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Nature-city assemblages, complex morphology and residential integration. An exploration of centralities in Valdivia, Chile

Ensamblajes naturaleza-ciudad, morfología compleja e integración residencial. Una exploración de las centralidades en Valdivia, Chile

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Abstract

The city of Valdivia, one of the most important cities in southern Chile, presents a complex morphology, which has defined the process of transformation and

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occupation that this manuscript intends to explore. Based on the Florence Coefficient of Localisation (FCL), we propose a study of the polycentric structure of Valdivia based on its exceptional situation as a medium-sized city, located in the middle of a system of rivers and wetlands. The paper provides, first, a historical vision of the relationship between nature and the city that exists in Valdivia, highlighting the residential value currently attributed to bodies of water, along with their relevance for the development of State-subsidized housing projects. The contemporary tensions noted from the methodology used allow us to explore, in terms of the Florence Location Coefficient, the structural qualities in each of the city's neighbourhoods, which are analysed in terms of effects and opportunities associated with the current policies of territorial and social integration to produce housing subsidized by the State, this time, within the framework of a complex urban space in Chile.

Key words: *Florence Coefficient of Localisation, polycentrality, middle cities, fluviality and wetlands, integration.*

Resumen

La ciudad de Valdivia, una de las más importantes urbes del sur chileno, presenta una compleja morfología, la que ha definido el proceso de transformación y ocupación que se pretende explorar en el presente manuscrito. A partir del Coeficiente de Localización de Florence (CLF) se propone un estudio acerca de la estructura policéntrica de Valdivia basándonos en su excepcional situación como ciudad media, emplazada en medio de un sistema de ríos y humedales. El trabajo proporciona, primero, una visión histórica de la relación entre naturaleza y ciudad, destacando el valor residencial atribuido actualmente a las masas de agua, junto con su relevancia para el desarrollo de proyectos de vivienda subvencionados por el Estado. Las contemporáneas tensiones advertidas a partir de la metodología utilizada permiten explorar, en términos del Coeficiente de Localización de Florence, las cualidades estructurales en cada uno de los barrios de la ciudad, los que son analizados en función de efectos y oportunidades asociados a las actuales políticas de integración territorial y social para la producción de viviendas subsidiadas por el Estado, esta vez, en el marco de un espacio urbano complejo en Chile.

Palabras clave: *Coeficiente de Localización de Florence, policentralidad, ciudades medias, fluvialidad y humedales, integración.*

1. Introduction

The relationship between nature and the spatial development of cities features a variety of conflicting interests, such as the conservation of natural surroundings, demand for residential solutions, optimal conditions to everyday life, and urban production in infrastructure. Although academic interest and public management efforts tend to focus on this issue, it is also true that the

complex morphology that defines the development of cities located on river systems helps to explain patterns of centrality in terms of two variables: the location of State-subsidised housing, and their level of access to goods and services (Mommaas, 2004; Rizzo & Galanakys, 2015; Urbano & Delpino, 2015). This complex morphology is exposed to even greater tension by the social and territorial integration defined by Chile's current urban policy, the principal objective of which is to guarantee access to goods and services according to patterns of proximity (Aguirre, 2014; Koppelman, 2018; Shlack & Vicuña, 2001).

These conditions of residential production, particularly those associated with subsidized housing and its surroundings, present, a strong dependence on the equipment and accessibility that each neighbourhood presents to sustain a housing project. Subsidy policies operate as vehicles that move the new owners from a precarious position in the habitation, to a definitive house or apartment, whose meaning is not only found in the built object; but also, in the environment that surrounds it.

The central problem addressed in the present article concerns the relationship between residential land use and accessibility of goods and services, which represents one of the cornerstones of social and territorial integration according to the Política Nacional de Desarrollo Urbano (National Urban Development Policy [PNDU]; Ministerio de Vivienda y Urbanismo [MINVU], 2014). The transformation of nature to provide city and services to the inhabitants of Valdivia is not a homogeneous process and varies according to the urban configuration of neighbourhoods whose historical development has varied according to natural systems. Although the manuscript uses methodologies for estimating smaller centralities in scale to explain a larger urban context, the truth is that it is impossible to analyse Valdivia without considering the fluvial and wetland systems present since before its occupation. This crossover between the human-social and the physical-natural allows us to enter the historical and special framework of one of the most important cities in southern Chile.

In this way, this article offers a perspective on the present situation and addresses several actions taken by the central State regarding identification of different urban spaces to produce residential zones, which are now generating their own centralities complete with critical elements, such as healthcare and education provision.

The first section of the article presents the study methodology along with a description of the locations of subsidised housing developments and their degree of access to goods and services, based on the Sargent Florence Coefficient of Localisation (FCL) (Florence & Baldamus, 1948). There follows a discussion of the relationship between nature and the city in terms of a proposed concept of complex morphology, within which service and commercial entities are defined as variables. Finally, the FCL results will be analysed in terms of the concept of complex morphology and contrasted with the definition of integration applied by the PNDU in territorial decisions relating to Chilean cities.

