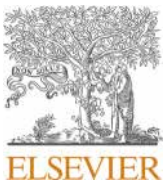
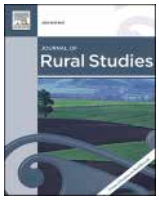
Journal of Rural Studies 113 (2025) 103502



Contents lists available at ScienceDirect

Journal of Rural Studies

journal homepage: www.elsevier.com/locate/jrurstud



Interconnected water scarcities and environmental amenities migration in rural Chile

Chloé Nicolas-Artero [a,*], Xenia Fuster-Farfán [b], Ana Huaico-Malhue [c]

[a] UMR SENS 71 rue Professeur Henri Serre, 34086, Montpellier, France
[b] Facultad de Arquitectura, Urbanismo y Geografía, Departamento de Geografía. Researcher, Centre for Sustainable Urban Development (CEDEUS), Universidad de Concepción, Víctor Lamas 1290, Casilla 160-C, Chile
[c] Departamento de Prevención de Riesgos y Medio Ambiente, Facultad de Ciencias de la Construcción y Ordenamiento Territorial, Universidad Tecnológica Metropolitana, Dieciocho 161, Santiago Centro, Chile

ARTICLE INFO

Keywords:
Water scarcity
Land use planning
Environmental amenities
Rural areas
Drinking waterscapes
Chile

ABSTRACT

This paper explores the repercussions of amenity migration on rural communities' access to water through a comparative analysis of three case studies in Chile. It examines the concept of rural drinking waterscapes to elucidate how access to water is dependent upon a metabolic process, wherein social, political, economic, and technical elements contribute to the construction of rural landscapes. This notion implies paying close attention to the daily practices of water access at the household level through ethnographic methods (multiplying interviews and observations), thus uncovering unregulated water habits and uses. The results underscore the pivotal role played by the State in shaping the desirability of these localities, attracting both capital and upper-class population influx. This socio-demographic shift triggers significant changes in land-use patterns, resulting in an amplified and diversified demand for water. The study identifies that water scarcity is a multifaceted issue, stemming from the intricate interplay of various scarcities occurring simultaneously across different scales. These include: 1) infrastructure scarcity, arising from households' inability to connect to the communal water network; 2) service management scarcity, induced by operational failures that reduce water pressure or increase supply interruptions; 3) economic scarcity, resulting from water organisation budget constraints or residents' inability to meet water bills; and 4) overexploitation scarcity, emanating from the excessive consumption of groundwater resources. Notably, these different forms of scarcity are interconnected. The responses of local populations and governing committees are identified as central to this intricate chain of causation, as they can inadvertently create new scarcity scenarios and exacerbate inequalities.

1. Introduction

Amenity migration is a central phenomenon in rural space recomposition. In some rural localities, the population has increased because of their beautiful landscapes, favourable climates, and/or comfortable conditions compared to other cities (Sánchez, 2019). This increase is the result of tourism development, the purchase of secondary residences, and the parcelling of agricultural land. Research has shown that this migration is based on the idealisation and romanticisation of destination locations (Zhang and Su, 2020). It is also known that environmental amenities are not inherent but rather political constructs resulting from state policies and investments aimed at enhancing the attractiveness of certain rural areas and developing tourist activities. In this regard, population flows reinforce the process of territorial and environmental transformation that has already begun. The arrival of new residents, often from higher social classes, has a negative impact on the population and its relationship with the territory, leading to social inequalities and conflicts (Rojo-Mendoza et al.). There is a gap in the literature on the effects of amenity-driven migration on access to clean drinking water. The aim of this study is to address this gap by understanding the social production of water scarcity in rural areas that have experienced an influx of higher-income populations attracted by environmental amenities.

In Chile, different media and environmental groups have focused on the processes of "environmental amenity migration", which seems to have risen in recent years and accelerated during the pandemic,

* Corresponding author.
E-mail addresses: chloe.nicolas-artero@ird.fr (C. Nicolas-Artero), xfuster@udec.cl (X. Fuster-Farfán), ahuaico@utem.cl (A. Huaico-Malhue).

https://doi.org/10.1016/j.jrurstud.2024.103502
Received 16 November 2023; Received in revised form 2 October 2024; Accepted 20 November 2024
Available online 25 November 2024

generating land use and housing changes. The city-countryside population flow is linked to a certain idealisation of "rural" areas, which are perceived as pleasant and peaceful spaces, as well as by a conceptualisation of nature as Edenic by neo-rural inhabitants or tourists (Núñez et al., 2021). Recently, this reality has been accentuated. Census data show that although the rural population decreased between 1992 and 2002 (−8.2%), it increased between 2002 and 2017 (2.7%). In 2022, the rampant construction of housing in rural areas has led the Ministries of Housing and Urban Development and of Agriculture to approve and apply resolutions aimed at curbing this situation[1]. However, there have been limited studies on the impact of this phenomenon, mainly driven by households with the financial means to migrate, on the living conditions of rural populations in receiving communities. To address this complexity, the article will not rely on Neo-Malthusian perspectives that analyse the relationship between population growth and water scarcity. The objective is to understand the political and economic variables that enable migration and, consequently, the reconfiguration of territorial dynamics that lead to scarcity.

The study of the construction of water scarcity in Chile is interesting for several reasons. First, this country is a paradigmatic case of the neoliberalisation of resources following the enactment of the Water Code in 1981 during the Augusto Pinochet dictatorship (Budds, 2012). Chile is currently facing a mega-drought that has resulted in a severe water crisis (Garreaud et al., 2020; Cantillana and Iniesta-Arandia, 2022). Water conflicts have played a central role in the so-called "Social Outburst" and the ongoing constitutional change process (Borgias, 2018; Usón et al., 2017). Various studies have revealed the connection between the expansion of metropolitan areas and the commodification of water, as well as inequalities in water access, highlighting the roles of private water corporations, real estate companies, and the state in these processes (Duran, 2015; Fragkou and Budds, 2020; Lukas et al., 2020; Pflieger, 2008). However, few studies have been conducted on the social origins of drinking water scarcity in small and/or isolated localities (Bravo and Fragkou, 2019; Duarte et al., 2022). In rural areas, the population is supplied through various modes of access (Chloé et al., 2022). The main mode is community organisations responsible for water distribution services in densely populated localities. In isolated areas, households have connections through wells or springs. The effects of mega-drought have primarily affected this population, which, to cope with the emergency, is supplied by water tanker trucks (Fragkou et al., 2022).

In this article, we employ the notion of drinking waterscapes (Lavie et al., 2020) to study the effects of amenity-driven migration on the construction of water scarcity in the rural population in three localities. Derived from research in political ecology and anthropology that examines the metabolic processes reshaping water access (Budds and Hinojosa, 2012), this concept advocates for an ethnographic approach to understand the daily behaviours and arrangements of populations concerning water (Suárez, 2024). It entails conducting empirical studies at the micro-local level of households and communities to uncover elements not visible at the city or watershed scale, as well as analysing cultural habits and daily interactions of residents with water (Lavie et al., 2020). Based on empirical research conducted in three rural communities, the article demonstrates that there is a plurality of local water scarcity situations at a community level, which are interdependent and mutually reinforcing. Furthermore, by focusing on residents' cultural habits, neighbour arrangements, and individual decisions in response to scarcity, the article reveals that adaptation strategies may not necessarily be beneficial for the community as a whole and can exacerbate scarcity situations. Lastly, the comparison of the three case studies, characterised by varying migration flows and environmental amenities, highlights a common issue: the contradictory position of the State, which seeks to support economic development in these areas by making them more attractive through various investments while neglecting to provide adequate legal, financial, or technical support to ensure sustainable access to potable water for all residents.

In the first section, amenity-driven migration and its effects on water access are discussed. The second section outlines the methodology used in this study. In the third section, we present the results for each case study and draw connections between them. We demonstrate how investments designed to enhance the attractiveness of localities attract upper-class populations, which increases water demand and leads to multiple interconnected scarcity situations. We also show that individual responses to scarcity collectively contribute to the social production of scarcity. The fourth section presents a discussion of the results obtained before concluding.

2. Migration for environmental amenities and local responses to the water scarcities in rural areas

This article proposes a conceptual framework to study the impact of amenity migration on water scarcity, based on a metabolic approach of development, water access and spatial production. This framework adopts a multi-scalar approach to understand water scarcity production, including global and local dimensions. We analyse the flow of capital and power that led to the transformation of drinking waterscapes and the relationship between inhabitants and water service delivery from the committees.

2.1. The reconfiguration of rural drinking waterscapes

The notion of waterscapes is understood as "the surface and groundwater resources of an area of land and their interrelationships with other physical, climatic, and biotic elements, as well as with human activities" (Molle et al., 2012:2). This notion has been studied in geography and development from a political-ecology perspective. This demonstrates how the distribution and access to water in a territory are influenced by history and the political economy. It involves analysing local hydrosocial relationships based on water artefacts, infrastructure, technical objects, capital flows, practices, and knowledge that reproduce power, class, ethnicity, and gender relationships (Budds, 2012; Caretta and Zaragocin, 2020; Heynen et al., 2006; Linton and Budds, 2014). In this sense, waterscapes reflect the production of nature and space as a metabolic process where social relationships and water are transformed together. The reproduction of capital, power relations, and conflicts around the appropriation of space is associated with the production of new waterscapes (Harvey, 1996; Heynen et al., 2006; Lefebvre, 2000; Smith, 2020).

The notion of waterscapes has focused on understanding conflicts and inequalities in the distribution of water at the regional or basin level, leaving aside the analysis of access to drinking water and sanitation in households of rural communities. For instance, Swyngedouw's founding research was conducted at the national level in Spain and at the urban level in Guayaquil, Ecuador. Harris (2006) and Molle et al. (2012) interrogate waterscapes at a regional scale in Southeast Asia and the Mekong region to analyse the practices of sharing water resources and the construction of subjectivity. However, this notion has been fruitful for studying the formation of inequalities in access to drinking water in urban areas. Many urban political ecological studies have focused on urban and suburban landscapes. Loftus and Lumsden (2008) analysed the construction of informal settlements in Inanda in post-apartheid South Africa. From an analysis of these interstitial spaces

[1] Sources: Law 21,458 amends regulations regarding the division of rural properties to guarantee access to public spaces and roads, https://www.bcn.cl/leychile/navegar?idNorma=1178903&idParte=10349884; Resolution Number 43,289 of the Ministry of Housing and Urban Development establishes regional criteria to ensure that subdivisions and constructions on rural land in the metropolitan region of Santiago do not lead to the creation of urban centres outside intercommunal urban planning, https://www.diariooficial.interior.gob.cl/publicaciones/2022/06/29/43289/01/2148984.pdf.

in Jakarta, Kooy (2014) revealed the importance of informal practices for water access. Others have been interested in the entanglement of water and power flows in city centres (Arango, 2015; Crombé and Blanchon, 2010).

In rural areas, the notion of waterscapes focuses more on the governance of water resources and the advancement of extractive mining and agricultural frontiers (Budds and Hinojosa, 2012). Sultana (2013) shows how unexpected techno-natural assemblages produce arsenic contamination of groundwater in agrarian societies in the southern Bengal delta. Prieto (2017) and Méndez (2021) have demonstrated how the waterscapes of the Atacama Desert in Chile have been shaped by mining and state modernisation efforts to date back to the 19th century, leading to the production of an unequal nature. There is a gap in the literature regarding the use of the concept of waterscape in rural areas, as few studies employing this concept focus on the daily difficulties of water access for rural households and their effects on the production of rural space. Furthermore, in the context of domestic water access in rural areas, other approaches prevail. On the one hand, economic and quantitative approaches concentrate on evaluating the performance of water management organisations (Fuster and Donoso, 2018). On the other hand, analyses of water governance from a political science perspective pay limited attention to daily practices (Nelson-Nuñez et al. 2019; Delgado et al., 2020). Additionally, studies on water conflicts, often based on cases study, do not adequately address multi-level interrelationships and the micro-local scale (Cantillana, 2018). Finally, feminist approaches, which examine the effects of scarcity on women, often overlook socio-technical aspects within households (Bravo and Fragkou. 2019).

