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Rural Shrinkage: Depopulation and Land Grabbing in Chilean Patagonia

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Abstract: One current global problem is the shrinkage of rural areas, which is expected to become an increasingly recurrent dynamic caused by the transformations in land uses and forms of habitation of the contemporary era. Patagonia is a suitable case study to understand the processes and challenges exposed by rural shrinkage, which not only addresses population loss but also the causes and consequences that transform rural territories. Its remote geographical location and climate conditions make it a complex place for human settlement. The objective is to describe the relationship between the agrarian structure and rural population decline in Chilean Patagonia. Taking a mixed methodological approach that combines the geohistorical review of settlement processes and the use of statistical procedures with census data, the presence of significant inequalities in the distribution of land and the accumulation of areas in large properties is discussed. The loss of rural population was identified, which may be driven by unequal access to land favoring concentration for extractive activities such as large-scale sheep farming, hydrocarbons and biofuels production. The prompts the exodus of young people to urban centers in search of work and education because land grabbing limits economic options, and rural depopulation reduces service coverage without timely responses from political institutions. This has caused the rural shrinkage in territories with demographic imbalances, with high aging and masculinization rates that hinder the repopulation of these areas, which have historically suffered from underpopulation. In conclusion, population strategies in these areas based on extractivism and a strict land ownership regime have not facilitated permanent human settlement but have instead complicated it more.



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1. Introduction

Depopulation of rural territories is a dynamic that threatens the sustainability of human settlements globally. In the context of the crisis of capitalist development and global climate change, the abandonment of rural territories becomes an increasingly pressing dynamic [1].

In Latin America, rural restructuring is framed in drastic processes of accumulation by dispossession. Industries and economic capital compete for land use for extractive and speculative activities, leading to the forced displacement and expulsion of traditional inhabitants [2–5].

Access to land is one of the main sources of spatial inequality and injustice in Latin American rural territories, the product of a historical geography marked by processes in which the lands of indigenous peoples and traditional communities were plundered. According to an Oxfam report [6], land ownership concentration in Latin America reveals a complex scenario, as over half of the productive land is concentrated in 1% of the largest farms. It establishes that the most complex cases are found in Colombia, with 67% of the productive land concentrated in just 0.4% of operations. It is followed by Chile and Paraguay, where 1% of farms account for over 70% of the productive land.

This paper addresses the case of Chile, which has experienced a sustained loss of its rural population over the last 30 years, falling from 16.6% in 1992 to 13.5% in 2002, and 12.3% in 2017 [7–9]. The main political–economic causes of this phenomenon are territorial transformations and changes in rural land use brought about by the neoliberal model that was introduced in the country in the 1970s during the civic–military dictatorship. The rolled back progress with access to land following the implementation of the agrarian reform [10–14]. The main sociospatial consequences of this political–territorial restructuring were: (a) the dispossession of lands belonging to peasants and agricultural cooperatives that had managed to gain access to land; (b) the privatization of natural common goods like water; (c) the agro-industrial modernization and the opening of international agricultural trade [15]; (d) the diversification of economic activities in rural areas, including the extraction of raw materials such as minerals and forestry products, among other activities that incorporate new actors and compete for land in rural areas [16].

The neoliberal rural development model has persisted to this day and created a series of problems. Rural depopulation and depeasantization stand out among them as processes entailing the loss of cultural identity and traditional livelihoods associated with working the land, in which former peasants and their families migrate to urban areas and are incorporated into activities in the tertiary economic sector [11,17]. These dynamics have also caused a loss of young population, population aging and a deterioration of rural settlements' spatial structure. In turn, this has created significant age imbalances, changes in economic occupations of peasant vocation for the development of extractive activities and areas with high aging and masculinity rates [17–20]. Rural counterurbanization dynamics have occurred in the framework of these territorial restructuring processes, causing abrupt land use changes due to urban expansion into rural areas and the replacement of traditional peasant logics with new forms of urbanization [21,22]. However, they have been incapable of counteracting the sustained demographic decline in areas with a trend toward depopulation.

These sociodemographic problems can be approached from the notion of rural shrinkage, which not only refers to population loss but also its causes and consequences from a territorial and integral approach that analyzes political, economic and social aspects that have an impact on depopulation.

Thus, according to Uribe-Sierra and Mansilla-Quiñones [11], in Chile, rural depopulation trends can be corroborated in three types of territories: (i) Municipalities in extreme regions that are geographically isolated and subject to extractive economic regimes; (ii) Municipalities in the central–southern region, where land use for extractive forestry activities is concentrated; and (iii) Municipalities affected by natural disasters, whose inhabitants have been forced to emigrate.

In particular, this article addresses the case of Chilean Patagonia, part of the first group of remote territories in depopulation processes. It is an area characterized by a historical regime of large tracts of land of low agricultural quality in few hands, with economic activities such as large-scale sheep farming, hydrocarbon extraction, biofuel production and land speculation [23] that may be related to the loss of rural population. This is a paradigmatic case for studying the demographic effects of land grabbing in an isolated territory with geographic and climate difficulties for settlement, where rural development policies that favor extractivism and speculation do not seem to be the solution to the problem. These forms of land tenure represent a historical challenge to attempts at rural settlement [24] in a region also characterized by “underpopulation” [25,26]. This refers to the historical downward trend in the concentration of the rural population, which represents an ongoing problem for demographic projection in this territory.

The objective is to describe the relationship between agrarian structure and rural population decline in territories in extreme areas from the notion of rural shrinkage. Descriptive statistical methods are used to understand the extent to which land grabbing drives depopulation processes and the transformation of rural settlements.

The results allow for the identification of how natural resource extraction activities that take up large expanses of land limit access to it for those living in rural territories. This especially affects the possibility for young people and women to settle. The results also show a historical trend of unequal land distribution in Patagonia, which has prevailed over the last three decades and will continue to project itself toward the future if territorial development continues to be guided by a framework of natural resource extraction.

2. Literature Review

2.1. Land Grabbing

Competition for land is a global problem in developing and developed countries [27]. Though the race for control over land is a longstanding and widely analyzed issue, interest on the part of academics, governments and civil society organizations regained importance after the food crisis of 2007–2008 [28].

One of the most recurrent phenomena stemming from these processes is land grabbing [27], which has been defined as a form of land acquisition that affects communities that have traditionally inhabited these territories and generates significant socioenvironmental impacts [29–33]. According to Borras et al., [28], land grabbing is a new form of land concentration and can be conceptualized as:

“the capturing of control of relatively vast tracts of land and other natural resources through a variety of mechanisms and forms that involve large-scale capital that often shifts resource use orientation into an extractive character, whether for international or domestic purposes, as capital’s response to the convergence of food, energy and financial crises, climate change mitigation imperatives, and demands for resources from newer hubs of global capital”.

Traditionally, land grabbing has been analyzed on the basis of three conditions: (1) the scale of land transactions is based on a minimum extension of 1000 ha; (2) the direct involvement of foreign governments and businessmen; and (3) its relationship with agro-industrial food production and the food crisis [28]. However, recent studies on land grabbing have broadened the debate by pointing out that the dynamics of land grabbing are currently linked not only to agro-food use but also to multiple crises affecting the planet: food, energy, environmental, climate and financial crises. Land grabbing is understood as the power to control land and its natural resources, such as water, minerals, hydrocarbons, rare earths, and others. Land grabbing can also be associated with private ecological conservation initiatives [28].

It has also been shown that land grabbing responds to global dynamics of power and capital accumulation, in which the mechanisms for acquiring control are varied, through purchase, lease, contract farming or forest conservation. However, the scale and nationality of the transaction are not limited to large expansions or foreign operators, as national capitals may participate or engage in inter-regional transactions [28,34].

