and living quarters during the work process.

Both objects, and the events they reference, date to the same moment in the almost 3000-year history of this community, but they materialize very different notions of time and place and very different visions of the future. They are fatefully entwined as well: the poster asserts community control over the future of Iruhito, while, according to community members, the dredging has posed acute challenges to the community, altering the ecology of the river,

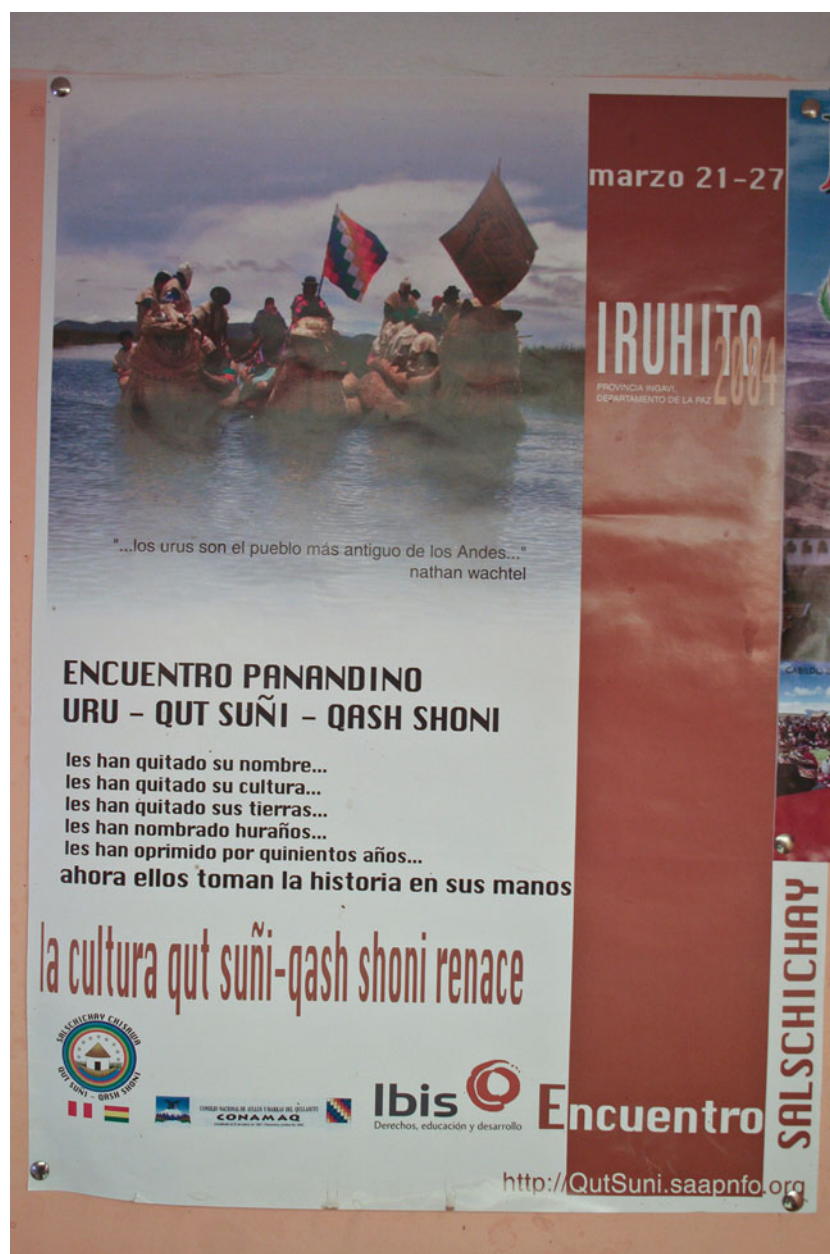


**Figure 1.** *Iruhito (A) and the Desaguadero River (B).* (Photographs: S.C. Smith.)

which has historically constituted a central economic base. We use the tensions arising from the creation of this flow-regulation infrastructure, tensions that are materialized in these two objects, as a case study to explore the ways that relationships to water emerge and are contested. We argue that these tensions refract deeper and discordant ways of understanding the river as a spatiotemporal formation. We advance the concept of ‘water regime’—adapted from Arturo Escobar’s (1999) notion of ‘nature regime’—as a way of understanding the historically contingent constellation of ideas, practices and social relations surrounding water. The rationale for the creation of the flow regulation infrastructure rests on a water regime that seeks the management, control and governance of the river. We argue that this modernist water regime is undermined and resisted by the

materiality of the water itself. The spatiotemporal regime of infrastructure requires and attempts to enforce predictability, linearity and rationality; however, this constellation of ideas, objects and relations runs aground on that which it is created to govern, the material dynamism of the river. In contrast, place-based water regimes, like the one we identify here, engage with and accommodate the dynamism of the river in ways that exceed modernist understandings.

This work is significant because it provides a framework for understanding conflicts over water resources in other times and places. Water regimes are historically situated and formed by the accretion of meanings and practices over time. Understanding tensions over water resources, then, requires a sensitivity to the history of human engagement with place



**Figure 2.** Poster promoting international Uru summit. (Photograph: S.C. Smith.)

over the *longue durée*, a perspective González-Ruibal (2019, 115) refers to as the ‘deep present’. Adopting a transhistorical lens to thinking about human engagement with the river affords a more nuanced understanding of these tensions. Thus, in this article we affirm the importance of an archaeological perspective to the understanding of contemporary conflicts over water.

Below we first outline the framework we use to understand histories of engagement with water, including our use of the water regime concept. We then use this framework to explore the tension between water regimes manifested in the conflict

over the flow regulation infrastructure in the Desaguadero river and the fate of the community of Iruhito. We discuss the modernist water regime underwriting the development of the infrastructure and we also trace the long-term emergence of a contrasting, place-based water regime.

### Water regimes

Water as nature appears as that flowing substance that culture may be mobilized to channel—think of canal locks, dams, and irrigation networks.