This lack of coverage in the literature highlights the need to apply the concept of rural drinking waterscapes to explore the daily water-related challenges in these areas. We used the concept of drinking waterscapes from Lavie et al. (2020) to understand the reconfiguration of water access in rural areas experiencing a population increase due to their environmental amenities. This concept proposes studying the transformation of waterscapes at a scale and on a topic that has been underdeveloped in the literature: access to clean water in rural households. It emphasises the importance of ethnographic approaches to study the issues surrounding household water access that are not observable at a broader scale. Consequently, it advocates for investigating how behaviours, beliefs, and neighbourhood relationships impact water access, alongside the political and economic factors operating at different scales. In this article, we employ ethnographic approaches to integrate daily practices and politics in shaping water access. Therefore, we analyse how access to water for domestic use in rural populations is a metabolic process influenced by flows of capital and power relations at various levels, simultaneously encompassing both local and global dimensions (Swyngedouw, 2004).

2.2. Building attractiveness: urban-rural migration for environmental amenities

In Global South countries, dynamics in rural areas are influenced by the expansion of extractive activities, development of tourism, and peri-urbanisation processes (Larsen et al., 2011; Matarrita-Cascante and Stocks, 2013; Zhang and Su, 2020). Consequently, rural areas are heterogeneous and have experienced diverse changes over time and space. A recent phenomenon observed and intensified after the pandemic is the migration of urban populations to rural areas due to environmental amenities (Martin and Bergmann, 2021; Cole et al., 2021; Nelson and Frost, 2023). While the reasons for this population flow are known, little is understood about its territorial effects on rural localities, which have historically concentrated on the poorest populations. In this article, we propose to analyse the relation between migration due to environmental amenities and water scarcity in rural communities with attractive landscape features.

The search for an idealised nature and the desire to escape the city explain these urban-to-rural migrations. Various studies in geography and social sciences have provided critical knowledge of the modern conception of nature that underlies this migratory flow (Smith, 2020; Harvey, 1996; Swyngedouw, 1999; Braun and Castree, 1998; Whatmore, 2002). Escaping urban nature and finding refuge in romanticised nature contribute to the transformation of space and the production of unequal natures and geographies. Smith (2020) asserts that ideas regarding nature materialise in the practices of the appropriation of space that have a social and political purpose and are driven by specific economic interests. The ideal dimension, or the ideology of nature, is not "just a set of wrong ideas, but a set of ideas rooted in practical experience - the experience of a social class that looks at reality from its perspective - and, therefore, its erroneous character is only partial" (Smith, 2020:42). For this reason, the conceptions and practices of a certain social class produce unequal natures and spaces within the framework of the geographical dynamics of capitalist development.

Storper and Scott (2009) questioned whether the scenic attributes of places influence residential preferences. This is because those who can engage in amenity or lifestyle migration are typically the affluent and highly skilled population (Benson, 2013; Zhang and Su, 2020), who are more attracted to economic conditions (both present and future) and idealised lifestyles in rural areas than the observable characteristics of the places themselves. Therefore, while it is a social and economic process, it is primarily political one, with the state playing a crucial role in creating conditions of attractiveness. The value of localities based on the beauty of their landscapes reveals a certain idealisation of nature that, in some cases, results in touristification led by state investments (Aliste et al., 2018; Núñez et al., 2018). The migrating population constitutes a wealthier segment of the society, revealing economic inequalities. Simultaneously, amenity migration, whether driven by tourism or short- or long-term mobility, reconfigures rural spaces, integrates them into globalisation, and generates hybrid lifestyles between rural and urban areas (Morales Gaitán and Rainer, 2013).

2.3. Water scarcities and the response from rural inhabitants

Water scarcity refers to a situation in which water resources are insufficient to meet the needs of human activities and to preserve ecosystems (Turton and Ohlsson, 1999). Water scarcity differs from drought, which is a natural risk resulting from insufficient precipitation compared to normal or predicted levels (Pedro-Monzonís et al., 2015). It is now known that the physical shortage of water can be attributed to various factors depending on the scale at which it is examined. Natural science disciplines distinguish three types of drought:1) meteorological drought defined as a sustained decrease in precipitation; 2) agricultural drought, a moisture deficit in the soil that hinders crop growth; and 3) hydrological drought, a period of low streamflow, lake levels, and groundwater levels below normal (Turton and Ohlsson, 1999).

However, these quantitative definitions are insufficient to understand the decline in water availability as they mask the social and political construction of scarcity (Castree and Braun, 2001; Harvey, 1996; Smith, 2008; Swyngedouw, 1999; Whatmore, 2002). Political ecology studies have demonstrated that water scarcity is not solely caused by local climatic or biophysical phenomena; political decisions, processes of political economy, knowledge, and practices defined at various scales also play a role in a metabolic process (Heynen et al., 2006; Linton and Budds, 2014). Different types of scarcity have been identified in the literature. First, scarcity could be due to the absence of infrastructure, resulting from households' inability to connect to the collective network (Guerrero Rojas and Cristina, 2019). Second, a scarcity of service management could be produced by failures that reduce overall pressure or increase water cuts (Mehta, 2007; Sultana, 2011). Third, economic scarcity refers to water organisation cuts due to a lack of resources or willingness to pay the residents' bills (Harris et al., 2016). Finally, overexploitation results from overconsumption of groundwater (Budds, 2012). Recent studies have highlighted the interconnectedness between

water scarcity and other social and economic scarcities (Ioris, 2012).

The responses of rural inhabitants to scarcity have been studied relatively rarely. The literature has primarily focused on studying the responses to water scarcity of social movements (Copeland, 2023; Borgias, 2018), urban dwellers (Weaver et al., 2019; Keough and Saidou, 2021; Lindsay and Supski, 2017) or farmers (Zobeidi et al., 2022), to water scarcity, overlooking the sociotechnical solutions implemented by rural residents to secure access to water. Sociotechnical approaches developed in urban studies and political ecology have shown that urban residents who are not connected to formal water networks create multiple sociotechnical devices to access water, such as rainwater harvesting, purchasing water from private suppliers, or obtaining it through tanker trucks (Coutard and Rutherford, 2015; Cawood et al., 2022; Harris et al., 2020; Jaglin and Zérah, 2010; Ahlers et al., 2014). In these studies, inhabitant, collective associations or household responses to scarcity are often perceived in a positive or constructive manner, as they lead to improved access. Generally, a range of literature on local water governance has supported the idea that locally defined solutions are the most appropriate, a claim that is often reiterated in studies on local adaptation strategies to climate change (Gupta and Pahl 2013). In this article, we argue that rural residents' responses to water scarcity trigger other situations of scarcity and reinforce collective water access problems at the drinking waterscape level (Fig. 1).

3. Materials and methods

The methodology is based on a comparison of three case studies in rural localities with different degrees of urbanisation due to their environmental attractiveness (Fig. 2). We used mixed methods (Hui and Wescoat, 2019) that combine the analysis of satellite images and census data with interviews and observations.

3.1. Presentation of the cases

Chile presents legal specificities in water governance that make it particularly interesting, while sharing certain commonalities with other Global South countries in terms of managing drinking water distribution in rural areas. In the 1980s, during the dictatorship, a reform of the Water Code and the new Constitution established private ownership of water rights, thereby limiting the State's ability to guarantee access to water. Although several reforms to the Code aim to guarantee the human right to water, the Constitution remains unchanged, and the State's powers are still restricted, intervening only in exceptional cases through Drought Decrees. This is especially evident in the distribution of drinking water in rural areas, where the recent Rural Sanitary Services Law struggles to be implemented (Nicolas-Artero, 2024). This law seeks to replace the water policy in place since the 1960s, which was centred around the Rural Drinking Water Program that funded the construction of water capture and distribution systems, delegating management to the residents of rural localities.

The design of the infrastructure set up under this Program was based on a view of rural areas as homogeneous and stable over time, with a population having lower needs compared to urban areas. This representation has remained unchanged during the 50 years of the APR Program's application and is reflected in the Rural Sanitary Services Law. Both legislative frameworks convey a vision of rural areas populated by poor inhabitants, with lower water consumption and payment capacities compared to urban areas. This has led to the design of sociotechnical systems limiting consumption to about 120 L per person per day for households of four people. To reduce costs, the diameters of the pipeline networks and storage capacity are also smaller than in urban areas.

The selection of the three case studies is justified by both similarities and differences. In terms of similarities, in the 1980s, the three localities belonged to rural areas and received support from the Ministry of Public Works to create rural drinking water committees under the APR programme. Thus, the national legal and institutional framework that applies is the same. Additionally, the average rainfall level has decreased over the last decade in all three cases (Table 1). However, the committees still have access to their water sources most of the year. This does not mean that the committees don't have difficulty providing water in terms of quantity and continuity to their inhabitants. In all three cases, the infrastructure stopped functioning before the renovation date estimated by the State, set at 20 years after their creation, rendering them incapable of meeting the population's needs. As a result, no committee is officially authorised to install new connections. This allows the Ministry of Public Works to ensure that the quality of service is not compromised by rapid population growth. Finally, environmental amenity migration occurred in all three cases, resulting in socio-spatial changes within the committees' service areas, with the arrival of new investors with higher incomes and greater water consumption than long-term residents. However, the migration, the support, and the role of the State in making

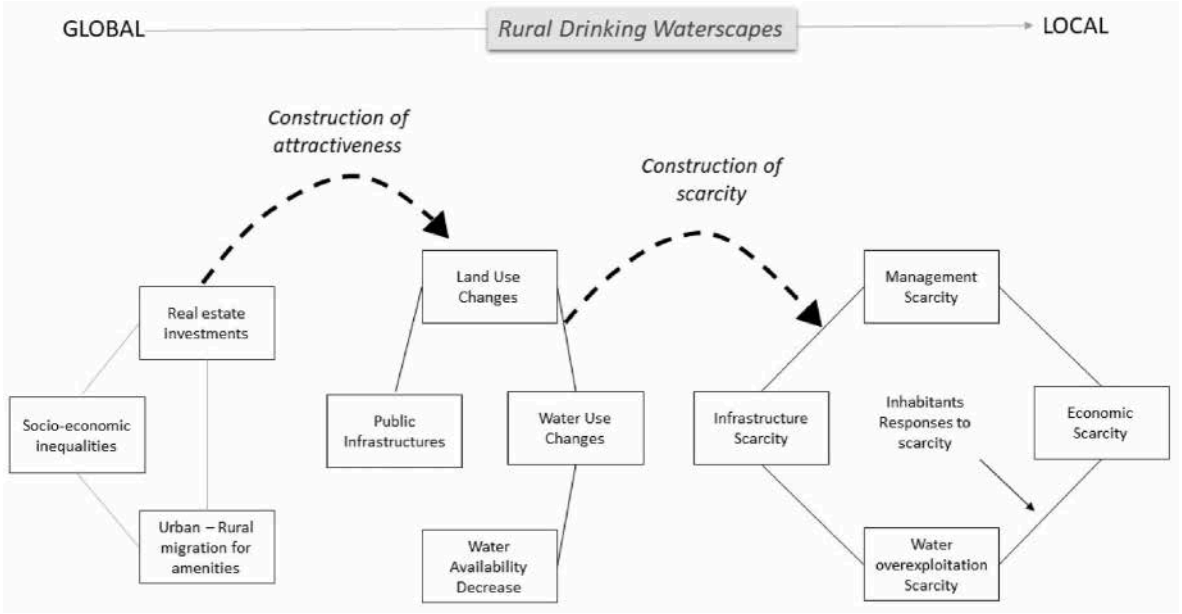


Fig. 1. Social construction of water scarcity in rural areas with environmental amenities.

