"The Early History of Water Wars in Chile: Rivers, Ecological Disaster, and Multinational Mining Companies"[1]

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In 1936, tailings and wastewater from Chile's El Teniente copper mine broke free of impoundment pools and flooded the Coya and Cachapoal rivers, spreading contaminants throughout the Cachapoal Valley, one of central Chile's most fertile agricultural regions and a primary source of agricultural goods for the capital city of Santiago. The Cachapoal and Coya, which drew their water from high-altitude snow pack in the Andes cordillera, provided water to the large estates (*fundos* or *haciendas*) that monopolized land in the valley, as well as drinking water to over one hundred thousand people. Commentators described how pollution from the mine had destroyed fields and killed livestock. So many of the region's workers fell sick from drinking polluted water that the valley's estates suffered a labor crisis and could not harvest their crops. The accident highlighted a trend: while El Teniente's production of copper for world markets had risen steadily since the early twentieth century, agricultural harvests in the region had declined precipitously. Major spillages caused by the combination of faulty engineering and disasters like landslides, earthquakes and flooding, had punctuated the mine's first decades in operation. Yet, while natural disasters provoked ecological catastrophes in the Cachapoal Valley, the valley's agriculturalists attributed the degradation of their soil and water to the copper company's more routine and surreptitious

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practice of dumping both sewage from the mining camps and tailings from the mine's concentrating plant into the region's rivers.[2]

When the North American Braden Copper Company began mining low-grade porphyry copper in its El Teniente mine in 1905, it initiated a new era in Chilean mining. While during the nineteenth century, Chilean mine owners had exploited high-grade ores lying in shallow deposits, which they mostly shipped to Europe for smelting, Braden introduced innovative capital-intensive techniques for extracting and processing low-grade ores, employing new technologies and machinery developed in the United States. The company built the infrastructure of an entire industry: the mine and its network of tunnels, a mill, a plant for producing sulphuric acid, a concentrating plant, a smelter, hydroelectric plants, and a railroad to transport refined copper to the port of San Antonio, where it was shipped to markets abroad. By the early 1920s, Chile had become the world's largest copper producer and copper had surpassed nitrates as the motor of the Chilean economy in a new cycle of Chile's export-driven economy. Carved into the side of the Andes cordillera between 2,300 and 2,700 meters above sea level near the city of Rancagua, the Braden Copper Company's El Teniente mine had become the world's largest underground copper mine and a unit of the Kennecott Copper Company. With the Anaconda Copper Company's open-pit Chuiquicamata mine in the northern Atacama Desert, it constituted a pillar of the Chilean economy.[3]

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[2]*El Esfuerzo* (Rancagua), 29 January, 4 and 1 February 1936, 1; *La Verdad* (Rengo), 23 January 1936, 1, 1 February 1936, 1 and 4.

[3]For histories of copper mines and mining in Chile see Thomas Miller Klubock, *Contested Communities: Class, Gender, and Politics in Chile's El Teniente Copper Mine, 1904-1951* (Durham: Duke University Press, 1998); Angela Vergara, *Copper Workers, International Business, and Domestic Politics in Cold War Chile* (University Park, PA: Pennsylvania State University Press, 2008); Janet Finn, *Tracing the Veins: Of Copper,*

Braden's modern industrial mining complex drew on the energy flowing in the same rivers that watered the Cachapoal Valley, primarily the Cachapoal River and two of its tributaries, the El Teniente and Coya rivers, and extracted huge quantities of water employed in the concentrating plant. Indeed, one of El Teniente's advantages lay in its easy access to sources of water and energy, as well as rich veins of low-grade porphyry copper. Coal and oil were expensive and difficult to transport to the high-altitude mine. Andean rivers provided the company a cheap means of powering its mining operations. The energy flowing in the Coya and Cachapaol produced the highly refined copper that, transformed into wire, would itself carry energy motoring industrial growth in the United States and Europe.[4] Yet, this chain leading from high-altitude Andean snowpack to the factories of the industrialized North Atlantic world was not without cost and conflict. Braden introduced for the first time in Chile both industrial mining and new environmental problems associated with industrialization, primarily the pollution of air from the chimneys of the company's smelter and water from the waste produced by its concentrating plant. Braden's contamination of the Cachapoal and Coya rivers sparked an early iteration of what today would be termed a "water war" with the Cachapoal Valley's agriculturalists that resulted in Chile's first law regulating industrial pollution.

Mining has driven Chilean history since the nineteenth century and still today motors the Chilean economy. Yet, there have been almost no historical studies to date of mining's ecological impact.[5] More generally, despite the importance of mineral-driven extractive

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Culture, and Community from Butte to Chuquicamata (Berkeley: University of California Press, 1998).

[4]Richard White describes this connection between the energy flowing in rivers and the modern industrial and post-industrial economy in *The Organic Machine: The Remaking of the Columbia River* (New York: Hill and Wang, 1995).

[5]Two exceptions to this are Ángela Vergara, "Cuando el Río Suena, Piedras Trae: Relaves de Cobre en la Bahía de Chañaral, 1938-1990," *Cuadernos de Historia*, no.35

development during the late nineteenth and twentieth centuries throughout Latin America, from Mexico to Bolivia, Peru, and Chile, environmental historians have spilled relatively little ink on mines and mining, in modern Latin America.[6] Environmental histories of mining in Latin American have been mostly limited to the colonial era.[7]

This article employs El Teniente's pollution of the Cachapoal Valley to make a number of contributions to Chilean environmental history and the environmental history of mining. First, I employ hitherto untapped archival and published sources, including documents from Chile's Ministry of Public Works and regional governments, government reports, and the local press, to uncover the unknown history of a series of ecological disasters caused by the El Teniente mine's pollution of the Cachapoal Valley's rivers and soil during the first decades of the twentieth century. This article is the first study of the El Teniente mine's destruction of regional ecosystems in Chile, making an original contribution to the

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(December, 2011) and Mauricio Fochi D., "La Insustentabilidad de la Industria del Cobre en Chile: Los Hornos y los Bosques durante el Siglo XIX," *Revista Mapocho*, no.49 (2001). As Folchi argues in another article, most scholarship on ecological degradation and environmentalism in Chile focuses on the impact of neoliberal economic reforms during Chile's military dictatorship (1973-1989) and transition to democracy (1990-present). "Conflictos de Contenido Ambiental y Ecologismo de los Pobres: No Siempre Pobres, ni Siempre Ecologistas," *Ecología Política*, no.22 (2001). The seminal study of the ecological impact of Chile's neo-liberal model of economic development is Marcel Claude, *Una vez más la miseria: ¿Es Chile un país sustentable?* (Santiago: LOM, 1997).

[6]Scholars have similarly only recently begun to write the environmental history of mining in North America. See, for example, George Vritis and J.R. McNeill, "Of Mines, Minerals, and Environmental History" in George Vritis and J.R. McNeill eds., *Mining North America: An Environmental History* (Berkeley: University of California Press, 2017), p.3.

[7]See, for example, Antonio Avalos-Lozano and Miguel Aguilar-Robledo, "Reconstructing the Environmental History of Colonial Mining: The Real de Catorce Mining District, Northeast New Spain/Mexico Eighteenth and Nineteenth Centuries" in Vritis and McNeill, *Mining North America*; Nicholas A. Robins, *Mercury, Mining, and Empire: The Human and Ecological Cost of Colonial Silver Mining in the Andes* (Bloomington: Indiana University Press, 2011); Daviken Studniki-Gizbert and David Schecter, "The Environmental Dynamics of a Colonial Fuel-Rush: Silver Mining and Deforestation in New Spain, 1522-1810," *Environmental History*, vol.15, no.1 (January 2010).

still embryonic field of Chilean environmental history, and more generally, the limited environmental history of mining in modern Latin America.

Second, I show how the appropriation of the commons in Chile's rivers underwrote Chile's extractivist model of development during the twentieth century. The Braden Copper Company would have been unable to build the world's most productive underground porphyry copper mine without engineering rivers, legally defined as public property, to provide water and energy to its mine and industrial plant.

Third, the ecological disasters in the Cachapoal Valley prefigured contemporary water wars in Chile caused by the combined effects of the privatization of water rights and global climate change. The creation of markets to trade water rights in 1981 by the dictatorship of Augusto Pinochet as part of a package of free-market reforms operated as an effective privatization of a resource once legally defined as a public good, funneling rivers' energy to transnational power and mining companies.[8] Since the 1990s, a series of water wars over hydroelectric projects and pollution have challenged this model in Chile.[9] The scholarship on

[8]Carl J. Bauer, *Against the Current: Privatization, Water Markets and the State in Chile* (New York: Springer, 1998).

