Water in the Southern Cone from the Mid-Nineteenth Century to 1950

A Rereading of Water and Sanitation Networks from the Perspective of the Anthropocene

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Scientific terms sometimes echo outside their fields and are appropriated by a wider public. While such diffusion does not imply complete agreement on what they designate, such terms often manage to express a number of widely shared concerns (Snow 1959). Anthropocene seems to be one such term (Trischler 2017). Coined to designate a new geological epoch in which humans are agents of planetary change (Crutzen and Stoermer 2000), it has sparked debates among geologists and scientists from other disciplines, but has also channeled concerns shared by a wider public regarding climate change and the global environmental crisis (Zalasiewicz et al. 2015).

Among the debates that the term has awakened in the scientific community, the discussions over the moment that marks the beginning of the Anthropocene and whether the human species itself is an agent of global change have stood out. In the first debate, the year of the nuclear bomb detonations (1945), also known as the beginning of the Great Acceleration, seems to be gaining more adherence over other dating (Waters et al. 2016). In the second discussion, the idea of the Anthropocene is questioned for obscuring the responsibilities of those who led the development of capital – or other processes associated with the change of geological epoch – and imposed the project of modernity as the only horizon (eg., Moore 2016).

The following chapter assumes its own perspective on these debates. Regarding the first, the impact of human action on the planet is understood as a process rather than linked to a specific starting date for a new geological epoch. Regarding the second debate, the analytical perspective assumed emphasizes the contribution and effects suffered by the Southern Cone and Brazil in the context of their incorporation into the international division of labor. In other words, the perspective offered here emphasizes regional aspects without ignoring the global change expressed by the Anthropocene.

The study of the expansion of water and sanitation networks in Latin America is not a very common topic in discussions on the Anthropocene, and even less so in

the period between the independence revolutions of the nineteenth century and the Great Acceleration in the middle of the twentieth. Information with distinct characteristics from different periods can be found on cities in Brazil (Rückert 2018; F. A. dos Santos 2013; Campos 2005; Poettering 2018) and Mexico (Aboites-Aguilar 1998); a more limited amount of information on the capitals of Argentina, Colombia, and Cuba (Casas-Orrego 2000; García-Blanco 1986; Lanciotti and Regalsky 2014); less data on Chile (Sánchez Andaur and Simón Ruiz 2014); few but detailed studies on Uruguay (Cooperativa de Trabajo Comuna and Federación de Funcionarios de la OSE 2020); and almost no knowledge on Paraguay, as well as very few comparisons between two or more countries during this period (e.g., Castro and Heller 2007).

In this context, this chapter periodizes the expansion of water and sanitation networks in Southern Cone countries (Argentina, Chile, and Uruguay) and Brazil between 1800 and 1950. To this end, it asks: How were water and sanitation networks expanded during the period studied? What phenomena are related to the ways in which such expansion developed?

In response to the first question, it is argued that the expansion of water and sanitation networks in the Southern Cone and Brazil between 1800 and 1950 developed in three major stages that, however, each country and city went through at different times and levels of intensity. In response to the second question, it is argued that this expansion is related to the specialization in the production of primary goods with which the region joined the international division of labor and the development models pursued in response to changes in the global economy.

In line with classic (e.g., Cardoso and Faletto 2004) and other more recent works (e.g., Svampa 2019) that have sufficiently shown that dependence and development are related phenomena, this chapter demonstrates how the general features of each stage of water and sanitation network expansion in the countries analyzed are related to the subordinate role that Latin America occupied in the global order. On a symbolic level, it illustrates how water network expansion was linked to a certain notion of modernity associated with Europe and the United States and the idea of development pursued by two models. At the material level, it shows how water and sanitation network expansion, regardless of the development models pursued, depended on primary goods export for financing. The end of the chapter suggests that such dependence-imposed limits to the universalization of services contribute to the degradation of the environment and the process of geological epochal change.

The lack of information on water and sanitation networks at the aggregate level until very late in the twentieth century sets a limitation on answering the questions posed. In order to mitigate this limitation, available information on subnational territories in the countries analyzed was systematized. In this regard, information was gathered on Buenos Aires, Rosario, and Córdoba (Argentina); Alagoas, Bahía, Belém, Campinas, Maranhão, Mina Gerais, Pelotas, Pernambuco, Porto Alegre, Recife, Rio de Janeiro, Rio Grande do Sul, Salvador, Santos, São Luis, and São Paulo (Brazil);

Iquique, Santiago de Chile, Talca and Valparaíso (Chile); Maldonado and Montevideo (Uruguay). The following accounts relate significant comparisons and facts to obtain an overview of water and sanitation network expansion during the period under analysis. The research design was complemented by reviewing historiographic sources on demographics, urban population, and exports, among other national indicators.

Before moving on to the description of each stage, there follows a conceptual framework of the Anthropocene, Latin America's place in the changing geological era, and its relationship to water and sanitation. The chapter ends with a section devoted to conclusions.

Anthropocene, Development, and Water and Sanitation

That the Holocene ushered in a new geological era seems to be an idea that is gaining more and more adherents every day (Zalasiewicz et al. 2015). Recently, a group of experts indicated that the "Anthropocene [has been] functionally and stratigraphically distinct from the Holocene" since the first nuclear detonations occurred in 1945 (Waters et al. 2016). This would relegate other hypotheses about the change of geological epoch, including the initial thesis that attributes the beginning of the Anthropocene to the Industrial Revolution (Crutzen and Stoermer 2000).

Just as the first nuclear detonations were the work of a small group of people, the Industrial Revolution can also be attributed to a specific place. Issues such as those mentioned above led to a discussion on the relevance of the category ánthrōpos, as it refers to humanity as a whole. Various aspects associated with the change in geological epoch are highlighted by alternative designations. Oliganthropocene, Chthulucene, Plantaciocene, and Urbanocene are some of these designations (Haraway 2016; Mendieta 2019). Capitalocene is another (Moore 2016) and possibly the denomination that has gained the most supporters in Latin America (Ulloa 2017). However, as shown in the following sections, the change of geological epoch cannot be explained by capital's advance or the factors stressed in the other denominations that dispute the meaning of the Anthropocene.