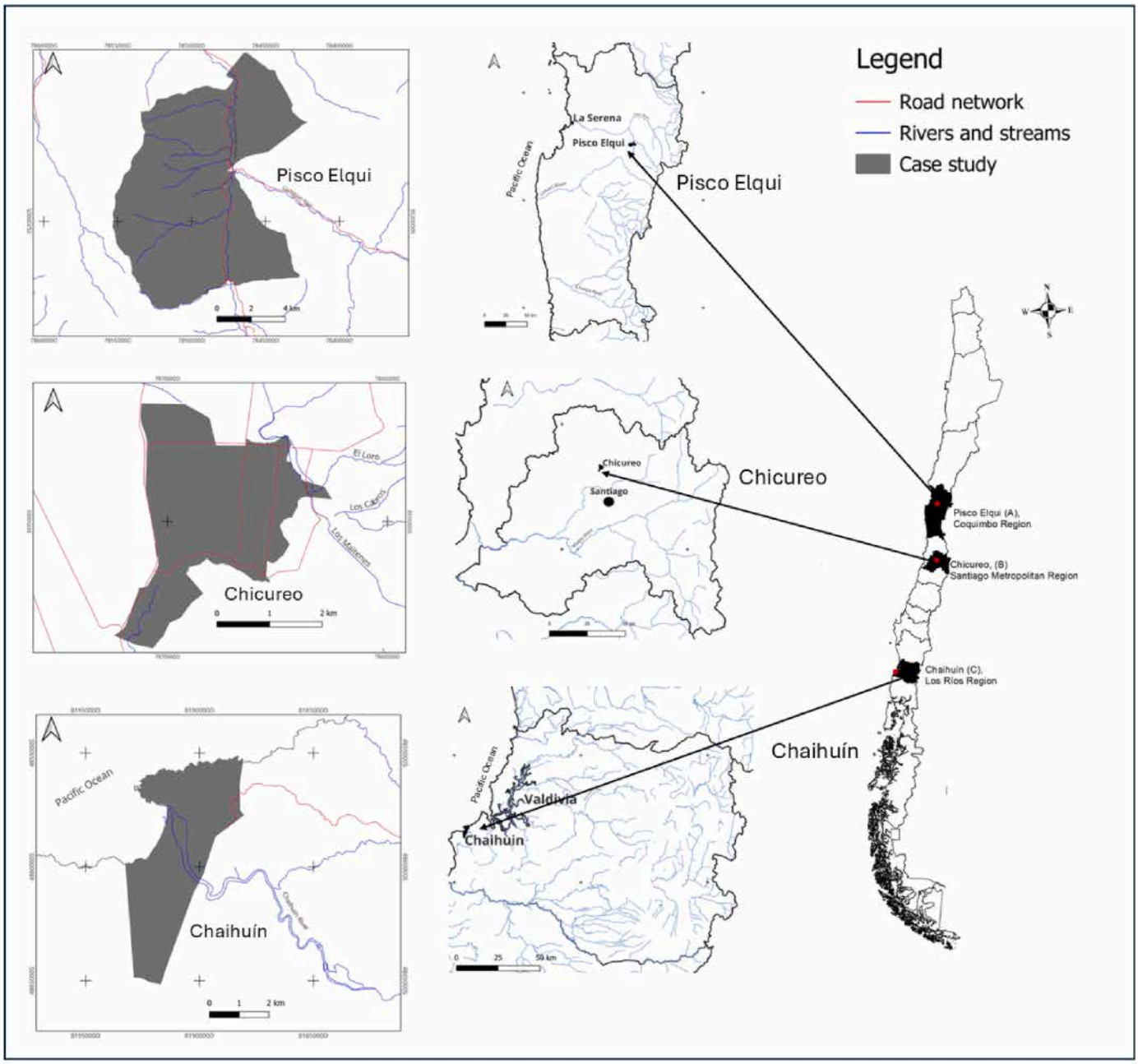


Fig. 2. Cases studies.
Sources: Authors.

these localities attractive differ, which allows for the coverage of a variety of rural transformation situations. In Chicureo, amenity migrants escape from Santiago in search of the "countryside" and suburban life (Lukas et al., 2020), while in Pisco Elqui, tranquillity and connection with the high mountain environment are pursued (Author, 2022). In Chaihuín, people seek seaside air, culinary cuisine, and beachside views (Evarisiti and Muñoz, 2006). This led to an increase in housing and the subsequent need for municipalities to create regulatory plans for land use (Table 1).

3.1.1. Pisco Elqui: Mass tourism in the context of agrarian capitalism

Pisco Elqui is in the Paihuano commune at the head of the Elqui River basin in the Coquimbo Region. As of 2017, there were 296 inhabitants (INE, 2023). Currently, there is a 32% precipitation deficit (Table 1). In this context, the municipality of Paihuano experiences a semi-arid, temperate climate in the pre-Ande region. Humidity levels range from 30% to 15% between 1000 and 2000 m in altitude. The average temperature is 24 °C and the annual rainfall is 100 mm (Municipalidad de Paihuano, 2016). In 2017, 61% of households were supplied with water by tanker trucks (INE, 2023).

Starting in the 1980s, along with the liberalisation of the economy, export-oriented agriculture and tourism expanded in the Pisco Elqui Valley. Three agricultural companies acquired land and water rights from indebted residents forced to sell (Nicolas-Artero, 2024). Tourism became an escape activity, initially developed by neo-rural settlers who moved to the valley, mainly after the fall of Halley Comet, attracted by its tranquillity and beauty. Parcellisation leads to an increase in the year-round or seasonal resident population in the valley, driven by both secondary housing and the influx of tourists during the summer. Nowadays, the original population is engaged in tourism or works as

Table 1
[1]Presentation of case studies.

Committee Name	Commune	Region	Year of Creation	Type of migration	Regulatory Plan	Rainfall (1979–2022)[2]	Number of housing units in 1992	Number of housing units in 2017	Number of home connections the year the committee was created	Number of home connections in 2022
Pisco Elqui	Paihuano	Coquimbo	1982	Neorural migrants, residents with secondary residence, investors and national and international tourists.	Rural area with an intercommunal plan (2018). Paihuano Regulatory Plan (2019): integrates Pisco Elqui	−32%	170	827	80	980
Chicureo	Colina	Metropolitan	1988	Upper-class families settle in gated communities on the outskirts of the capital.	Urban area with a communal regulatory plan (2010)	−29%	301	856	60	660
Chaihuín	Corral	Los Ríos	2015	Regional tourists, investors and residents with second homes.	Nonexistent	−7%	74*	301	35	240

Source: Authors. Housing and population census INE 1992, 2017; CASEN 1996; interviews with leaders. Figure elaborated by authors 2022.

labourers for the three agricultural companies in the area. This change also affected the water access methods: underground water sources, small reservoirs, and localised irrigation replacing gravity-based irrigation. With regard to drinking water, the population gradually shifted from using canal water to tap water owing to a lack of properly regulated water rights. However, some families continued to use canal water to irrigate small gardens.

3.1.2. *Chicureo: Gated communities in priority urban areas*

Chicureo is a locality within Colina Municipality in the Metropolitan Region of Santiago. The study area has a semi-arid climate, with precipitation concentrated during winter. However, it experienced a decrease in precipitation between 1979 and 2022, reaching −29% (Table 1), resulting in meteorological drought conditions. According to microdata from the National Institute of Statistics (INE, 2023), in 2017, the city had a population of 2548 inhabitants, with 594 households, of which approximately 76.9% sourced their water from the public network.

The current history of Chicureo occupation is closely tied to land-use policies. In the late 1990s, the government designated it as a "Zona de Desarrollo Urbano Condicionado" (Zone of Conditioned Urban Development) and funded a highway that connected the locality to the economic center of the capital in less than 30 min. This has led to the urbanisation of the entire area. Simultaneously, rural estates were subdivided and sold. Residents and farmers recall that supposed cholera contamination of vegetables, reported in the media, caused a decline in the sale of their products, forcing them to sell their lands. In these rural spaces, numerous gated communities, commercial areas, and recreational facilities have been built to cater to affluent individuals seeking environmental amenities. However, the construction of houses with gardens and swimming pools, golf courses, and lagoons has increased water consumption in the watershed (Author, 2015). Socio-spatial inequality is highly noticeable between Chicureo and the population of Las Canteras, whose families work to provide services to affluent families (caregivers, gardeners, etc.) or to new businesses in the area.

3.1.3. *Chaihuín: Regional tourism on the coast as a development strategy for the indigenous population*

Chaihuín is situated within the Corral Municipality in the Los Ríos Region. It is a coastal town with a total population of 175 residents and 162 households, of which 60 are permanently occupied. According to microdata from the INE (2023), approximately 68% of the water supply in the area comes from the public network. The climate in the study area is temperate and rainy (Municipalidad de Corral, 2016), indicating that precipitation occurs throughout the year in an irregular pattern. The total annual precipitation averages around 1871 mm; however, it has experienced a −7% deficit in precipitation (Table 1).

Traditionally, the residents of Chaihuín have lived in livestock and fishing. Women tended to garner, craft textiles, and engage in shellfish gathering. The products were sold in Corral, or traders from Valdivia would purchase them by boat. The use of space was organised vertically around the home, from the mountains where the livestock lived to the sea for fishing or gathering shellfish, and close to a spring for water access. In 1998, the construction of a road connecting Chaihuín to Corral and the installation of an electrical grid altered the population's habits. The road disrupted the vertical use of space and posed a threat to livestock owing to increased vehicular traffic. Additionally, tourists began to arrive progressively to visit the locality, attracted by various features, such as the white sandy beach and the interpretative trail of the tusks. Consequently, women shifted their focus toward tourism, specialising in local cuisine, handicrafts, and commerce. An association of indigenous women has established a restaurant that attracts visitors through a Valdivia-based tourism agency. More recently, some families have decided to enter the tourism industry by offering lodging services through the construction of cabins with hot tubs. The government built a pier and several food trucks and vendors sold quick meals. Some families also chose to sell parts of their land to acquire vehicles. This has led to a parcellisation where the construction of homes is no longer determined by proximity to springs, which have degraded over time, or access to the mountains and the sea. Instead, it is driven by panoramic views of the sea, access to the beach, and connections to the potable water network.

3.2. *Land use and land cover changes*

It is relevant to study the combined effects of land-use changes from environmental, economic, and social perspectives in the three case studies. Land use change can modify the properties of ecosystems and influence hydrological processes such as evapotranspiration,

groundwater recharge, and soil moisture content (Rafiei-Sardooi et al., 2022). Thus, it can affect water availability and demand, and its effects on water resources can be exacerbated in climate change scenarios. In this regard, land use and land cover change (LULC) assessment provides insight into some of the drivers of water scarcity (Sharannya et al., 2021). To carry out this analysis, Landsat satellite images were obtained from the United States Geological Survey (USGS) for 2015, 2019, and 2021. A spatial resolution of 30 m × 30 m was used, and the dry season (November–February) was analysed.

The images were pre-processed with QGIS software using the SCP function, in which atmospheric and topographic corrections were carried out, which, according to Wang et al. (2021, is an important step in establishing a direct affiliation between the acquired data and the biophysical phenomenon. The evaluation of use and coverage change was conducted based on the supervised classification method with precision analysis, a tool that allows the comparison of random sample points on the classified map with reference pixels (Singh et al., 2022). Coverage and/or land use was identified in each scene, focusing on the variability of land use destined for construction in the three case studies.