2. Area of study

Valdivia is in southern Chile (39° 48' S, 73° 14' W), within a fluvial landscape where the Valdivia, and Cruces rivers converge, forming an ecologically significant wetland system. Its temperate-rainy climate and proximity to the Valdivian temperate rainforest contribute to its unique natural identity. The city is surrounded by hills and green areas, which have influenced its fragmented urban development, with expansions into peripheral sectors such as Isla Teja and Niebla (Borsdorf, 1976; Borsdorf, 2000; Zumelzu, *et al.*, 2015; Hidalgo, *et al.*, 2018a). This spatial configuration is by no means unique, either in terms of its polycentric structure or its riverside location, both of which are aspects that affect connectivity, exchange and mobility between its various neighbourhoods (Figure 1) (Del Castillo, 2010; Zumelzu, *et al.*, 2015).

Figure 1. Location of Valdivia in southern Chile.
Source: authors.

Founded in 1552 as a strategic colonial outpost, Valdivia played a key role in the defence of the Spanish Empire. However, its growth was disrupted by natural disasters, most notably the 1960 earthquake, which destroyed much of its infrastructure. During the 20th century, its economy relied on timber and shipbuilding industries, but its geographical isolation limited urban development, keeping it as a secondary city in Chile's urban system (Águila & Prada, 2020).

In recent decades, Valdivia has experienced moderate yet selective growth, accelerating after its designation as a regional capital in 2007. Although its population growth rate (8.9% between 2017-2023) remains below the national average (13.6%), the real estate market has driven urban expansion, particularly in peri-urban areas (INE, 2017). This recent dynamism, combined with its natural and historical heritage, makes it a relevant case for studying urbanisation in

medium-sized cities with high biodiversity (Águila & Prada, 2020; Borsdorf *et al.*, 2008).

For this reason, and given the complexity of the case in question, we decided to conduct our analysis using the FCL, which, as seen above, is a widely used method in Urban Geography and can provide information on specific aspects of cities of this type, in which nature constantly adapts to the needs of humanity and vice versa.

3. Methodology

The Florence Coefficient of Localisation (FCL) (Florence & Baldamus, 1948) is used to measure the degree of concentration or dispersion of productive activities and services within a territory. For the purposes of the present study, each of these will be labelled as a commercial or service entity, as applicable. The relevance of FCL here lies in its capacity to evaluate the relationship between two variables that are positioned at opposite ends of a scale, such as the number of entities within a city and the number present within a particular neighbourhood. It also allows observation of differences in the degree of benefit provided by one of these sectors at a neighbourhood level compared to the overall benefit across the city. Finally, in the field of public policy analysis, the FCL results point to whether densification of commercial or service entities would have a positive effect on the social integration of subsidised housing projects which traditionally have been studied in terms of concepts such as segregation and fragmentation. While the present article does not seek either to prove or disprove the validity of the latter concepts, development of an alternative form of analysis would be beneficial (Cartes, 2012).

For the purposes of the present study, the city of Valdivia was divided into neighbourhoods, based on documentary and research sources for the city of Valdivia, mainly Fogle (1962) and DIPLADEU (*Dirección de Planificación de Desarrollo Urbano* [DIPLADEU], 1969). Details of which are provided in the next section. For each neighbourhood, a ratio was established between the proportion of the offering of a given sector in that neighbourhood and the total offering of the same sector at the city level. A second ratio was then produced between the proportion of the offering of one sector and the total offering of all sectors, both at the city level. For a sector i, this is calculated as:

$$FCL = \left(\frac{oi}{ot}\right)\left(\frac{Oi}{Ot}\right) \quad (1)$$

were:

FCL: Florence Coefficient of Localisation.

oi: offering of sector i in the neighbourhood.

ot: total offering of all sectors in the neighbourhood.

Oi: offering of sector i across the city.

Ot: total offering of all sectors across the city.

Interpretation is straightforward. A commercial or service entity with a strong presence within a neighbourhood will have a value greater than 1. A value close to 0 indicates a weaker presence or absence of the entity in the neighbourhood. Urban centralities are defined based on the quantity, variety and diversity of goods and services offered within a given area (Truffello & Hidalgo 2015). The more significant the indicators, the greater the centrality, and vice versa.

The choice of this spatial exploration model is based on its medium-scale analytical capabilities, being the appropriate one to identify those neighbourhood units in which the concentration of one or more services can determine the income of a greater volume of subsidized housing, the main objective of the political orientations that the PNDU proposes in the public management of cities. residential property and sustainability.