Thus, land grabbing is understood as the acquisition and control of land and other natural resources through various mechanisms, including big capital, with resources often being diverted to various national or international extractive activities such as tourism, mining, agriculture, energy, and others [28,35]. Land grabbing is thus a serious problem that can have environmental, economic, social and human rights impacts [35,36], including demographic impacts in rural areas, which have been less explored in the literature.

Land grabbing explains the inequalities of access among the different actors involved in its use and management [30]. Latin America has the highest land grabbing in the world [37], with a Gini coefficient of 0.81 in the second half of the 20th century, higher than Africa (0.61) and Asia (0.56) [37]. The evidence generated by recent research [27–29,38] reveals that the factors driving land grabbing in the region are: (1) neoliberal economic deregulation policies, (2) land purchases by foreign capital, (3) the pursuit of economies of scale, (4) the development of agricultural technology, (5) the development of agro-industrial complexes with new economic groups and so-called joker crops because of their diverse uses, such as African palm or sugarcane, (6) economic diversification and financial

speculation with natural resources, (7) the acquisition of land for conservation purposes and 8) the control of low-quality land for lease to exploit resources such as hydrocarbons and biofuels.

2.2. Rural Shrinkage and Population Decline

Rural decline and the consequential territorial abandonment have become increasingly recurrent problems in the context of global-scale changes. Any human settlement could experience sociospatial reduction and depopulation due to political, economic and environmental uncertainties [39]. Thus, rural decline and the consequential abandonment of places can “be identified as a stage of the current cycle of human settlements and land use” [40] and as one of the most important challenges that contemporary rural development faces [41].

Scientific debate has arisen in recent years to understand the multiplicity of factors that affect rural depopulation, for which the concept of rural shrinkage has been used [39]. The scientific literature tends to analyze rural decline from two perspectives: (i) the analysis of material factors of territories in depopulation processes, which are affected by economic or environmental transformations, as is the case with changes in land use [42]; and (ii) the analysis of the subjective dimension associated with rural inhabitants’ perceptions and their decisions to migrate [43].

The scientific literature notes that depopulation is a matter of concern in several European countries, where the main consequence of accelerated rural depopulation has been the abandonment of these territories. This hinders the sustainability of rural settlements over time and the challenges posed regarding development objectives [44]. These dynamics have mostly been studied in Spain and Portugal, the European countries that have had to face the biggest challenges in this matter. In Latin America, the decline in rural settlements and their inhabitants’ consequential emigration to urban agglomerations is a process that has been observed since the mid-20th century and remains in force to this day. Currently, this dynamic remains latent, associated with the decline in economic models and the severe environmental transformations caused by the extractive dynamics of natural resources typical of the region and the global reformulation of productive systems [17,45].

Global studies to explain rural decline analyze the individual decisions accompanying the rural-to-urban movement, paying special attention to the young population as the one most prone to emigrate [46,47]. They also address young people’s spatial discourses, which have tended to be rendered invisible by public policies seeking to halt rural depopulation [24]. This has also been addressed in the work of McLaughlin et al. [48], who analyzed the residential aspirations of young people who decide to stay, as a way to generate strategies that enhance these places. Similarly, emphasizing social difference from a gender perspective, Rauhut and Littke [49] note that rural migrations are mainly undertaken by women.

Other studies address the consequences emigration has for communities of origin, both in terms of its implications for development as well as in the physical–geographical and demographic sphere. These studies address the material dimension through landscapes of abandonment, which are currently convening a significant number of researchers to an interdisciplinary dialogue on “new ruins” [50]. There are also studies on the changes caused to territories’ material dimensions such as, for example, the case of abandoned schools that have been closed for lack of students [51,52]. Regarding demographics, evidence shows that the population tends to age and masculinize places and that the social conditions of settlements deteriorate due to the lack of available young labor, affecting the availability of services such as education and health [24,53].

Other research emphasizes the study of phenomena such as the influence of accessibility and access to health and care as determining factors in rural emigration processes [54]. There are also studies analyzing the relationship between environmental transformation dynamics and rural emigration decisions [55] in territories where socioecological relations are close and susceptible to changes due to the alterations generated between society and nature in the context of environmental changes. The research gives an account of how

the “natural capital” [55] that territories have generates subsistence conditions for rural communities and prevents their inhabitants from emigrating [24]. At the same time, some studies discuss the negative and positive transformations that ecosystems undergo once the inhabitants have left.

Within this literature, research like that of Bezu and Holden [56] shows that the problem of access to land by young people represents one of the main determinants of rural emigration in countries of the global south. However, as this article argues, there is still scant research that relates the problem of access to land and rural depopulation and its territorial consequences.

Most studies on rural decline use the notion of depopulation, emphasizing the loss of population and the actual data, neglecting the territorial consequences of this process. This paper uses the concept of rural shrinkage to explain the effects of land grabbing in rural areas, highlighting the political, economic and social causes and consequences of these dynamics.

Territorial contractions in rural studies—rural shrinkage [39]—originated in initial findings on depopulation processes in urban contexts, shrinking cities. This was the case with large metropolises like Detroit, affected by drastic population changes induced by transformations in local economic geography [57–59]. On the other hand, the multidimensional effects of rural shrinkage are particularly expressed in the “loss of inhabitants, economic recession, declining employment and social problems like the symptoms of a structural crisis” [60], in addition to aspects “such as aging, brain drain, vacant housing, and the failure to use infrastructure and services,” as Pužulis and Kūle [39] note. In fact, the demographic contraction in these settlements affects these territories’ social and cultural capital and creates a “vicious cycle” due to the loss of knowledge and practices that were deep-rooted in habitation, implying the inability to promote social innovation strategies to help reverse these processes [39]. At the same time, from a cultural perspective, it implies the inhabitants’ cultural deterritorialization [61], or the loss of control over territories where the social practices, knowledge and social meanings that sustained socioecological relations were generated.

3. Materials and Methods

3.1. Study Area

The Magallanes Region is in the far south of Patagonia, which straddles the border between Chile and Argentina. On the Chilean side, it is considered to extend from the Araucanía Region to the south, covering the Los Ríos, Los Lagos, Aysén and Magallanes Regions. The continental Magallanes Region borders Argentina’s Santa Cruz Province, and the insular part borders Tierra del Fuego Province. There is a marked contrast between the population dynamics of these territories in the two countries, with the development of human settlements in Argentine Patagonia standing out, thanks to the implementation of political and economic decentralization and territorial deconcentration policies, including in remote territories such as Ushuaia on the island of Tierra del Fuego (Figure 1).

However, despite Argentine Patagonia having a larger population than Chilean Patagonia, there is scientific evidence of an accelerated process of rural depopulation in parts of the Pampas in the context of the transformations that economic activities associated with sheep farming have undergone [62]. Meanwhile, land ownership foreignization dynamics have also been observed [35].

According to the 2017 Population and Housing Census, the Magallanes Region covers a total of 132,291 continental square kilometers and has a population density of 1.26 inhabitants per square kilometer. According to Population and Housing Census projections for 2022, the region has 179,949 inhabitants, with a high urban primacy index: 91.9% of the inhabitants surveyed in the 2017 Census lived in urban areas, and about 75.6% of the region’s total population is concentrated in the metropolitan area of the city of Punta Arenas, the capital of the Magallanes Region [9].

The regional gross domestic product is marked by industrial manufacturing activity, which moves the largest amount of money¹ at USD 636,958,279, followed by public administration with USD 302,555,182 and personal services with USD 300,105,343. Despite their historical role in shaping forms of rural production, agriculture, livestock husbandry and forestry represent the smallest share of the region's economy, with USD 36,747,593 in 2019.