With few exceptions (Shellenberger and Nordhaus 2015), the narratives around the Anthropocene question the culture-nature dichotomy (Mauelshagen 2017). In doing so, they join the perspectives questioning the modern ethnocentrism that placed the West at the top of a civilizational continuum and justified its dominance over other beings, communities, and the natural realm (Cuche 1999). In Latin America, such narratives enjoy a unique acceptance (e.g., Svampa 2019). The questioning of the culture-nature dichotomy has led to a certain elective affinity between Anthropocene narratives and positions that rescued the ontologies of native peoples as an alternative to the way in which Western culture thinks of its relationship with

the world (Descola 2005; Escobar 2005; Viveiros De Castro 2008; Mantiñán 2022). A certain affinity can also be observed between the Anthropocene narratives and several studies that criticize the role of primary goods producers assumed by the region's states in the international division of labor between the end of the nineteenth century and the beginning of the twentieth century (e.g., Alimonda 2017).

These studies are heirs to a line of thought that emerged with ECLAC. It identified problems for the region's development along the paths followed or proposed by early industrializing countries and proposed to develop its own paths, linked to import substitution industrialization (Furtado 1993; Prebisch 1992). Subsequently, the questioning included the very notion of development in order to think of alternatives to it (Svampa and Viale 2020; Gudynas 2010).

The following sections show how development models and drinking water and sanitation network expansion in the Southern Cone and Brazil are linked beginning in the period of the independence revolutions until the Great Acceleration. Newly incorporated into the international division of labor as independent states, local elites accepted the role or specialization of their nations as primary goods producers (Bértola and Ocampo 2010). In a context of free movement of capital, products, and labor, the new states benefited from the expansion and consolidation of their borders and the incorporation of new arable land (Pinilla and Aparicio 2015). In parallel, an accelerated urbanization process affected the cities best connected to the flow of international capital (Castro and Heller 2007; Mendieta 2019). Faced with the emergence of epidemics and the need to attend to a growing population, a substantial part of the income obtained from primary goods exports was earmarked for the modernization of these cities (Paiva 2000; Melosi 2020). In this context, the aim was to replace colonial forms of water access and sanitation strategies with infrastructure and service networks similar to those developed in Europe and the United States (e.g., Lanciotti and Regalsky 2014).

The effects of World War I (1914–1918), the international crisis of the 1930s, and World War II (1939–1945) changed the international stage and, with it, the aspirations and development models pursued in the region (Halperin Donghi 2005). Liberal states gave way to entrepreneurial states that more decisively took on the task of modernizing their social structures, betting on the development of industry and the universal provision of services, such as drinking water and sanitation (Bulmer-Thomas 2003). In a more unfavorable international context, the lack of alternative financing sources to the foreign currency obtained from primary goods exports and the political instability itself presented difficulties for these projects (Castro and Heller 2007).

Within this framework, three stages of access to water and sanitation networks are identified below. The first stage was characterized by the "backwardness" of the systems inherited from the colonial period and by the aspiration to achieve "modern" networks to prevent problems such as epidemics, at least in territories directly

linked to international trade. The second stage was characterized by the expansion of the first network sections in the face of numerous drawbacks by means of concessions to private companies whose main feature – unlike those in Western Europe and the United States (e.g., Matés-Barco 2013) – is their foreign origin. Finally, the problems experienced during this stage and the lack of infrastructure, especially in the context of economic recession or exchange rate instability, gave way to the third stage, characterized by a process of centralization in the hands of nation-states with the intention of universalizing and improving water and sanitation services.

As will be seen in the following and all subsequent stages, despite having common features that are theoretically significant, each territory traversed these with a different manner, frequency, and intensity.

Stage I: Colonial Backwardness and Modern Networks as Aspiration

The Southern Cone countries and Brazil joined the international market as sovereign nations during the first decades of the twentieth century (Halperin Donghi 2005). Their participation in an international context of free movement of products, capital, and labor was characterized by primary goods exports (Bértola and Ocampo 2010). The expansion of national borders and the incorporation of arable land favored such participation through military campaigns. In general, these campaigns were to the detriment of Indigenous peoples, such as the Aymara population in Tarapacá (Chile) (Gentes 2001), and other states in the region.

Exported goods varied between countries and from year to year. Livestock products predominated in Argentina and Uruguay until the end of the nineteenth century, later giving way to agricultural production (Rayes 2015). The nitrate obtained in saltpeter territories notably increased Chilean coffers after its victory in the War of the Pacific of 1879–1884 (Fernández Domingo 2015). The sugar trade, cotton exploitation, and gold and diamond mining receded in the face of the coffee boom in Brazil around the middle of the nineteenth century (Murtha, Castro, and Heller 2015). The livestock sector was also consolidated in the territories between São Paulo and Rio Grande do Sul.

Foreign exchange earned from trade in primary goods, labor, and international financing was not evenly distributed within each country (Rückert 2018). The territories that captured most of the resources experienced strong transformations in infrastructure and demographics (Bulmer-Thomas 2003). New ports were added to those inherited from colonial times (Castro and Heller 2007). Large works were built with the purpose of favoring the exploitation and commercialization of the aforementioned resources (ibid.). Works such as channeling the waters of the Carioca River (1750) and constructing an aqueduct of the same name also served to meet the

water demand of a growing population through public sources (Murtha, Castro, and Heller 2015).

By the outbreak of World War I (1914), the urban population had increased exponentially. In Uruguay, it had reached 79.1 percent of the total population, and in Argentina, 52.7 percent (MOxLAD 2022). In the first case, the population was concentrated mainly in Montevideo. In the second case, it was mainly distributed between Buenos Aires and Rosario. The Brazilian states of Rio Grande Do Sul, Pernambuco, and São Paulo reached exorbitant demographic figures for the time (Rückert 2018). Santiago de Chile, Valparaíso, Talca, and Iquique also experienced significant growth (Fernández Domingo 2015).

The poor living conditions offered to subaltern sectors, whether newly arrived migrants or ethnic groups with a long history in the territory, contributed to the emergence of epidemics (Paiva 2000). In spite of this, most of the population continued to obtain water and dispose of their feces using methods and means inherited from the colonial period (Murtha, Castro, and Heller 2015).

Several records indicate that well water was common among the better-off, and rainwater storage was common among the less-so (Jacob 2011). Public fountains and watering places were used by many people to supply themselves with water by means of pots or buckets that they transported to their residences (Castillo Fernández 2017). Purchases from water carriers who distributed the resource to areas with difficult access were also common in the Southern Cone (Castro and Heller 2007). Enslaved individuals performed similar work – before the practice's abolishment in 1888 – for wealthy families in Brazil (Murtha, Castro, and Heller 2015). Direct extraction from rivers, streams, and other watercourses was common wherever possible (OSN 1993). Popular sectors collected water from irrigation ditches as another method of consumption in Santiago de Chile (Muñoz 2019). Spread over the layout of the Chilean colonial city, these ditches were also used to evacuate excreta. This system was cleaned with buckets that were then deposited on public roads, removed with carts, and dumped in drains near the city.