4. Results

4.1. Nature and urbanisation in cities with complex morphologies

In Latin American Urban Geography, the study of nature has increasingly focused on issues such as urban climate (Henríquez & Romero, 2019), natural hazards (Sarmiento *et al.*, 2020), and management of green areas and ecosystem services (Rojas *et al.*, 2019) The key concepts addressed by these lines of research have concerned uncertainty in terms of access to urban goods, rights and services, opening up a new vein of work to reassess the types of city currently being produced. However, insufficient consideration has been given to the complex morphology approach as applied, for instance, to the relationship between riverside location and the differentiated creation of neighbourhood units.

Coastal, lakeside and riverside cities are sites in which human interference with the waterfront is a continuous phenomenon. Valdivia has been a true continental polder even since before the Spanish invasion (Chamorro & Urbina, 2018; Urbina, 2019), and the filling of coastal and other wetland areas to reclaim land and thus extend the terrestrial surface over the liquid space has been a key feature of the history of all cities of this type.

However, this form of land acquisition ultimately constitutes the advance of urbanisation across fragile spaces, affecting all the living beings alongside which human society exists. The filling of wetlands to create polders, a strategy used extensively in the Netherlands, is achieved by artificially raising the level of the land using a variety of materials to produce additional firm, buildable land (Roth & Warner, 2017).

Research on this process has addressed a range of aspects, from low-lying land, soil types, flooding, fluid management models for rivers, construction processes, and the characteristics and draining of deltas, to the impact of climate change in these areas, their protection and restoration, and adaptation of urban planning to changing climate phenomena (Vermaat & Hellmann, 2010).

Another important factor in this context is the way in which land reclamation has become a tradition and how socio-spatial relations set within nature result

in a complex morphology. The present study focuses on the human and social dimension of land reclamation, and the concept of reclaimed space is ultimately seen as the advance of urbanisation for the purposes of social reproduction and development of the city's productive economy (Smith, 2020).

In riverside cities like Valdivia, the sinuosity of its meanders and the physical barrier to connectivity posed by the courses of its rivers provide the conditions for true isolation in certain neighbourhoods and sectors of the city, and this has led to the emergence over time of certain patterns in terms of the provision of goods and services, which in turn provide insights into the degree of centrality present (Berry, 1967).

Over the course of its history, the urban expansion of the city of Valdivia has involved disruption of nature (Cerda-Brintrup, 2016; Borsdorf, 2000). The urban area in 1961 has 1,064 HA; but, in 2013, the full constructed space is 2,538 HA (Secretaría Comunal de Planificación Valdivia [SECPLAN], 2018). Prior to the twentieth century, its development into a multifunctional city was driven by the filling of wetland areas in what is now the city centre (Almonacid, 2000). Residential areas and agricultural and fishing infrastructure were joined by brewing operations and workshops producing leather and wool for sale in central Chile and later for export to Europe, promoted by the networks of contacts maintained by Valdivia's German colonial settlers with their counterparts in Hamburg and elsewhere (Bernedo, 1999).

During the twentieth century, poorer segments of the population began to settle around the edges of the wetlands. These areas were classed as swamps at the time, and the concept of ecosystem conservation did not exist. As such, there was no recognition of their value, and they were disregarded (Hidalgo *et al.*, 2018a). The turn of the century saw the dawn of the concept of environmental responsibility, and the wetlands were identified as a complex ecosystem that must be valued by society and protected (Rojas *et al.*, 2013; Rojas *et al.*, 2019; Silva *et al.*, 2015). The Figure 2 presents the features of the area as they exist currently.

This background highlights two important considerations for the definition of the concept of complex urban morphology. Firstly, nature and space are not synonymous; there is neither consciousness of nor intervention in the former on the part of society, and as such it may be referred to as "first nature" (Castree & Braun, 2001). Geographical space is a second level on which altered nature becomes an object that is integrated within a system – in this case, an urban system (Anton Clave & Wilson, 2017; Fauveaud, 2016). Cities spread out into space, transforming nature, appropriating it and subjecting it to anthropogenic uses. Housing occupies a central position among these uses, although alone it cannot generate major urban flows.

Secondly, economic development, featuring expansive real estate operations, positions urban systems at the centre of the distribution of goods and services derived from exploitation of the natural world (McFarlane, 2016). The temporal and spatial trajectory of housing, for example, explains the transformative role of bodies of water —rivers and wetlands— in the construction of a complex urban morphology.