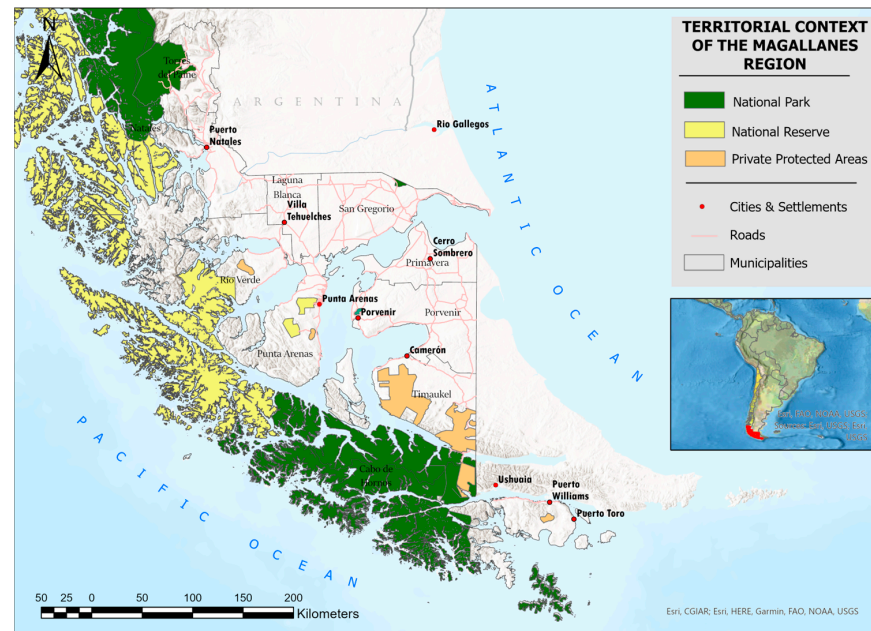


Figure 1. Study area.

3.2. Settlement Phases in Chilean Patagonia

Settlement phases in Chilean Patagonia are very closely related to variations in economic-extractive activities, which, according to Martinic [25], cover five successive stages: (a) colonization and development of livestock husbandry; (b) mining; (c) oil, gas and methanol; (d) agrarian reform; (e) geopolitical conflicts. New processes affecting land transformation and rural repopulation models can now be added to these: (f) environmental conservation and touristification; (g) new renewable energies such as green hydrogen.

The first stage of colonization and the development of livestock husbandry marked forms of territorial occupation in two periods through 1930. The first was the pioneering phase in 1872–1902, followed by the period 1903–1906, when the state began auctioning off lands for the establishment of settlers, giving rise to the sociospatial formation of latifundia [25]. The livestock production model, also known as “*estancias*”, resembles the British sociospatial formation of livestock production, as it is framed in the context of the British Empire’s global demand for wool for industrial production in the early 20th century [63].

The most important capital operating at the time was the company Sociedad Explotadora de Tierra del Fuego. It was created by European settlers from the Nogueira, Braun and Menéndez families, who arrived under the auspices of the state’s settlement policies. They managed to control over 1 million hectares and almost 80% of the region’s territory. The original violence of land accumulation by dispossession took place in this stage and determined the almost total extermination of the indigenous peoples that lived in the area. They also maintained a policy contrary to the settlement of inhabitants in rural areas. The meant that rural workers were in constant movement through rural areas [63]. The Sociedad Explotadora de Tierra del Fuego’s power as a large landowner began to decline over the course of the 20th century due to the loss of land concessions and culminated in the expropriations of the Agrarian Reform.

The next stage was marked by the gold mining that gave birth to Porvenir, whose rapid decline diminished the importance of the settlement process [26], followed by the

development of coal mining, which had a greater impact on the territory over time, until its decline in 1960. It should be noted that there was recently another boom in coal mining between 2013 and 2020, with the Invierno Mine operating in the municipality of Rio Verde. It boosted the local economy and attracted hundreds of workers who moved to and from the region's main urban centers in a pendular way under shift systems. However, it shut down under pressure from international coal prices and due to noncompliance with environmental standards.

Oil, gas and methanol production became the main regional economic activity starting in the mid-20th century. However, it failed to change the demographic decline dynamics. The settlements created in the "company town" format were largely mobile workers who moved back and forth between the regional capital and oil settlements. At the same time, larger settlements like those in Cerro Sombrero in Tierra del Fuego registered significant demographic variations in the following decades depending on market prices. It should be noted that many of the "*estancias*" in areas on the Argentine border are no longer supported by livestock husbandry but instead by the lease of properties to oil companies to access sites to extract this resource.

The agrarian reform was the only decisive action that managed to transform land ownership and promote the incorporation of families in rural areas through the creation of livestock cooperatives by means of the "Demographic development and equipment of rural centers program" [25]. Land ownership in the form of livestock cooperatives in rural areas, composed of former latifundia workers, was constituted in this period. At the same time, the family of workers was seen as a fundamental axis in rural settlement dynamics. In contrast to the early disappearance of cooperatives caused by the agrarian counter-reform in other Chilean regions, in Magallanes, many of the livestock cooperatives continued to exist until the first decade of the 21st century and closed due to the decline in livestock activity and the wool trade. It was also due to what Orstrom [64] defines as the tragedy of the commons, with cooperatives overexploiting their resources and overindebted. In addition, many of the children of cooperative members decided not to continue living in the countryside and migrated to the city of Punta Arenas, though they continued to receive profit distributions and participate in decision-making regarding the cooperatives' common goods, which at some point prompted them to sell due to low profits.

Between 1977 and 1979, during the military dictatorship, regional settlement was also affected by the implications of geopolitical matters in the delimitation of borderlines between Chile and Argentina. Voids had to be filled in these border territories, especially with the founding of Puerto Williams and the so-called "internal borders" defined by the army.

Going into the 21st century, there has been a shift in the economic direction of Chilean Patagonia through the incorporation of a large proportion of the Magallanes Region's territory into environmentally protected areas, a process associated with international tourism circuits. Nuñez et al. [65] have described similar processes in Northern Patagonia from a critical perspective that points out that many of these experiences can be considered new forms of colonialism and eco-extractivism due to the elitization of access to natural spaces, in addition to the idea of environmental conservation without considering the area's traditional inhabitants.

The most recent economic transformation puts the Magallanes Region in the spotlight of global interest with transformations in the energy matrix, given its exceptional conditions for exploring new energy sources like green hydrogen. However, this development agenda based on the exploitation of nature does not contemplate a rural settlement policy that allows the problems of rural depopulation to be reversed.

As Martinic [25] points out from a historical perspective, rural underpopulation can be identified in the Magallanes Region, or the difficulty in maintaining and increasing the population. In this context, he recognizes that it is founded on: (i) the rural work modality, which fostered an eminently male, seasonal and individual population without the necessary conditions to form families; (ii) the creation of closed, isolated and poorly equipped

settlements heavily dependent on local economic actors; (iii) scant state participation in the territorial development process, leaving territorial management in the hands of the private sector and only acting through the provision of law enforcement services and the creation of road infrastructure; and, as the most relevant factor, (iv) high concentration of property in latifundia and therefore low availability of lands for inhabitants to acquire their own properties, which Harambour [23] states has been the case since the internal colonialism deployed in the 19th century. In addition to this, one can add: (v) the incidence of geographical isolation and rural settlements' accessibility problems, as according to studies by the Undersecretariat for Regional Development, SUBDERE [66] (2012), 80.7% of settlements in the Magallanes Region are isolated (equivalent to 6647 people, or 4.4% of the population), the highest proportion in the country.

3.3. Research Methodology

This is exploratory research, as there is scant scientific evidence relating rural shrinkage with land grabbing. Descriptive Statistical methods are used to obtain relevant information to understand the effects of rural decline and its relationship to land grabbing. The first step is to analyze rural decline indicators and their demographic consequences based on Population and Housing Census records for 1992, 2002 and 2017 (Table 1).