[9]The first major water war in Chile was waged by the indigenous Ralco community against a series of megadam projects in the Bío Bío River during the late 1990s. The history of the community's struggle with the transnational energy company ENDESA is told in Domingo Namuncura, *Ralco: ¿Represa o pobreza?* (Santiago: LOM Ediciones, 1999) and Diane Haughney, *Neoliberal Economics, Democratic Transition, and Mapuche Demands for Rights in Chile* (Gainesville, FL: University Press of Florida, 2006). Perhaps the most famous water war in contemporary Latin America broke out in Cochabama, Bolivia in 2000 following the privatization of the city's water system. See Olivera, Oscar et al., *Cochabamba! Water War in Bolivia* (Cambridge Massachusetts: South End Press, 2004); Thomas Perreault, "From Guerra Del Agua to the Guerra Del Gas: Resource Governance, Neoliberalism and Popular Protest in Bolivia," Antipode (2006); Susan Spronk, "Roots of Resistance to Urban Water Privatization in Bolivia: the 'New Working Class,' the Crisis of Neoliberalism, and Public Services," *International Labor and Working-Class History*, 71(1) (2007). For an article on mining and its impact as a force of dispossession among indigenous communities in contemporary Bolivia see Thomas Perreault, "Dispossession by Accumulation? Mining, Water and the Nature of Enclosure on the Bolivian Altiplano," *Antipode*, 45(3) (2013).

water and water wars in Chile, and Latin America more generally, explains these as largely contemporary phenomena caused by the imposition of first neoliberal economic reforms during the 1980s and then "neo-extractivist" strategies of development during the 2000s, and exacerbated by the impact of global climate change.[10] In this article, I show that the contemporary appropriation of the energy in Chile's rivers by transnational mining companies has roots in the state's concession of water rights to North American copper companies at the beginning of the twentieth century.[11] In addition, the state's willingness to turn a blind eye to mining companies' contamination of soil, water, and air reflected its choice to sacrifice the interests of agriculture, and the rural population more generally, in order to promote copper mining, a crucial source of export earnings as Chile's cycle of nitrate-driven growth closed during the 1910s and 1920s.[12]

Finally, I argue that the early water wars over El Teniente's pollution of the Cachapoal Valley were shaped by both the history of conservation in Chile and the

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[10]Fochi D., "Conflictos de Contenido Ambiental y Ecologismo de los Pobres." For scholarship on privatization, water rights, and wáter wars in Latin America see Sarah Hines,"The Power and Ethics of Vernacular Modernism: The Misicuni Dam Project in Cochabamba, Bolivia, 1944–2017," *Hispanic American Historical Review*, no. , vol. (May 2018); Rutgerd Boelens Tom Perreault, Jeroen Vos, *Water Justice* (Cambridge: Cambridge University Press, 2018); Tom Perreault ed., "*Minería, agua y justicia social en los Andes: experiencias comparativas de Perú y Bolivia* (Cusco: Centro Bartolomé de las Casas/La Paz: PIEB, 2014); Tom Perreault, "The meaning of mining, the memory of water: Collective experience as environmental justice" in Rutgerd Boelens, Tom Perreault, and Jeron Vos (eds.), *Water Justice* (Cambridge: Cambridge University Press, 2018). For similar work on South Asia see Vandana Shiva, *Water Wars: Privatization, Pollution, and Profit* (Berkeley: North Atlantic Books, 2016);

[11]New extractivism has been understood as a development model shared by both leftist and non-leftist governments throughout Latin America based on extracting natural resources, especially minerals and oil, but also forest products, for export markets abroad in response to the commodities boom sparked by the growth of Asian economies during the 2000s. Henry Veltmeyer and James Petras, *The New Extractivism; A Post-Neoliberal Development Model or Imperialism of Twenty-First Century?* (New York: Zed Books, 2014).

[12]For a study that similarly looks backward to trace the historical origins of contemporary water wars in to the period predating neoliberal restructuring see Hines, "The Power and Ethics of Vernacular Modernism."

organization of landownership in the Chilean countryside. As throughout most of central Chile, the Cachapoal Valley had no significant population of *campesino* (peasant) small holders or *campesino* villages with communally-held land. Land in the Cachapoal Valley was monopolized by a number of large properties (known as *haciendas* or *fundos*). Conflicts over water rights and pollution in rivers thus followed traditional patterns of competition between agriculturalists and miners, the two dominant sectors of the economy and pillars of Chile's political oligarchy. Chile's landed elites were the most important voice for conservation in Chile during the nineteenth and much of the twentieth century because degradation of natural resources like forests and water, often by mining, impacted the health of agricultural production on their estates. However, landowners' commitment to the core principles of Liberalism - private property rights and free trade - and a model of development driven by exports of primary commodities and foreign investment limited their ability to elaborate a critique of the ecological degradation caused by industrial mining. Until the 1990s, conservation in Chile was a movement and ideology dominated by large landowners. Notably silent in the debates about the ecological impact of industrial mining were the voices of "popular" groups - agricultural laborers, workers, and miners - and their political allies in the Left and in the labor movement. Water wars over the El Teniente copper mine's degradation of the Cachapoal Valley's rivers would be waged during most of the twentieth century not as "environmentalism of the poor," but as conservationism of Chile's wealthy landed elite.[13]

[13]Joan Martínez-Alier, *The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation* (Cheltenham, UK: Edward Elgar, 2003). For a discussion of environmental conflicts and environmentalism of the poor, including a very brief discussion of El Teniente's pollution of the Cachapoal, in Chile see Folchi D., "Conflictos de Contenido Ambiental y Ecologismo de los Pobres."

Background

As William Braden went about surveying the copper deposits where he would develop the El Teniente mine, he made certain to acquire rights to the water in the Andean rivers that ran nearby. The mine, Braden argued, needed "all the power (and more) the river will generate." The company required electricity to power workers' drills and the carts that would transport ore through the mine's tunnels. But, Braden also planned to install "other [industrial] centers," including mills with giant crushers and grinders, a concentrating plant, a smelter with blast furnaces, a plant for producing sulphuric acid, and a plant for the electrolysis process, which was key to producing highly refined copper bars, as well as a rail line, which would transport refined copper forty kilometers from the mine to the city of Rancagua and from there to the port of San Antonio for shipment to the United States.[14] In 1909, the government gave the company final approval of *mercedes de agua* (grants to water rights) in the Codegua, Coya, El Teniente, and Cachapoal Rivers and its plans to build hydroelectric plants.[15] That year, Braden sold his shares in the company to the Guggenheim mining consortium, which availed itself of the capital required to finance construction of the electrical plants, railroad, mill, concentrating plant, and smelter.[16]

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[14] Guillermo Braden a Intendente de O'Higgins, 11 December 1909, and Guillermo Braden a Intendente de O'Higgins, 29 March 1909, Ministerio de Obras Públicas (MOP), vol.2170, Archivo Nacional de la Administración (ARNAD), Santiago.

[15]Ministerio de Industria y Obras Públicas, Valparaíso, 20 May 1909, MOP vol.2170, ARNAD.

[16]The Braden Copper Company was founded by William Braden and William Nash, president of the Guggenheim family's American Smelting and Refining Company in 1905. The Guggenheims invested a significant amount of capital in the new copper company and served on its board of directors. In 1909, the Guggenheims purchased Braden's shares and then sold the Braden Copper Company to the Kennecott Copper Company in 1915. See Braden Copper Company, "Mineral de Cobre 'El Teniente': Breve Relato de Su Historia, Desarrollo, y Organización" (1942) and Luis Hiriart, *Braden: historia de una mina* (Santiago: Editorial Andes, 1964).