(Helmreich 2011, 132)

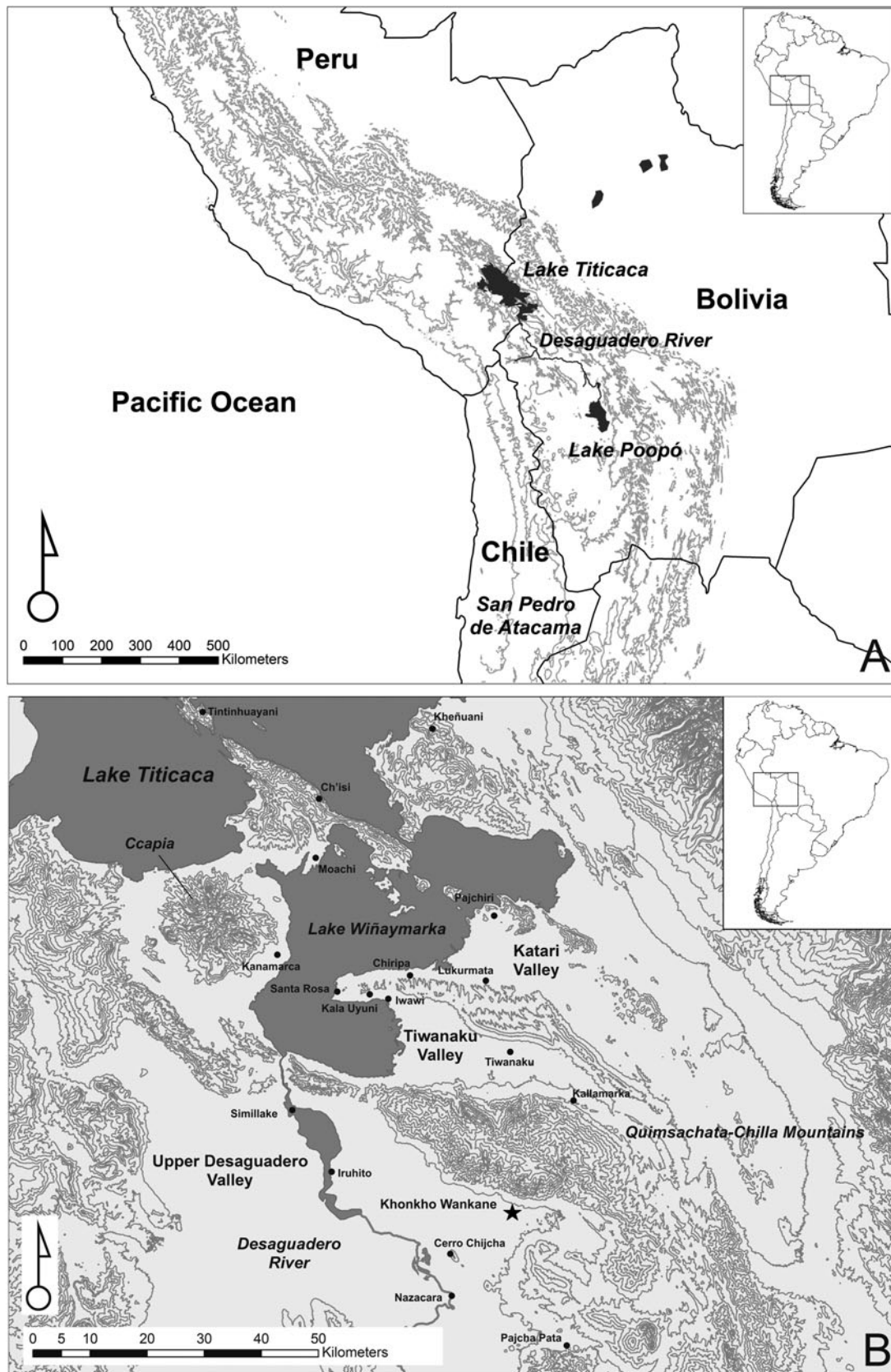


Figure 3. Maps showing (A) TDPS system; (B) location of Iruhito and places mentioned in the text. (Maps: S.C. Smith.)



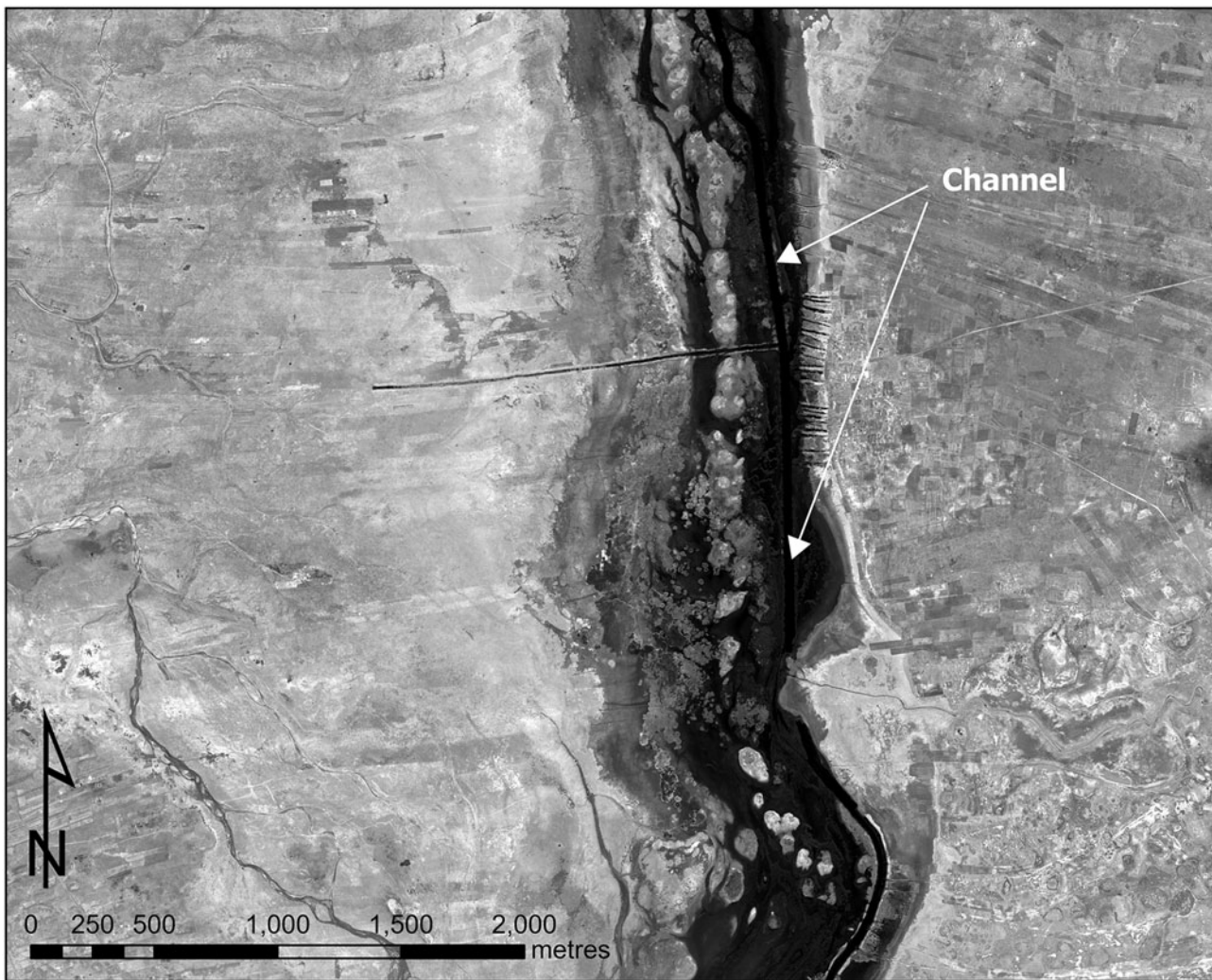
**Figure 4.** Barracks used by engineers and workers who dredged the channel. (Photograph: S.C. Smith.)