Table 1. Statistical procedures for the analysis of rural decline.

INDICATOR	CALCULATION	INTERPRETATION
Percentage intercensal variation	$[(\text{Current Census Population} - \text{Previous Census Population}) / \text{Previous Census Population}] \times 100$	The percentage of population that varied between two census periods. The procedure was undertaken for the total population, the rural population and by gender and age groups.
Population aging	$[(\text{People 60 years and older}) / (\text{people under 15 years})] \times 100$	Measures the number of elderly people for every 100 children and young people.
Masculinity Index	$[(\text{Total men}) / (\text{Total women})] \times 100$	Measures the total number of men for every 100 women.

The second step consists in analyzing levels of inequality and land grabbing by calculating the Gini index for land ownership based on indicators from the 2022 Chile Agricultural and Forestry Census.

The land area values by number of hectares were grouped in intervals to determine the arithmetic mean required in the analysis of 0–1, 1–5, 5–10, 20–50, 50–100, 100–200, 200–500, 500–1000, 1000–2000 and 2000 and more hectares. It should be noted that while the Agricultural Census carried out by the National Statistics Institute works with these property size intervals, a significant proportion of rural properties cover up to 30,000 hectares. The highest hectare value per territorial unit was considered for the last interval. The calculation was then made following the steps to estimate the Gini coefficient [67] and using the formula below:

$$CG = \sum_{i=1}^{N-1} (P_i - Y_i) / \sum_{i=1}^{N-1} P_i$$

To verify reliability, two approaches were made with an almost identical result. The Gini coefficient was then multiplied by 100 to determine the Gini index.

In parallel to this procedure, a statistical exercise was carried out to identify the percentage of land concentrated in properties covering over 2000 hectares. Intervals were grouped together to establish size ranges of 1–100, 100–1000, 1000–2000 and over 2000 hectares. Next, the percentage was calculated by dividing the total in each range by the total number of hectares per territorial unit, multiplying the result by 100. The statistical application allows one to observe which property size ranges land area is concentrated in.

$$\text{Relative land grabbing} = \sum x_n / X$$

In this case, $\sum x_n$ refers to the sum of land area x of the proposed interval n . And X is the total land area per territorial unit. Relative land grabbing shall be obtained using this procedure.

In addition, thematic maps were developed: one to contrast population distribution with the intercensal population and another to contrast the size of land holdings with the Gini index for the land grabbing analysis.

4. Results and Discussion

4.1. Rural Decline in the Magallanes Region

The urban and rural population classification in the Magallanes Region indicates that of the 11 municipalities that make up the territory, Torres del Paine, Laguna Blanca, San Gregorio, Río Verde, Primavera, Timaukel and Antartica are 100 percent rural, while Natales, Porvenir, Punta Arenas and Cabo de Hornos are mixed municipalities as they have both types of population [9]. Most of these municipalities register historical underpopulation conditions, with demographic records that in some cases remain below 1000 inhabitants (Figure 2).

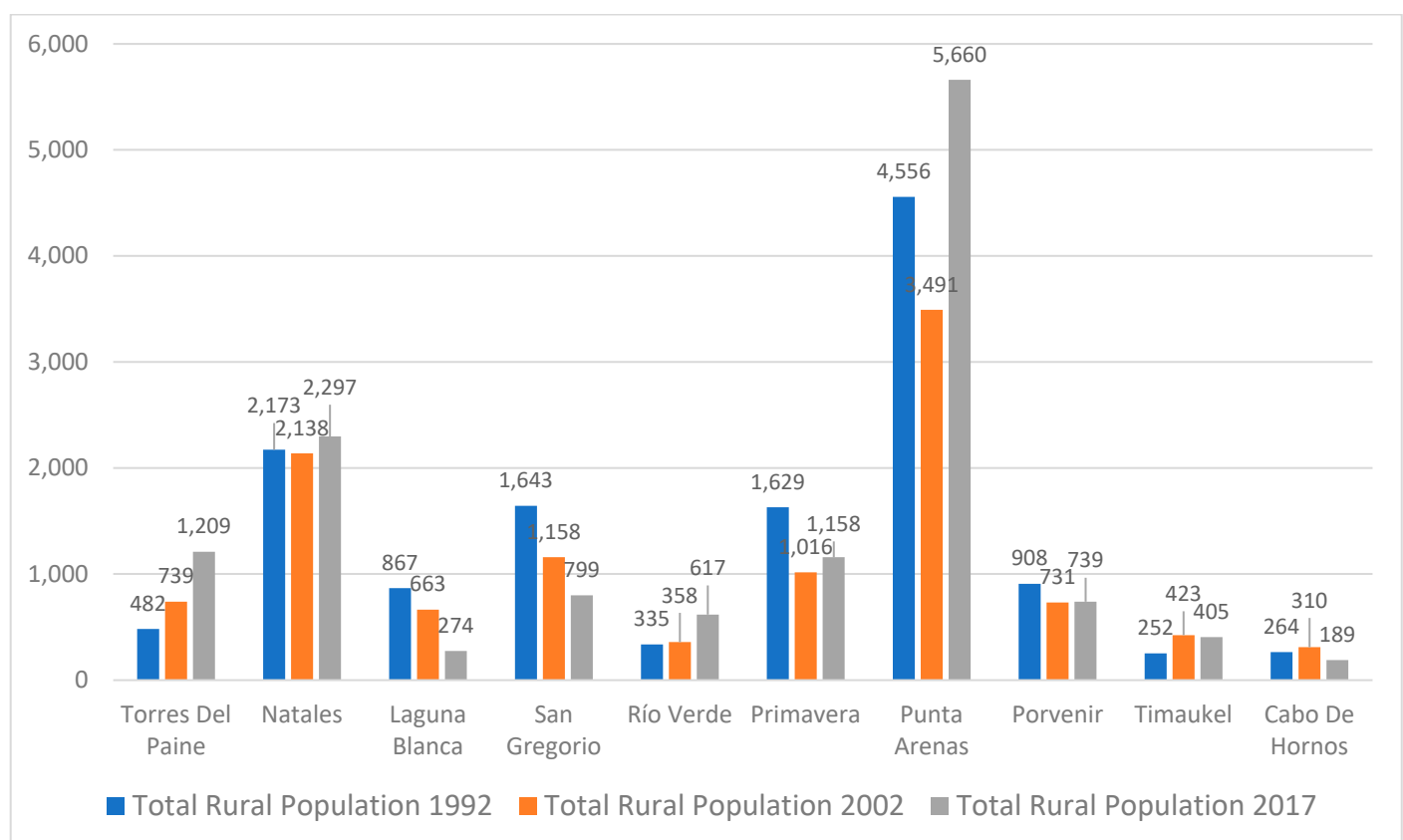
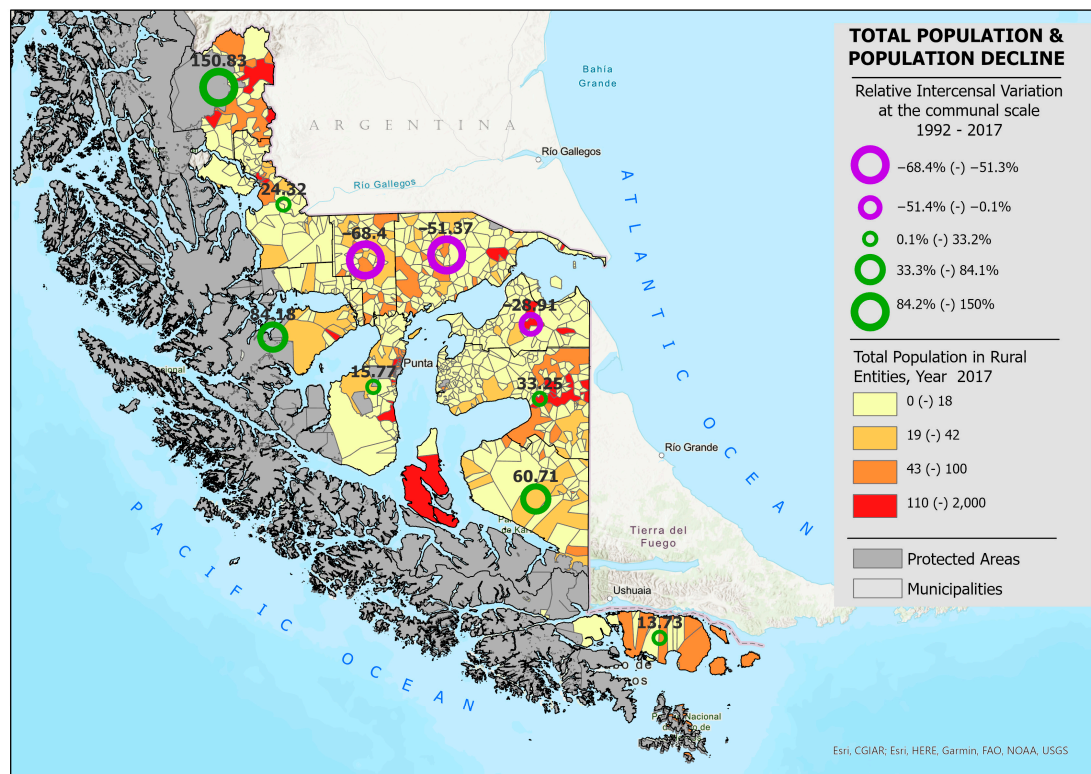