While Braden's petitions for water rights provided detailed accounts of how much water would be used and how the dams would operate, they made no mention of the company's plans to employ enormous quantities of water in its concentrating plant, which would then have to be stored or filtered if returned to the rivers. The absence is glaring given the importance of water in processing milled ore in the concentrating plant, where it was mixed with sulphuric acid and oil. The concentrating plant employed 4.5 tons of water for each ton of ore it processed. Braden only described the company's plan to use the rivers to extract their energy and then return their water to their natural course down into the Cachapoal Valley. On the stretches of rivers where he planned to build dams, there were no canals or agricultural producer that might be impacted since the steep, high-altitude mountainsides were rocky, arid, and free of vegetation. According to Braden,

> There are no third parties that could be damaged by the works. Not taking away even one drop of water from anyone. Waters that have never been used by anyone, and their exploitation in a manner and at a scale that will benefit the entire country and will convert the entire region, today unpopulated . . . into a center of [industrial] activity. . . . The region is arid and rugged. The intake pipe will be high up in the cordillera.[17]

He made no mention of either the importance of the river's water to irrigating the agricultural estates below in the Cachapopal Valley or the potential threat of water contaminated with tailings to the fundos' fields. It must have required an intentional geographic myopathy to ignore the fact that while the Coya, Codegua, El Teniente, and Cachapoal rivers were not in use high up in the arid Andes near their origins, many kilometers down river in the valley below the life of an entire agricultural province depended on their water.

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[17]Guillermo Braden to Intendente, Rancagua, 11 December 1909, MOP, vol.2170, ARNAD.

The Cachapoal Valley's ecology had already been remade over the centuries by the activity of large landowners (*hacendados*) who monopolized land in one of Chile's most fertile and well-irrigated valleys. Landowners had won rights to the water flowing in the Cachapoal River from the state in colonial-era grants and built an extensive network of canals to irrigate their *fundos* on which they produced cereals, garden crops, and pasture for their livestock. The landowners managed these canals in a legally recognized association, the Asociación de Canalistas del Cachapoal. In Chilean civil law, based on colonial codes, water was a "public good" whose use rights could be granted in *mercedes de agua*. However, once the water entered the association's canals it attained the legal status of private property. Thus, the grants of water to the valley's *hacendados* and the river's management in canals can be understood as a form of privatization that underwrote estates' monopoly over land and Chile's notorious landed inequality.[18] In the Cachapoal Valley, unlike in Chile's Andean neighbors Bolivia and Peru where pollution from tin and copper mines eroded the resource base of indigenous communities, the El Teniente mine's pollution of rivers and appropriation of water rights did not lead to what some geographers have referred to as "accumulation by dispossession" or in Marx's phrase "primitive accumulation." This process had occurred centuries earlier following the Spanish conquest and appropriation of land belonging to Chile's indigenous Mapuche population.[19]

During the nineteenth and twentieth centuries, the Cachapoal Valley's *campesino* population was composed of resident estate laborers (*inquilinos*) who exchanged their labor

[18]Bauer, *Siren Song*, p.32.

[19]For accumulation by dispossession see David Harvey, *The New Imperialism* (Oxford: Oxford University Press, 2003). In Bolivia and Peru, mining waste and the appropriation of water rights by mining companies has driven the deracination of rural indigenous communities. See Perreault, "Dispossession by Accumulation?" and for an earlier period in Peru Florencia Mallon, *The Defense of Community in Peru's Central Highlands: Peasant Struggle and Capitalist Transition, 1860-1940* (Princeton: Princeton University Press, 1983).

for the right to work a plot of estate land and, at times, a small wage. A significant population of itinerant landless seasonal laborers supplemented estates' *inquilino* labor force during seasons of high labor demand. The absence of small holders and villages with longstanding rights to water and land meant that when El Teniente initiated its operations, the ecologically destructive impact of mine tailings and chemicals used in its concentrating plants and released into the Cachapoal River's water was felt most heavily by large property owners organized in the Cachapoal Valley canal owners' association and represented by the trade association of Chile's landed oligarchy, the Sociedad Nacional de Agricultura (SNA-National Agricultural Society). Until 1924-1925, when a new constitution ushered in a period of social reform during the government of Arturo Alessandri (1920-25) and then reform and authoritarian rule during the regime of Carlos Ibáñez (1927-1931), large estate owners, represented in the Liberal and Conservative parties, exercised a political monopoly over Chile's "Parliamentary Republic" (1891-1925). They continued to exercise their political influence during Alessandri's second government (1932-1938), which relied on both Liberal and Conservative support, and translated their control over land and labor in the countryside into political power until Chile's 1966-1967 agrarian reform. Estate owners were, then, well-equipped to challenge the powerful North American mining company.

Mining, Ecological Disaster, and Chile's Water Law

In 1911, the Braden Copper Company began to produce significant amounts of copper with a labor force of seven thousand Chilean workers. The company had completed the infrastructure of its industrial complex. In the mine, it used a block caving system, transferring ore by gravity downward to the main tunnel at the bottom level of the mine, to extract 4,500 tons of ore a day. It sent the ore to the mill, where it was ground by huge crushers and grinders built in the United States into a very fine dust. In the concentrating

plant, the finely ground particles of ore were then added to water extracted from the local rivers and mixed with pine tar oil, crude oil from petroleum, and sulphuric acid produced in the company's own plant. Using a flotation system, the copper ore floated to the top of this mixture in the surface foam containing copper at levels of roughly twenty percent, while the rest of the rock in which the copper was embedded drained off into the Coya River. This mixture was pushed through filters and presses, also manufactured in the United States, and then transported to the smelter where converter ovens and blast furnaces produced bars that had 99.5% copper purity. Using this method, 4,500 tons of ore produced 80 tons of refined copper.[20]

While this method of industrial mining in the forbidding terrain of the Andes represented something of a miracle of engineering and innovative adaptation of technologies developed in the United States, it produced alarm among the owners of the Cachapoal Valley's *fundos*, who early on witnessed the devastating effects El Teniente's tailings could have on agriculture. In 1913, estate owners in the Cachapoal Valley sent a number of petitions to the government because of their concern over the mine's contamination of water they relied on for irrigation. The company had followed the practice of simply dumping tailings and water contaminated with oil and sulphuric acid into the Coya River, which then flowed into the Cachapoal. A number of landowners had already had their crops and fields ruined.[21] Julio Kaulen, who owned a *fundo* in the valley, reported that "I myself . . . saw in

[20]See the description of El Teniente's operations in Luis Riso Patrón, *El Mineral del Teniente i el Río Cachapoal: informe pasado a la Comisión de Canalistas del Río Cachapoal* (Santiago: Imprenta Universitaria, 1916), pp.3-6 and "Report of Roberto Opazo," Ministerio de Industria i Obras Públicas, Servicio Agónomos Regionales, Agrónomo Jefe, Santiago, 6 September 1916, both located in MOP, vol.2619, ARNAD.

[21]Miguel R. Machado, "Informe Sobre las Causas del Derrumbe del Tranque de Barahona," *Boletín del Museo Nacional*, no.12, 1929: 74.

the Coya River . . . . . a thick soup of tailings, on top of which was floating oil ."[22] The national Hygiene Institute took a sample from the Cachapoal and found that because of high levels of contaminants the river's water was apt for neither drinking nor irrigation.[23] The company management itself recognized that "when it initiated the extraction process on large scale" it had caused "damages" to neighboring *fundos*.[24]

In response to landowners' complaints, the Braden Copper Company devised a system for storing tailings and waste water from the concentrating plant. It built an open wooden canal, or flume, one and a half kilometers long to transport the water filled with contaminates to a dammed impoundment pool in the Coya River. Once it arrived in the pool, the sediment composed of tailings filtered downward, while the water rose, "running off into the Coya through openings at the top of the dam." As one company report described it, the filtered water was "clear and free of contaminants" because the tailings "had already settled" to the bottom of the pool. At the site of the pool, workers managed the tailings to build the dam itself from coarse "sand" tailings released by the concentrating plant and separated from finer silt tailings. Finally, the company built a cement aqueduct that conducted the waters of the Coya not mixed with tailings and waste, and which were ostensibly uncontaminated, to the El Teniente River and then to the Cachapoal.[25]

In August of 1913, this recently installed system for storing the concentrating plant's waste failed catastrophically. Amid winter rain storms, the heavy flow of water in the Coya

[22]"Report by Mr. Julio Kaulen of visit paid as Government Commissioner to the plant of the Braden Copper Co. Rancagua, Chile, accompanied by Mr. Roberto Opazo, Government Agricultural Engineer, on the 6th. December 1915," MOP, vol.2619, ARNAD.

[23] "Report by Mr. Julio Kaulen."

[24]S.S. Sorensen, Braden Copper Company to Intendente de O'Higgins, 15 April 1914.