Helmreich presents this common understanding as a point of departure for a more anthropologically grounded consideration of water as both substance and symbol. The passage highlights a particular framework that often guides discussions of water and politics, a framework that understands water primarily in resource terms, as something that is controlled, managed, and regulated—water as a passive substance onto which social designs are projected. Harmansah (2018, 261) is explicit: ‘These debates on water politics and resource access, use/management, and ownership remain heavily anthropocentric as they tend to leave out bodies of water themselves as agents within political ecologies or render them powerless, inert, or subservient.’ This framework for thinking about water is rooted in a modernist perspective that sees landscapes and waterscapes as objects of management and extraction.

In contrast, we might also think of water as overflowing the material and conceptual boundaries that culture builds for it. Water is, in Orlove and Caton’s (2010, 410) analysis, a ‘total social fact’ following Mauss ([1950] 1990): a phenomenon that pervades social life, expressing symbolic, political, economic, religious, juridical, aesthetic and moral valences together (Hastrup & Hastrup 2016). Water is a material force that acts in unpredictable ways, often resisting and subverting attempts to manage and govern its dynamism (Edgeworth 2018, 248; Harmansah 2018). The physical properties of water, its fluidity and dynamism, are central to understanding the social and political histories that flowed through the

river (Barnes 2014; Edgeworth 2011). The physical substances of the river—the water, the shallow gradient of the bed, the stands of *titora* reeds, the fish and aquatic fowl—have shaped the histories of political relationships at different spatial scales.

Drawing on Escobar’s (1999; 2008) work, we understand the Desaguadero river as a field of historically situated articulations of practices, materials and ideas. Escobar (1999) developed the concept of nature regime to understand how constellations of human–environment relationships are produced historically and come to exist in tension with other sets of relationships (Biersack 2006). A nature regime, as he defines it, ‘can be seen as constituting a structured social totality made up of multiple and irreducible relations, without a centre of origins, ... a field of articulations’ (Escobar 1999, 5). Importantly, Escobar foregrounded the inseparability of the material and the discursive in the analysis of place, something that is also emphasized by Janusek in his analysis of emergent urbanism at Tiwanaku (Janusek 2020a, b). Janusek adapts Escobar’s framework using the term ‘ecoregime’ to avoid projecting the concept of nature into a deep past where nature/culture dichotomies held no meaning. His definition of ecoregime as ‘a field of articulations that assembled mountains, celestial movements, water flows, humans, and nonhuman lithic persons as a coherent, if shifting, master geopolitical cartography’ centres the material in the constitution of a historically situated way of understanding the world (Janusek 2020b, 233).



**Figure 5.** Worldview 2 satellite image showing section of channel. (Map: S.C. Smith. Satellite imagery © 2019 DigitalGlobe, Incorporated.)

Escobar focuses his discussion on three regimes operating in contemporary contexts. In his capitalist nature regime, the 'natural' world is managed, processed, controlled, measured and regularized to facilitate extraction. The organic nature regime, in contrast, while standing in for a diversity of conceptualizations of the world, tends to see the interpenetration of the social and landscape, eschewing the conceptual divide that anchors modernist dichotomies of nature and culture. This is the 'nature' found in local knowledges and practices. In the final configuration, Escobar highlights the capacity of science and biotechnology to alter and deconstruct modernist categories of nature, referring to this regime as technonature. Escobar is insistent that this schema is not essentialist: particular regimes are relational, co-constituting each other within

particular social and historical contexts (Biersack 2006, 238). 'As much as identities, natures can be thought of as hybrid and multiform, changing in character from place to place and from one set of practices to another. In fact, individuals and collectivities are compelled today to hold various natures in tension' (Escobar 1999, 2). We think the broad concept of nature regime is potentially useful as a lens to think about the contested history of the river. At the risk of proliferating concepts, though, we wish to focus the idea somewhat to centre the field of articulations surrounding water in general, and the Desaguadero river in particular. As such we adapt Escobar's framework, using the term 'water regime' in this article to track how particular water regimes come to be in tension with one another through time.

Escobar and others (e.g. Ashmore 2004; Ingold 1993; Santos [2006] 2021) emphasize the deeply historical nature of spatial formations. Places are dynamic, accreting meanings, memories, materials and practices over time, as they anchor the paths and projects of people, and as particular spatio-temporal formations come into tension, and sometimes conflict. A nuanced understanding of tensions surrounding water regimes requires recognition of the political genealogies of contemporary phenomena—of the roots of the spatiotemporal regimes of the present in histories of colonial relationships, the tendrils of which continue to structure social relations today (Diserens Morgan & Fryer 2022; González-Ruibal 2019, 115). In the case study discussed here, we suggest that the roots of the contemporary struggle over the Desaguadero river can be illuminated by considering the histories of water regimes in tension. A deep sense of memory emerges from people's engagement with place over the *longue durée*. It is rooted in the practices, both everyday and more periodic, that continually reinscribe meaning in landscapes (Abercrombie 1998; Basso 1996; Dawdy 2016). This framework rejects simplistic models of people as passive tradition-bearers; in rooting memory in emplaced practice, we centre the dynamism of how people intentionally and unintentionally situate and construct the present in relation to the past.