Figure 2. Total population in the Magallanes Region at the municipal level in the 1992, 2002 and 2017 Population and Housing Census.

Underpopulation has motivated the population's residential mobility and reterritorialization to the city of Punta Arenas, characterized by its high concentration of the regional population, which was 79.01% according to the last census carried out in 2017 [9]. While population growth at the national level was 31.66% between 1992 and 2017 and regionally in Magallanes it was 16.30%, thanks to the population increase in Punta Arenas (15.42%), Porvenir (44.47%) and Natales (27%), the municipalities of Laguna Blanca (−68.40%), San Gregorio (−51.37%) and Primavera (−5.19%) registered a very significant decline in total population between 1992 and 2017 (Table 2 and Figure 3).

Table 2. Relative intercensal variation in the total population at the national, regional and municipal levels (1992, 2002 and 2017).

Territory	Type	Population Density	1992–2002	2002–2017	1992–2017
Torres Del Paine	Rural	0.18	53.32	63.6	150.83
Natales	Mixed	0.44	10.66	12.35	24.32
Laguna Blanca	Rural	0.08	−23.53	−58.67	−68.4
San Gregorio	Rural	0.12	−29.52	−31	−51.37
Río Verde	Rural	0.07	6.87	72.35	84.18
Primavera	Rural	0.27	−37.63	13.98	−28.91
Punta Arenas	Mixed	7.41	5.13	10.12	15.77
Porvenir	Mixed	0.93	7.07	24.45	33.25
Timaukel	Rural	0.04	67.86	−4.26	60.71
Cabo De Hornos	Mixed	0.13	24.7	−8.8	13.73
Region	-	0.12	5.33	10.41	16.3
Country	-	8.77	13.25	16.26	31.66

**Figure 3.** Total population decline. Relative intercensal variation at the communal scale 1992–2017.

When focusing the analysis on rural areas, some mixed municipalities like Cabo de Hornos (−28.41%) and Porvenir (−18.61%) were found to have also registered a decline in population between 1992 and 2017 (Figure 4). For their part, other rural municipalities such as Timaukel, which registered 60.71% population growth in the study period, have no more than 500 inhabitants. The exemplifies the problems of underpopulation in this part of the country, where all rural municipalities except Torres del Paine (7.41 inhab./km²) have very low population densities. The rest do not exceed 0.50 inhab./km², except for Porvenir, where it is 0.93 (Table 2). The most extreme cases are those of Timaukel (0.04 inhab./km²), Laguna Blanca (0.08 inhab./km²) and Río Verde (0.07 inhab./km²), falling short of the regional level of 0.12 inhab./km² (Table 2 and Figures 5 and 6) and posing a tremendous challenge for settlement strategies in these places.

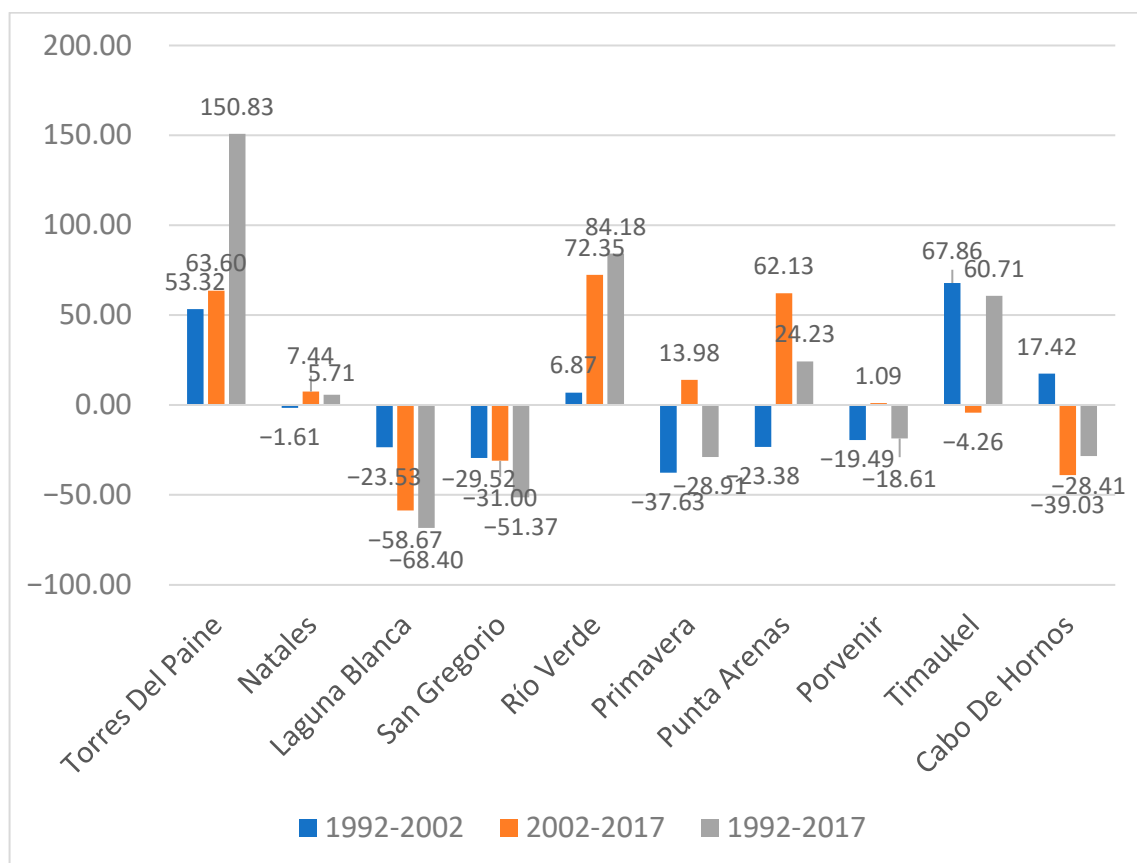


Figure 4. Relative intercensal variation of the rural population in the Magallanes Region at the municipal level (1992, 2002 and 2017).



Figure 5. The village of Villa Tehuelche, capital of the municipality of Laguna Blanca. The photo shows the small concentration of houses surrounded by large areas of private property.