[25]S.S. Sorensen, Braden Copper Company to Intendente de O'Higgins, 15 April 1914; Report of Roberto Opazo."

and El Teniente rivers swept away the dam. Because the dam itself was constructed of tailings sand, these joined the runoff flowing unobstructed into the Cachapoal River and the network of canals in the Cachapoal Valley.[26] The valley's landowners once again raised the alarm about the contamination of their fields. Now, however, they were represented by the SNA, which petitioned the government to form a commission of agronomists to investigate the accident and the impact of El Teniente's operations on agriculture more generally. The government acceded to the powerful landowners' lobby and appointed a commission composed by Roberto Opazo, the government agronomist for the region, Julio Kaulen, a delegate for the Cachapoal Valley canal owners' association, and Luis Riso Patrón, an engineer employed by the Public Works Directorate.[27]

The government commissioners did not submit their reports until October, 1916. During the intervening three years, El Teniente's system for containing tailings and the waste from the concentrating plant failed four more times, in November, 1914, January, 1915, April, 1915 and June, 1916. In April, 1915, during a period of heavy rain, the flow of the Coya River increased dramatically from 1450 to 10,200 cubic feet per second. The company's aqueduct, overwhelmed, collapsed on top of the dam, which was swept away along with millions of tons of tailings that had accumulated over two years in the impoundment pool. In the valley below, Julio Kaulen reported, "the lands that were being irrigated received all the accumulated tailings over the course of several days so that the ground was covered with a layer of fine white grey sand."[28] Just over a year later, the dam was breeched again as a result of heavy winter rains; over six hours, 160,000 tons of water

[26]Riso Patrón, *El Mineral del Teniente i el Río Cachapoal*, p.7.

[27] Ministerio de Industria i Obras Públicas to Eulogio Altamirano, Sociedad Nacional de Agricultura, 22 May1914, MOP, vol.2619, ARNAD.

[28]"Report by Mr. Julio Kaulen."

containing tailings and chemicals dumped into the Coya River and flowed into the Cachapoal and then the canals in the valley below. As the company struggled to rebuild the dam over the next two weeks, it shut down its operations, while an additional 110,000 tons of contaminated water entered the river. Luis Riso Patrón noted that "the rural inhabitants found the water to have an odor of tar and paraffin, animals refused to drink it, there was a high level of mortality of fish in the river, and the fields reached by the water were covered by a thin layer of fine sediment."[29]

Shortly after this accident, the members of the commission released their reports on the Braden Copper Company's system for retaining contaminated water. In addition, the SNA directorate pursued its own investigation and submitted its own report to the ministry. In the first report, Julio Kaulen described how a steady flow of fecal matter and garbage from the company's camps and tailings, oil and sulphuric acid from its concentrating plant had entered into the Cachapoal River since the company had begun production.[30] Kaulen noted that the company had introduced a filtering system, aqueduct, impoundment pool, and dam in the Coya River "to quiet the clamors of protest [from agriculturalists] about the damage caused by tailings mixed into water used for irrigation on the *fundos*." However, he pointed out that any dams built by the company to retain tailings would be just as vulnerable to "natural dangers" as its predecessors: "Whoever knows the country, knows that mountain storms . . . can happen anytime of the year. The destruction of the dams can happen again at any time." As commissioner Luis Riso Patrón similarly noted in his report to the Ministry of Public Works, "It is clear that these works are easily destroyed by the currents of water, either because the dams erode, sweeping away with them most of the material of which they are composed, or other parts of the infrastructure, the aqueduct, for example, are

[29]Riso Patrón, *El Mineral del Teniente i el Río Cachapoal*, p.7.

[30]"Report by Mr. Julio Kaulen."

destroyed."[31] Both Kaulen and Riso Patrón concluded that the company should move the location of its impoundment pools away from the basins of the Coya and Cachapoal to sites where the rivers would not be vulnerable to the inevitable spills caused by natural disasters.

As a landowner in the Cachapoal Valley himself, Julio Kaulen had first-hand experience of the ways in which the Cachapoal's waters had changed in quality since the Braden Copper Company initiated its operations. He described how "the waters of the Cachapoal that I could see daily in the irrigation canals varied frequently in color, having a milky color." While it was easy to trace the contamination of the Cachapoal to accidents and major spillages, Kaulen remarked on the more routine problem of pollution encountered by the valley's agriculturalists. He gave voice to a suspicion circulating among the region's landowners that Braden, animated by "the desire to maintain for a longer time the reduced space [it] had for storing the tailings . . . takes advantage of the muddy waters of the river to dump most of the tailings before the river clears up at the end of the period of thawing snowpack." Like many agriculturalists, Kaulen was convinced that the company was relieving pressure on its impoundment pools by illicitly dumping tailings into the river when its flow was highest so as to avoid detection.

Kaulen's analysis was seconded, in part, by Luis Riso Patrón, who observed that while the filtered water which drained from the pool into the aqueduct appeared clear, just below the surface were suspended particles of fine dust that flowed into the river. However, rather than blame the company for dumping contaminated water into the Coya and Cachapoal, Riso Patrón only commented that the system for filtering tailings was "imperfect."[32] He noted that samples taken from the Coya's riverbed also demonstrated that the water, even after passing through the dam and filtering system, was so contaminated as to

[31]Riso Patrón, *El Mineral del Teniente i el Río Cachapoal*, p.21.
[32]Riso Patrón, *El Mineral del Teniente i el Río Cachapoal*, p.12.

be fit for neither drinking nor irrigation.[33] Rather than an occasional occurrence produced by natural disasters like floods or rockslides, the waters of the Coya and Cachapoal, and the canals they fed, were continuously cloudy, "a sign of the presence of a problem, that appears with a certain permanence."[34] For Riso Patrón this was not due to intentional clandestine dumping, as for Kaulen, but constituted a problem inherent to the location of the impoundment pools in the Coya River basin.

In August, 1916, the directors of the SNA met with Chilean president Juan Luis Sanfuentes. They presented the president with a bottle of water extracted from the Cachapoal seventy kilometers down river from El Teniente in the valley below. The bottle, they said, demonstrated that the water in the Cachapoal had a 45% content of suspended solid matter, "a material composed of impalpable fine dust and sand" from the mine's concentrating plant. The president was "deferential" with the politically powerful landowners and informed them that he would wait for a report from the SNA before he took any action. As a sign of the SNA's political influence, he also assured them that he would ask the Braden Copper Company to consult with the association's directors before it implemented any measures to repair its system for containing tailings.[35]

The SNA directorate then commissioned one of its members, Diego Vial Guzmán, to investigate the levels of contamination in the water entering the Coya and Cachapoal rivers. Vial analyzed the water that ran through the cement aqueduct channeling the Coya's putatively filtered waters and found that the surface of the water for two centimeters was clear, but that the water that ran off through the trap and filter was contaminated: "The

[33]Riso Patrón, *El Mineral del Teniente i el Río Cachapoal*, pp.15-17

[34]Riso Patrón, *El Mineral del Teniente i el Río Cachapoal*, pp.7-8.

[35]Sociedad Nacional de Agricultura to Minister of Public Works, 16 August 1916, MOP, vol.2619, ARNAD.

waters that the Coya sweeps away, being pure and crystalline before entering the mine, become in this way muddied until they arrive at the Cachapoal." When the water arrived in the valley it was "absolutely inadequate for the needs of the towns and countryside." Like Kaulen, Opazo, and Riso Patrón, Vial proposed laws, which would be developed in consultation with Braden managers, to regulate the storage of contaminated water and tailings. [36]

The weight of the SNA made itself felt. Only one month after Vial submitted his report, the Chilean congress, with the support of the president, produced legislation (Law no. 3133, 4 September 1916, "Neutralization and Purification of the Residues of Industrial Establishments") regulating the disposal of industrial waste. The law marked the modern Chilean state's first efforts to regulate industrial and mining pollution, as well as the first legislation designed to protect the nation's rivers. It was shaped in almost literal terms by the reports of the government commissioners and Vial and instigated by the disasters produced by El Teniente's contamination of the Cachapoal. The law regulated the pollution of water by industries whose waste contaminated water consumed by humans and animals and was prejudicial to agriculture, and which damaged the air of populated areas.[37] It prohibited mining companies and industries from emptying their tailings and contaminated water into rivers providing drinking water and water for irrigation. It also mandated that industries and mining companies submit plans for the disposal of waste to the Ministry of Industry and Public Works. One key article of the law, clearly penned with El Teniente in mind, prohibited mining companies from building impoundment pools in the beds of rivers that provided water for consumption or irrigation, and from dumping tailings in rivers.