Finally, a multi-temporal analysis of use changes was carried out, which, according to Alawamy et al. (2020), consisted of a comparative analysis between different periods to identify natural changes and the scope of different land use and cover changes. This temporary definition sought to identify the quantitative changes in the time before and after the COVID-19 pandemic.

To complete the analysis, data from the 2002 and 2017 Population and Housing Censuses were consulted, as well as the existing Municipal and Intercommunal Regulatory Plans (Colina 2010; Paihuano, 2019). Also, data related to the 2002 and 2017 rural residential properties were requested from the National Institute of Statistics but were only available in Chicureo.

3.3. Qualitative data collection

Fieldwork at the three locations was conducted between November 2021 and January 2022. For comparison, common interview guidelines were used with the leaders of each committee to understand the factors affecting service management and water access. In addition, semi-structured interviews were conducted with inhabitants and workers in the tourism sector. Two field visits were made to the installed infrastructure, and the landscape was analysed. The same interview schedules were used with municipal officials at the communal level and the Public Works Board of Directors of the Ministry of Public Works at the regional and national levels. The collected discourses were coded and analysed using ATLAS-TI.

4. Reconfiguring rural drinking waterscapes: Exploring the impact of amenity migration on water scarcity

The state's ambivalent action in terms of land use planning in rural areas that have environmental amenities - through the promotion of tourism, late or lacking regulation, and investment in public infrastructure–has generated land-use changes in all three cases. The population that settles either permanently or for short stays has water consumption habits that significantly increase demand. These changes coincided with climatic phenomena such as reduced precipitation, resulting in scarcity. In response to water shortages, the actions of the residents paradoxically exacerbated the situation. In this section, we describe land-use change processes that generate scarcity chain reactions (Table 2).

[2] Sources: CR2Met, Boisier et al., 2018 and Álvarez C. from the on-going project "*Tema Integrativo Seguridad Hídrica*" (Water Security Project).

Table 2
Waterscapes transformation and scarcities in the three cases studies.

Types of Scarcity and responses	Pisco Elqui	Chicureo	Chaihuín
New types of housing units	Tourist residences (hotels, campsites) Secondary residences Housing for relatives	Rural residential properties Condominiums Housing for relatives	Tourist residences (cabins) Secondary residences
New water uses	Swimming pools Irrigation	Swimming pools Irrigation Gardens	Hot tubs Irrigation
Pending feasibility requests	600	175	100
Scarcity 1 **Management scarcity**	Low pressure Networks breaks	Low pressure Networks breaks Small Pond	Low pressure
Scarcity 2 **Infrastructure scarcity**	Lack of feasibility	Lack of feasibility	Lack of feasibility
Response 1 **Individual**	Individual wells or intakes in the irrigation channels	Individual wells	–
Response 2 **Interindividuales**	–	Thefts Rentals	Thefts Rentals Sharing
Scarcity 3 **Overexploitation scarcity**	Pressure on aquifers and channels in a closed basin	Pressure on aquifers in the Chicureo ZODUC upstream of the committee	–
Scarcity 4 **Economic scarcity**	–	Service disconnections due to non-payment	–

Sources: Authors.

4.1. Pisco Elqui

In Pisco Elqui, land use planning instruments were applied to regulate and strengthen pre-existing urbanisation due to the increase in visitors after the passing of Halley's comet. In addition, at the end of the 1990s, the state paved the way to facilitating the accessibility of agro-industrial export companies, which also favoured tourism. In 2019, the Plan Regulador Intercomunal (PRI) of the Province of Elqui came into force, the first planning instrument that was applied in the concession area of the drinking water committee. In addition to establishing urban expansion zones for Pisco Elqui, this device also established an urban development plan for the provinces' communes. The existence of the PRI made it possible to promulgate the Plan Regulador Comunal (PRC) for the commune of Paihuano in the same year. Local authorities consider the PRC an opportunity to distinguish between urban and rural areas, tourism development sectors, heritage zones, and public and private investment areas, among others. One of the contextual elements that gave rise to the PRC was the Paihuano inhabitants' demand to protect the environment, which has deteriorated as a result of the growing installation of tourist centres. To respond to this demand, the tourist market was not restricted or limited, but "Tourism Zones" were established in places where the centres already exist. In other words, the PRC legalised the use of tourist land in Pisco Elqui. Also, it established "High-Density Zones", whose residential use can be both for homes and lodging. Therefore, it indirectly allows for the existence of infrastructure for tourist accommodations in areas other than those established for this purpose.

Therefore, the locality of Pisco Elqui has experienced an increase in its population, as reflected in the expansion of land use for infrastructure. Over time, this growth is evident in the rise of households, from 170 in 1992 to 827 in 2017 (INE, 2017). This growth continues, as observed in the expansion of land use for infrastructure in the Elqui

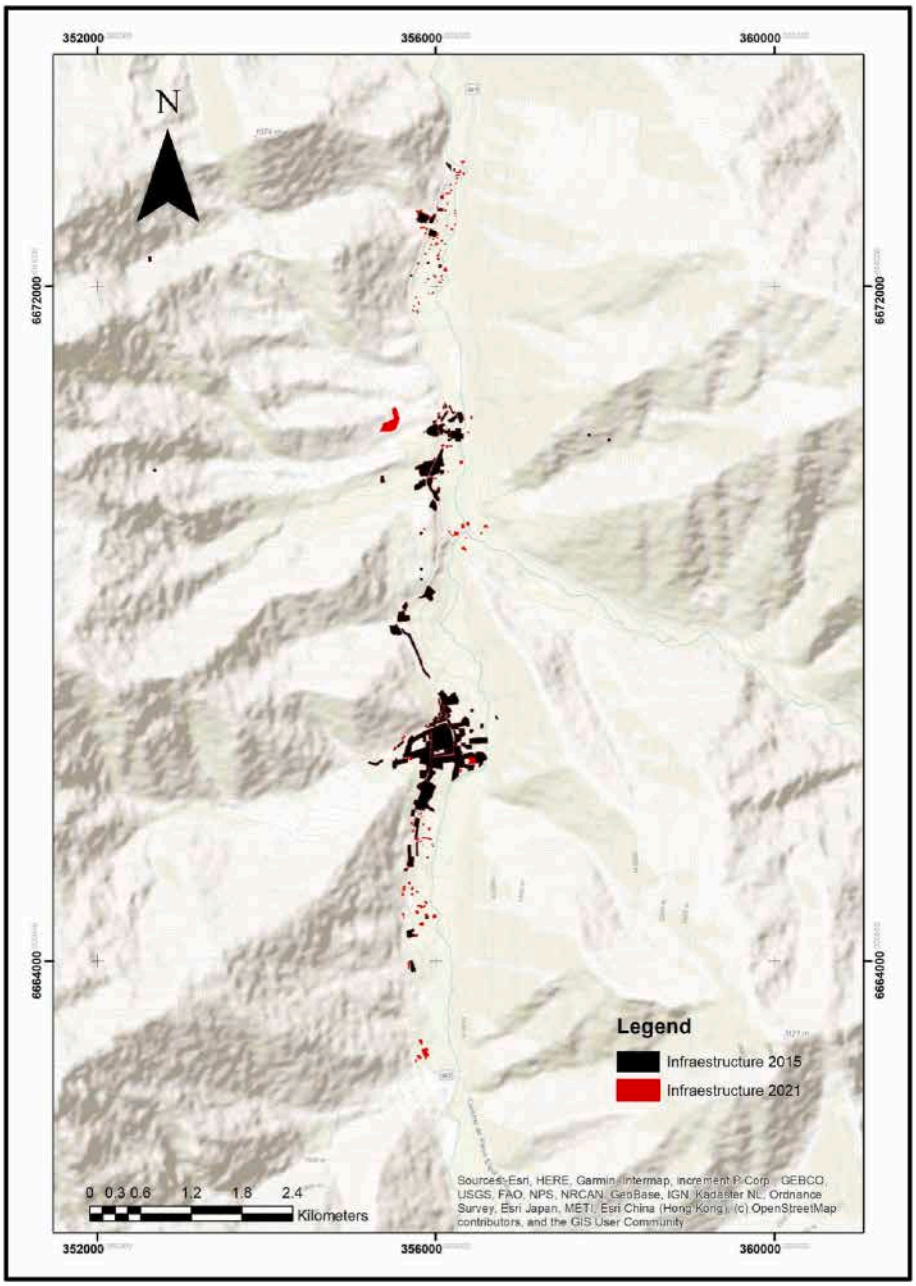


Fig. 3. Evolution of land occupation in Pisco Elqui in 2015 and 2021 (*color*). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

Valley (Fig. 3). The arrival of these new residents and tourists, who come from social classes wealthier than the local farming families, has altered water usage due to their different consumption habits compared to those of the residents, which has increased pressure on the resource. Often, secondary residences or hotels are equipped with swimming pools, which are highly sought after in this semi-arid region where access to the river has become difficult due to the fences erected by private properties (Author, 2024). Furthermore, the massive influx of tourists during the summer period increases daily demand for essential needs (hygiene, consumption).

In Pisco Elqui, this population growth and an increase in the number of households have resulted in various scarcity situations. One type of scarcity arises due to service management issues, leading to a decrease in water pressure, particularly during summer when the population increases due to tourist arrivals. For the same reason, there is an increase in pipeline breaks when the committee boosts the pressure to meet high demand. Another form of scarcity emerges from the arrival of new residents to new secondary or permanent homes in the valley. In response to the difficulties during the summer, the committee decided not to accept new connections to its networks, leaving 600 homes without connections. This means that they do not grant “feasibility”, creating scarcity due to a lack of infrastructure for the residents of new homes. Initially, this technical decision was made by the Ministry of Public Works based on the capacity of the installed networks to avoid service saturation. It is worth noting that in many cases, leaders of committees do not adhere to the prohibition of connecting more people to networks to avoid reprimands from neighbours and the guilt of denying a vital resource to a family. However, this is not the case with the Pisco Elqui committee, which prefers not to connect new users to ensure the quality of previously connected families.

Both the residents and the committee seek solutions in response to these two types of scarcity. An initial response involves the construction

of wells based on their properties. Initially, the sub-basin where the committee was located has been closed since 1948, meaning that it is not possible to request new rights to the surface or groundwater (Author, 2024). However, the Water Code allows for the construction of wells for domestic use, and the oversight capacity of the Water Directorate (DGA) is minimal in Chile (Budds, 2020). As a result, wells have been built, increasing pressure on the basin in the context of low water availability due to mega-drought. Furthermore, an interindividual response is manifested in the diversion of water from irrigation canals, both by the residents and committee. When residents divert water without proper appropriation rights, it can be considered theft. Simultaneously, the committee has an agreement with irrigators to use the remaining water from a canal to fill the second reservoir in an area known as La Jarilla. However, these two responses tend to create a new type of scarcity through overexploitation as they increase the pressure on groundwater and surface water in the basin.

4.2. Chicureo

In the Chicureo case, land use planning instruments triggered the urbanisation of agricultural properties located near the capital, generating an important real estate business (Hidalgo et al., 2007; Lukas et al., 2020). In 1997, the Santiago Metropolitan Regulatory Plan (PRMS in Spanish) was modified for the first time after the dictatorship. The main modifications of the PRMS were the creation of Conditioned Urban Development Zones (ZODUC in Spanish) and priority urbanizable development areas (AUDP in Spanish). Both devices created a model of conditioned urban development that stimulated the construction of large real estate projects and urban infrastructure (such as highways) in rural areas with low residential density. This model was at the heart of the PRI in Chacabuco, a province where the Colina commune is located, of which Chicureo is a part.