Different temporalities are inherent in water regimes, constituting places like the Desaguadero river as multitemporal in two ways: distinct temporal imaginaries reside in different water regimes, but additionally, places like the river valley are comprised of the accumulated material vestiges of the past. Infrastructural projects like the Desaguadero flow-regulation works operate within a temporal framework based on the modernist promise of future progress. As we discuss below, the rationale for this project is rooted in a contention about the current poverty of the region and the future potential of mechanized agriculture to generate wealth, if only the dynamism of the river could be controlled. As Appel (2018, 45) discusses, this idealized chronotope belies the actual temporal experience of many infrastructural projects, which 'stutter' or 'oscillate' as construction inevitably accelerates or slows and as works fall into ruin, are abandoned, or are replaced. Complicating this heterochrony are the other temporalities that pervade the contexts of infrastructural projects. Material fragments of past societies persist, constituting a palimpsest, a multitemporal present (Dawdy 2016; Lucas 2021; Olivier 2013). The infrastructural projects of capital often have as their focus the erasure of these pasts—the subsuming of

this palimpsest into one totalizing temporal frame (Gonzalez- Ruibal 2019, 116). In the case of the Desaguadero River, and water regulation projects more generally, the dynamic expansion and contraction of the river, on both annual and longer scales, constitutes a distinct temporality, one that is in tension with the linear time of the infrastructural projects of late modernity.

### Case study: flow regulation and the dynamic Desaguadero River

#### *The dredging*

While the dredging took place around 2004, by 2009 it was clear to community members that the fish population had decreased dramatically. 'No hay pescado' [there are no fish], we were told when our project asked about fishing in the river. A 2012 document produced following an *autodiagnóstico comunitario* [community self-study] discusses the issues traced to the dredging under the heading 'El dragado nos está matando' [the dredging is killing us]: 'El dragado les ha quitado parte de su vida, especialmente su sentimiento de hombre del agua' [the dredging has taken away a part of their lives, especially their sense of being men of the water] (Torres et al. 2012, 74, our translation). One community member phrased the issue succinctly:

*Aquí en la comunidad fue difícil ya con lo que se perdió el pescado, por el dragado que hicieron, ya no se podía mantener a mi familia, yo fui el primero en salir, después mis hijos y esposa se fueron a La Paz y así también me ayudaban [Here in the community it was difficult now that we lost the fish because of the dredging. I couldn't support my family. I was the first one to leave, and after that my children and my wife left for La Paz, and that's how they helped me]. (Torres et al. 2012, 74, our translation).*

The *autodiagnóstico* makes clear that migration away from the community accelerated because of the changes to the river and the economy it supported.

The rationale for the dredging project is rooted, in part, in the historical dynamism of the lake and river. A series of reports submitted as a part of the UNESCO World Water Assessment Program (WWAP) outline the history of joint efforts by Peru and Bolivia to manage Lake Titicaca (which is split by the international boundary between the two nations) and the wider hydrological basin that includes Lake Titicaca, the Desaguadero River, Lake Poopó and the Coipasa Salt Lake (see Fig. 3) (Martínez Gonzales et al. 2007; UNESCO 2003). These basins constitute an endorheic system covering



**Figure 6.** Dam at Desaguadero. (Photograph: S.C. Smith.)

a total area of 143,900 sq. km (UNEP 1996, 27). In the 2003 United Nations World Water Development Report, Lake Titicaca is lauded as a case study in strong binational collaboration to manage and preserve water resources. Under the section 'Identifying Critical Problems', the first challenge listed is the uncertainty and variability of the water system (UNESCO 2003, 477). Both flooding and drought are listed as critical problems facing the development of agriculture. While residents of the region have been agriculturalists since the second millennium BCE, the region is viewed by the authors of the report as fundamentally impoverished because production remains largely for subsistence, rather than for market. Without specifying how, the OAS document calculates the loss in agricultural potential from severe flooding and drought episodes in the 1980s at US\$341.5 million (UNEP 1996, 29).

Since the gradient of the riverbed in the upper section of the river is relatively flat (1.59 cm/km) (Martínez Gonzales *et al.* 2007, 72), changes in the outflow from Lake Titicaca can have dramatic effects on the form of the river in this upper section, called

Hakonta-Palayani (actually classified as a lake by hydrologists), expanding to flood low-lying areas or contracting to expose vast areas of the river bed (Baucom & Rigsby 1999). The solution, in part, has been the development of a regulation infrastructure to manage the flow of water from Lake Titicaca into the upper Desaguadero (Martínez Gonzales *et al.* 2007). As the WWAP report states: 'Taking into account the fragility of the system with regard to flood protection and prevention, a series of flow regulation works have been defined at the basin level and in the system in general' (UNESCO 2003, 478). This infrastructure included a dam with four sluice-gates that was constructed in the town of Desaguadero at the outlet of Lake Titicaca that regulates the flow of water from the lake into the river (Fig. 6). The construction of this dam was complicated by precisely the dynamism it sought to control. In times of flooding, sedimentation downriver can obstruct the flow of water such that it becomes reversed, with the river becoming a tributary of the lake. Controlling this process was essential to the successful installation of the dam at the lake outlet



(Martínez Gonzales *et al.* 2007, 72). To mitigate this effect and manage the river's dynamism, a channel was dredged through sections of the upper Desaguadero, particularly near Iruhito. The dredged channel is 65 km in length and roughly 25 m wide, stretching from Desaguadero to Nazacara, where the riverbed narrows and becomes well defined (see Fig. 3).