[36]Sociedad Nacional de Agricultura to Minister of Public Works, 16 August 1916.

[37] Ministerio de Industria y Obras Públicas, "Comisión que propondrá al gobierno el reglamento para la aplicación de la Ley No.3133, de 4 de septiembre de 1916," 13 November, 1916 in MOP, Vol.2619, ARNAD.

The 1916 law on industrial and mining pollution made no mention of water conservation. The engineers and agronomists who drew up the new regulations on mining pollution viewed the water flowing in Andean rivers as an unlimited resource, which could be distributed freely to miners and agriculturalists. The problem posed by the mining industry's extraction of huge quantities of water was not conservation, but contamination. In part, this may have been because agriculturalists relied on water for irrigation during spring and summer when Andean snowpack thawed and water levels rose in the Cachapoal and central Chile's rivers. Water levels dropped during the winter, restricting production levels in mines like El Teniente. But, diminished flow during winter months would have had significantly less of an impact on agriculturalists. This may also have shaped Chilean agriculturalists' approach to conservation. Agriculturalists and agronomists alike viewed water conservation largely in terms of forests' role in regulating the hydrological regime.

During the first decades of the twentieth century, Chilean conservationists, led by Prussian-trained forester, Federico Albert, director of the Department of Forests, Water, and Hunting, directed their energies toward forest conservation and installing tree plantations to protect rivers from erosion and sedimentation.[38] Water conservation was understood not in

[38]Federico Albert, "Mi Opinión Profesional sobre los Bosques, la Pesca, i la Caza en el País," *Boletín de Bosques, Pesca i Caza* (vol.1, no.1, 1912). For an extended analysis of Federico Albert, conservation, and forestry in Chile see Thomas Miller Klubock, *La Frontera: Forests and Ecological Conflict in Chile's Frontier Territory* (Durham: Duke University Press, 2014). Mikael D. Wolfe describes an analogous focus on forests' role in water conservation in the thought of Mexican conservationists like Miguel Ángel Quevado during this same period in *Watering the Revolution*: *An Environmental and Technological History of Agrarian Reform in Mexico* (Durham: Duke University Press, 2017), pp.18-19. Wolfe, citing Andrew S. Mathews, *Instituting Nature: Authority, Expertise, and Power in Mexican Forests* (Cambridge, MA: MIT Press, 2011), p.40, also notes that environmental scientists consider the desiccation theory espoused by conservationists like Albert and Quevado to be "only partially correct." (note 44, p.244). Richard H. Grove discusses the origins of desiccation theory in the work of late seventeenth and eighteenth-century British scientists who elaborated environmental theories based on the colonial experience in the Americas in *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism* (Cambridge: Cambridge University Press, 1995), pp.157-159.

terms of regulating use, but in terms of regulating the destruction of forests since, as Albert argued, "the destruction of forests is inevitably followed by the disturbance of the water regime since [forests] are the true regulators [of the water regime]." Albert articulated a standard version of "desiccation theory." "Through the retention of water by their leaves and their prevention of erosion," he wrote, "forests contribute to the formation of the correct course of water ([in rivers]." According to Albert, forests "regularize the water regime guaranteeing the supply of water during droughts."

Albert and other conservationists understood water conservation almost entirely in terms of regulating the destruction of native forests and cultivating tree plantations.[39] As Albert noted, managing and planting forests was essential to "conserving watersheds of the springs that provide drinking water, . . . irrigation in the countryside, energy, the navigability and transportation of rivers, the regulation of the flow of rivers,"[40] In one of the first conservationist measures taken towards water, the government decreed in 1912 the acquisition of land containing watersheds that supplied drinking water to population centers "in order to maintain the greatest production of the springs." The decree, apparently penned by Albert, promoted forestation on this land: "to conserve the purity of the water it is necessary to submit this land to a permanent forestry regime."[41]

Water conservation during the early twentieth century built on nineteenth-century conservationist thinking about the impact of deforestation on the hydrologic regime. In 1837,

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[39]Federico Albert, "El Agotamiento de los Recursos Naturales de Bosques, Pesca i Caza," *Boletín de Bosques, Pesca i Caza* (vol.1, no.4, 1912):.217.

[40]Federico Albert, "El Problema Forestal en Chile," *Boletín de Bosques, Pesca i Caza* (vol.1, no.10, 1913): 649.

[41]"Movimiento Administrativo," *Boletín de Bosques, Pesca i Caza* (vol.1, no.1, 1912): p.138.

French naturalist Claudio Gay penned one of the earliest statements of conservationist thought in Chile, critiquing the northern mining industry's destruction of forests to provide fuel for its smelters. Gay described how copper miners had almost completely destroyed forests in Coquimbo province, leaving an arid landscape free of vegetation. The fault, he argued, lay with the absence of laws regulating deforestation and a mining code handed down from the colonial era designed to encourage prospecting, which "authorized miners to tear everything out [of the soil]and destroy everything," often at the expense of agriculturalists. Gay noted that the elimination of Coquimbo's forests had caused "awful atmospheric changes: the seasons have become hotter, the air is drier, rainfall more infrequent . . . the flow of water in the rivers declines more every day." Deforestation had produced dramatic changes in the province's major rivers: "Not that long ago the desperate agriculturalist saw for the first time the water in the Coquimbo and Limari Rivers disappear completely in some places."[42]

Gay's call for government action to regulate deforestation was taken up by the SNA. The landowners' association rearticulated Gay's argument about the impact of deforestation on climate and the hydrologic cycle, as well as his call for a revision of the colonial-era mining codes that they viewed as prejudicial to agriculture.[43] For the SNA, regulating deforestation was essential to preserving the conditions necessary for a healthy agricultural economy. The SNA linked the conservation of forests to the conservation of water, and the conservation of both to a healthy agricultural economy, which the owners of Chile's large

[42]Claudio Gay, "Ministerio del Interior. Viaje Científico. Sobre las Causas de la Disminución de los Montes de la Provincia de Coquimbo," *El Araucano*, 20 April 1838: 2.

[43]Sociedad Nacional de Agricultura, *Memoria económico-legal sobre bosques que la comisión encargada al efecto presenta a la sección de policía rural, y legislación agrícola* (Santiago, 1839), p.3.

estates viewed, in a physiocratic vein, as the source of the nation's wealth.[44] The SNA's calls to regulate deforestation, drawing on the example of ecological disaster so vividly described by Gay, bore fruit in 1873-1874, when the Chilean congress passed its most significant piece of conservationist legislation regulating the destruction of forests. The congressional commission charged with authoring the new Forests Law, observed that due to deforestation "if not desert, then something very similar to desert has invaded entire provinces . . . . . The rivers have lost slowly but visibly their flow of water. The watersheds are disappearing."[45]

Agriculturalists' critique of the ecological damage wrought by mining was part of a larger battle over property rights and the status of subsoil mineral rights. Chilean mining law was founded in the colonial code, the Ordenanzas de Nueva España, which defined mineral rights as belonging to the nation, even minerals lying within the boundaries of private property. The mining code granted individuals the right to prospect, excavate, and stake claims to mineral deposits lying within both public and private property.[46] For landowners, miners' extraction of ore, as well as rights to wood and water for their mines and smelters, within the borders of landed estates, constituted a violation of their private property rights. In its early incarnations, conservationist critiques of the ecological impact of mining composed

[44]For a discussion of both Gay's and the SNA's conservationist critique of mining and the mining codes see Pablo Camus Gayan, "Los Bosques y la Minería del Norte Chico, S.IX: Un Mito en la representación del Paisaje Chileno," *Historia*, vol.2, no.37 (July-December 2004). Camus argues that both Gay and the SNA exaggerated transformations in Coquimbo's landscape to assert the rights of landowners against those of miners to control forest resources. For a discussion of physiocratic thought and botanists' role in state projects to "improve nature" see Richard Drayton, *Nature's Government: Science, Imperial Britain, and the 'Improvement of the World* (New Haven: Yale University Press, 2000).