Chicureo's ZODUC allowed for the construction of gated communities in rural residential properties[3] that, thanks to this instrument, increased their density and transformed the social practices linked to the rural world that were developed there. Data from the 2002 and 2017 censuses showed an increase in rural residential properties in the concession area of the Las Canteras Committee in Chicureo, where the number of properties doubled between both periods. Therefore, the number of housing units has increased (from 174 to 1283). It is estimated that, in recent years (2015–2021), the land area designated for infrastructure in the locality has increased from 338 ha to 418 ha (Fig. 4). However, the population density decreased from 882 to 314 people. This indicates the consolidation of the suburban residential model.

In this commune, the pandemic appears to have led to an increase in the population, despite the pre-existing difficulties in providing water to the population because of several committees no longer granted feasibility. A municipal agent explained the following:

> The entire pandemic year came and the only institution that continued to work was the municipality. […] There is a feeling that the municipality has an obligation to provide water, and neighbours take advantage of this situation and buy land knowing that there is the possibility [of having water]. […] Today, the only thing left for us to believe is that people go to these places because they seek peace and quiet even when it is not 100% comfortable. […] We began to put up signs that said there was no possibility [of water]. Do not buy here. Even after [these efforts], People continue to buy, even after these efforts.

The role assumed by the municipalities during the pandemic to deliver water strengthened the phenomenon, as the new residents assumed that the municipalities would supply water to the incoming population.

These new residents are middle- or upper-class families who decide to settle on the outskirts of the capital to have a house with a garden. Their water use is higher than that of the long-established families, as it involves maintaining these green gardens where pools are installed. A telling example is the new neighbourhood of Piedra Roja, which features a golf course and a lagoon for water sports. It is located upstream from the Las Canteras committee, inhabited by families of former farmers or quarry workers from the area, who now work as gardeners, housekeepers, or in service jobs in the capital.

Real estate development in the upper Chicureo Basin (Piedra Roja), as well as the settlement of extended family members in the Las Canteras area, has had multiple repercussions on water access for the population living in the lower sectors. The committee was affected in various ways. On the one hand, there is a scarcity due to management issues manifested in water cuts resulting from the breakdown of old pipelines. Additionally, the water pressure was low for the sector most remote from the reservoir. In fact, the reservoir is not equipped to meet the demand in the sector, especially during the summer. On the other hand, scarcity arises from the lack of infrastructure. Similar to Pisco Elqui, the committee decided not to grant feasibility to new homes in the area, as it would threaten the already degraded service quality for all residents, leaving 175 households without connection.

Faced with these two types of scarcity, the population has adopted individual responses. On the one hand, families that own land install wells to supplement the use of network water. It is worth noting that because of the declining water table in the basin, well depths have quickly become insufficient, and only wealthier families can afford to deepen their wells. Thus, the increased demand for water across the entire basin, especially because of real estate projects and various recreational uses in the Piedra Roja area upstream of the basin, leads to overexploitation-induced scarcity.

On the other hand, residents implement an inter-individual response because of their inability to connect to the network. Some families connect to offshoots. These connections can be illegal, meaning that they are made without informing the owner of the main offshoot. They can also result from the agreement, usually when the owner of the offshoot is a family member who decides to provide water. In both cases, informal connections resulted in very high consumption, as measured by the water meter. This leads to the application of the highest water tariff, because water prices are proportional to the volumes consumed. Often, households cannot afford the water bill, leading to significant arrears that have resulted in water cut-offs and scarcity owing to delinquency.

4.2. Chaihuín

In the case of Chaihuín, land use change was generated before the application of a regulatory instrument, as indicated by an APR committee leader:

> They sell a lot of land, and people who are building do not do so with the proper supervision of the municipality. The problem is that Chaihuín has completely expanded in terms of housing […] There is a municipal problem. The regulatory plan is clearly rural when it is urban. Some form of municipal ordinance should be sought to organise the land issue because otherwise there will be complete disorder.

[3] In 1980, in the midst of the neoliberalisation process of Chilean territorial policies, the decree-law on "subdivision of rural properties" (DL 3516/80) was approved, a device popularly known as "property subdivision". This decree allows landowners located outside the urban limit - according to the territorial planning instruments - to freely subdivide their land, provided that the result is no less than 0.5 ha. These lands, called "rural residential properties", have accelerated the urbanisation of the countryside, regardless of the instruments that regulate urban spaces. The size of these new properties prevents them from carrying out a profitable agricultural activity and, in addition, those who acquire them do not seek to maintain said use. An "infiltrated city" is then produced in the rural space (Naranjo, 2009; 2017).

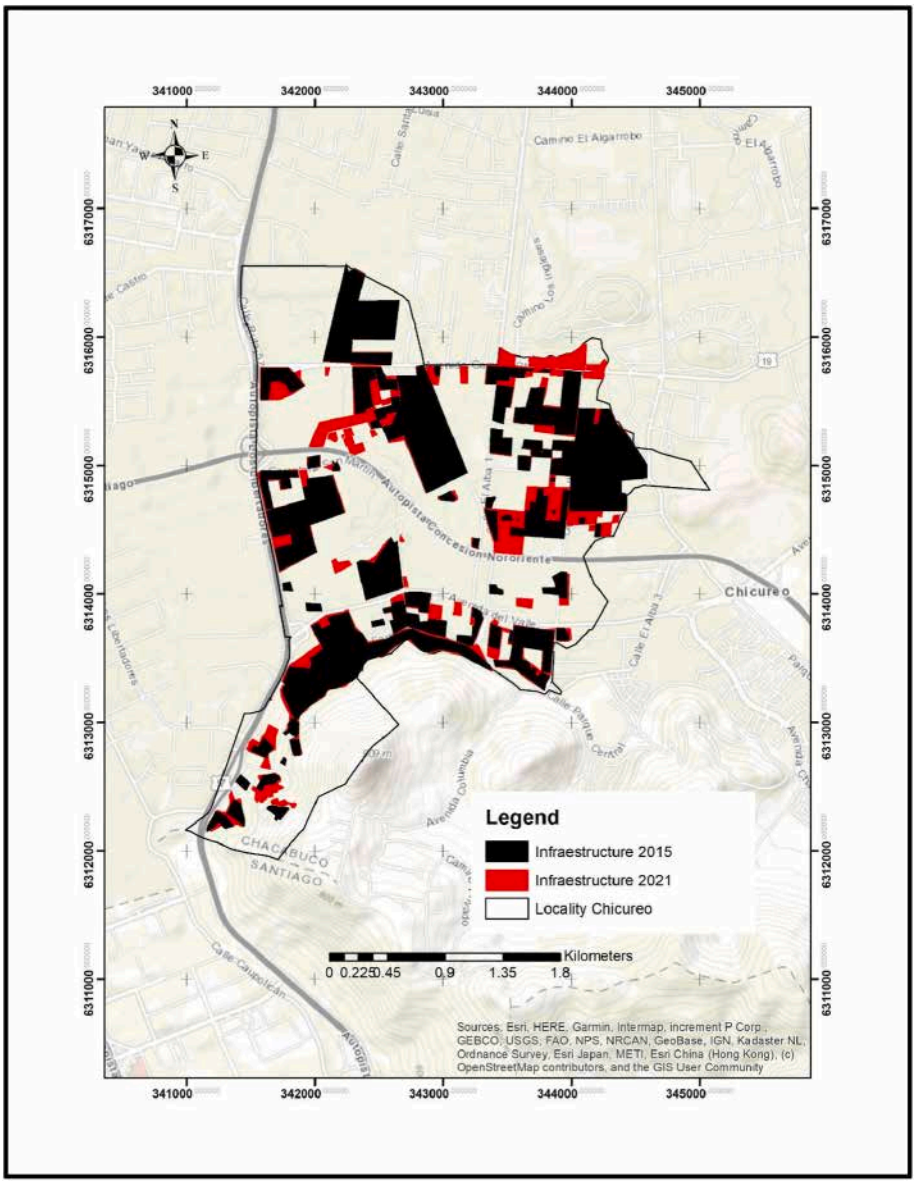


Fig. 4. Evolution of land occupation in Chicureo in 2015 and 2021 (*color*). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

In Chaihuín, tourism is promoted by the state. In the mid-1990s, the Corral-Chaihuín Rural Tourism Network was created and promoted by the Agricultural Development Institute (INDAP) and the Local Development Programme (PRODESAL), followed by the construction of a road that connects the town to Corral in 1998 and its subsequent paving in 2012 (Evarisiti and Muñoz, 2006). Since then, the state has created the Los Colmillos trail, built a fishermen's cove, and created a craft market. The inhabitants economically shifted (fishermen and collectors) towards tourist activities (gastronomy, craft, and commerce), which increased tourism. Although Corral Commune has a PRC, it has not been updated since 1996. Chaihuín was not included in the zoning of the instrument, which could be explained by the scarcity of urban settlements in the locality during the 1990s. The outdated PRC and Chaihuín's exclusion from legal grants to individuals and companies the freedom to develop economic and residential investments without urban regulations.

Of the three cases studied, Chaihuín showed the greatest transformation on a territorial scale. The number of houses increased from 74 (CASEN, 1996) to 301 (INE, 2017). Consequently, this is an ongoing process over time, as land use designated for infrastructure increased by 26.6%, from 30 ha in 2015 to 38 ha in 2021. As shown in Fig. 5, there is evidence of an increase in the installation of infrastructure during the pandemic period, which can be explained by the growing amenity migration experienced by the Los Ríos region, especially to Valdivia. However, this trend has recently developed. Property purchases and sales have increased during the pandemic. As reported by the committee leader, "Chaihuin has grown because there are people who have bought [homes] and come to live in this sector. The pandemic has also led many [people] who have a summer home to come live [here] permanently." The latter is also related to the effects of the pandemic on family economies, as commented by a local craftsperson: "The willingness to sell is related to the pandemic. Much of the land is being sold. I think it is because of problems or because people liked making money quickly." The arrival of these new residents with higher incomes or those investing in tourist accommodations increase the demand for water. Indeed, one of the luxury recreational practices carried out by these new residents or tourists is bathing in small wooden pools (called *tinajas*) filled with heated water. It is estimated that there are 17 tubes of 1000 L each.