The concerns by hydrologists and engineers over the effects of flooding and drought stand in contrast to perceptions in Iruhito. For example, in 2012 we asked a collaborator how the community reacted to the historic drought of the early 1940s, reasoning that since the community was so reliant on riverine resources like fish, reeds and waterfowl, severe droughts would have a disastrous effect. He responded simply that the community 'followed the water', suggesting that drought was not an issue that community members regularly worried about. Our collaborator elaborated that as *Qut suñi*, or 'people of the water', the Uru have use-rights to contiguous areas of water, including the upper Desaguadero River and Lake Titicaca. Historically, the community also had the right to occupy islands in the river and lake. As the river retreated in the early twentieth century, he recounted, the community moved north to occupy the island of Simillake, located in the river 12 km away.

Anthropologists have long documented the dynamic ways that people in the Lake Titicaca basin have responded to climate fluctuation, and many have criticized the underlying assumptions of homeostasis and fragility that guide thinking by many scientists and engineers about the region as an ecological system (Erickson 1999; Orlove 2002). Reconstructions of precipitation over several temporal scales have revealed a large amount of variability in the past. For example, Roche *et al.* (1992, 79) discuss the historic variation in the level of Lake Titicaca between 1914 and 1989. The range of variation over that period was 6.37 m, with a low point of 3806.21 masl in December 1943 and a high point of 3812.49 masl in April 1986. At the annual scale the greatest variability was 1.80 m in 1986 and the least 0.04 m in 1983. Indeed, the floods and droughts of the early 1980s may have accelerated plans for the flow-regulation infrastructure (Martínez Gonzales *et al.* 2007, 45). Paleoenvironmental studies have also documented variability over longer temporal frames. Recent work by Bruno, Hastorf, Capriles, Weide and their colleagues (Bruno *et al.* 2021) tracked diatoms from soil cores in Lake Wiñaymarka (the southern sub-basin of Lake Titicaca) to produce a relatively high-resolution history of changes in the

level of the lake over the past several millennia. They concluded that 'changes in rainfall and lake level were relatively common and unexceptional in the lives of people residing in this region' (Bruno *et al.* 2021, 141).

To understand how changes to the level of the lake and thus outflow into the Desaguadero River may have been experienced by riverine communities, Rojas and present author Smith used multispectral satellite imagery to assess this dynamism (Rojas & Smith 2023). Using the Modified Normalized Difference Water Index (MNDWI) to estimate the surface area of water in the upper Desaguadero River valley, we were able to track the expansion and contraction of the river over the past 35 years. Over the period from 1987 to 2002 the mean coefficient of variation (CV) was 42.2 per cent with a mean surface area of 78.20 sq. km. Between 2013 and 2021, after the flow-regulation infrastructure had been constructed, the mean CV dropped to 33.5 per cent, while the mean surface area of water dropped to 47.36 sq. km. Even after the construction of the dam and dredging of the channel, both designed to regulate the fluctuation of the water, the variation was still quite strong. Even within these relatively short spans of time the river expanded and contracted significantly, both before and after the creation of the flow-regulation infrastructure.

The creation of this infrastructure was undergirded by a modernist water regime that envisions the dynamism of the Desaguadero River as threatening to efforts at regional development. The river must be controlled, regulated and managed for the promise of progress to be realized. In contrast, we identify an older water regime inherent in the river, one that embraces the river's fluidity and generative power. Below we first discuss Andean notions of water in general, and then reconstruct the emergence of a local, place-based water regime associated with the river.

#### *Andean water regimes*

Andean material worlds are animate, full of powerful places that watch and intervene in the lives of humans (Allen 2015; de la Cadena 2015; Salomon 1991; Villanueva Criales 2022). Contemporary highland communities often conceptualize mountain rivers, lakes, streams and springs as powerful places, places where animating forces are concentrated and most potent (Allen 2002). Weismantel (2018) discusses water's capacity to transform and remake the world through an analysis of the sixteenth-century document referred to as the *Huarochiri Manuscript*

(Salomon & Urioste 1991). This manuscript is unique among colonial documentary sources; while it was arguably commissioned by the Catholic priest Francisco de Avila, it was written in Quechua by indigenous authors and largely away from the oversight of Avila. The manuscript is complex, recounting stories from the Huarochiri region of the formation and shaping of material and social worlds through the acts of people and powerful *wak'as*, defined by the translators of the manuscript as 'any material thing that manifested the superhuman' (Salomon 1991, 17). In the *Huarochiri Manuscript*, water has both life-giving and dangerous aspects rooted in the physicality and properties of the substance. Water animates—in the life-giving rains and irrigation waters it manifests a generative and fecund power—but it can destroy as well when rains become torrential downpours, causing mudslides and rivers to overflow their banks (Weismantel 2018).

Weismantel (2018, 183–4) explores this dual aspect, at once generative and dangerous, in the character of the trickster Cuni Raya, a coastal deity with the power to transform whole landscapes. In pursuit of the female *wak'a* Caui Llaca, who flees Cuni Raya toward the ocean, the water *wak'a* shapes the land and bestows the animals he encounters with personalities and attributes. 'Cuni Raya's ability to create whole landscapes by fiat [is] probably an allusion to the way water can transform land dramatically' (Salomon 1998, 15, cited in Weismantel 2018, 183). The generative, life-giving capacity of rivers, lakes, streams and springs is reflected in the histories of Andean communities, many of which trace their ancestral origins to mountain rivers and lakes (Bastien 1978; Dransart 2002; Sherbondy 1986). There seems to be some time depth to this idea: colonial observers noted that many sixteenth-century Andean communities also traced their origins to mountain rivers, streams, caves and springs (e.g. Sarmiento de Gamboa [1572] 1942, 53). For many Andean communities, then, mountain rivers, springs and streams were powerful and dangerous places of emergence, liminal points of mediation between the world of living and otherworldly realm of ancestors and generative capacity (see Smith 2012). These places were part of a vast animating, circulatory ecology, flowing down from the high Andean peaks to the ocean (*Mama cocha*) (Gose 2019). From the ocean, water is carried back up to the cordillera via the celestial river *Mayu* (the Milky Way) where it is deposited in the form of rain.