[45]*Corte de bosques: Informe de la comisión nombrada para dictaminar esta materia i reglamento dictado por el Presidente de la República* (Santiago: Imprenta Nacional, 1873), pp.7-8, 43. For a description of this early conservationist legislation see Thomas Miller Klubock, *La Frontera: Forests and Ecological Conflict in Chile's Frontier Territory* (Durham: Duke University Press, 2014), pp.58-62.

[46]Thomas W. Palmer Jr., "A Study of the Mining Law of Chile," *University of Pennsylvania Law Review* vol.69, no.1 (November, 1920): 49-52.

a weapon in large landowners' arsenal as they competed with miners to assert rights to soil, forests, and water.

The Cachapoal Valley's landowners thus inherited a long tradition of conservationist thought dating back to the 1830s. Yet, while they were vocal in their denunciations of the runoff of wastewater and tailings from El Teniente's concentrating plant, they did not wage a nationalist war against the dominant role played by North American mining companies in the Chilean economy, which they largely supported. Nor did they critique the extractivist strategy of development based on mining and North American investment. They understood that mining and foreign investment drove the national economy and muted both their rhetoric and demands in their petitions to the government for increased regulation of mining pollution. While they criticized Braden's handling of mine waste, they made frequent assurances that they understood the importance of North American investments in developing industrial mining in Chile. Landowners and the SNA called for laws regulating pollution by industrial mining enterprises, but celebrated the North American company's achievements in building a modern copper enterprise that would resuscitate Chile's export-driven economy. In 1916, the SNA assured the government that El Teniente's managers were "reasonable men, belonging to a more advanced civilization than ours" who would certainly support new environmental regulations similar to those already passed in parts of the United States.[47]

Even social groups and political parties not identified with Chile's landed oligarchy pulled their punches when it came to mining pollution. At the local level, Rancagua's *La Semana*, which was identified with Chile's social reformist Democratic Party and drew significant support from urban workers and artisans, opposed any government measures that would halt or slow production in the mine. Following the 1916 disaster, while the company

[47]Sociedad Nacional de Agricultura to Minister of Public Works.

shut down for two weeks, the paper noted that even a temporary halt to production to build new dams and impoundment pools "would bring as an immediate consequence the misery of at least 10,000 inhabitants [in El Teniente's camps] . . . and many other thousands who live elsewhere but who receive monthly remittances from their relatives who work [in the mine]." In addition, the paper noted, the city of Rancagua in the valley below, would also suffer since every week local commerce and industry received an infusion of $40,000 pesos from workers' wages. The paper observed that calls to shut down production in the mine or impose measures to prevent future spills of tailings had caused "true consternation among the *elelemento obrero* (workers) who make very hard comments about those who have attacked blindly the Company, without thinking of their ten thousand compatriots who earn their daily bread in this mine."[48] El Teniente's mine laborers apparently did not share estate owners' concern with the pollution of the Cachapoal Valley.

While *La Semana* spoke to a traditional urban and mining working-class Democratic Party constituency, it combined its *obrerista* or "workerist" critique of efforts to regulate the mining company's environmental impact with a traditionally Liberal belief that the development and "progress" brought by the North American company far outweighed any damage to either the environment or the agricultural economy. In fact, we might read *La Semana*'s support for the mining industry, which the paper contended would bring progress and benefits to the nation and its workers, as shaped, in part, by its hostility to the traditional landholding elite, whose properties were most impacted by the contamination of the Cachapoal, and to the labor movement's and Left's traditional political adversary, the SNA which was the major proponent of conservation in Chile. The Democratic Party newspaper lauded the funds El Teniente provided the state-run railroad company to transport its material

[48]*La Semana* (Rancagua), 29 June 1916, 1.

and supplies, as well as the millions it spent on goods and services, and paid in taxes.[49] Conservationist responses to the ecological impact of industrial mining thus remained confined to large landowners organized in the SNA.

The Braden Copper Company responded to the 1916 law by producing plans for more secure impoundment pools and by seeking exceptions to the law that would allow it to build a new dam in the Coya River's ravine in complete disregard for the recommendations made by the government commission and the SNA. In November, 1916, the company proposed an impoundment pool and dam, three times the size of the pool that had flooded the Cachapoal the previous June. The company also proposed a series of measures to rebuild the original dam in the Coya.[50] Engineers employed by the public works directorate approved both these proposals and the government authorized Braden to build an impoundment pool in the Barahona ravine, a kilometer away from the site of its first four dams, but still in the basin of the Coya River.[51] The waters of the Barahona estuary ran straight into the Coya River. However, the directorate did require the company to introduce a series of "improvements" to guarantee against future floods and accidents.[52]

In early June, 1920, only weeks after the new impoundment system went on line, it failed catastrophically. A rock slide broke open the flume carrying tailings from the concentrating plant to Barahona; for hours contaminated water flowed into the Coya River once again. By that year, the mine had increased its output fourfold since 1913 and

[49]*La Semana* (Rancagua), 29 June 1916, 1.

[50]Dirección General de Obras Públicas, Hidráulica, "Mineral de El Teniente – Informe sobre proyecto de tranque para decantación relaves," 29 November 1916, MOP, vol.2619, ARNAD.

[51]Miguel R. Machado, "Informe Sobre las Causas del Derrumbe del Tranque de Barahona," *Boletín del Museo Nacional*, no.12, (1929): 76-77.

[52]Ministerio de Industria y Obras Públicas, Decreto, 7 December 1916 in MOP vol.2619, ARNAD.

expanded by the same factor the volume of tailings and waste water sent to the impoundment pool.[53] Over the next few years, El Teniente continued to dump contaminated water into the Coya and Cachapoal, often with the government's approval. The 1916 law on industrial pollution, while a milestone in Chile's history of environmental regulation, remained largely unenforced. In June 1926, for example, amid heavy rain storms, the Barahona pool overflowed once again and the government authorized Braden to empty its entire contents into the Coya River for four weeks while it repaired the damaged Barahona dam. The dam had been easily breeched because, like its predecessors, it had been built on an uneasy foundation of coarse sand tailings.[54]

These were years of significant social reform during the first government of Arturo Alessandri and then dictatorship of Carlos Ibáñez, including the establishment of a corporatist, labor relations system that created extensive labor regulations, legalized unions, and established state inspection of working conditions and arbitration of labor disputes. Alessandri particularly courted an urban and mining working-class base. Significantly, this era of social reform largely left out the countryside, where labor reforms were not implemented, and ignored the ecological damage produced by North American-owned copper mines.[55] In part, this was because Chilean governments during the 1920s viewed regulation of mining pollution as a threat to the thousands of jobs created by the mining company. Following the 1926 disaster, for example, a public works ministry report reasoned

[53]Aquiles Concha, *Informe presentada al Director Servicio de Minas y Geología del Ministerio de Industria y Obras Públicas sobre la "planta beneficiadora" de minerales de El "Teniente" de propiedad de la Braden Copper Company* (Santago: Imprenta y Litografía Universo, 1920), p.35.

[54]Ministerio de Obras Públicas, Confirma y amplía telegrama sobre reparaciones perjuicios ocasionados por lluvias en depósito relaves mineral Teniente, 12 July1926, IOH, vol.457, AN.

[55]The best overview of this history is Brian Loveman, *Chile: The Legacy of Hispanic Capitalism* (Oxford: Oxford University Press, 2001).

that the heavy flow of water in the Cachapoal would dilute the pollution, and that allowing Braden to empty it impoundment pool into the Coya was necessary in order to avoid the company shutting down its operations and "leaving unemployed thousands of workers with their families."[56]

In part, building a dam and enormous pool to contain waste from the mine high up in the Andes was doomed to fail because of the constant threat of storms, avalanches, and earthquakes. This was brought to light most clearly when a powerful earthquake shook Chile on 1 December 1928. The quake was centered far from El Teniente in Talca, but impacted an area stretching from the city of Concepción to the port of Valparaíso. High up in the Andes, the shaking earth produced a crack in the Barahona dam and contaminated water once again flooded the Coya and Cachapoal Rivers, this time in an exponentially larger quantity than in previous accidents. Following the earthquake, "large quantities" of the region's livestock died and people who drank from the Cachapoal "were attacked with fits of vomiting and bloody dysentery." The Cachapoal deposited a leaden sediment that leached into the soil of the region's fields, "leaving them unsuitable for cultivation."[57] The fractured dam let loose a deluge of 30,000,000 tons of waste water that killed more than twenty workers in the mine's Coya camp, sweeping away entire houses.[58]

Braden's defenders in congress, even while acknowledging the devastating human and ecological consequences of the massive spill, argued that the company had designed the dam according to all the "rules of engineering." [59] An official government report on the

[56]*La Semana* (Rancagua), 17 June 1926, 1.