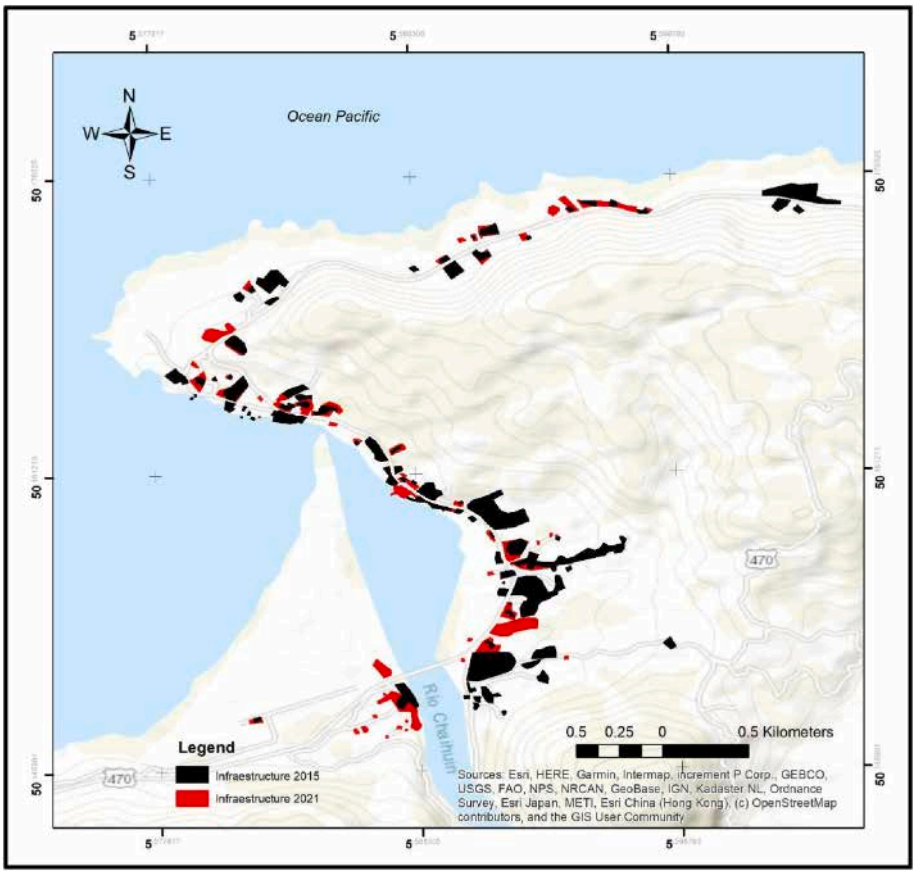


Fig. 5. Evolution of land occupation in Chaihuín in 2015 and 2021 (*color*). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

In Chaihuín, the arrival of new residents in secondary homes and tourists generated scarcity problems. Similar to previous cases, there is a scarcity due to management issues, primarily affecting a population sector situated on top of a hill, resulting in low water pressure. The situation worsens in summer because of two processes. First, there is an influx of tourists. Second, the combined effect of climate change and monoculture pine plantations upstream of the basin have dried up the springs that the population used to irrigate their gardens. As a result, the population uses tap water for irrigation, leading to increased demand for the committee during the spring and summer.

Furthermore, the gradual degradation of the service has led the committee to no longer grant feasibility for 100 homes built in recent years, resulting in scarcity owing to a lack of infrastructure. These are secondary homes built after the land subdivisions. To gain access to water, these new families resort to inter-individual responses. They connect to networks illegally, make agreements with neighbours to connect to the already installed offshoot, or borrow water on occasions. However, similar to the case of Chicureo, this generates conflicts as it significantly increases water consumption and cost, making it difficult for families to pay for water. However, in this case, the committee's leadership decided not to cut off water despite the existence of arrears.

4.3. Exploring interconnected scarcities

The state's normative ambivalence toward rural land meant that in the 1980s and the 1990s, rural areas began to be urbanised due to their environmental value and/or attractiveness for tourism. Over the last few decades, important socio-spatial transformations have been observed in the three localities under study. Although the roles of state and local authorities differ depending on the case, private investments in housing and tourism are important in all cases, but these are not accompanied by measures to support the committees and guarantee the population's access to drinking water.

The land use changes in the three case studies reconfigured the rural drinking waterscapes, producing scarce situations. On one hand, new houses were built on subdivisions (houses for relatives) or new subdivisions (rural residential properties). In Pisco, Elqui, and Chaihuín, the construction of hotels, campsites, and cabins has increased. On the other hand, there was also an increase and diversification of the water demand. This is partly due to the arrival of populations from higher social classes, either permanently or temporarily (tourism, second homes), which generates an increase in the number of housing units or people per housing unit (households with relatives) where the rise in land and housing prices makes it inaccessible. The consumption of water per person increased, and therefore, it also increased per housing unit because of 1) the use of household appliances (washing machines, dishwashers, showers); 2) new recreational use in tourist residences or the construction of certain amenities (swimming pools in Pisco Elqui and Chicureo, *tinajas* in Chaihuín); and 3) the use of drinking water to irrigate gardens or orchards, especially during the summer.

In the three localities, the increase and diversification of housing and water use generated four situations of intertwined water scarcity (Fig. 6). The results show that the four scarcity types feed on each other. Additionally, people's responses to water scarcity strengthen the chain of water scarcity situations.

The first situation called "management scarcity" occurs when the new inhabitants can connect to the network of the drinking water committee. The increase in water demand exceeds the committee's supply capacity, which is defined by the installed infrastructure, resulting in a service decline. Water pressure is reduced, or water cuts become more frequent, creating scarcity.

The second situation called "infrastructure scarcity" occurs when the

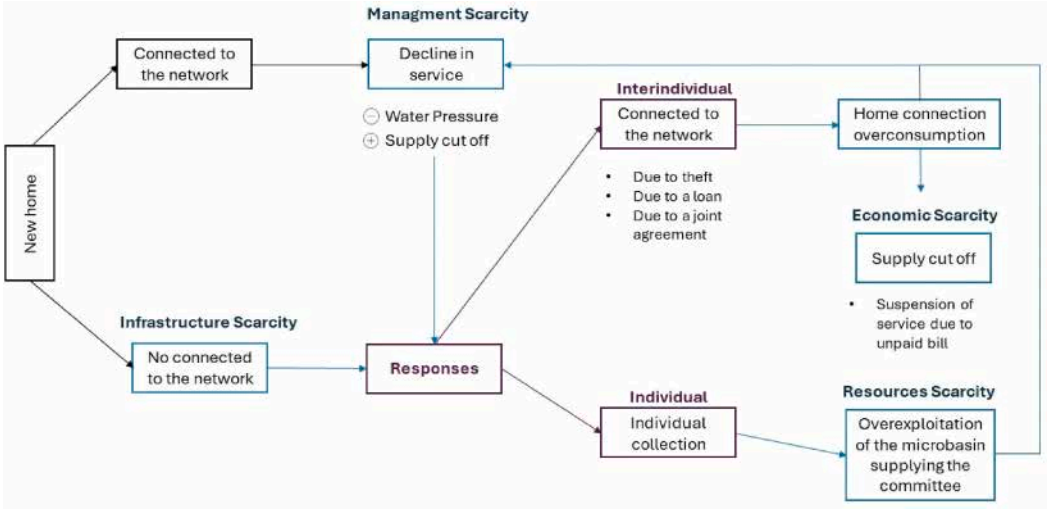


Fig. 6. Water scarcity in case studies.
Sources: Authors, 2024

new inhabitants cannot connect to the committee's network. That is, the Ministry of Public Works does not give the committee permission to expand its network (it does not grant new feasibility), and the committee respects this decision (Table 2). Due to the state's ambivalent role in land use planning in these localities, new houses are built, even though they are not able to connect to the water network. This generates water scarcity situations until the inhabitants find an alternative solution.

To address these two scarcity situations, residents implement solutions to ensure their access to water. We identified two types of responses: individuals and inter-individual. These responses had a counterproductive effect on water access in the locality, generating two new types of scarcity. We identify scarcity due to individual collection and scarcity due to the overexploitation of the watershed.

The first individual response occurred when new inhabitants, in general, with more capital, installed individual collection points to self-supply water. In Chaihuín, the conditions for taking in water from springs through relief and rainfall levels are favourable; however, a decrease in rainfall poses a threat to this practice. In Chicureo, the population invests in wells, as in Pisco Elqui, when people also extract water from irrigation canals or the river, often illegally, that is, without regularised water rights (Author, 2024; 2015). This individual solution produces a negative effect because it uses water from the water resources in the supply basin, which affects the committee's long-term supply in the long run. This ultimately leads to a resources scarcity, due to overexploitation. In Pisco Elqui and Chicureo, the increase in demand in the context of low supply has led committees to drill deeper wells in different locations (Author, 2019; 2015).

The second interindividual response occurs when inhabitants look for ways to connect to a previously installed home connection. Three situations can occur:1) new residents can connect without notifying the homeowner. This action is comparable to theft and is revealed when, to the owner's surprise, water consumption increases significantly, without any observed losses in the network. 2) New residents sublease their connections with the inhabitants. This commercial agreement among individuals is mostly used in secondary residences. 3) New residents share connections and split rates. This agreement usually occurs among family members who build houses on the same land. These arrangements are made up for the water scarcity generated by the new inhabitants' inability to connect to a network, but they often create conflicts and, in some cases, cause committee leaders to cut off water supply. In effect, these double connections cause water overconsumption in the meter readings of the main housing unit because, in the three committees, the water rate increases proportionally to the amount of water consumed. Sometimes, users cannot pay water bills. If there is a prolonged delinquency situation, this may lead to the water supply being cut off by leaders and an economic scarcity owing to moroseness.

5. Discussion. The social production of scarcity in the reconfiguration of waterscapes

In this article, we apply the notion of drinking waterscapes in three rural localities to contribute to the discussion on the social construction of scarcity. Recent studies on water scarcity have emphasised the plurality of scarcity types. On one hand, it has been shown that water scarcity cannot be understood as an isolated phenomenon but is interconnected with other types of scarcity related to income or housing (Ioris, 2012). Other studies have highlighted different types of water scarcity, based on the factors that cause it or its manifestations (Bravo and Fragkou et al., 2019). More broadly, the notion of the hydrosocial cycle has been used to show how the flows of water, money, and power overlap, reproducing inequalities and scarcity situations at the basin scale (Prieto), as well as through the distribution by water trucks (Fragkou). The contribution of the notion of rural drinking waterscape lies in its focus on a larger scale, analysing how individual and collective behaviours also play a role in the social construction of scarcity, without disconnecting them from broader metabolic processes. In this sense, the article extends the idea of different types of scarcity proposed by Bravo and Fragkou (2019). The ethnographic perspective at the family level has revealed how the various types of scarcity are interconnected and reinforce each other, including the responses to scarcity.

The article highlights how individual or inter-individual responses to scarcity, in a context of state non-intervention to guarantee access to water to a human being, generate new forms of water scarcity. This is an important contribution found through empirically examining the links between individual behaviours and changing access to water on a micro-local scale. This finding is interesting because the literature has generally shown how residents' or organisations' responses to scarcity can improve access to water. For example, Lindsay and Supski (2017) demonstrated how, in the face of scarcity in Australia, household consumption practices become more sustainable to ensure future access to water. Similarly, Tippin (2021) highlighted the resilience of communities in the border colonies of Mexico and the United States through rainwater harvesting, shared resource use, and participation in community support networks. At the organisational level, Minnes and Simpson (2020) have shown how private providers in Ontario manage to

supply water to rural areas despite the difficulties arising from scarcity. Our studies demonstrate that currently in rural Chilean localities, individual and committee responses to scarcity create another type of scarcity, resulting in two forms of inequality in access to water. These manifest, on the one hand, between residents in older homes and residents in new homes and, on the other hand, among inhabitants with higher and lower economic resources. The former has the option to purchase water or invest in deeper wells, which is not the case for the latter, whose solution (informal network connections) can lead to supply cutoffs.

Additionally, the comparison illustrates that these results are not an isolated or exceptional phenomenon in one locality, but a pattern common to rural localities in Chile that experience different forms of amenity migration. The metabolic process at play is similar, where the contradictory position of the State stands out, as it promotes the economic development of a locality without modifying the legal and institutional framework for water that would ensure its access to the population. Our findings extend the reflections on the responsibility of the Chilean State in the social construction of water scarcity in rural areas (Budds, 2012; Fragkou et al., 2022). The empirical study and comparison of the three cases highlight commonalities despite different locations, socio-demographic changes, and territorial specifics. On one hand, we observe the contradictory role of rural development policies. While the State increases investments in infrastructure (roads, paving) to improve connectivity in these localities and promote tourism-related activities, these investments do not go hand in hand with efforts to maintain essential services, such as potable water supply. Despite the problems faced by the water committees, such as breakages or low pressure, the only measure taken by the State, through the Ministry of Public Works (MOP), is to suggest not granting feasibility, resulting in infrastructure scarcity. In no case was the construction of attractiveness in rural areas carried out in conjunction with investments in the improvement of infrastructure to address the increased demand for water that would accompany population and tourism development in these localities. Nor are measures implemented to limit overconsumption of water in areas impacted by climate change (agro--industry, lagoons, golf, agro-industry), prioritising the human right to water. In this sense, rural development policies appear to be more focused on constructing amenities for resource-rich populations than ensuring decent living conditions for an already marginalised rural population (Bustos-Gallardo).

