Received: 25 November 2019 | Revised: 15 June 2020 | Accepted: 14 November 2020
DOI: 10.1111/1745-5871.12458

ORIGINAL ARTICLE

Geographical Research WILEY

Community mapping with a public participation geographic information system in informal settlements

Francisco Vergara-Perucich[1] | **Martin Arias-Loyola**[2]

[1]Centro Producción del Espacio, Facultad de Arquitectura, Diseño y Construcción, Universidad de Las Américas, Providencia, Chile

[2]Departamento de Economía, Instituto de Economía Aplicada Regional (IDEAR), Universidad Católica del Norte, Antofagasta, Chile

Correspondence
Francisco Vergara-Perucich, Centro Producción del Espacio, Facultad de Arquitectura, Diseño y Construcción, Universidad de Las Américas, Providencia, Chile.
Email: franciscovergarap@gmail.com

Funding information
Fondo Nacional de Desarrollo Científico y Tecnológico, Grant/Award Number: 11180569

Abstract
This article shows how a public participation geographic information system (PPGIS) may be used as an asset to foster the right to the city. It describes the implementation of one such public participatory process for registering the story of the macrocampamento Los Arenales in Antofagasta, Chile. Specifically, it stresses how a geographic information system can help build collective engagement regarding special policies and urban life. Los Arenales is the largest macrocampamento in Antofagasta, comprising 13 different campamentos and being organised into a political structure aimed to achieve people's right to the city. In the study, a PPGIS process facilitated better comprehension of the shared history and spatial evolution of built and relational environments in Los Arenales. The PPGIS also provided valuable input for planning and decision-making processes in campamentos in terms of both how to build and organise inhabited spaces and how to conduct external political bargains to ensure the realisation of a collective urban form based on community engagement. In addition, the article considers the experience of applying a PPGIS in a context of extreme socio-economic scarcity, in which it facilitated people's recognition of their shared urban life on a map. Such insights were fostered by co-creating data in collaboration with different urban development practitioners.

KEYWORDS
Chile, community, informal settlements, participatory mapping, PPGIS, right to the city

1 | INTRODUCTION

Since the early 20th century, slum-dwellers[1] have organised themselves in order to develop varied approaches to finding shelter within the Chilean urban system (Handelman, 1975; Salcedo, 2010), leading to a survival strategy that has involved building informal housing near urban centres (Cortés, 2014). However, the Chilean state has responded to this practice with violent evictions and political indifference or both, which is why slum-dwellers have found strength in political organisation and internal governance (Vergara-Perucich & Arias-Loyola, 2019). Moreover, Chilean urban policy first established in 1906 allowed the transfer of privately owned dwellings to the poorest segments of the population (Salcedo, 2010). Thus, the housing system is a top-down scheme by which the government provides unilateral solutions, giving ownership rights to the dwellers who fulfil the requirements and patiently wait for their turn in the queue. This scheme produced a stark reduction in urban poverty since 1990, but it was a trend that did not last long (Arias-Loyola & Vergara-Perucich, 2020).

 © 2020 Institute of Australian Geographers

Recent data indicate the number of slums has increased in just a decade, and especially since 2011, at the close of the commodity super-cycle (CIS TECHO-Chile, 2016; TECHO, 2018). Just in 2018, there were around 40,000 families living in *campamentos*. For the Chilean economy, which is highly dependent on mining (Arias, Atienza, & Cademartori, 2014; Phelps, Atienza, & Arias, 2015), the end of the super-cycle of historically high copper prices caused a cascade effect in mining regions, where workers were expelled from increasingly expensive formal cities (Vergara-Perucich & Boano, 2019). Among these, one of the most affected has been the city of Antofagasta, capital of the Antofagasta Region, where most of the worldwide copper production and reserves are located (USGS, 2018).

Indeed, in Antofagasta City the number of families living in slums has increased from 632 in 2007 to 6,831 in 2018, which translates to an increase of around 980% (CIS TECHO-Chile, 2016; TECHO, 2018). This expulsion of workers and families from the formal city has been an indirect outcome of the rising cost of living, mostly because of severe speculation in the housing market influenced by the mining super-cycle bonanza (Arias-Loyola & Vergara-Perucich, 2020; Vergara-Perucich & Aguirre Nuñez, 2019; Vergara-Perucich & Boano, 2019). Such dark sides of extractive Chilean geographies have required different strategies to deal with housing scarcity and affordability (Phelps, Atienza, & Arias, 2018).