"Cesspools" were another mechanism usually used to dispose of waste (Besana 2018). More common than the previous methods was the dumping of sewage directly in public roads. In Brazil, the same slaves who carried water to drink traveled great distances to dispose of wealthy families' sewage (Murtha, Castro, and Heller 2015).

Generally speaking, the poorest sectors had access to more unfavorable sanitation methods, as well as water of lower quantity and quality (Castro Castro and Simón Ruiz 2020). Their "moral backwardness," together with the "material backwardness" of the cities, was conceived as the cause of the epidemics by the local elites under the influence of the miasma theory and hygienist thinking (Fernández Domingo 2015). "The solemnly poor, whose lack of hygiene habits and whose half-savage way of living hasten the death of their children" (Murillo 1875 cited in Fernán-

dez Domingo 2015: 15) became the focus of the "social question." Their deaths, "numbering in the thousands" (17), constituted a threat to the health of the local elites.

In Buenos Aires, Montevideo, Santiago de Chile, and Porto Alegre, among other cities, committees or commissions of notables were formed to evaluate the actions to be taken (Lanciotti and Regalsky 2014; Bertino et al. 2012; Castillo Fernández 2017). Along with the education of the poorest in hygiene habits, improvements were promoted for the main popular housing strategies of the time (Fernández Domingo 2015). Measures were also enacted that simply sought to displace numerous sectors to the urban peripheries (Murtha, Castro, and Heller 2015; Besana 2018). Faced with the "moral" and "material backwardness" inherited from the colonial era, the solution to epidemics was thought to lie in the expansion of "modern" water and sanitation networks, such as those in cities in Europe and the United States (Paiva 2000). The occurrence of droughts that affected cities such as Montevideo (1867–1869) and territories in Chile and Brazil led to decisions along these lines (Cooperativa de Trabajo Comunal and Federación de Funcionarios de la OSE 2020). The replacement of methods inherited from the colonial period, however, did not occur automatically, nor was it carried out uniformly in all cities.

The consolidation process of an impersonal state structure – still in its infancy – the separation of powers and competencies between national and regional states and regime changes brought with them numerous delays and inconveniences (Murtha, Castro, and Heller 2015). In Buenos Aires, for example, in 1867, a Comisión de Aguas Corrientes (Running Water Commission) was constituted to promptly initiate water and sanitation works (Lanciotti and Regalsky 2014). However, conflicts between regional elites led to the federalization of the city (1880), delaying the process and transferring responsibilities to the Comisión de Obras de Salubridad (Commission of Health Works) under the Ministerio del Interior de la Nación (Ministry of the Nation's Interior).

The usufruct of saltpeter exploitation allowed the Chilean state to structure its administration towards the end of the 1890s (Sánchez Andaur and Simón Ruiz 2014). It was then that the state gained relative autonomy from sectors of the Santiago elite and took on urban infrastructure projects in a different way. Even so, the "excessive cost" of the sewage works was one of the reasons given for rejecting a national loan in a session of the Chilean Senate in 1896 (Muñoz 2019).

The Brazilian empire, on the other hand, managed to build administrative structures only after the collapse of the customs agreement that united it with Great Britain (1842) (Murtha, Castro, and Heller 2015). Cities such as Pelotas and Rio Grande, however, saw four projects pass, but these took twenty years (1851–1871) to raise the necessary capital and successfully initiate the first waterworks (Rückert 2018). Financing was also a source of problems in Buenos Aires (Lanciotti and Regalsky 2014). The first concession was halted less than a year after beginning due to the bankruptcy of the company's main financier (OSN 1993).

In short, the period was characterized by a multiplicity of modes of sanitation and water supply inherited from the colonial period. As a result of the demographic increase and the poor living conditions in which popular sectors resided, they were unable to prevent the emergence of epidemics. Climatic aspects, such as droughts and floods, also hastened certain decisions. The local elites' aspiration to leave behind the colonial "backwardness" and the marking of the European and North American networks as a symbol of modernity shaped the identification of a single solution. However, the first network sections' expansion was not without its difficulties.

Stage II: Foreign Companies and First Network Services

Between the late nineteenth and early twentieth centuries, Latin American states tried to follow the course dictated by the great powers, even when this did not entirely coincide with the one they had set for themselves (Furtado 1993). The comparative advantages of the neoclassical model were widely accepted by the local elites. The development of the Southern Hemisphere, unlike yet complementary to that of the North, would come from exploiting its natural resources. During this period, the exported primary goods, although fluctuating, showed an upward trend, as did their volumes and average value (Fig. 1).

Most of the exports at the time were mainly destined for Great Britain. This destination, however, represented a smaller percentage of total Argentine exports (Rayes 2015). In other words, Argentina enjoyed greater diversification of products and buyers. Unlike the rest of the region, Brazil's main importer was the United States, especially since the beginning of the coffee cycle (Murtha, Castro, and Heller 2015). The foreign exchange earned through saltpeter nitrate export was the largest contribution to Chile's national budget until 1919, when it lost momentum as a result of a synthetic substitute (Castro Castro and Simón Ruiz 2020). One-third of this budget was absorbed by the Ministerio de Industria y Obras Públicas to develop urban infrastructure.

Until World War I, population growth in Argentina was much higher than in other countries and higher than in later periods (Fig. 2). In global terms, Brazil and Chile lagged behind Argentina and Uruguay. However, during this period, certain Brazilian and Chilean regions grew at the expense of others. In Brazil, for example, some cities prospered around coffee exploitation, which demanded labor, investments, and services (Santos 2013). In Chile, something similar happened with saltpeter nitrate. The population increase of Iquique – which until 1879 belonged to Peru – is illustrative of this. It grew from 300 inhabitants in 1814 to 54,740 by 1895 (Castro Castro and Simón Ruiz 2020). Far from natural water sources and located in the Atacama Desert, one of the driest on the planet, the early – albeit precarious –

access to mains water in Iquique (1890) can only be understood by the income that saltpeter exploitation meant for the coffers of the Chilean state.

In this context of economic expansion and population growth, water network expansion was an expression of the modernization desired by the local elites (Paiva 2000). The expansion of sewage networks was rather considered a priority in the face of epidemics. The latter explains why Montevideo (1857) and Rio de Janeiro (1863) deployed sanitation networks before water (Bertino et al. 2012; Poettering 2018).