We contribute more broadly to the literature on amenity migration, understood as an inherently political phenomenon. Studies have portrayed the state as a significant actor in amenity migration, particularly in regulating land use and stimulating tourism. A recent debate on this phenomenon in countries of the Global South (Rainer, 2019), particularly in Latin America, invites researchers to focus on the role played by the state in amenity migration and the facilitation it provides for the installation of the global real estate industry, the construction of sociocultural and landscape values, and the development of national-local tourism, which, in turn, drives the processes of Spatial Fix (Harvey, 2001). Following this line, this research illustrates the facilitation and arrangements that the state develops to construct areas of interest, both in terms of tourism and residential purposes, that favour the migration and circulation of affluent populations, exacerbating territorial inequalities and water scarcity, and necessitating reparatory actions by the state itself. Furthermore, little is understood about the territorial effects on rural localities. In the case of Chile, amenity migration has focused on describing the process and analysing its effects on the involved localities (mainly rural areas), primarily developed within the field of tourism geography. Therefore, knowledge production about this phenomenon is oriented toward understanding how natural spaces become areas of economic and tourist interest; the values and imaginaries transmitted; and the political, spatial, material, and symbolic transformations that the process brings about. While some studies have shown that amenity migration negatively impacts access to drinking water for rural populations (Hidalgo et al., 2009; Hidalgo and Zunino, 2017; Sánchez, 2019), they have not delved into the relationship between amenity migration, water scarcity, and the strategy communities, individual residents, and the state employ to address it. This knowledge is essential to understand and modify the factors generating scarcity. Our article analyses these interrelationships and how political, economic, and spatial conditions are created to drive amenity migration, without anticipating the consequences of this process on water scarcity.

6. Conclusion

This study has mobilised the notion of rural drinking waterscapes to examine the effects of amenity migration on the rural population's access to water. The comparison of three case studies reveals the role of the State and the shortcomings of normative and institutional frameworks in guaranteeing access to water for the rural population. The State played a central role in building the attractiveness of these localities. The capital and upper-class population flow in these localities lead to land-use changes and an increase and diversification of water use in the context of decreasing water availability due to the local effects of climate change. Water scarcity is based on the interplay of multiple water scarcities triggered by material and immaterial processes that unfold concurrently at various scales:1) scarcity due to infrastructure absence resulting from households' inability to connect to the collective network; 2) scarcity of service management, caused by failures that reduce overall pressure or increase water cuts; 3) economic scarcity resulting from water organisation cuts due to lack of resources or willingness to pay the residents' bills; and 4) overexploitation scarcity resulting from the overconsumption of groundwater. These situations are interconnected and produce new water scarcity. The individual responses of the population play a central role in this chain because they generate new scarcity situations and inequalities.

CRediT authorship contribution statement

Chloé Nicolas-Artero: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing. **Xenia Fuster-Farfán:** Conceptualization, Funding acquisition, Validation, Writing – original draft, Writing – review & editing. **Ana Huaico-Malhue:** Conceptualization, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interests

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Xenia Fuster Farfan reports financial support was provided by University of Concepción. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors gratefully acknowledge the research support provided by CEDEUS, ANID FONDAP 1523A0004, ANID SA77210085 and ANID FONDAP 1523A0002.

Data availability

No data was used for the research described in the article.

References

Ahlers, Rhodante, Cleaver, Frances, Schwartz, y Klaas, 2014. Informal space in the urban waterscape: disaggregation and Co-production of water services. Water Altern. (WaA) 7 (1), 14.

Alawamy, J., Balasundram, S., Hanif, A., 2020. Detecting and Analyzing Land Use and Land Cover Changes in the Region of Al-Jabal Al-Akhdar, Libya Using Time-Series Landsat Data from 1985 to 2017. Sustainability 12, 4490.

Aliste, E., Folchi, M., Núñez, A., 2018. Discourses of nature in new perceptions of the natural landscape in southern Chile. Front. Psychol. 9.

Arango, L., 2015. Some theoretical models, methods, and concepts of urban anthropology in Sudan: the case of Tuti Island revisited *Canadian Journal of African Studies*, 49 (1), 197–213.

Benson, M., 2013. Living the 'real' dream in la France Profonde? Lifestyle migration, social distinction and the authenticities of everyday life. Anthropol. Q. 86 (2), 501–526.

Boisier, J.P., Alvarez-Garreton, C., Cordero, R.R., Damiani, A., Gallardo, L., Garreaud, R. D., Lambert, F., Ramallo, C., Rojas, M., Rondanelli, R., 2018. Anthropogenic drying in central-southern Chile evidenced by long-term observations and climate model simulations. Elementa: Science of the Anthropocene 6, 74.

Borgias, Sophia L., 2018. "Subsidizing the state:" the political ecology and legal geography of social movements in Chilean water governance. Geoforum 95 (octubre), 87–101. https://doi.org/10.1016/j.geoforum.2018.06.017.

Braun, B., Castree, N., 1998. Remaking Reality: Nature at the Millennium. Routledge, London and New York.

Bravo, Leslie, Maria Christina Fragkou, y, 2019. Escasez hídrica, género, y cultura mapuche. Un análisis desde la ecología política feminista. Polis 18 (54). https://doi.org/10.32735/S0718-6568/2019-N54-1401.

Budds, J., 2012. La demanda, evaluación y asignación del agua en el contexto de escasez: Un análisis del ciclo hidrosocial del valle del río La Ligua, Chile. Rev. Geogr. Norte Gd. 52, 167–184.

Budds, J., Hinojosa, L., 2012. Restructuring and rescaling water governance in mining contexts: the Co-production of waterscapes in Peru. Water Altern. (WaA) 5 (1), 119–137.

Budds, Jessica, 2020. Securing the market: water security and the internal contradictions of Chile's water Code. Geoforum 113 (julio), 165–175. https://doi.org/10.1016/j.geoforum.2018.09.027.

Cantillana, R., 2018. Conflictos por el agua en sus dimensiones sociales y culturales: Política de Estado y gestion comunitaria en Tarapacá, Chile. Estudios Socioterritoriales 23, 27–43.

Cantillana, R., Iniesta-Arandia, I., 2022. Beyond scarcity and its management: sociocultural dimensions of the water crisis in the Atacama Desert. Water Pol. 24 (7), 1124–1145. https://doi.org/10.2166/wp.2022.297.

Caretta, M.A., Zaragocin, S., 2020. Women's resistance against the extractive industry: embodied and water dimensions. Hum. Geogr. 13 (1), 3–5.

Castree, N., Braun, B., 2001. Social Nature: Theory, Practice, and Politics. Blackwell Publishers, Malden.

Cawood, Sally, Wahby, Noura, Ferrara, y Luciana Nicolau, 2022. Hybridity in practice: responding to water insecurity in são paulo, dhaka, and cairo. Water alternative 15 (3), 21.

Chloé, N., Gustavo, B., Carlos, B., Noelia, C., 2022. Modes of access to water for domestic use in rural Chile: a typological proposal. Water Policy 24 (7), 1179–1194. https://doi.org/10.2166/wp.2022.026.

Cole, H.V.S., Mehdipanah, R., Gullón, P., Triguero-Mas, M., 2021. Breaking down and building up: gentrification, its drivers, and urban health inequality. Curr Environ Health Rep 8 (2), 157–166. https://doi.org/10.1007/s40572-021-00309-5.

Copeland, Nicholas, 2023. Politicizing water: rescaling resistance to extractive development in Guatemala. Geoforum 140 (marzo), 103704. https://doi.org/10.1016/j.geoforum.2023.103704.

Crombé, L., Blanchon, D., 2010. Les (micro)— réseaux à la reconquête de la ville : Le cas de Khartoum. Bull. Assoc. Geogr. Fr. 87 (4), 517–533.

Delgado, L.E., De Ríos, R., Perevochtchikova, M., Marín, I.A., Fuster, R., Marín, V.H., 2020. Water governance in rural communities of Chiloé Island, southern Chile: a multi-level analysis. Journal of Rural Studie 83, 236–245. https://doi.org/10.1016/j.jrurstud.2020.11.008.

Duarte, A., Vanhulst, J., Letelier Araya, E.A., 2022. Peri-urban territories and rural water community governance in Chile. Int. J. Soc. Econ. 49 (1), 59–72. https://doi.org/10.1108/IJSE-09-2020-0633.

Duran, G., 2015. Water and poverty in Santiago de Chile. Morphology of the inequity in the distribution of the residential consumption of drinking water. Eure-Revista Latinoamericana De Estudios Urbano Regionales 41 (124), 225–246.

Evaristi, V., Muñoz, C., 2006. Evaluación y caracterización de los establecimientos turísticos rurales que prestan el servicio de alojamiento. Caso en estudio: red Corral-Chaihuín. MCs Thesis, Universidad Austral de Chile, Valdivia, Chile.

Fragkou, M.C., Budds, J., 2020. Desalination and the disarticulation of water resources: stabilising the neoliberal model in Chile. Trans. Inst. Br. Geogr. 45 (2), 448–463.

Fragkou, M.C., Monsalve-Tapia, T., Pereira-Roa, V., Bolados-Arratia, M., 2022. Abastecimiento de agua potable por camiones aljibe durante la megasequía. Un análisis hidrosocial de la provincia de Petorca, Chile. Revista EURE - Revista de Estudios Urbano Regionales 48 (145), 1–22.

Fuster, R., Donoso, G., 2018. Rural water management. In: Donoso, G. (Ed.), Water Policy in Chile. Springer International Publishing, pp. 151–163. https://doi.org/10.1007/978-3-319-76702-4_10.

Garreaud, R.D., Boisier, J.P., Rondanelli, R., Montecinos, A., Sepúlveda, H.H., Veloso-Aguila, D., 2020. The Central Chile Mega Drought (2010–2018): a climate dynamics perspective. Int. J. Climatol. 40 (1), 421–439.

Guerrero Rojas, R., Cristina, Fragkou Maria, 2019. Infraestructura estatal en contexto de escasez hídrica : la Provincia de Petorca como territorio hidrosocial. Disponible en. https://repositorio.uchile.cl/handle/2250/172912.

Gupta, J., Pahl-Wostl, C., 2013. Global water governance in the context of global and multilevel governance: its need, form, and challenges. Ecol. Soc. 18 (4), art53. https://doi.org/10.5751/ES-05952-180453.

Harris, L.M., 2006. Irrigation, gender, and social geographies of the changing waterscapes of southeastern anatolia. Environ. Plann. Soc. Space 24 (2), 187–213.

Harris, L., Goldin, J., Sneddon, C., 2016. Contemporary Water Governance in the Global South: Scarcity Marketization and Participation. Routledge.

Harris, Leila M., Staddon, Chad, Wutich, Amber, Budds, Jessica, Jepson, Wendy, Pearson, Amber L., Adams, y Ellis Adjei, 2020. Water sharing and the right to water: refusal, rebellion and everyday resistance. Polit. Geogr. 82 (octubre), 102245. https://doi.org/10.1016/j.polgeo.2020.102245.

Harvey, D., 1996. Justice, Nature and the Geography of Difference. Blackwell Publishers, Cambridge.

Harvey, D., 2001. Globalization and the "spatial Fix". Geographische Revue 2, 23–30.