[57]Cámara de Diputados, *Boletín de Sesiones*, "Sesión Extraordinaria," 28 January 1936, pp.2658-2665.

[58]*La Semana* (Rancagua), 5 December 1928, 5.

accident described in detail the Barahona dam's collapse, but absolved the company of any legal responsibility. Engineers and inspectors employed by the public works ministry had approved the company's plans for the Barahona dam so the company bore no legal responsibility for the accident. The report echoed company managers in ascribing the accident to "natural causes" for which Braden could not be held accountable.[60] For the Cachapoal Valley's landowners, however, the accident was an extreme moment in a long and continuous history of pollution caused by the mine's practice of dumping tailings into the Coya. Joaquín Tagle Ruiz, representing the landowners organized in the Asociación de Canalistas de Cachapoal, argued that the pollution of the Cachapoal was a problem that had endured since the company began production.[61]

Tagle was a Conservative Party deputy who represented Caupolicán and owned two *fundos* in the Cachapoal Valley.[62] He cited the opinions of "the region's agriculturalists, who unanimously assert that the tailings are prejudicial for agriculture and that they have noticed a slow decline in the fertility of the soil during the mine's seventeen years of production."[63] The destruction of the Barahona dam "unfortunately is not an isolated incident," Tagle declared, "but is the culminating event in an uninterrupted series of unfortunate accidents

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[59]See, for example, the debate in Cámara de Diputados, *Boletín de Sesiones*, "Sesión Ordinaria," 3 December 1928, pp.3883-3884.

[60]Miguel R. Machado, "Informe Sobre las Causas del Derrumbe del Tranque de Barahona.

[61]Cámara de Diputados, *Boletín de Sesiones*, "Sesión Ordinaria, 3 January 1929, pp.4649-50.

[62]Biblioteca del Congreso Nacional de Chile, Reseñas Biográficas, Joaquín Tagle Ruiz, https://www.bcn.cl/historiapolitica/resenas_parlamentarias/wiki/Joaqu%C3%ADn_Tagle_Ruiz, 6 June 2018.

[63]Cámara de Diputados, *Boletín de Sesiones*, "Sesión Ordinaria, 3 January, 1929, p.4648.

that have been produced for years . . . . ." He gave voice to the suspicions of the valley's landowners when he stated that "for a long time, sometimes with the permission of the authorities and sometimes without it, they have been dumping into the river water full of poisonous sediment, taking advantage of the rising levels of the Cachapoal, both in winter and summer." This had led to a gradual accumulation of sediment on land irrigated by the Cachapoal's canals. According to Tagle, "the decline in the fertility of the soil is already well known, since harvests today are smaller on average than they were fifteen years ago."[64] For Tagle and the Cachapoal's landowners, the company's regular practice of easing pressure on its impoundment dams by dumping wastewater into the Coya was a problem made visible only during moments of natural disaster.

In December, 1936, the water of the Cachapoal turned poisonous once again. But this time there was no natural disaster to explain why. People who relied on the river for their drinking water became sick with "bloody dysentery." Armando Celis Maturana, a landowner and member of the Liberal Party, who had succeeded Tagle as deputy for Caupolicán and Cachapoal, described in congress how the sick had filled the region's hospitals. The health ministry sent investigators who discovered that the river was "saturated" with the bacteria that cause dysentery. In Malloa, 200 of the town's 800 residents were sick with dysentery and eight people had died.[65] The governor of Caupolicán reported to the Minister of the Interior that between December 28, 1935 and the first days of January, 1936, "a violent change in the Cachapoal's waters occurred." The water, he said, "carried a thick sediment that gave the river a leaden color in some places and in others a whitish or milky color." To the valley's

[64]Cámara de Diputados, *Boletín de Sesiones*," Sesión Ordinaria, 19 December 1928, p.4273.

[65]Cámara de Diputados, *Boletín de Sesiones*, "Sesión Extraordinaria, 28 January 1936, pp.2658-2665. See descriptions of the sick and a list of those who died in *El Esfuerzo* (Rancagua), 29 January, 4 and 1 February 1936, 1

agriculturalists, the water appeared very similar to what it had looked like following the 1928 earthquake. Just as in 1928, the sediment carried by the river leached into the soil. Crops languished and livestock died. The governor spoke with people who lived near the Cachapoal who informed him that when the Andean snowpack melted during the summer and the waters in the Coya River rose, the "American Company" dumped tailings from the impoundment pool, which then mixed together with the natural chalky sediment in the Cachapoal. The river then "distributed these poisonous substances to the fields and canals."[66]

The head of Olivar's *carabineros* also interviewed a number of "residents and owners of *fundos*" who told him that "both their livestock and workers were continuously ill owing to the bad quality of the water, which also caused serious damage to the soil." The water in the Cachapoal, they noted, ran thick with a white sediment that damaged their crops. One *hacendado* complained that he no longer had enough laborers because as soon as those who recovered from the illness caused by the "terrible water quality" returned to work, others then succumbed to the same illness. Another complained that work on his estate had slowed because all the *inquilinos* were sick and still another testified that he had to contract laborers from outside the region since all his *inquilinos* had become incapacitated with vomiting and diarrhea after drinking water from the Cachapoal.[67]

The local press also denounced the contamination of the Cachapoal, and like Celis, accused the North American company of surreptitiously dumping tailings when the Coya's waters rose. Rancagua's *El Esfuerzo* editorialized that inspectors from the health directorate should take samples from the river every day as the best way of determining with precision

[66]Gobernador de Caupolicán to Ministro del Interior, 27 January 1936 in *La Verdad* (Rengo), 1 February 1936, 1 and 4.

[67]Leopoldo Courbis Otero, Teniente de Carabineros, Olivar to Tenencia de Carabineros, Requinoa, 21 January 1936 in Cámara de Diputados, *Boletín de Sesiones*, "Sesión Extraordinaria, 28 January 1936. pp.2662-2663.

when the company dumped its waste. This would be the only way of preventing the company from opening the dams and "so frequently poisoning with impunity the inhabitants and livestock."[68] In another editorial, the paper stuck by its claim that the company emptied tailings regularly into the Coya: "studies by inspectors have found that the water has high levels of sulphuric acid and e-coli bacteria that come from the sewers that serve Sewell, Caletones, Rancagua, and Coya."[69] Rengo's *La Verdad* similarly editorialized that "we maintain our position that El Teniente's tailings are emptied frequently into the Coya River, a tributary of the Cachapoal, which produces the poisoning of the water."[70] The paper denounced the company's "criminal acts of dumping tailings, which poison the water and produce the death of people and animals, and render the soil uncultivable."[71]

Armando Celís voiced local landowners' concerns in congress. He noted that "on many occasions I have personally verified that not only do they empty the filtered tailings from the Barahona dam, but also the accumulated sediment [of tailings], and in enormous quantities." "Any visitor to the Coya region will have witnessed how 'the clear' waters of the Coya arrive at the Cachapoal thick with sediment and with a greenish color, which justifies my opinion that the company is not following the law as it should." Celis was joined by a number of "distinguished *hacendados*" from the Asociación de Canalistas del Río Cachapoal who seconded his accusation that the company routinely dumped water mixed with tailings into the Coya. The landowners viewed the 1936 catastrophe not as an anomaly but as one in a series of continuous spills from the impoundment pool. "These spills occur

[68] *El Esfuerzo* (Rancagua), 1 February 1936, 1.

[69] *El Esfuerzo* (Rancagua), 5 February 1936, 4.

[70] *La Verdad* (Rengo), 1 February 1936, 1 and 4.