Archaeological evidence from the upper Desaguadero River valley reveals similar conceptualizations in the deeper past. Before the development

and expansion of the urban centre of Tiwanaku around 500 CE, during the Formative period, the Desaguadero River was one of several key routes of movement for camelid caravans connecting regions to the south with the Lake Titicaca basin (Smith 2016; Smith *et al.* 2022). The caravans carried objects, food and ideas along circuits stretching hundreds of kilometres between the central *altiplano* near Lake Poopó, warmer fertile valleys on the slopes of the cordilleras, and the lake (Fig. 7). While Tiwanaku emerged as an urban state sometime after 500 CE, its political efforts in the Desaguadero valley began to accelerate after around 700 CE. The focus of Tiwanaku's expansive efforts seems to have been on developing strategic politico-religious relationships with key centres along the riverine route of movement to gain access to this ancient circuit (Smith & Janusek 2014). In the Desaguadero valley, the most significant Tiwanaku-affiliated sites are located along the river, while inland occupations are more ephemeral. At Iruhito, after 700 CE, Tiwanaku-affiliated peoples built a unique politico-religious space, consisting of a sandstone, paved surface flanked by andesite pedestals that would have supported four sculptures of anthropomorphic felines holding axes and disembodied heads, referred to as *chachapumas*, carved in andesite (Fig. 8) (Pérez Arias 2013). We have argued elsewhere (Smith & Janusek 2014) that people who were affiliated with the Tiwanaku state reoccupied Iruhito, in part, to gain access to the Desaguadero River route. This kind of ritual site is unique in the area of Tiwanaku hegemony, and we argue it is testimony to the power and influence of this old river trade route.

Research at the city of Tiwanaku itself suggests that the state's efforts to incorporate the river involved more than simply gaining access to an ancient trade route. The Pumapunku complex at Tiwanaku was constructed around the same time as the Iruhito complex as a place of entry into the city centre for visitors approaching from the west, from the lake and river (Vranich 2009). As visitors moved through a series of stone portals, they passed under archways with lintels carved in the form of bundles of the aquatic reed *totorá*, the same reed used for the construction of boats and structures at Iruhito and other riverine and lacustrine communities. Visitors also encountered *chachapumas* carved in the same style as those from Iruhito. Janusek and Bowen (2018) have argued that the production of Tiwanaku involved an intricate relational ecology that indexed the generative power of surrounding landscapes. In particular, they draw our attention to the way that water, guided from streams flowing down from nearby mountains into the city and channelled



**Figure 7.** Contemporary camelid caravan near Qhunqhu Likiliki, Bolivia. (Photograph: S.C. Smith.)



**Figure 8.** Photograph (A) and painting (B) of chachapuma sculpture from Iruhito. (Photograph S.C. Smith. Original painting by Justin Nessly Allison, @jnesslya.)



**Figure 9.** One of two burial chambers at Cerro Chijcha. (Photograph: S.C. Smith.)

around the central core, was active in the production of a novel form of urban subject. Their work suggests that the riverine emphasis to Tiwanaku's expansion into the Desaguadero involved more than simply the economics of caravan trade, but also the world-changing power of water and reeds as material substances. We can detect a water regime that constructed the river as a powerful corridor of movement and fluidity, of people, animals, objects and ideas, and as a source of generative power.

The Tiwanaku state disintegrated sometime after 1000 CE and Iruhito was largely deoccupied until people affiliated with the Inca state began to use the site sometime after 1400 CE. However, the nature of these occupations was distinct. We see evidence of Inca associated burials, and feasting events that may have celebrated and marked these burials. These people chose the oldest occupations at the site—the Formative period mound adjacent to the river—as a place of burial, incorporating the memory

of these ancient and powerful places into Inca conceptual geography. We see this pattern farther south along the river at the site of Cerro Chijcha, where Inca-affiliated peoples occupied an important Tiwanaku-period hilltop site and constructed at least two subterranean structures that we believe were used as burial chambers (Fig. 9) (Smith *et al.* 2014). Whereas the Inca administrative infrastructure was located at inland sites, along the river the Inca reoccupied the powerful places of the past, symbolically incorporating them into the Inca political landscape through the act of burial (Lau 2016, 177).

The Desaguadero River also makes appearances in Inca mythology. A myth recorded by Rodrigo de Cabredo, Bertonio, Ramos Gavilán and Pachacuti Yamqui Salcamaygua, among others, recounts the story of Tunupa, also referred to as Taguapaca (Abercrombie 1998; Medinacelli Gonzales 2012; Urbano 1988; Wachtel [1990] 2001). The myth describes the creation of the sun, moon and stars at Lake Titicaca by the creator Viracocha. Viracocha is assisted by three sons, one of whom is named Tunupa. The mischievous Tunupa, however, follows his father and, being rebellious, undoes and reverses many of his creations. Where Viracocha made mountains, Tunupa converted them to plains. Where there were plains, Tunupa made mountains. Where Viracocha fashioned streams, Tunupa caused them to dry up. When Viracocha created people, Tunupa corrupted their bodies and spirits. Eventually, Viracocha became angered at Tunupa's rebelliousness and had him bound hand and foot by his two brothers and thrown onto a *titora* raft in Lake Titicaca. Strong winds and currents drove his boat across the lake, until it hit land at Chacamarca, where the force of this encounter opened the Desaguadero River. Tunupa then floated down the Desaguadero, cavorting with two *sirenas* [mermaids] before eventually disappearing into the Pacific Ocean (Medinacelli Gonzales 2012; Wachtel [1990] 2001). A contemporary version of this myth, recorded by Ramiro Molina Rivero who conducted ethnographic research in the southern part of the Desaguadero River, reverses several key themes. Tunupa, in this version, is a beautiful woman who flees her abusive husband, a powerful mountain spirit named Asanaques. As she flees, following what becomes the course of the river, she shapes the landscape with her actions. Asanaques pursues her, but never catches her and she becomes materialized in the mountain of the same name overlooking the Uyuni salt flat (Molina Rivero 2006).

Although scholars debate the influences and antiquity of this story, with some arguing that this



**Figure 10.** *Stands of totora reeds. (Photograph: S.C. Smith.)*

represents a pre-Inca, Aymara myth (see Medinacelli Gonzales 2012), it is useful to think about the character of Tunupa, who is associated with the Desaguadero River. He is rebellious and mischievous, reversing the world-making endeavours of his father. He is powerful and dangerous as well. In the contemporary telling, Tunupa the beautiful woman is also powerful and rebellious, shaping the world and forming the river as she escapes the abusive relationship with her husband, who is portrayed as Aymara. Recalling the ethnographic and ethnohistorical evidence discussed above that suggests rivers and streams were powerful and dangerous places, capable of generating life or causing illness, we might argue that Tunupa's traits of generative power, but at the same time rebelliousness and danger, were associated with the Desaguadero River as well.