Heynen, N., Kaika, M., Swyngedouw, E. (Eds.), 2006. In the nature of cities: urban political ecology and the politics of urban metabolism. Routledge. London.

Hidalgo, R., Borsdorf, A., Sánchez, R., 2007. Hacia un nuevo tejido rurbano. Los megaproyectos de ciudades valladas en la periferia de Santiago de Chile. Ciudad Territ. - Estud. Territ. 39 (51), 115–135.

Hidalgo, R., Borsdorf, A., Plaza, F., 2009. Parcelas de agrado alrededor de Santiago y Valparaíso: ¿Migración por amenidad a la chilena? Rev. Geogr. Norte Gd. (44), 93–112.

Hidalgo, R., Zunino, H., 2017. Negocio inmobiliario y migración por estilos de vida en La Araucanía, lacustre: La transformación del espacio habitado en Villarrica y Pucón. AUS 11, 10–13.

Hui, R., Wescoat, J.L., 2019. Visualizing peri-urban and rurban water conditions in Pune district, Maharashtra, India. Geoforum 102, 255–266.

Ioris, Antonio A.R., 2012. The geography of multiple scarcities: urban development and water problems in Lima, Peru. Geoforum, The Global Rise and Local Implications of Market-Oriented Conservation Governance 43 (3), 612–622. https://doi.org/10.1016/j.geoforum.2011.12.005.

Jaglin, S., Zérah, M-H, 2010. Eau des villes : repenser des services en mutation. Introduction. Rev. Tiers Monde 203 (3), 7. https://doi.org/10.3917/rtm.203.0007.

Keough, Sara Beth, Saidou, y Hadiara Yayé, 2021. Water delivery and the creation of hydrosocial Routes: comparing five Neighborhoods in Niamey, Niger. Geoforum 125 (octubre), 96–106. https://doi.org/10.1016/j.geoforum.2021.07.006.

Larsen, Soren C., Foulkes, Matt, Sorenson, Curtis J., Thompson, y Amy, 2011. Environmental learning and the social construction of an exurban landscape in fremont county, Colorado. Geoforum 42 (1), 83–93. https://doi.org/10.1016/j.geoforum.2010.10.003.

Lavie, E., Crombé, L., Marshall, A., 2020. Reconceptualising the drinking waterscape through a grounded perspective. Geogr. J. 186 (2), 224–236.

Lefebvre, H., 2000. La production de l'espace. Anthropos, Paris.

Lindsay, Jo, Supski, y Sian, 2017. Changing household water consumption practices after drought in three Australian cities. Geoforum 84 (agosto), 51–58. https://doi.org/10.1016/j.geoforum.2017.06.001.

Linton, J., Budds, J., 2014. The hydrosocial cycle: defining and mobilizing a relational-dialectical approach to water. Geoforum 57, 170–180.

Loftus, A., Lumsden, F., 2008. Reworking hegemony in the urban waterscape: reworking hegemony in the urban waterscape. Trans. Inst. Br. Geogr. 33 (1), 109–126.

Lukas, M., Fragkou, M.C., Vásquez, A., 2020. Hacia una ecología política de las nuevas periferias urbanas: Suelo, agua y poder en Santiago de Chile. Rev. Geogr. Norte Gd. 76, 95–119.

Martin, S., Bergmann, J., 2021. (Im)mobility in the age of COVID-19. Int. Migrat. Rev. 55 (3), 660–687. https://doi.org/10.1177/0197918320984104.

Matarrita-Cascante, David, Stocks, y Gabriela, 2013. Amenity migration to the Global South: implications for community development. Geoforum 49 (octubre), 91–102. https://doi.org/10.1016/j.geoforum.2013.06.004.

Mehta, L., 2007. Whose scarcity? Whose property? The case of water in western India. Land Use Pol. 24 (4), 654–663.

Méndez, M., 2021. Genealogy of mining territories in the Atacama Desert: the production of modern waterscapes in Tarapacá region, northern Chile (1853–1924). Extr. Ind. Soc. 8 (1), 111–122.

Minnes, Sarah, Simpson, y Hugh, 2020. Capacity for source water protection in ontario's privately-serviced rural areas. Geoforum 116 (noviembre), 12–23. https://doi.org/10.1016/j.geoforum.2020.07.008.

Molle, F., Foran, T., Kakonen, M., 2012. Contested Waterscapes in the Mekong Region: Hydropower, Livelihoods and Governance. Earthscan, London.

Morales Gaitán, S.B., Rainer, G., 2013. Migración por amenidad y turismo: ¿dinámicas globales en el espacio rural ? El caso de Tafí del Valle (Tucumán, Argentina). PASOS *Revista de turismo y patrimonio cultural*, 11 (4), 571–582.

Naranjo Ramírez, G., 2009. El rol de la ciudad infiltrada en la reconfiguración de la periferia metropolitana de Santiago de Chile. Estud. Geográficos 70 (266), 205–229.

Naranjo Ramírez, G., 2017. La expansión urbana en Chacabuco: hacia la redefinición de un nuevo territorio. Pontificia Universidad Católica de Chile, pp. 1980–2010. PhD thesis.

Nelson-Nuñez, J., Walters, J.P., Charpentier, D., 2019. Exploring the challenges to sustainable rural drinking water services in Chile. Water Pol. 21 (6), 1251–1265. https://doi.org/10.2166/wp.2019.120.

Nelson, Peter B., Frost, Wright, 2023. Migration responses to the COVID-19 pandemic: a case study of new england showing movements down the urban hierarchy and ensuing impacts on real estate markets. Prof. Geogr. 75 (3), 415–429. https://doi.org/10.1080/00330124.2022.2114092.

Nicolas-Artero, C, 2024. S'approprier l'eau. Droits, espaces et pouvoirs au Chili. Presses Universitaires de Rennes 267.
Nicolas-Artero, C., 2024. Chronotope, Water Law and Rurality. Unraveling the challenges of implementing the Chilean Rural Sanitation Services Law. Investigaciones Geográficas: Una Mirada Desde El Sur 67, 57–71. https://doi.org/10.5354/0719-5370.2024.74102.
Núñez, A., Aliste, E., Bello, A., Astaburuaga, J.P., 2018. Eco-extractivismo y los discursos de la naturaleza en Patagonia-Aysén: Nuevos imaginarios geográficos y renovados procesos de control territorial. Rev. Austral Ciencias Soc. 35, 133–153.
Núñez, A., Aliste, E., Martínez-Wong, A., 2021. La mercancía-espectáculo de las redes sociales : la producción del paisaje edénico y la reserva de vida en patagonia-aysén. Diálogo andino 66, 53–67.
Pedro-Monzonís, María, Abel, Solera, Ferrer, Javier, Estrela, Teodoro, Paredes-Arquiola, y Javier, 2015. A review of water scarcity and drought indexes in water resources planning and management. J. Hydrol. 527 (agosto), 482–493. https://doi.org/10.1016/j.jhydrol.2015.05.003.
Pflieger, G., 2008. Achieving universal access to drinking water and sanitation networks in Santiago de Chile: An historical analysis 1970-1995. J. Urban Technol. 15 (1), 19–51. Poupeau, Franck. 2019. *Water conflicts and hydrocracy in the Americas: coalitions, networks, policies*. Sao Paolo: IEE USP. Sao Paolo.
Prieto, M., 2017. El Riego que el Mercado no Quiere Ver: Historia del Despojo Hídrico en las Comunidades de Lasana y Chiu-Chiu (Desierto de Atacama, Chile). J. Lat. Am. Geogr. 16 (2), 69–91.
Rainer, G., 2019. Amenity/lifestyle migration to the Global South: driving forces and socio-spatial implications in Latin America. Third World Quart 40 (7), 1359–1377. https://doi.org/10.1080/01436597.2019.1587291.
Rafiei-Sardooi, E., Azareh, A., Shooshtari, S.J., Parteli, E.J.R., 2022. Long-term assessment of land-use and climate change on water scarcity in an arid basin in Iran. Ecol. Model. 467, 109934. https://doi.org/10.1016/j.ecolmodel.2022.109934.
Sharannya, T.M., Venkatesh, K., Mudbhatkal, A., Dineshkumar, M., Mahesha, A., 2021. Effects of land use and climate change on water scarcity in rivers of the Western Ghats of India. Environ. Monit. Assess. 193 (12), 820. https://doi.org/10.1007/s10661-021-09598-7.
Singh, B., Venkatramanan, V., Deshmukh, B., 2022. Monitoring of land use land cover dynamics and prediction of urban growth using Land Change Modeler in Delhi and its environs, India. Environ. Sci. Pollut. Res. https://doi.org/10.1007/s11356-022-20900-z.
Smith, Neil, 2020. Desarrollo desigual: naturaleza, capital y la producción del espacio. Traficantes de sueños, p. 280p.
Storper, M., Scott, A.J., 2009. Rethinking human capital, creativity and urban growth. J. Econ. Geogr. 9, 147–167. https://doi.org/10.1093/jeg/lbn052.
Sultana, F., 2013. Water, technology, and development: transformations of development technonatures in changing waterscapes. Environ. Plann. Soc. Space 31 (2), 337–353.
Suárez, A., 2024. Unpacking "community water management" in rural Chile: an institutional ethnography. J. Rural Stud. 110, 103–345. https://doi.org/10.1016/j.jrurstud.2024.103345.
Sultana, Farhana, 2011. Suffering for water, suffering from water: Emotional geographies of resource access, control and conflict, Geoforum, Volume 42 (2), 163–172.
Swyngedouw, E., 1999. Modernity and hybridity: nature, regeneracionismo, and the production of the Spanish waterscape, 1890-1930. Ann. Assoc. Am. Geogr. 89 (3), 443–465.
Swyngedouw, E., 2004. Social Power and the Urbanization of Water: Flows of Power. Oxford University Press, Oxford.
Turton, Anthony, Ohlsson, y Leif, 1999. Water Scarcity and Social Stability: towards a Deeper Understanding of the Key Concepts Needed to Manage Water Scarcity in Developing Countries. publisher not identified, Pretoria.
Tippin, Chilton, 2021. The household water insecurity nexus: portraits of hardship and resilience in U.S-Mexico border colonias. Geoforum 124 (agosto), 65–74. https://doi.org/10.1016/j.geoforum.2021.05.019.
Usón, Tomás J., Henríquez, Cristián, Juliane Dame, y, 2017. Disputed water: competing knowledge and power asymmetries in the yali alto basin, Chile. Geoforum 85 (octubre), 247–258. https://doi.org/10.1016/j.geoforum.2017.07.029.
Whatmore, S., 2002. Hybrid geographies. Natures Cultures Spaces. SAGE Publication, London.
Wang, S.W., Munkhnasan, L., Lee, W.-K., 2021. Land use and land cover change detection and prediction in Bhutan's high altitude city of Thimphu, using cellular automata and Markov chain. Environ. Challeng. 2, 100017. https://doi.org/10.1016/j.envc.2020.100017.
Weaver, M.J.T., O'Keeffe, J., Hamer, N., Palmer, y C.G., 2019. A civil society organisation response to water service delivery issues in South Africa drives transformative praxis. Part 1: emergence and practice. Geoforum 107 (diciembre), 1–13. https://doi.org/10.1016/j.geoforum.2019.08.020.
Zhang, Heqing, Su, y Xiaobo, 2020. Lifestyle migration and the (Un)Making of ideal home. Geoforum 115 (octubre), 111–119. https://doi.org/10.1016/j.geoforum.2020.07.001.
Zobeidi, T., Yaghoubi, J., Yazdanpanah, M., 2022. Developing a paradigm model for the analysis of farmers' adaptation to water scarcity. Environ. Dev. Sustain. 24, 5400–5425. https://doi.org/10.1007/s10668-021-01663-y.