The current Chilean housing market presents a pronounced disequilibrium, in which increasing demand for housing by formal and informal inhabitants has not been matched by the supply and market prices, due to collusion (Vargas, 2016), financialisation (Gasic, 2018; Vergara-Perucich & Aguirre Nuñez, 2019), and gentrification (Inzulza-Contardo, 2016). As a result, successive Chilean governments have faced increasing difficulties for providing housing solutions within the formal urban landscape.

Tired of waiting and because of the extremity of their needs, some Chilean slum-dwellers are advancing their own solutions via bottom-up, solidarity-based approaches that are meant to increase their productive autonomy and the recognition of their rights to the city. Among these, informal grassroot movements have fostered self-empowerment and strategic multipartite alliances with academics, civil society and other slum-dwellers' organisations, politicians, and national and international NGOs to provide stronger, novel, and effective responses to their extreme problems (Arias-Loyola & Vergara-Perucich, 2020; Vergara-Perucich & Arias-Loyola, 2019).

As part of these strategies, some slum-dwellers have reached out to academics to better comprehend their social and urban built environments, because most *campamentos* shift dynamically in terms of their inhabitants, features, and lived spaces. Thus, engaging slum-dwellers in measuring their own socio-economic and built spaces has become a common request to academics and professionals interested in supporting *campamentos*' claims in respect of the right to the city.

In this context, the impetus to measure their experiences and conditions implies producing a *settlement profile* among slum-dwellers through a mapping exercise in which members of a given community themselves identify its settlement's symbolic and physical boundaries (Patel, Baptist, & D'Cruz, 2012) and their attachments to these relational spaces (Brown, Raymond, & Corcoran, 2015). This is valuable input for both their sense of political belonging and their bargains with state representatives and governmental political actors. By collaborating with academics and communities under a participatory scheme, these communities obtain a map delivered and approved by experts. However, and more importantly, they also gain invaluable experiences and social cohesion by engaging in processes involved in producing the map, and increasing their technological understanding and comprehension over the dynamics of their inhabited and relational spaces.

For the case presented, we used a public participatory mapping method (Brown & Raymond, 2014; Brown, Weber, & de Bie, 2015; Emmel, 2008), which served as an effective alternative to the professionally managed survey methods usually employed by burdened states. This method has been used to inform local and regional policies regarding land use and planning and has become a relevant tool for anticipating areas of potential land use conflict (Brown & Raymond, 2014) which, if unresolved, might escalate into multiform violence (Alston, Libecap, & Mueller, 2000).

A public participation geographic information system (PPGIS) was employed as part of a four-way partnership involving slum-dwellers, NGOs, local professionals, and academics, which was formed during the first Know Your

Key insights

Use of a public participation geographic information system has been shown to improve relationships among communities living in informal settlements and territories. To develop a map collectively raises questions about identity in communities and helps to address differences between individuals and groups.

City (KYC) project approved and funded for Latin America by Slum Dwellers International (SDI), aimed to reconfigure anti-slum policies. The project placed slum-dwellers at the centre of the slum's activities, as in the situations analysed by McFarlane (2004) in India. It also sought to co-produce local knowledge as a source of political empowerment for informal communities in their struggle to gain their right to the city and to obtain secure tenure, decent livelihoods, and adequate infrastructure (Mitlin et al., 2020; Patel et al., 2012).

The article starts with a discussion of the PPGIS as a tool for spatialising the right-to-the-city struggle, which is followed by a detailed description of the methodology implemented, a georeferenced story of Los Arenales as the main result of these efforts and, finally, we advance some concluding arguments reflecting on the relevance of this co-production process and its political implications for Los Arenales' inhabitants' bargaining position in their struggle for their rights to the formal city.

2 | THE PPGIS FOR SPATIALISING THE RIGHT-TO-THE-CITY STRUGGLE

In the critical literature on geography and urban planning, practices in which the urban poor take control over certain primary data-generating processes such as surveying, mapping, and classifying within their own communities are broadly accepted and fostered (Brown & Kyttä, 2014; Brown & Raymond, 2014; Brown, Weber, & de Bie, 2015; Kahila-Tani, Broberg, Kyttä, & Tyger, 2016). Such processes are perceived to facilitate slum-dwellers developing new capacities while collecting critical information that could positively influence and accelerate their decisions about their urban future (Bryan, 2011; Cabannes & Lipietz, 2018; de Vries, 2016; Hamdi, 2004; Patel, D'Cruz, & Burra, 2002).