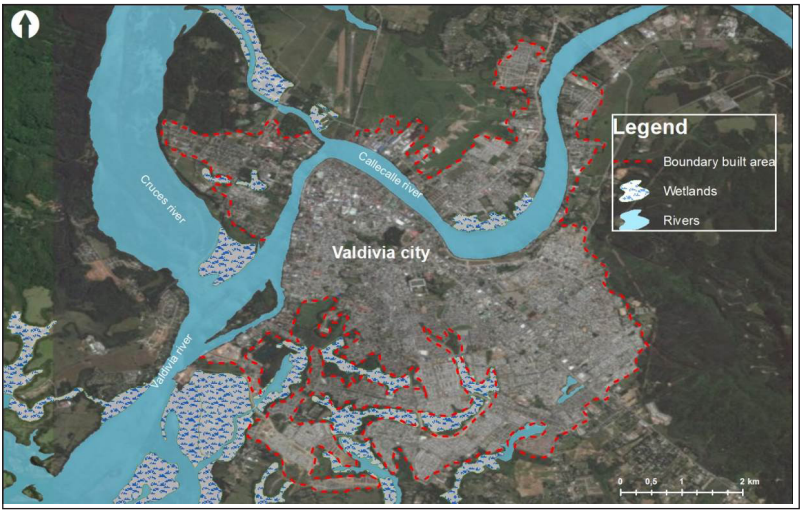

Figure 2. Urban zone of Valdivia, its river system and wetlands.
Source: authors with accurate as of January 2020.

These considerations also cast doubt on the interpretation of sustainability that permeates current urban political discussions in Chile. Reduced to a certain amount of green space per person, advances in sustainable urban planning have seen a transformation in perceptions of wetlands. Once viewed as the worst land on which to build, they are now at the top of the sustainability priority list, owing both to their ecosystem qualities and to new appreciation of their potential as landscape units.

It is precisely this observation of landscape units that makes it possible to enter differently from the conventional analysis of neighbourhoods, their relationship with natural elements and the result of innovation processes based, in general, on the increase in infrastructures. We will review this in more detail from the next section.

4.2. Rental niches and the creation of new centralities

Urban growth in Valdivia has been heavily influenced by the expansion of formal and informal housing (DIPLADEU, 1969). Prior to and following the 1960 earthquake, the southern part of the city was the site of slums inhabited by impoverished residents from rural sectors. These areas constituted a new thrust of urbanisation which became regulated in later decades. Chilean State housing corporations and international aid programmes such as the Alliance for Progress led material improvements to the slums, converting them into a series of neighbourhoods and integrating them into the city (Fogle, 1962).

Towards the end of the 1960s, *Estudios Preinversionales* (Pre-Investment Studies) commissioned by the *Oficina de Planificación Nacional* (National Planning Office) devised nomenclature for these neighbourhood units and

assessed housing entities resulting from formalisation of slum areas, along with those developed as part of a process of planned urbanisation (DIPLADEU, 1969). This work helped to identify potential locations for new subsidised housing over the coming decades, paving the way for considerable urbanisation in Valdivia. The process led to sustained expansion of the city in the form of new housing projects focused on the consolidation of a rental niche capable of attracting new owners as well as smaller businesses and services such as education and health (Figure 3).

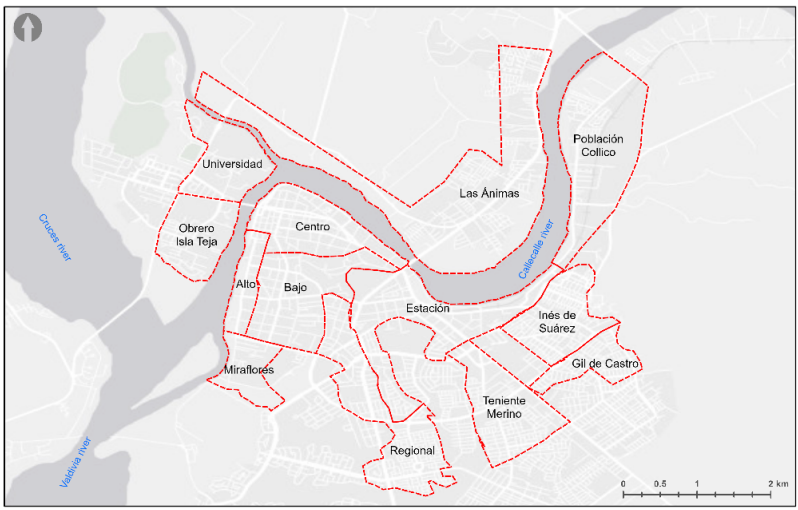

Figure 3. Neighbourhood boundaries established by Pre-Investment Studies in Valdivia, 1969.
Source: authors.

During the first decade of the twenty-first century, growing State subsidy policies began to incorporate the so-called emerging sectors that comprised those families who had succeeded in lifting themselves out of structural policy, giving them access to commercial bank mortgages (Hidalgo *et al.*, 2018a; Hidalgo *et al.*, 2018b). The combination of subsidies, mortgages and personal savings allowed people to take advantage of the new infrastructure built during previous decades and the resulting expansion of services and emergence of new centralities.

Central spaces, associated with a flat urban morphology, tend to become flexible and adapt within river systems that incorporate wetlands (Rodriguez *et al.*, 2019). Chile offers other examples like Valdivia. In the metropolis of Greater Concepción, although most services are focused within the central district, the other sectors of the city maintain a differentiated autonomy in terms of education, healthcare and businesses (Aliste & Musset, 2014; Perez-Fargallo *et al.*, 2018). In terms of the larger metropolitan spaces of Latin America, São Paulo, for example, uses river courses as a landscaping feature in sectors dominated by skyscrapers and corporate buildings (Lencioni, 2011; Valdoski,

2014). In Spain, by contrast, illegal urbanisation is often led by the wealthier middle classes who occupy peri-urban riverside land in Bajadoz which, in recent decades, has shown itself to be susceptible to frequent flooding (Jiménez *et al.*, 2020).