Figure 6. The village of Punta Delgada is the capital of the municipality of San Gregorio. As in Figure 5, there is a small concentration of houses surrounded by large areas of land for livestock and hydrocarbon production.

4.2. Inequality and Land Grabbing in the Magallanes Region

Among the main economic activities, intensive extractive sheep farming stands out, which requires large expanses of land to develop, and the use of the land for green hydrogen production and oil extraction. The territory concentrates 56% of Chile's sheep population, equivalent to 1,417,421 head [68] and ranking first place in this category in the country. Analysis of the Gini index, which expresses inequality in the distribution of land in the region, indicates that Cabo de Hornos (83.49), Punta Arenas (86.21) and Natales (82.16) have very significant levels of inequality (Table 3 and Figure 7).

Table 3. Gini coefficients and indexes for land grabbing in the Magallanes Region.

Territorial Unit	Gini Coefficient	Gini Index
Cabo de Hornos	0.8349	83.49
Laguna Blanca	0.2723	27.23
Natales	0.8216	82.16
Porvenir	0.6194	61.94
Primavera	0.2581	25.81
Punta Arenas	0.8621	86.21
Río Verde	0.219	21.9
San Gregorio	0.1935	19.35
Timaukel	0.115	11.5
Torres del Paine	0.3488	34.88
Región	0.7851	78.51
País	0.8805	88.05

The municipalities of Punta Arenas and Puerto Natales represent the main population centers in the region and therefore have more diverse land distribution, with most owners of Productive Agricultural Units (UPAs) concentrated in areas ranging from 1 to 100 hectares (Table 4). Levels in these municipalities and Cabo de Hornos are higher than the regional level index (78.51). Meanwhile, Porvenir has a significant level of inequality for the indicator analyzed, at 61.94 (Table 3).

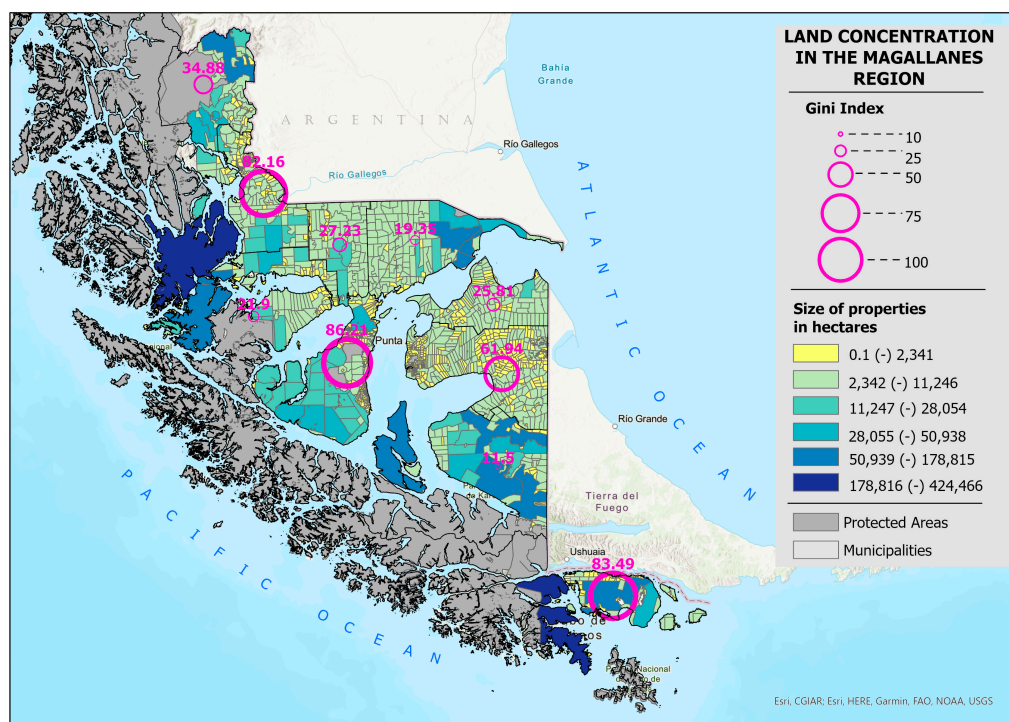


Figure 7. Land grabbing in the Magallanes Region.

Table 4. Percentage of land area according to property size in the Magallanes Region (2021).

Territory	Total		1–100 Ha		101–1000		1001–2000		Over 2000	
	UPA	Sup Ha	UPA	Ha (%)	UPA	Ha (%)	UPA	Ha (%)	UPA	Ha (%)
Punta Arenas	174	460,792.56	114	0.1715	27	2.2492	8	2.62	25	94.96
Laguna Blanca	32	275,505.23	1	0.0085	2	0.2254	0	0	29	99.77
Río Verde	35	263,110.09	0	0	1	0.3801	8	4.91	26	94.71
San Gregorio	26	597,330	1	0.0084	0	0	0	0	25	99.99
Cabo de Hornos	21	1,762,259.7	12	0.01	6	0.2126	1	0.11	2	99.67
Porvenir	122	681,196.49	16	0.0116	19	1.4397	7	1.38	80	97.17
Primavera	43	318,130.96	1	0	1	0.1194	2	0.82	39	99.06
Timaukel	23	623,134.9	0	0	1	0.1106	1	0.3	21	99.59
Natales	160	6,024,668.4	79	0.017	27	0.1502	10	0.23	44	99.6
Torres del Paine	28	497,404.35	2	0.0092	0	0	0	0	26	99.99
Region	583	11,503,533	220	0.018	78	0.2789	26	0.32	259	99.39

Natales (52%) and Cabo de Hornos (15%) contain 67% of the total agricultural area in the Magallanes Region and represent 17% of this statistic nationally (Table 4). These municipalities have a land Gini index of 83.49 and 82.16, respectively (Table 3). One particular case is the island territory of Cabo de Hornos, where just 2 agricultural production units concentrate 99.67% of the area, equivalent to 1,756,364.63 hectares operated on properties of over 2000 hectares (Table 4).

The remaining municipalities do not show significant levels of inequality in land distribution according to this indicator. The interpretation is that land area and production units are larger where the Gini index is higher. Meanwhile, the opposite is the case where the Gini index is low: there is less area and fewer production units, with the exception that in all cases almost the entire area and the owners of production units are grouped in the over 2000 hectares property interval (Table 4).

When studying the proportion of land area according to property size by intervals, it was found that 99.39% of land in the Magallanes Region is concentrated in the largest interval, with properties of over 2000 hectares (Table 4). An analysis of Agricultural Censuses reveals a −55.80% decline in agricultural production units regionally between 2007 and 2021 [68,69]. On the other hand, the land area for agricultural use in the region increased 114.72% to over 11,503,532 hectares [68,69]. This may have increased the degree of land ownership inequality in the region.

In parallel to these changes, in all intervals proposed for land area, the area and number of production units fell by over 50%, except for the over 2000 hectares interval, where the area increased by 120.28% and production units decreased −38.18% (Table 4). This means that there is more land for fewer owners, who have focused on production units that exceed 2000 hectares.

One significant finding is that, except for Punta Arenas (174), Porvenir (122) and Natales (160), all remaining municipalities have fewer than 50 agricultural production units, and most correspond to areas covering over 2000 hectares with percentages that are between 90 and 100 percent of the total land in that interval (Table 3). Laguna Blanca (99.77%), San Gregorio (99.99%), Cabo de Hornos (99.67%), Porvenir (99.17%) and Primavera (99.06%) show high levels of land concentrated in large areas, while simultaneously registering a loss of rural population, whose most critical census period was between 2002 and 2017 (Figure 3).