Initially, the aim was to extend networks of one type or another through concessions to private companies, as occurred in countries in the Northern Hemisphere (McDonald 2012). Concessions in the Southern Cone, unlike in the Northern Hemisphere, mainly benefited foreign-owned companies (e.g., Bertino et al. 2012). Great Britain, in particular, captured the largest share of the market out of any other country. The British presence in other markets, as well as that of France and the United States, facilitated its dominance in the water and sanitation sector (Rückert 2018). As a result of this presence, commercial water supply was often favored over domestic water supply (e.g., Castro Castro and Simón Ruiz 2020).

The expenditure required to undertake works and extend networks was a factor driving foreign investment. The rentier profile of states that preferred to offload the risks associated with the exploitation of certain resources to the private sector was manifested in specific measures and regulations (Sánchez Andaur and Simón Ruiz 2014). The Código do Imperio (1850, Imperial Code) in Brazil, for example, laid the groundwork for private investment in urban infrastructure and services (Murtha, Castro, and Heller 2015). The laws on the organization and powers of municipalities (1854 and 1887) in Chile did not provide means for local governments to provide networks for themselves (Castillo Fernández 2017).

The impression that Western Europe and the United States had more advanced development and knowledge than those cultivated in the region had much to do with the preference for foreign capital over local capital. The Chilean senate, for example, rejected a sewage network project by local engineer Valentín Martínez pending European bids at the end of the nineteenth century (Muñoz 2019). The first experiences with water networks in Brazil were concessioned to foreign companies under the same pretexts (Rückert 2018).

The concessions in Montevideo were an exception to this pattern. The first master pipes that served the city's sewage network were built between 1852 and 1857 by a Uruguayan firm (Jacob 2011). Montevideo thus became the first city in South America to have sanitation services. In 1869, a partnership between a Uruguayan and two Argentineans won a public bid to supply water to Montevideo. The first sections of the network were inaugurated in 1871. The company, however, had financing difficulties and did not last long in the hands of the Rio de la Plata society, passing into British hands.

The foreign companies, in most cases, were often financed through debentures and shares acquired, on occasion, by members of the local elites and contracting states (Lanciotti and Regalsky 2014). The first experiences with water networks in Brazil are examples of the latter (Rückert 2018). Subsidies, tax exemptions, and interest payments on the applied capital completed the financing strategies for the works, showing the tenor of public participation during the private management stage. In other words, although the services were concessioned to foreign firms, part of the capital with which they developed the works came from the local public and private sectors.

The portion of public capital, however, did not have a major impact on some of the management decisions made by the companies. Among these decisions, the growth of demand – through network expansion – was a priority (Lanciotti and Regalsky 2014). Private investments, on the other hand, were carried out almost exclusively during periods of economic expansion. On the other hand, in less favorable periods, works were suspended, or services became more expensive. This was the case in several regions of the countries analyzed during the crisis of 1890, World War I, and the crisis of 1930, among other contexts. The actions of water and sewage companies owned by the British fund The River Plate Trust Loan & Agency with concessions in Rosario (Argentina) and Montevideo (Uruguay) illustrate this point (Lanciotti and Regalsky 2014; Bertino et al. 2012).

In turn, works aimed at improving the quality of the services provided were developed only under pressure from public counterparts. The creation of municipal companies in Chile and the conflicts in which the central government had to settle, the frustrated expropriation attempts in Montevideo (1875, 1905, and 1921), and the inspections that detected poor quality materials or construction errors in Rosario (1890) are some examples of these disagreements between different levels of government and private companies (Jacob 2011; Castro Castro and Simón Ruiz 2020; Lanciotti and Regalsky 2014).

The services, in most cases, were considered expensive for the time, excluding most of the population from access. The water commodification process formed in similar ways in some regions of Chile and Brazil. Public fountains, which supplied popular sectors water at no cost, were dismantled as the networks were extended. Some state governments in Brazil required concession companies to maintain or build such fountains (Menezes and Aaraújo 1991), but these were exceptions to the rule. More common were cases such as São Paulo (1877), where the argument in favor of destroying the fountains was made in order to force the population to pay for water from the concessioned network (Santos 2013).

With the exception of Chile, and unlike what would have occurred in Europe and the United States (McDonald 2012), it was generally not the municipal states that contracted the services of foreign companies. Most of the experiences in Brazil resulted from agreements between private parties and state governments (Rückert

2018). Others, on the other hand, required large loans from the latter. For its part, the first concession that attempted to extend networks in the City of Buenos Aires was held by the Argentine state (OSN 1993).

The private concession experience in Buenos Aires was one of the shortest in the region. Since 1869, the first water system – only 600 meters of pipes – had supplied the central streets of the city (Lanciotti and Regalsky 2014). Shortly after the city was federalized, towards the end of the 1880s, the Comisión de Obras de Salubridad granted a concession for water and sewage services to the English capital company The Buenos Aires Water Supply (OSN 1993; Pereyra 2009). The crisis that hit Great Britain hard in 1890 pushed the Baring House – the main financier of the awarded company – into bankruptcy and led to the termination of the contract in 1891.