However, the tension between rental niches and the fluviality and wetlands of Valdivia is compounded by new centralities and a tendency for housing subsidies to affect real estate prices. Pre-twenty-first century, land near wetland areas, particularly in the southern part of the city, were occupied by slums and social housing; however, the opposite has now become true. The new centralities provide diversified services to an equally diverse population, within a space traversed by more recent integration-oriented territorial policies and long-running State-subsidised real estate operations. The analytical logic of the FCL reveals the present State of this action, which combines to form a nature-city assemblage of complex morphology that links subsidised housing with the urban structures that provide services, goods and rights.

The following questions are therefore raised: What scope is there for social and territorial integration in a context of rental niches within natural surroundings? What is the extent of this new phenomenon of polycentrality?

4.3. Production of subsidised housing: centralities in a complex morphology

Subsidised housing in Valdivia has been built in two types of localities since 1980. Housing classified as *social*, namely residences acquired without a mortgage, are situated within the urban limits, primarily in the city's southern sector which is dominated by wetlands. This location not only promotes social integration due to its proximity to the city centre but forms a suburban belt in which the nearby wetland areas are perceived as a benefit in terms of landscape. This is a new dimension of urban value based on nature.

Dotted here and there within this urban belt are groups of condominiums built by private developers, along with the second type of subsidised housing, known as low-cost housing. The latter are larger properties than those found in the social housing areas and have been purchased since 1980 with the help of mortgages, personal savings and State subsidies. Both types of subsidised housing are located close to wetland areas, forming an urban-rural interface with natural areas, protected, for the most part, for their ecosystemic value. The traditional notion of the suburbs has yet to be achieved in Chile. For decades, social housing has been pushed to the edges of cities and starved of commercial or service provision; in other words, with no centralities (Figure 4).

The mixture of subsidised housing types has led to the presence of State-funded primary healthcare and pre-school services, such as the Fundación INTEGRA.[1] The large areas of low-cost housing in the Las Ánimas and Norte

[1] INTEGRA is a State-run non-profit foundation that provides certain services in areas not served by private providers. It runs pre-schools and nurseries across Chile.

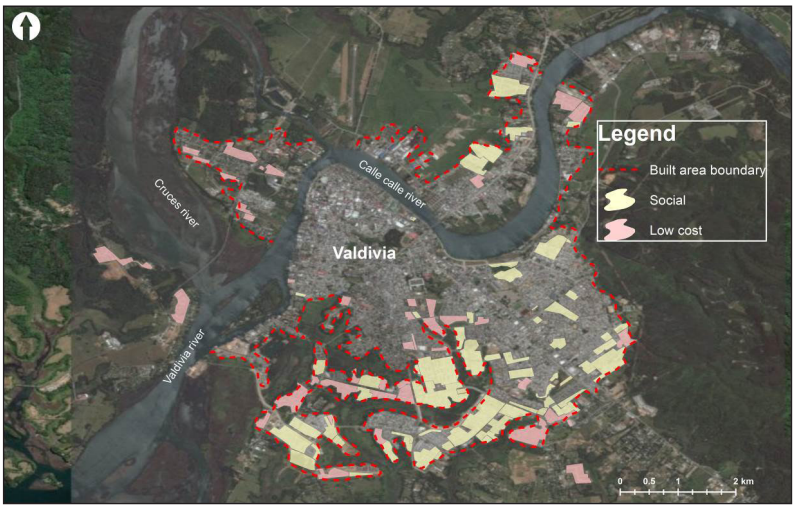

Figure 4. Social and low-cost housing in Valdivia, 1980-2018.
Source: authors.

Grande neighbourhoods, situated on the northern bank of the Calle River, are served by these publicly funded services. The Education indicator, applied to Valdivia's public, private-subsidised and fully private schools, the majority of which are in the south-eastern neighbourhoods of Yáñez Zavala and El Bosque, is slightly more complex. This residential area follows the traditional pattern of occupation of the southern bank of the Valdivia River. This is the site of the city's oldest neighbourhoods, such as Barrio Bajo and Regional, both developed between the 1940s and 1970s.

An interesting element of the spatial configuration of the subsidised housing sectors is the CORVI[2] neighbourhood, in which the largest concentration of private pre-schools may be found. CORVI is a flagship neighbourhood created by the housing policies of the 1950s, 60s and 70s which sought to form an urban middle class by means of State subsidies and a strong developmentalist approach (Figure 5).