#### *The colonial context*

If the Inca envisioned the river as a place of rebellious power associated with Tunupa, by the mid seventeenth century the river was in a literal state of

rebellion (Wachtel 1986; [1990] 2001). Urus up and down the river had 'entered the water', abandoning their lands along the river to escape colonial authority. Colonial observers wrote about groups of Urus living in the river on constructed islands of reeds. These groups launched raids on the Aymara communities along the shores of the river, creating a constant state of insecurity, which was particularly unnerving for the colonial state because a major route of movement between Cuzco and the silver mines at Potosi followed the Qapaq Ñan, the old Inca Royal Road, which crossed the river where Lake Titicaca flows into the Desaguadero. Silver had not been transported through here since the 1570s, but this was still a major route of movement.

The dense stands of *titora* reeds, which the people of the water navigated with ease, were inaccessible to Aymara and Spanish pursuers (Fig. 10). The Augustinian friar Antonio de la Calancha described an event that took place in 1632: a group of Ochosumas of the upper Desaguadero river had raided several settlements and the Aymara lord of Chucuito ordered them to stop raiding. Calancha

writes: 'They answered, scandalously, that they were not Christians, that they did not intend to obey the king and would give in only if the Viceroy withdrew' (Calancha 1972, cited in Wachtel 1986, 302–4). These events might be read as efforts to take refuge from the state, to escape and hide, but we think they can also be read as overt acts of political resistance. The Ochosumas explicitly framed the raids as resistance to the distant figure of the Spanish king, demanding that the Viceroy withdraw from the region. In 1677 the Corregidores of Chucuito and Pacajes led a combined campaign against these rebellious people of the water, and they were vanquished, with several being executed and numerous others sent to labour in the Potosi mines. Indigenous observers noted that the Spanish had hanged the leader of the Iru-itu, specifically using the term 'king' to refer to him.

Descriptions of these people in the sixteenth and seventeenth centuries are doubly filtered, through both a Spanish colonial lens, but also through the views of the Inca and Aymara elites that Spanish chroniclers interviewed. Bertonio ([1612] 2006), for example, described the Urus as 'despised', 'unintelligent', 'dirty' and 'ragged'. But they were also described as beings from a previous age, before the emergence of the sun. This status as primordial beings led at least one colonial observer to describe the people of the water as a human *wak'a* (Salomon 1991, 17). Thinking about the events of the seventeenth century, we see again that the physical substances of the river were politically potent: the water as a place of escape and an internal frontier, the labyrinthine reeds as constituting strongholds from which to raid, the reeds as the materials for the construction of islands. The river itself—dangerous, full of generative power, associated with remaking the world for the Incas in the sixteenth century—was, a short century later, a place of political rebellion.

Spanish observers described the pacification of the people of the water as a process of 'extracting them from the water'. Clearly this phrasing refers to the literal act of pulling Urus from their reed strongholds, but we believe this phrasing also reflects a Spanish policy of resettlement (*reducción*) that was, in part, tied to an ethico-moral project of 'civilizing' indigenous peoples, of imposing rationality, virtue, morality (Abercrombie 1998; Gose 2008; Kopp & Díez-Astete 2009). For example, a Spanish inspector in 1574, Gutierrez Flores, argued that the people of the water should be apportioned land: 'The principal caciques of Zepita have been ordered to distribute land to them ... to make sure that they plant and

cultivate, without pushing them into servitude' (Wachtel 1986, 294). Extracting them from the water meant extracting them from a life of mobility, fishing and hunting birds, and resettling them into a 'civil' life tied to the spatiotemporal regime of agriculture.

## Discussion

In 1926, Arturo Posnansky travelled the Desaguadero River from Lake Titicaca to Lake Poopó, visiting Iruhito and the island site of Simillake, among other places (Posnansky 1934). Writing about the community of Iruhito, he describes that since they were exclusive owners of the marshes that extend from the outlet of the Desaguadero River to the current location of their community, their use-rights to riverine resources as Urus were respected by the surrounding Aymara communities who had to request permission and pay a fee to cut the *titora* reeds for use in their constructions (1934, 245). Posnansky (1934, 246) also notes the island of Simillake in this area was used by the people of the water as a residence and ship-building place in dry years. Similar ideas were expressed to our project a century later, in 2023: '*No les importaban los Urus el terreno, les importaban donde hay pescados, donde hay choca, donde hay titora, eso no mas*' [Land wasn't important to the Urus, what was important was where there were fish, where there were aquatic birds, where there was *titora*, that's all]. In times of drought, when the river receded, Urus followed the water, even as far as Guaqui on the banks of Lake Titicaca. As the river rose, the community moved again, settling in different places along the lake and river. Similar practices have been documented for the Uru of Lake Poopó to the south, where ecological knowledge co-produced with the material elements of the lake enabled the people of the water to live in a dynamic and fluid context (Cottyn 2023). In Iruhito, our conversations revealed a distinct sense of community in Iruhito, a sense of community very much mediated by the river itself. A sense of place that is as dynamic as the fluctuating Desaguadero.

By tracing the history of the river and its engagement with people, we can reconstruct how the river accreted distinct meanings and practices over the *longue durée*. A particular water regime, always emergent and changing, developed through the history of how people have interacted with the river. Importantly, we reconstruct a water regime that, through time, has recognized, accommodated and even embraced the dynamic fluctuations of the river. During Tiwanaku times, the river was an axis

of movement and social fluidity, circulating objects, animals, people and ideas between regions, and it was also a source of animating power. The association of generative power with the river continued as the Inca state became influential in the region; however, there was an additional element of danger and liminality, an association of the river with the world shaping and reversing powers of Tunupa. Inca engagement with the riverine centres of old involved a focus on incorporation of the river into Inca politico-religious landscapes through mortuary ritual.