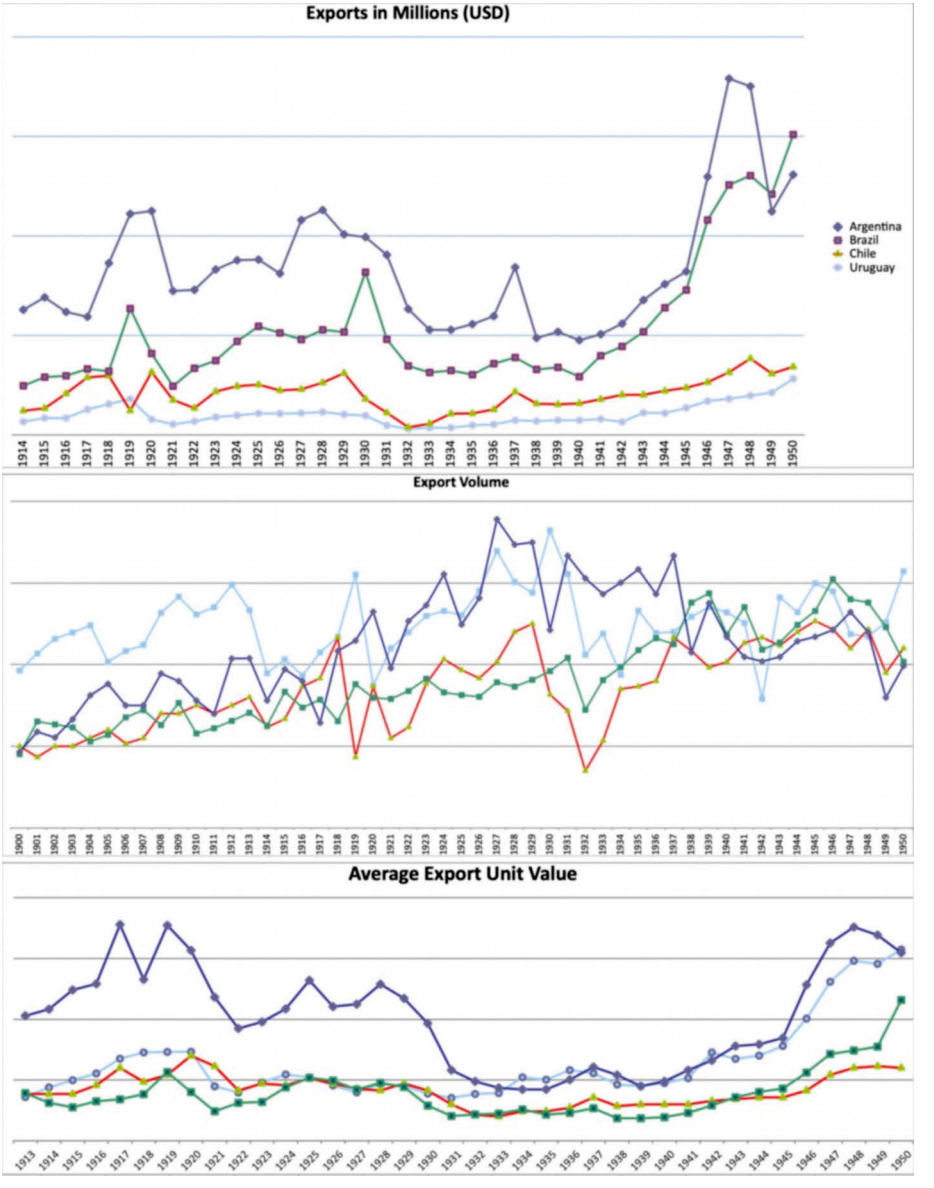
The short duration of private management in the City of Buenos Aires contrasts with the experiences of Rosario, in the same country, and Montevideo, in neighboring Uruguay (Cooperativa de trabajo Comuna and Federación de Funcionarios de la OSE 2020), as well as with those of Santos and Rio de Janeiro, for sanitation services, in Brazil (Castro and Heller 2007). In all cases, the concessions were extended until the mid-twentieth century.

By 1914, the demand for water increased (e.g., Santos 2013). In addition to population growth, this was caused by the effect of hygienist preaching, the implementation of concrete measures that favored better hygiene habits, and the emergence of economic activities that demanded more water, among other factors.

Most private companies, however, only provided services to those with the ability to pay, generally in the central ejidos (municipal territories) of large cities (Murtha, Castro, and Heller 2015). During this period, the remaining sectors continued to access water and sanitation mechanisms of varying quality through multiple means (Castillo Fernández 2017). Privately owned utilities were characterized by several problems, such as low water pressure, bad odors, color, and excessive nutrient load, among others (Jacob 2011).

The end of the first globalization ushered in an international context that was less favorable for countries that based their development on natural resource exploitation (Rayes 2015). While before that period foreign companies considered the water and sanitation market in the region auspicious, later on, disinterest in investing in works without attractive returns led them to divest their assets (e.g., Lanciotti and Regalsky 2014). In view of the dissatisfaction with the services provided by the previous networks, some local and provincial governments tried to extend water and sanitation, but the economic difficulties they experienced presented serious obstacles. A series of factors paved the way for the intervention of central states where they did not beforehand. The idea of an entrepreneurial state that would dynamize national economies and structure societies on a path of modernization laid the ideological foundations for the next stage (Pinilla and Aparicio 2015).

Figure 1: Exported Primary Goods in Millions of USD 1914–50 (top), Percentage Volume 1900–50[1] [1] (middle), and Average Unit Value 1913–50[2] [2] (bottom)



Source: Authors' elaboration with data from MOxLAD (2022).

1 [1] The 1970 value is considered to be equivalent to 100 percent.
2 [2] The 1970 value is considered to be equivalent to 100 percent.

Figure 2: Population growth (1900–50)