The distribution of commercial entities has a significant influence on the generation of polycentrality, greater even than the complex morphologies of the city. While wetland areas have become rental niches thanks to their superior value as landscape, the general homogeneity of the city explains the circuits of consumption maintained by the urbanised economies of the Global South. Valdivia's moderate size serves as a good illustration of these processes which, in larger cities, often become invisible.

[2] CORVI was the Corporación de la Vivienda (Housing Corporation), a public and technical organisation responsible for housing policy in Chile between 1953 and 1976.

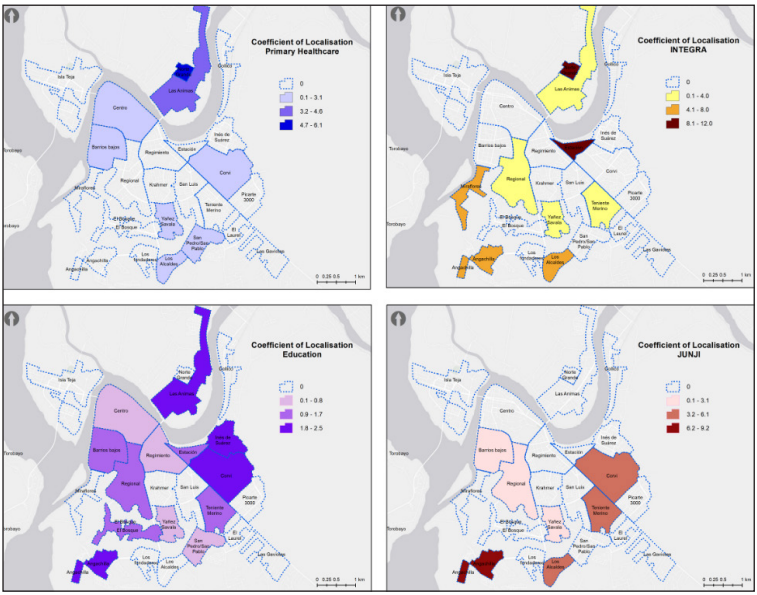

Figure 5. FCL for Primary Healthcare, INTEGRA, Education and JUNJI[3] (National Association of Preschools) in neighbourhoods of Valdivia.
Source: authors.

There is a particular concentration of restaurants in the San Pedro/San Pablo and Inés de Suarez neighbourhoods, both of which began life as slums in the 1930s and subsequently received a considerable influx of people in the wake of devastation caused by the earthquake of 1960. These are working-class neighbourhoods whose food businesses are generally not traditional restaurants, tending instead towards more transient fast-food offerings.

Commerce is more evenly distributed across the city than the other variables. Of particular interest is the strong presence of commercial establishments selling homeware products, such as in the Los Alcaldes neighbourhood. Until the 1990s, this area marked the boundary between the city and the southern wetlands, although at that point, low-cost housing developments began to appear around the marshes, followed by condominiums. This urban-natural frontier is key to explaining the formation of the suburban belt, in that the complex morphological component was compounded by the instrumental role of the wetlands as the target of urban sustainability.

The distribution of *Technology* and *Other Services* is as expected, generally concentrated in the city's central neighbourhoods. Here there is a strong presence of beauty salons, relaxation and yoga studios, and CrossFit training gyms (Figure 6).

[3] JUNJI is the National Association of Preschools, part of the Ministry of Education. Its primary function is to supervise private and State-subsidised private preschools, as well as those run by INTEGRA.

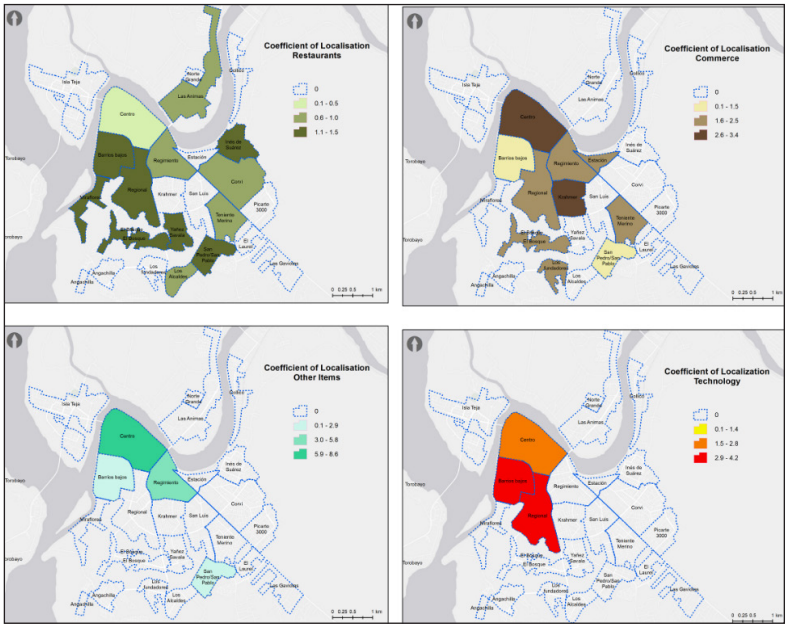

Figure 6. FCL for Restaurants, Commerce, Technology and Other Items in neighbourhoods of Valdivia.
Source: authors.