[71] *La Verdad* (Rengo), 5 February 1936, 1 and 4.

constantly in this zone," Celis declared. "These dams empty into the river, . . . bringing to the fields desolation and death. These very serious events occur with great frequency and it can be said, they have already become regular [occurrences]."[72]

The fact that local newspapers from small towns like Rengo and from the larger city of Rancagua had joined in the call for regulating El Teniente's contamination of the Cachapoal River may have indicated a broadening of support for landowners' efforts to draw attention to the ecological costs of copper mining. The outcry in congress and in the local press produced some changes in Braden's system for disposing of tailings. In 1939, the company built a new flume that carried the concentrating plant's waste forty-two kilometers to the Cauquenes Lagoon. However, like its predecessors, this new impoundment system did little to mitigate the damage to the region's soil and water. Braden continued to release waste water from the lagoon into the Cachapoal River over the following decades. In addition, through the 1960s, contaminants from the site of the former Barahona Dam continued to flow into the Cachapoal, damaging agricultural production in the valley.[73]

The only significant regulation of the copper industry's disposal of its wastewater and tailings came in 1970 when a new law established more rigorous regulations on the use of tailings sand in building dams.[74] Five years earlier, a dam containing tailings from the Disputada de Las Condes mine had been destroyed in an earthquake and the El Cobre mining camp had been swept under a deluge of toxic sludge. Approximately four hundred people

[72]Quoted in *La Verdad* (Rengo), 23 January 1936, 1.

[73]Fusa Sudzuki Hills, "Relaves de Cobre y Aguas de Riego del Río Cachapoal," *Agricultúra Técnica*, vol.23 (1964): 12; 21-22; 57.

[74]Sergio Barrera, Carlos Cacciuttolo, and Jack Caldwell, "Reassessment of Best Available Tailings Management Practices," *Proceedings, Tailings and Mine Waste*, Vancouver, B.C., 26-28 October 2015, pp.2-3.

died.[75] Despite its detailed regulations and far-reaching scope, the 1916 law on industrial pollution, had remained largely unimplemented. As late as 2002, a study of pollution in the Cachapoal found that El Teniente's tailings continued to drain into the river during periods of summer thaw and heavy winter rain.[76] Regulating water pollution from the mine's impoundment pools was simply incompatible with maintaining profitable levels of production in the environmental conditions of the Andes cordillera. And, despite pressure from local landowners and the press, governments from across the political spectrum remained unwilling to impose regulations on an industry that motored the national economy. Landowners and the SNA were able to win passage of the 1916 law regulating industrial and mining pollution, but were less successful in pushing Chilean governments to enforce its provisions.

Conclusion

After the 1940s, the Chilean Left and labor movement made nationalization of the copper industry a central demand. In congress, deputies and senators from Chile's Socialist and Communist parties regularly called for Chilean governments to expropriate the North American-owned mines and denounced frequent mine accidents, as well as insalubrious living conditions in mining camps. They did not, however, make mining pollution an issue. In El Teniente, workers' militant Communist Party-led unions engaged in frequent wildcat work stoppages and legal strikes, leading the movement to nationalize the copper mines, but did not concern themselves with the mine's pollution of the surrounding region's water and

[75]For a description of the accident see Confederación de Trabajadores del Cobre, "CTC Conmemora los 51 Años de la Tragedia del Relave Minero 'El Cobre,' www.confederaciondelcobre.cl/erbocefnoc/tag/tragedia-del-relave-minero-el-cobre/

[76]Teófilo Sanfeliu, Manuel Jordán Vidal, and Ana Boix Sanfeliu eds., *Contaminación y medio ambiente: Santiago (Chile)- Castellón (España), 1998-2002* (Castellón, Spain: Universitat Jaume, 2005), p. 414.

soil.[77] Only local landowners and their Liberal and Conservative representatives in congress like Tagle and Celis called for measures to regulate pollution of water and soil. A useful comparison is with Japan, where disasters caused by pollution from the Ashio copper mine gave birth to what historian Robert Stolz has referred to as "modern environmentalism" and a rejection of Meiji Liberalism during the early twentieth century.[78] In Chile, pollution sparked little reconsideration of the effects of mining and capitalist industrialization on nature and human bodies. While in Japan, environmental activists produced an important critique of the ways in which industrial toxins penetrated porous human bodies and broke down the divide between humans and nature, even nationalist and leftist critics of North American copper mining companies in Chile maintained a largely Liberal-era vision of labor and nature, celebrating workers' capacity to conquer nature through their labor and mining companies' ability to wrest value from the forbidding natural landscapes of the Atacama desert and Andes cordillera. The ecological crises in the Cachapoal Valley's rivers caused neither new ways of looking at nature nor debates about water rights.

Nor did the disasters caused by the mining industry during the first decades of the twentieth century produce a concern with water conservation. In Chile, unlike in Mexico and the United States' West, where conservationists advocated building dams to regulate the supply of water to arid and semi-arid agricultural regions, dams were viewed largely in terms of energy, not irrigation.[79] Even the North American mining company made little effort to

[77]Klubock, *Contested Communities.*

[78]Robert Stolz, *Bad Water: Nature, Pollution, and Politics in Japan, 1870-1950* (Durham: Duke University Press, 2014). See also Brett L. Walker, *Toxic Archipelago: A History of Industrial Disease in Japan* (Seattle: University of Washington Press, 2011).

[79]Wolfe, *Watering the Revolution*; Donald Worster, *Rivers of Empire: Water, Aridity, and the Growth of the American West* (New York and Oxford: Oxford University Press, 1985).

regulate the flow of water to its hydroelectric plants. Despite the fact that rates of production in the mine were dictated by vicissitudes in Andean snowpack and rainfall, neither Chilean government officials nor company managers concerned themselves with maintaining a stable supply of water through conservation or reusing wastewater. In 1966, one study of El Teniente's geology observed that "the mine's production rate is governed by the availability of water." During the coldest part of the winter and seasons of low rainfall and drought, "when run-off is very low," the study noted, "production is restricted."[80]

Landowners in the Cachapoal Valley also expressed little interest in water conservation. Contamination rather than conservation was their central concern, despite the mine's appropriation of water from the rivers they relied on for irrigation. In part, this was because of the history of conservationism in Chile, which continued to view management of water resources in terms of forest policy and to view the water flowing from Andean snowpack as unlimited. But this was also due to the fact that the seasons when estates relied on the Cachapoal for irrigation were also the seasons when the flow of water in the river was at its highest. In 1965, water conservation in the mining industry was finally placed on the legislative table, but not as a result of pressure from agriculturalists. That year, as part of a deal between the Christian Democratic government of Eduardo Frei (1964-1970) and the North American copper companies to increase investment in expanding their mining operations, the Braden Copper Company planned to build a new dam in the Cachapoal River to supply water to the hydroelectric and concentrating plants so that it could maintain production levels during winter months.[81] In this case, the company invested in the dam as a

[80] Fred H. Howell and John S. Molloy, "Geology of the Braden Orebody, Chile, South America," *Economic Geology*, vol.55, no.5 (August 1966): 867.

[81]Comisiones Unidas de Hacienda y de Economía y de Comercio, 2 September 1963 in Cámara de Senadores, *Diario de Sesiones*, Legislatura Ordinaria, 6 September 1965.

result of government pressure at a moment when Chile was increasingly reliant on the revenues generated by copper exports. The dam was eventually completed following the nationalization of the copper industry in 1971 by the government of Socialist Salvador Allende.

Not until the 1990s did an environmentalist movement produce a new "environmental consciousness" of the devastating impact of mining on water resources and spark debates about the privatization of water rights following the seventeen-year dictatorship of Augusto Pinochet (1973-1990) when popular protests over industrial pollution of waterways and hydroelectric dams emerged for the first time. Unlike the conflicts between the Cachapoal Valley's landowners and the El Teniente mining company, these recent water wars were waged by local (often indigenous) rural communities allied with environmentalist organizations. Perhaps the most important and emblematic of the conflicts was the 1997 battle between the indigenous Pehuenche community of Ralco and the transnational energy company ENDESA over a project to build dams in the Bíobio River in southern Chile's Bío Bío region. The struggle over the dams represented a shift in debates over water rights, produced in part by the emergence of both the indigenous rights and environmentalist movements as important political actors in democratizing Chile and throughout the Americas. These movements helped to shape a dynamic "environmentalism of the poor," which defined water rights as both human and democratic rights, and posed a significant challenge to Chile's much vaunted model of neoliberal development.[82]

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[82]For discussions of water privatization, water rights, and ecological crises in Chile see Bauer, *Siren Song*; Folchi D., "Conflictos de Contenido Ambiental y Ecologismo de los Pobres;" Namancura, *Ralco ¿Represa o pobreza?*; Sara Larrain and Colombina Schaeffer eds., "Conflicts over Water Rights in Chile: Between Human Rights and Market Rules" (Santiago: Chile Sustentable, 2010).