	Argentina		Brazil		Chile		Uruguay	
Years	Total Population in Thousands	Interannual Population Growth %	Total Population in Thousands	Interannual Population Growth %	Total Population in Thousands	Interannual PopulationGrowth %	Total Population in Thousands	Interannual Population Growth %
1900	4632		18599		2959	1.16	977	
1901	4762	2.81	19023	2.28	2994	1.18	987	1.02
1902	4893	2.75	19426	2.12	3030	1.20	916	-7.19
1903	5003	2.25	19840	2.13	3066	1.19	1038	13.32
1904	5124	2.42	20254	2.09	3102	1.17	1058	1.93
1905	5315	3.73	20688	2.14	3139	1.19	1089	2.93
1906	5546	4.35	21133	2.15	3176	1.18	1120	2.85
1907	5847	5.43	21578	2.11	3213	1.16	1160	3.57
1908	6179	5.68	22033	2.11	3253	1.24	1069	-7.84
1909	6460	4.55	22498	2.11	3294	1.26	1120	4.77
1910	6832	5.76	22984	2.16	3336	1.28	1150	2.68
1911	7103	3.97	23471	2.12	3378	1.26	1201	4.43
1912	7505	5.66	23967	2.11	3421	1.27	1252	4.25
1913	7877	4.96	24474	2.12	3465	1.29	1303	4.07
1914	8037	2.03	24991	2.11	3509	1.27	1343	3.07
Subtotal	3405	73.51	6392	34.37	550	18.59	366	37.46
1915	8188	1.88	25519	2.11	3553	1.25	1374	2.31
1916	8339	1.84	26067	2.15	3598	1.27	1404	2.18
1917	8490	1.81	26615	2.10	3644	1.28	1435	2.21
1918	8640	1.77	27184	2.14	3690	1.26	1455	1.39
1919	8791	1.75	27763	2.13	3737	1.27	1486	2.13
1920	9012	2.51	28343	2.09	3785	1.28	1506	1.35
1921	9263	2.79	28932	2.08	3853	1.80	1527	1.39
1922	9565	3.26	29522	2.04	3907	1.40	1547	1.31
1923	9936	3.88	30132	2.07	3961	1.38	1567	1.29
1924	10268	3.34	30742	2.02	4017	1.41	1577	0.64
1925	10549	2.74	31373	2.05	4073	1.39	1598	1.33
1926	10851	2.86	32015	2.05	4130	1.40	1628	1.88
1927	11182	3.05	32677	2.07	4188	1.40	1659	1.90
1928	11494	2.79	33339	2.03	4246	1.38	1700	2.47
1929	11805	2.71	34032	2.08	4305	1.39	1730	1.76
1930	12106	2.55	34725	2.04	4365	1.39	1761	1.79
Subtotal	3918	47.85	9206	36.08	812	22.85	387	28.17
1931	12348	2.00	35439	2.06	4429	1.47	1791	1.70
1932	12579	1.87	36163	2.04	4495	1.49	1822	1.73
1933	12790	1.68	36897	2.03	4563	1.51	1852	1.65
1934	13001	1.65	37652	2.05	4631	1.49	1873	1.13
1935	13212	1.62	38428	2.06	4700	1.49	1903	1.60
1936	13433	1.67	39214	2.05	4771	1.51	1924	1.10
1937	13674	1.79	40021	2.06	4842	1.49	1842	-4.26
1938	13905	1.69	40838	2.04	4914	1.49	1862	1.09
1939	14126	1.59	41676	2.05	4988	1.51	1985	6.61
1940	14236	0.78	42524	2.03	5063	1.50	2005	1.01
1941	14467	1.62	43517	2.34	5149	1.70	2025	1.00
1942	14709	1.67	44541	2.35	5244	1.85	2046	1.04
1943	14950	1.64	45503	2.16	5341	1.85	2066	0.98
1944	15201	1.68	46383	1.93	5440	1.85	2097	1.50
1945	15472	1.78	47438	2.27	5541	1.86	2117	0.95
1946	15723	1.62	48586	2.42	5643	1.84	2137	0.94
1947	16005	1.79	49817	2.53	5748	1.86	2158	0.98
1948	16346	2.13	51120	2.62	5854	1.84	2178	0.93
1949	16738	2.40	52506	2.71	5962	1.84	2208	1.38
1950	17150	2.46	53975	2.80	6082	2.01	2239	1.40
Subtotal	4802	38.89	18536	52.30	1653	37.32	448	25.01

Source: Authors' elaboration with data from MOxLAD (2022).

Stage III: Public Management, Centralization, and Attempted Universalization

The expectations with which the South American elites received the twentieth century (Ortemberg 2016) were reduced to little more than memories fifty years later (Furtado 1993). Three international shocks shattered the consensus on the primary goods export model, promoting other models aimed at circumventing the developmental limits it imposed (Pinilla and Aparicio 2015).

South American exports suffered the effects of World War I (1914–18), but showed signs of recovery soon after, reaching record figures between 1924 and 1928. The foreign currency obtained by these means and from international financing favored an initial process of nationalization and the creation of public companies (Lanciotti and Regalsk, 2014). Private concessions coexisted and competed with municipal water companies in Chile between the end of the nineteenth century and the beginning of the twentieth century (Castro Castro and Simón Ruiz 2020). The Dirección General de Obras Públicas (Directorate General of Public Works) of the Chilean state was also empowered to collaborate in the drafting of water and sewage projects in several localities of the country. The sanitation network in Montevideo was transferred to the municipal sphere in 1915 (Bertino et al. 2012). The water and sewage works in the City of Buenos Aires – once the first concession was federalized and aborted – required part of the extraordinary income being obtained by the Argentine state (Lanciotti and Regalsky 2014). Brazilian state governments created public companies after the declaration of the federal republic (1889) due also to the possibility of contracting international debt and obtaining a monopoly on export taxes previously shared with the imperial state (Santos 2013).

More kilometers of networks and better services were reasons given in favor of public intervention in the sector. "The ideal would be that all drinking water supplies are funded by the Public Administration properly and without interest," claimed a commissioner in charge of evaluating access to the resource in Iquique (Salas Lavaqui 1908: 221, in Castro Castro and Simón Ruiz 2020: 20). Such demands became more frequent as the population increased (Fig. 2).

The demographic phenomenon took on a greater dimension in the cities. 81.8 percent of the Uruguayan population lived in cities in 1937; in Argentina, 62.5 percent in 1947; and in Chile 52.5 percent in 1940. The situation in Brazil was different until 1950, with 36.16 percent of the population living in urban areas. However, the inhabitants of São Paulo – among other Brazilian cities – increased significantly, from 64,934 in 1890 to 579,033 in 1920 (Santos 2013).

Population growth and public management of urban services were, in general, linked to economic interests. The immigration subsidies and the nationalization of water and sewage services by the São Paulo government (1892), for example, were implemented only a year after a federal decree that established the decentralization

of sanitary organizations and utilized resources from the coffee oligarchy to meet their needs (ibid.). In this sense, the first years of public administration were not aimed at moving towards universal provision. Mains water in Buenos Aires only reached the central streets until the end of the nineteenth century (OSN 1993). Restrictive housing legislation conspired against formal land tenure (1909) and drove vast sectors to the urban peripheries of Santiago de Chile (Fernández Domingo 2015). Something similar happened in São Paulo, Campinas, Santos, Rio de Janeiro, Recife, Belém, São Luis, among other Brazilian cities (Castro and Heller 2007). Informal land tenure conspired against the popular sectors' connection to water and sewage networks as unplanned forms of urbanization advanced (Besana and Gutierrez 2022).

The provided services' poor quality was not exclusive to the private management that dominated in the previous stage. Scarcity and high prices continued to characterize the mains water supply in northern Chile after the creation of municipal companies (Castro Castro and Simón Ruiz 2020). An advertisement for a soft drink in the newspaper O Estado de São Paulo (1921) illustrated the water quality with a cartoon in which the person in charge of the network recommends soft drink consumption – "Doctor, here is an example of the water they make us drink [...] My God! [...] Do as I do. It is better to drink Guaraná Espumante" (Santos 2013: 17).

Popular sectors' access to public services began to expand along with incipient industrialization. In Buenos Aires, this process occurred well in advance of development theory's formalization, with emphasis on the domestic market and import substitution industrialization. The Argentine state's management of water and sanitation contributed to this substitution, bringing in American-style filters and ferric aluminum, among other imported goods, until the outbreak of World War I (Lanciotti and Regalsky 2014).