This coincides with the land ownership records established in agricultural censuses, meaning that rural demographic decline is probably associated with the Magallanes Region's property dynamics of large areas for the development of intensive sheep farming, green hydrogen and oil extraction, making settlement difficult due to the unequal conditions of access and usufruct of lands that prevent permanent settlement processes.

4.3. Effects of Rural Decline in Relation to Land Grabbing in the Magallanes Region

While in general rural decline is only perceived in some municipalities, when the analysis is broken down by large age groups, it was found that all municipalities except Punta Arenas have lost rural population in at least one age group (Figure 8). The relationship between demographic decline in rural areas and land ownership in the Magallanes Region becomes clearer under this parameter. It was found that in 80% of territorial units, the age group that has lost the most population is that of young people aged between 0 and 14 years (Figure 8). Meanwhile, in 90% of municipalities, the population aged 65 and over has grown considerably (Figure 9).

This shows a trend of young rural depopulation and a rising population of people over the age of 65 in municipalities with high Gini indexes (Porvenir and Natales) and those with land grabbing in areas covering over 2000 hectares (Laguna Blanca, Río Verde, Primavera and Timaukel) (Figures 5 and 6).

Some municipalities have also lost rural populations in groups between the ages of 15 and 64 years (Laguna Blanca, San Gregorio, Cabo de Hornos, Porvenir and Primavera). Cabo de Hornos stands out, where the demographic decline in this range was −33.61% due to a 600% increase in the 65 and over group (Figure 5). The largest demographic declines analyzed were among young men (−27.79%) and young women (−27.65%) (Table 5). The difference of just 0.14 reveals that the rural demographic decline in young people in the Magallanes Region has been homogenous among men and women.

The situation changes in older age groups: women between the ages of 15 and 64 increased 34.78% and men decreased −5.35% (Table 5). Meanwhile, women grew more than men in groups 65 and over (102.99% and 70.02%, respectively) (Table 5). This reveals territorial aging trends, as the aging rate increased in all the municipalities analyzed, and this indicator is above the national level of 47% in all except Cabo de Hornos (Figure 9). In addition, high levels of masculinization are maintained in all municipalities, despite a relative increase in the number of women in age groups between the ages of 15 and 65, significantly exceeding the national level of 95.9% (Figure 9).

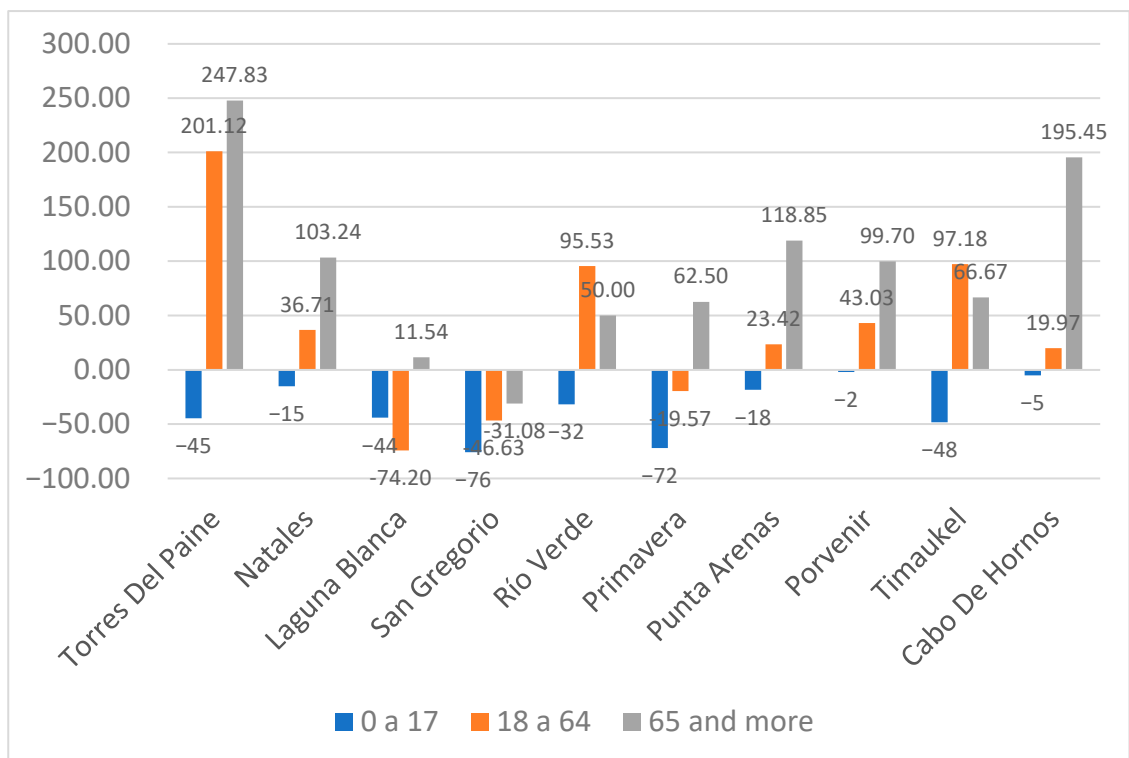


Figure 8. Relative rural depopulation in the Magallanes Region by age groups, 1992–2017.

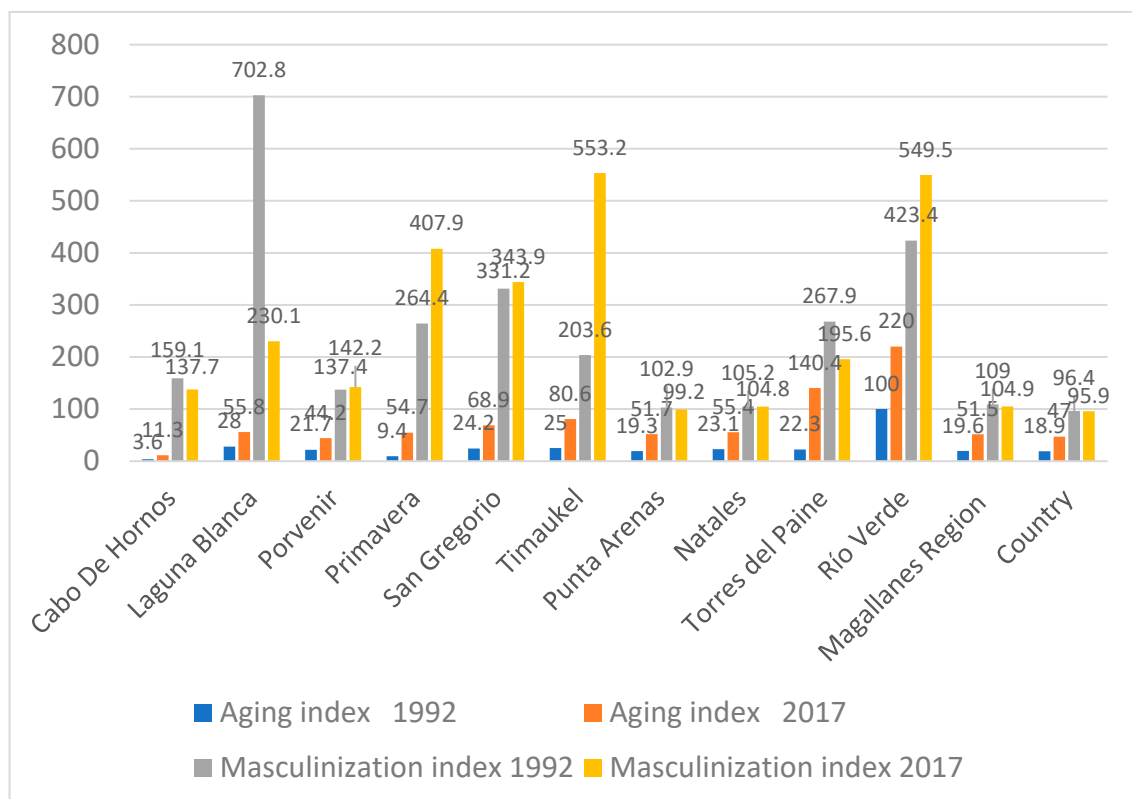


Figure 9. Aging and masculinization indexes in the Magallanes Region, 1992–2017.