A summary of commercial and service entities for each neighbourhood is presented in Table 1. Neighbourhoods that emerged after the Pre-Investment Studies of 1969 —constituting a series of spatial units with a variety of valuable characteristics— contributed to the formation of the so-called rental niche, and their potential value will be the basis of future urbanisation drives in the city of Valdivia.

Although at times contradictory, each of the elements analysed constitutes a thread of centrality associated with the integration profile promoted by the PNDU. Restaurants account for a large portion of the urban employment matrix in present-day Chilean cities such as Valdivia, where these diverse services are categorised as "small businesses". This is the case in the Barrio Bajo, Regimiento, Yañez-Zavala and other neighbourhoods (Table 1).

Table 1. FCL for each of Valdivia's neighbourhoods

Neighbourhoods	PH	EDU	RST	ITG	JNJ	CMC	TECH	OI
Angachilla	0.0	2.2	0.0	6.0	9.2	0.0	0.0	0.0
Barrio Bajo	0.5	1.5	1.3	0.0	0.7	0.7	3.9	1.0
Centro	0.1	0.4	0.5	0.0	0.0	3.4	2.1	8.6
Collico	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Continuation of Table 1

Neighbourhoods	PH	EDU	RST	ITG	JNJ	CMC	TECH	OI
CORVI	2.4	2.2	0.7	0.0	5.5	0.0	0.0	0.0
El Bosque	0.0	1.2	1.2	0.0	0.0	1.9	0.0	0.0
El Laurel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Estación	0.0	1.6	0.0	9.0	0.0	1.8	0.0	0.0
Inés de Suarez	0.0	2.5	1.4	0.0	0.0	0.0	0.0	0.0
Isla Teja	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Krahmer	0.0	0.0	1.6	0.0	0.0	3.4	0.0	0.0
Las Animas	3.9	1.9	0.8	1.3	0.0	0.0	0.0	0.0
Las Gaviotas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Los Alcaldes	2.3	0.0	0.8	6.8	3.4	0.0	0.0	0.0
Los Fundadores	0.0	0.0	1.6	0.0	0.0	1.8	0.0	0.0
Miraflores	0.0	0.0	1.5	6.0	0.0	0.0	0.0	0.0
Norte Grande	6.1	0.0	0.0	12.0	0.0	0.0	0.0	0.0
Picarte 3000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Regimiento	0.0	0.7	1.0	0.0	0.0	2.4	0.0	4.4
Regional	0.0	1.1	1.3	0.5	0.7	1.0	4.2	0.0
San Luis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Pedro/San Pablo	0.9	0.8	1.5	0.0	0.0	0.5	0.0	2.0
Teniente Merino	0.0	0.9	0.9	2.4	3.7	1.4	0.0	0.0
Yáñez Zavala	1.7	0.6	1.5	0.9	1.3	0.0	0.0	0.0

Source: authors (Acronyms: PH, Primary Healthcare; EDU, Education; ITG, INTEGRA; JNJ, JUNJI; CMC, Commerce; TECH, Technology; OI, Other Items)

5. Discussion

A review and discussion of the results of the FCL and their contribution to the analysis of polycentrality in Valdivia provides insights into the opportunities presented by the PNDU's social and territorial integration policy. The central elements of the policy that are applicable to morphologically complex urban spaces propose the following (MINVU, 2014, p. 42):

- Consideration of nature as the framework within which the city exists. The logic of noticing assemblages in the association of elements such as Primary Healthcare or Education is since both have a strong impact on the correction of historical situations of segregation and social postponement. The fact that the neighbourhoods of the south and north of Valdivia present dissimilar results in both and that subsidized housing continues to be built increases the possibilities of spatial marginalization, both quantitative and qualitative.

- The application of special regulations to coastal, riverside and lakeside cities that have more to do with natural hazard risk management than with social and territorial integration. This situation makes nature a scenic space without much value towards the conditions of habitability that an integration policy should offer. It is true that natural hazards are a permanent part of the key considerations in territorial planning. But what kind of city, subdivided into 24 neighbourhoods, could generate a real alternative in social integration based on a harmonious relationship with nature? In this way, which visions —not requirements— concerning sustainable development within the relationship between land and bodies of water?

These findings contrast sharply with international literature on polycentric urban development in medium-sized cities. While Mommas (2004) indetified clear clustering patters in European cities, and Truffello & Hidalgo (2015) documented more balanced service distribution in flat morphological contexts mlike Santiago, Valdivia presents a fragmented centrality structure where natural elements act as both connectors and barriers. This challenges conventional planning approaches that assume linear relationships between proximity and accessibility.