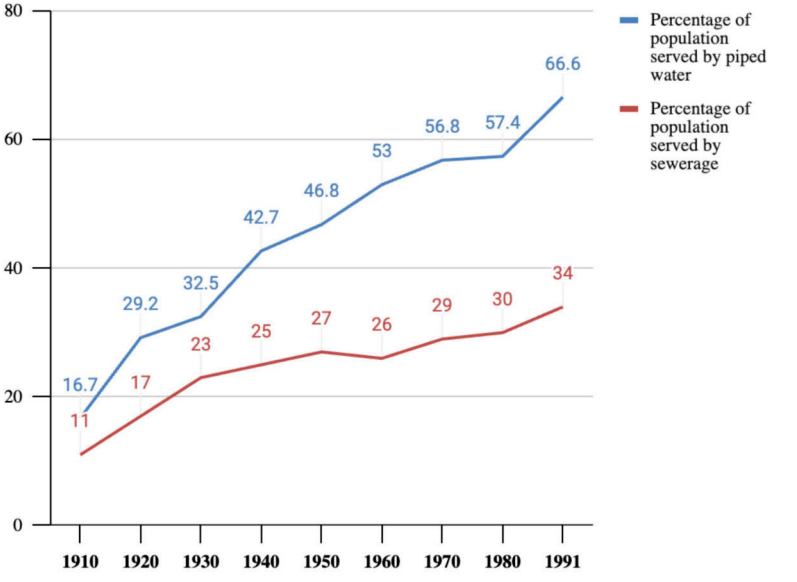
The greater involvement of central states and significant progress in water and sanitation networks coincided with universal male suffrage in Argentina (1912) and female suffrage in Brazil (1933) (Castro and Heller 2007). However, a direct relationship between social actor demands and network expansion during the period analyzed is not indicated – or even hinted at – in any of these cases. On the contrary, some studies suggest that there is no link between these two aspects, both in the region (e.g., Castro and Heller 2007) and in other parts of the world (Dryzek and Pickering 2019).

The creation of the public company Obras Sanitarias de la Nación (OSN, Sanitary Works of the Nation) was a milestone in Argentina's healthcare (OSN 1993). Together with cases in Europe, it inspired the centralization of water and sanitation services in the hands of the Brazilian (1934) and Uruguayan (1952) central states (Murtha, Castro, and Heller 2015).

An accelerated expansion of networks and a surplus balance that allowed the cancellation of loans earlier than requested (1907) took place after the creation of

the Ministerio de Obras Públicas (Ministry of Public Works) in Argentina (Lanciotti and Regalsky 2014). The National Congress accepted a request to complete the laying of networks in the federal capital by 1920 and extend it to cities in the interior of the country based on previous successes. In response, OSN was created in 1912 and given autonomy to finance itself (Acuña et al. 2017). The portion of the population served with potable water nearly doubled during its first decade. Such an increase has never been repeated since (Fig. 3).

Figure 3: Percentage of population served by piped water and sewerage in Argentina (1910–91)



Source: Author's elaboration with data from Acuña et al. (2017).

The 1929 crisis ended the illusion of a return to a more favorable context for South American exports (Pinilla and Aparicio 2015). This event began a period in which OSN's good performance was sustained by national treasury contributions (Lanciotti and Regalsky 2014). Such revenues were also the main sources of financing for the nationalization and centralization of services in Brazil, Chile, and Uruguay (e.g., Menezes and Aaraújo 1991).

Bilateral treaties offering significant concessions, increases in export volume (Fig. 1), and the destruction of surplus commodities, among other strategies, proved unsuccessful in addressing the deterioration of the terms of trade, sustaining the

export model, and confronting the protectionist policies adopted by core countries (Pinilla and Aparicio 2015). The outbreak of World War II (1939–45) interrupted a budding and timid recovery of exports (1937–38 – Fig. 1), definitively putting an end to a return to the pre-war context.

Measures aimed at strengthening the domestic market and substituting industrial imports for domestic products became more common as a response to the fluctuations suffered by primary goods exports during the first half of the twentieth century. Population growth continued between 1930 and 1950 (Fig. 2). Brazil's demographic rate exceeded that of other countries, while Chile showed higher percentages than the previous period.

Modernizing national industries and providing better welfare became imperative when faced with population growth and the instability of South American exports. The Brazilian revolution (1930), in this sense, put an end to the pact of alternation in federal power between elites associated with the coffee-growing complex in São Paulo and the cattle-raising complex in Minas Gerais (Castro and Heller 2007). Soon after, the sanctions of a new constitution and the Código das aguas (1934, Water Code) nationalized water resources and prioritized hydroelectric power generation for industry and the expansion of price-regulated water and sewage services. In Argentina, OSN's coverage area was expanded twice in 1941 (Besana 2018). First, fourteen districts of the Province of Buenos Aires bordering the federal capital were incorporated, then localities of up to 1,000 inhabitants in the interior of the country (Lanciotti and Regalsky 2014). The nationalization of Uruguayan services went from the periphery to the center. Five cities in the interior of the country were provided with water and sewage by the Dirección de Saneamiento de Uruguay (Sanitation Directorate of Uruguay) around 1930, which also had an impact on reducing the country's mortality rate (Bertino et al. 2012).

On the other hand, a British company continued to be in charge of water supply in Montevideo until 1952. At that time, the creation of Obras Sanitarias del Estado (OSE, Sanitary Works of the State) included in its coverage the entire Uruguayan territory (Santos 2010; Taks 2008), with the exception of the sewage service in Montevideo itself, which continued to be municipal (Jacob 2011). The service centralization in Chile took longer. A water code sanctioned in 1951 and the merger of two bodies into the Dirección de Obras Sanitarias (1953, Directorate of Sanitary Works) gave the Chilean state more tools to combat excessive prices in some territories and to try to expand coverage in the cities (Madaleno 2009). However, until then, the right to use water in some places continued to benefit the private sector. It was only with a new water code (1967) and within the framework of an agrarian reform initiated three years earlier that the central government reserved the power to reassign water rights and establish priority for its use.

In short, service universalization and centralization were the features that nation-states tried to implement during this stage. In general, both were linked to a

new development model based on import substitution industrialization to provide services to an enormous labor force. However, despite the change in the model pursued, both import substitution industrialization and service expansion continued to depend on foreign currency obtained through primary goods export. Unfavorably, this situation contributed to the degradation of the region's environment and climate in line with the passage of the geological era without achieving the goal of universalizing water and sanitation services. A discussion of these and other issues concludes this paper.