Table 5. Relative rural decline by gender and large age groups between 1992 and 2017.

Territory	Male				Female			
	0–14	15–64	65+	Total	0–14	15–64	65+	Total
Punta Arenas	−0.54	9.17	118.18	12.17	5.53	57.31	156.67	47.43
Laguna Blanca	−50	−78.86	−8.7	−74.84	−38.89	−23.19	166.67	−23.15
Río Verde	−58.33	103.73	44.44	92.62	100	42.86	75	48.44
San Gregorio	−76.39	−49.06	−21.43	−50.95	−76.06	−37.1	−61.11	−52.76
Cabo de Hornos	57.14	−35.98	400	−31.08	−25	−16.67		−14.29
Porvenir	−33.33	−21.59	59.32	−15.51	−61.54	−19.83	−34.62	−30.65
Primavera	−68.63	−15.75	42.31	−21.32	−74.72	−36.12	150	−48.99
Timaukel	−30.77	130.3	90.91	102.96	−66.67	−2.04	0	−25.3
Natales	−24.67	−4.38	59.14	−3.53	−13.07	35.63	113.33	27.73
Torres del Paine	−57.14	153.52	227.78	127.92	−40	345.68	320	212.21
Region	−27.79	−5.35	70.02	−4.85	−27.65	34.78	102.99	19.14

5. Discussion

The results describe how the property structure and sociodemographic transformations in Chilean Patagonia may be related. According to Kay [30], the causes of rural land grabbing are related to the implementation of neoliberal policies that incentivize speculation, the development of extractive activities and the lease of lands with low agricultural quality to produce biofuels. The coincides with the settlement history of this extreme region, linked to the accumulation of large expanses of land privileging large-scale extractive activities over other community or local productive uses.

The results show that unequal land distribution over the last 30 years has been maintained by the development of livestock husbandry, extraction of hydrocarbons, speculative practices, land conservation without local participation and, more recently, the production of green hydrogen. According to the most recent census data from 2021, 99.39% of land in the study area corresponds to properties covering over 2000 hectares.

The deployment of extractive and speculative activities limits minority groups' access to land compared to large economic groups. This is due to the characteristics of extractivism, which requires large expanses of land to develop [45]. While this is promoted as a rural development strategy to improve conditions in settlements, most of which are rural and underpopulated, the result has been population decline, aging, masculinization and reduced economic and educational opportunities, as these activities have not allowed the consolidation of settlements or managed the labor coverage that the region demands. This in turn is translated into failed rural development strategies in extreme regions.

This reveals rural shrinkage processes that cause the sociodemographic deterioration of rural settlements due to socioeconomic factors [39]. The group most exposed to this phenomenon is that of young people between the ages of 0 and 17 years, a sector that has declined over the last 30 years in Chilean Patagonia. This can be explained by the unequal distribution of land in areas with greater diversity of owners and by the accumulation of properties in large areas, in line with Meyer [47] (2018), Mandujano-Bustamente et al. [70] (2016) and Soza-Amigo and Aroca [71], who explain that the young population tends to migrate for better working conditions or education in contexts of rural decline, but also due to limited access to land ownership [24,59].

In line with [39], the declining young population and aging in rural contexts reduce the workforce. It also reduces the coverage of education and health services due to gradual population loss, revealing a vicious cycle that affects the social, economic and cultural capital of these places and causes them to shrink [39]. Rural shrinkage will remain active as long as rural development policies are not improved. In addition, the young population is regularly rendered invisible in territorial development planning processes [47], despite

its potential to address and halt depopulation problems [24]. The limits the possibilities of generating strategies to reverse the situation even further.

One important detail is that the loss of the young population was homogenous among men and women. The dynamic differs from the global literature, where more women than men emigrate [49]. The trend is also different from central and southern Chile, where it was found that territories are recovering female population due to a probable increase in emigration by men [18]. These results indicate that the dynamics of rural decline and rural shrinkage can behave differently according to the spatial characteristics of each area.

6. Conclusions

From a critical political perspective of territorial organization, rural shrinkage and rural decline are indicators of the failure of an unsustainable projection of the population and territory's development through models based on the exploitation of nature. The dynamics of rural shrinkage are expected to intensify in the coming decades due to the preponderance of this type of economic rationale underpinning development policies in the region, especially in environmentally fragile areas and in "places where livelihoods depend on narrow ranges of natural resources" [40], as is the case with rural settlements in remote parts of Chilean Patagonia.

This article presents an analysis of the relationship between land grabbing and demographic shrinkage in rural areas of the Magallanes Region. Statistical procedures were used to identify the way in which this dynamic of underpopulation and rural depopulation persists due to the presence of significant inequalities in the distribution of land and the accumulation of large properties.

The results show that land ownership in Magallanes is concentrated in large areas, where rural depopulation dynamics can be observed that especially affect young people. Possibly driven by unequal access to land, there has been an exodus of young people to urban centers in search of better work and education opportunities. This reveals the difficulties that these sectors of the population face and the deficient population policies implemented by the state, due to the prioritization of a rural development strategy that does not facilitate human settlement in these areas, instead making it more complex as it is based on protection of private land ownership. At the same time, significant demographic imbalances have been produced, with high aging and masculinization rates that hinder the repopulation of these areas, which have historically suffered from underpopulation. This demonstrates the need to promote an intersectional approach to rural development policies, which allows us to identify situations of spatial injustice generated by land grabbing that are reinforced in terms of class, gender and age.

At the same time, studying the land grabbing and the unequal distribution of land as a trigger of demographic imbalances in these territories poses a political challenge that calls into question deficient population strategies based on rural and territorial development strategies that fail to reverse population loss and the demographic effects that it brings. This is especially so in the context of new scenarios of extractivist development on the global-regional scale. And they pose new challenges for policies to facilitate land redistribution.

Institutionally, the problem of population and rural development in Chilean Patagonia is promoted through a series of policies based on the individual economic entrepreneurship of investors, without participation by other community and cooperative forms of land use. This reveals a scant understanding of the geohistorical processes and control over land ownership that have triggered Patagonia's historical population problem.

One of the policies public institutions have deployed to reverse rural decline has been the promotion of public investment in transportation networks, something clearly specified in the Regional Development Strategy. This is to be through the creation of road and port infrastructure, in addition to implementing inter-regional mobility subsidies for the residents of isolated areas to overcome the obstacles of rural geographical isolation. These territorial strategies have not been evaluated in terms of their post-investment effectiveness and their implications for forms of habitation and can be subjected to a critical

analysis focusing on mobility. Nor has the issue of land distribution and the possibilities of access to property on the part of rural youth in these areas been addressed.

The relationship between land grabbing in large areas and rural shrinkage poses an academic challenge due to the literature's lack of depth on the subject. It is important to expand studies involving other variables, using statistical and qualitative methods and tools that can overcome description and explain the causality of this phenomenon. For example, understanding of the phenomenon can be broadened by including the influence of environmental and climate factors, geographical isolation conditions, territories' lack of connectivity and governance parameters in rural decline. It is also suggested that it should address the way in which public and private environmental conservation processes influence land ownership and sociodemographic changes like shrinking rural populations. This is important because these problems do not only take place in the Magallanes Region, but there are other extreme regions with similar geographical conditions around the world that need to be addressed.

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Notes

- ¹ Values in 2019 US dollars, obtained from the Central Bank of Chile.

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