Soon after, the river and its people encountered the Spanish colonial state, its agents bringing different modes of conceptualizing and engaging with the environment, seeds of a modernist water regime (Bettancor 2017; Cañizares-Esguerra 2006). Davidson (2016), for example, has argued that the Spanish colonial state of the sixteenth and seventeenth centuries was concerned with the rational management and control of what it conceptualized as the resources of nature. While it is difficult to reconstruct the way in which the river was conceptualized by early colonial agents, their views of its people are well documented. They were viewed as wild and uncivilized and as less-than-human consumers of uncooked food, pejorative views that were rooted, in part, in the economic practices of fishing, hunting and gathering, in contrast to the agropastoralist Aymaras of the region. Acosta, writing in 1590, described the people of the water as 'so brutish that they do not consider themselves human. I am told that when asked who they were, they answered that they were not men but Uru, as if we were talking of a kind of animal' (cited in Wachtel 1986, 283). For the Spanish, the extraction of the people of the water from the river was justified as part of a moral project to propel the river's people into lives of agriculture and, thus, civilization. It was precisely these efforts to deconstruct Uru relationships with the water, to extract and resettle them, that led to the rebellions of the seventeenth century (Barragán Romano 1996, 36, cited in Kopp & Díez Astete 2009, 54). Without dismissing the complexity of Spanish colonial processes of racialization and how this history influenced the construction of the people of the water as wild, we wish to note the congruence of these ideas with the construction of the river as dangerous, wild and uncontrollable. Efforts to resettle the people of the water follow from the modernist logic of rational management of an unruly and wild 'nature' (Cottyn 2023).

After resettlement, Uru populations declined significantly, which Wachtel attributes in large part

to processes of acculturation (Wachtel [1990] 2001). After extraction from the water, however, remaining Uru communities encountered an impossible context, a hybrid nature regime emergent from the colonial encounter: they were resettled on land to push them toward agricultural practice and yet, to the Aymara communities surrounding them, they remained people of the water, an identity which had become ossified when these people sought refuge from colonial agents in the river and lakes. Their use-rights to the water continued to define Uru communities, while their use-rights to land were highly circumscribed, since the riverside lands they fled upon Spanish arrival were now claimed by Aymara communities (Cottyn 2023). Indeed, their identity with the water was, at times, used as a rationale for expropriation of use-rights to land. This tension continues to define Uru communities like Iruhito today and is now exacerbated by environmental crises that have devastated water resources (Barra Saavedra *et al.* 2011).

Returning to the recent past, we can see the ways that contemporary tensions between water regimes resonate from past engagements with the river and its people. At the core is a tension in how to accommodate water as a spatiotemporal formation. Riverine communities have long engaged with and embraced the dynamism of the river, seen as a powerful and generative substance. Community was rooted in a sense of place that ebbed and flowed with the river, a sense of dynamism that accumulated through time as the people of the water continually engaged with the river in daily practice (de Munter *et al.* 2019). In tension with this is a modernist drive to linearize the flow, spatially and temporally, of the river, to control, manage and direct its fluidity: to pacify the river, and its people. Like the early colonial encounter, the rationale for the creation of the flow-regulation infrastructure is tied, in part, to a moral project that seeks to 'improve' people through the imposition of particular productive regimes, in this case intensive agricultural production for the market.

The experience of infrastructure, however, diverges from its modernist promise: a community member told us in 2023, '*en vano han dragado ... Peor que nada está tapado el río*' [the dredging of the river was in vain ... the river is blocked worse than ever]. At the core of this analysis is the materiality of the river itself, its ebbs and flows, its ecologies, also dynamic and changing. The satellite imagery modelling discussed above makes clear that expansion and contraction of the river was the norm at various temporal scales over the past several



Figure 11. Painting on repurposed barracks in Iruhito. (Photograph: S.C. Smith.)

millennia. The very dynamism of the water had political implications at different moments in time, as did the stands of *titora* reeds, which marked ritual thresholds in the urban centre of Tiwanaku, and, six centuries later, served as strongholds of resistance to colonial rule.

The landscape of the Lake Titicaca basin is littered with the skeletons of development projects (Roddick 2019). From abandoned clinics to unused meat-processing facilities, the ruins of efforts to pull rural communities along in the trajectory of ‘growth’ are commonplace (Hirsch 2022). These projects, like the Desaguadero flow-regulation works, are rooted in a modernist spatiotemporal framework, one that is in tension with local social logics. This article contributes to an understanding of these tensions, and the unintended consequences that arise from projects that ignore the histories and logics of place.

### Coda

The notion of colonality thus signals two parallel processes: the systematic suppression of subordinated

cultures and knowledges ... by dominant modernity; and the necessary emergence, in the very encounter, of particular knowledges shaped by this experience that have at least the potential to become sites of articulation of alternative projects. (Escobar 2008, 12)

In recent years, when stories of Uru communities reach news audiences of the Global North, the narrative is usually one of cultural extinction from climate crises. This is especially the case for the Urus of Lake Poopó, located in the central altiplano, 300 km downriver to the southeast of Iruhito. In 2016, after Lake Poopó had largely disappeared, the *New York Times*, for example, published an article titled ‘Climate Change Claims a Lake, and an Identity’ (Casey & Haner 2016). The narrative of the ‘vanishing’ Uru (*sensu* Wilcox 2009) is not new. For example, Wachtel’s ([1990] 2001) historical study of Uru communities is a magisterial analysis of what he interprets as long-term processes of acculturation or ‘Aymarization’. And yet the colonial encounter, while subordinating Uru cultural practices and further marginalizing some of the most marginalized peoples of the region, is, at the same time, a context



generative of ‘alternative projects’ as Escobar notes in the quote above. The narrative of disappearance is founded on a highly static vision of identity, and it can blind us to the dynamic ways that marginalized peoples navigate power-laden social contexts. In the tension between spatiotemporal regimes, alternate futures can emerge. Returning to the poster and the barracks—the two objects we opened this article with—the poster announces precisely this capacity to envision an alternate future, one that eschews the ‘vanishing’ narrative. And the ruined barracks that housed the dredging crew? It has been repurposed into an expanded primary school, one in which the near extinct language of Uchumataqu is taught alongside Aymara and Spanish and where community students develop award-winning robotics projects (Quartucci 2022). The building is adorned with a number of paintings, including the one shown in Figure 11 with this sentence written in Uchumataqu, Spanish and English: ‘When I chose to be Uru I know I chose the path of my people’.

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