The methodological application of the FCL in this context reveals both strengths and limitations. While the coefficient successfully identifies service concentrations that might be invisible to traditional accessibility analyses, it fails to capture qualitative dimensions of service delivery and temporal dynamics of urban change. Furthermore, the reliance on 1969 neighbourhood boundaries introduces potential bias in contemporary analysis, as these delimitations may not reflect current socio-spatial realities.

On this basis of these proposals, whose approach to integration focuses more on sustainability than on social cohesion or spatial justice, the analysis of centralities conducted here reveals several important issues.

Coverage of commercial entities is more robust than that of services, and this is the case for two reasons. The first is the choice of an urbanisation model based on subsidised property ownership that has led to the growth of a suburban belt around the city whose appearance has involved little planning beyond simply building more houses.

The second is the high concentration of businesses in the southern part of the city. The greatest concentration of social and low-cost housing is within the Angachilla, Los Fundadores, San Pedro/San Pablo, Las Gaviotas and El Laurel neighbourhoods, but it is unclear whether a process of integration such as that proposed by the PNDU is in fact possible. The Angachilla neighbourhood is the subject of a final analysis (Skewes & Mancilla, 2012).

These patterns align with McFarlane (2016) observations about the complex geographies of urban density, where proximity does not automatically translate into social integration. However, our findings extend this analysis by demonstrating how natural elements —rivers and wetlands— actively shape centrality patterns in ways that differ from the purely economic logic documented in most urban geography literature.

It extends inland from the southern bank of the Valdivia River and follows the edge of the Angachilla wetland area, bordered by a mixture of low-cost housing and more expensive condominiums (Hidalgo *et al.*, 2018b). This configuration leaves the nearby areas of social housing cut off and deprived of access to the waterfront, robbing them of the possibility of integration with green, sustainable areas as proposed by the PNDU. This serves as a clear illustration of how the value contributed by the natural world to real estate development comes into conflict with the goals of social justice specified by the PNDU.

This tension between nature valorisation and social equity echoes Smith (2020) critique of uneven geographical development, where natural amenities become commodified assets that reproduce spatial inequalities. Unlike the polder strategies documented by Roth & Warner (2017) in the Netherlands, where land reclamation served broader social purpose, Valdivia waterfront development appears to prioritise market-driven residential expansion over equitable access to natural amenities.

Finally, it is important to note that the PNDU is still relatively new in spatial and urban terms and, as such, it is too early to draw conclusions from it. However, the urgent need for more subsidised housing in Chile has served as an example across the Latin American region, with Mexico being one of the best examples (Salinas & Pardo, 2020). The problem is that location alone cannot guarantee greater social and territorial integration, at least in terms of access to goods and services. Furthermore, the uniqueness of Valdivia and its setting raises another question regarding the integrative perspective of the PNDU: Given its reality as a river city, will access to nature and green areas in Valdivia cease to be a real problem of urban integration?

6. Conclusions

The present work seeks to enter the current discussion surrounding social and territorial integration in Chile by juxtaposing proposals by the National Urban Development Policy (PNDU) and the polycentrality generated within the neighbourhood units of Valdivia. The city's moderate size reveals certain limitations to social urban integration, particularly in terms of the value of Valdivia's River waters and wetlands in the development of subsidised housing projects. Social and low-cost housing must become the primary focus of efforts to guarantee access to green areas and river water within the city, rather than to alternative forms of consumption.

The idea of nature-city assemblages reveals that the historical trend of urbanization towards the peripheries of Valdivia has not been abandoned. At present, the provision of services seems to compensate for the segregation that results from observing a strong and solid concentration in the historic neighbourhoods of the city. Thus, assembly occurs when two or more variables or spatial elements, with no greater relationship than the topology of the proximities, merge in the production of a new neighbourhood entity. This

situation is seen towards the southern and northern edges of Valdivia, both with a strong presence of subsidized housing.

The role of the State goes beyond provision of primary healthcare and education which, according to the FCL is favourable across Valdivia. The logic of subsidies seeks to guarantee access but performs poorly when it comes to enforcement. Density of services tends to be mistaken for integration, but services do not necessarily equate to the notions of spatial justice held by the PNDU.

The FCL data gives rise to two interesting proposals. The Pre-Investment Studies of 1969 identified critical points within the existing neighbourhoods which paved the way for the installation in later decades of services and businesses. This subsequently generated polycentrality within the city, despite its complex morphology. These neighbourhoods constitute a spatial configuration that is of great interest to the field of urban research, particularly in middle cities where size is not synonymous with complexity. Valdivia's moderate size provides access to a series of sub-spatialities that exist between natural and social elements.

A second proposal is the need to explore the different ways in which spatial value is manifest, beyond the relationships that exist between city and materiality. The natural world continues to define the orientation of growth and urban boundaries, where suburban belts provide the rental niches that drive this relentless advance. It is through these elements that we may achieve, in the relationship between urban and natural, a glimpse of the future of middle cities in Chile and Latin America.

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