Conclusions

Of the many controversies surrounding the Anthropocene, its partial coincidence with the modern period does not arouse much discussion. Along with this, the discrimination between culture and nature and the idea of unlimited development, among other foundations of modern thought, are often understood as a symbolic basis for the change of geological epoch. This association, among other issues, is due to the fact that both the Anthropocene and Modernity designate a general state of affairs composed of a set of diverse elements and processes. In other words, Anthropocene and Modernity are not synonyms, but they present an elective affinity.

The expansion of water and sanitation networks in the Southern Cone and Brazil, as well as in other regions, is one of the processes that characterized the modern project that contributed to the passage of the geological epoch. More broadly, historiography associates this expansion with the modernization of the region (Halperin Donghi 2005). In addition, the link between water and sanitation networks and the Anthropocene has been discussed in this work.

This chapter has focused on the analysis of network expansion in order to fully understand how it was associated with the change of the geologic era. In symbolic terms, it showed how network water and sanitation were conceived as an expression of man's dominion over his environment, more specifically, underlining how this was seen as a way of reaching the development of Western Europe and the United States to move away from colonial or pre-Columbian backwardness. In structural terms, it has shown how the possibilities of extending service networks were tied to obtaining foreign exchange through the exploitation of nature and the trade of primary goods.

Considering such exploitation and trade as a counterpart of Latin American overurbanization was reason enough to choose Anthropocene over Urbanocene as the new geological epoch's name. This does not mean ignoring the responsibility regional and international power sectors had in the exploitation of goods and the overurbanization of territories connected to international trade. Various forms of

exploitation (colonialist, capitalist, etc.) entrenched geographical, socioeconomic, and ethnic inequalities, among others.

Droughts, on the other hand, had a minor impact on the ways and times in which networks were extended in different territories. Along with other climatic events, these occurred more frequently from 1950 onwards (Castro 2011). However, the main victims of droughts and other climatic events after the mid-twentieth century result from inequalities originating before 1950 (Soluri, Leal, and Pádua 2018). Based on this chapter's approach, the clearing of native trees for commodity production, the overexploitation of some territories, the huge urbanization of others, and the inequality of freshwater consumption, among other vast factors commonly associated with climate change and disaster risks, have a relationship to water and sanitation network expansion.

In general terms, however, this narrative came about from one of the most important research results: the distinction of three stages in the process of extending service networks. Unlike what other research suggests, these stages are not a mere reflection of network expansion in countries such as the United States or Great Britain. On the contrary, the countries analyzed here occupied a subordinate position in relation to those just mentioned, and this had a particular impact on the features common to each period.

The first stage was characterized by a multiplicity of methods inherited from the colonial period that were insufficient to meet the needs of a growing population and avoid the emergence of epidemics. As to the latter, it could be observed that the local elites associated the emergence of epidemics with the "social question" – the hygiene habits and characteristics of subaltern sectors – and identified in European and North American networks a solution to the risks that afflicted them, giving way to a new stage.

In the face of numerous inconveniences, expansion of the first networks through concessions between governments at different levels and foreign companies was the central feature of the second stage. Foreignness was as important as the companies' private nature because both aspects determined how networks spread. In this sense, the companies not only favored the expansion of demand over the quality of the services provided in search of higher revenues but were only active in periods of economic expansion and exchange rate stability. Changes in the terms of trade, international crises, or crises in their countries of origin increased the cost of services and delayed work. Although local actors (state and private) participated in financing foreign companies, the interests of the latter prevailed in management. In this sense, this stage resulted in expensive, low-quality services that only benefited sectors with the ability to pay. As an added bonus, numerous conflicts between these companies and their public counterparts paved the way for the next stage.

A trend toward service centralization and the search to universalize or at least extend services as much as possible characterize the third stage. In the latter, the

main purpose of national companies was not to maximize profits, but to strengthen a process of industrialization by import substitution, providing water to production sectors and the huge labor force required in this process.

Despite the commonalities, service centralization in these various countries and subnational territories began years apart. On the extremes, in Argentina, this process began in 1912, while in Chile, it started in 1967. Similarly, the transition from a private company to one dependent on the central state took place almost without mediation in the capital of Argentina, while state and municipal government companies in Brazil and Chile, respectively, took over functions before national public companies did so. In Uruguay, on the other hand, centralization took an inverse path geographically to the other countries, moving from the interior to the capital.

The previous stages also present differences in the ways and times in which they developed in each country or territory. Each stage laid the foundations for the next, although some territories maintained features of the previous. Thus, private companies survived for a long time after centralization, and even today there are still territories and sectors that have access to water and sanitation by the means described in Stage I. In general, these are made up of popular sectors, ethnic minorities, and Indigenous peoples who tend to reside in urban and rural peripheries.

More broadly, each stage was linked to global processes. The first stage took place in the context of the free movement of products, capital, and labor. The countries here analyzed joined the international division of labor as sovereign nations and specialized in primary goods production. To this end, they expanded their national borders and incorporated exploitable lands through military campaigns, generally to the detriment of native peoples and criollos. A development model based on foreign exchange obtained through the exploitation of nature and the export of primary goods was established at that time and maintained during most of the second stage.

During the second stage, three international shocks had a strong impact on commodity prices, profit margins, and export volumes. In an attempt to sustain the export model in the face of deteriorating terms of trade and protectionist policies adopted by core countries, production volume was increased, or entire crops were destroyed. This increased the pressure of the Southern Cone countries and Brazil on their natural assets, although without significant impacts on foreign exchange earnings. After several failed attempts, it was decided to pursue a development model based on import substitution industrialization.

This model characterized the third stage and was related to the influence of central states. However, the same difficulties that pushed the search for a new development model imposed limits on it. Ultimately, neither the path of industrialization taken nor the universalization planned to bring water and sanitation to its workers was completed.

In short, the expansion of water and sanitation networks in the Southern Cone and Brazil followed a different path from that of the major world powers, although

marked by their dependence on them. The region's subordinate incorporation into the international division of labor as a primary goods producer was not completely reversed. Thus, water and sanitation network expansion, as well as any other process associated with modernity, exerted strong pressure on the natural assets necessary for its financing. This pushed large portions of the rural population to settle in cities, making Latin America the most urbanized region on the planet. At the local level, this situation has increased the population living in informal conditions, without access to services and exposed to environmental risks. On an international scale, it has contributed to the global climate and environmental crisis and reinforced the conditions associated with the emergence of the Anthropocene.

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