By generating these invaluable data and placing urban informality at the centre of critical analyses (Banks, Lombard, & Mitlin, 2020), communities get to know themselves better (Brown, Raymond, & Corcoran, 2015), control their own information, and strengthen their bargaining position regarding state authorities and civil society (Friedmann, 1992). Increased levels of empowerment and autonomy are direct outcomes of efforts to recompile evidence, because the highly shifting characteristics of informal settlements make it extremely difficult for external institutions to generate similar information by themselves.

In Chile, many such experiences and efforts have been successful, among them *La toma de Peñalolén* (Salas-Serrano, 2009), *Movimiento de Pobladores en Lucha* (Casgrain & Janoschka, 2013), and *UKAMAU* (Del Romero, 2018; di Girolamo, 2015). All these have employed participatory methods to advance discussions about new geographical imaginations, while also empowering communities to create spaces of political engagement and (in)formal bargaining in order to improve their living conditions (McFarlane, 2004). The data collected by using participatory methods have been highly accurate and have informed crucial decisions about the formalisation of the informal built environment and the slum-dwellers' comprehension and prioritisation of their own needs and conflicts. Likewise, they have created spaces for discussions about future redevelopment options by encouraging the participants to “look at themselves as part of a collective instead of just a set of individual households” (Patel et al., 2012, p. 15). It is, indeed, a fruitful exchange of knowledge and a chance to learn collectively. These experiences are mostly fuelled and supervised by academics, professionals, and activists for the urban poor (Livengood & Kunte, 2012).

The guidance of experts is fundamental to gathering information in the most accurate ways possible and to systematise and analyse this information. When these processes are appropriately developed, the outcomes can prevent the implementation of top-down solutions from the government and aid the development of counterproposals. The outcomes from community surveying and mapping processes can activate bargaining processes in which both government officials and slum-dwellers can discuss spatial solutions more equitably, because the government cannot use as a rationale to do otherwise accusations or assumptions that slum-dwellers misunderstand the situations in which they find themselves. Hence, primary data creation might stop the current supplier–consumer relationship between the government and slum-dwellers, permitting horizontal negotiations (Bradlow, 2015; De Sousa Santos, 2009; Heinelt & Hlepas, 2006).

Therefore, incorporating technology in the bargaining processes is a decisive technique for stabilising horizontal negotiations and decision-making processes. The Chilean Government is well aware of this matter and has incorporated technologies as part of a series of technocratic solutions to increase its transparency, efficiency, and capacity to organise solutions (Ndou, 2004). In relation to managing geographical information, the legal decree N.28 was implemented in 2006 by the Ministry of Public Property. This decree established an agency to coordinate the territorial information of the country within a trans-institutional scheme that aimed to support and optimise the decisions made regarding public policies (MBBNN, 2006).

The availability of territorial information has increased the government's accountability for managing data from communities. All information gathered by the state is public and can be challenged when it is perceived as inconsistent. Additionally, the scheme has retained its strict top-down approach, meaning communities must develop spatial information about their settlements to contest government actions against dwellers' interests. Such tasks can be achieved through the collection, presentation, and analysis of territorial information for decision-making based on geographic information systems (GIS). GIS improve the visibility of complex spatial information, making it more accessible and comprehensible to broader audiences lacking technical knowledge; this enhances the decision-making processes related to urban transformations, while also creating better instruments to organise collective projects aimed to upgrade a territory (Jankowski & Nyerges, 2001).

The collective engagement of communities in building GIS layers has been referred to as the PPGIS approach (Sieber, 2006). The PPGIS includes grassroots communities in using GIS to improve their presence in the public debate about future developments in their environment. They also allow people to detect problems with GIS when organising information gathered directly from the field (Harrison & Haklay, 2002). Although the PPGIS has been criticised for lacking positional accuracy (Brown, Weber, & de Bie, 2015), its use in dispossessed communities has subjective outcomes, thus allowing analytical maps to be built collectively. This practice is extremely useful for making consensual decisions, empowering the participants, and fostering a stronger sense of belonging (Han & Peng, 2003).

Similarly, the right-to-the-city agenda is based on the possibility of creating empowered communities capable of making, re-making, and re-shaping their cities and neighbourhoods. This agenda is based on collective and democratic deliberations for advancing the construction of urban spaces and striving to achieve a utopia that best represents the people's wishes, expectations, conflicts, and ideas (Harvey, 2008). The right to the city was developed to promote the concept of a concrete utopia, which is an imagined future based on the technological, social, and political capacities of communities that could be exploited to develop democratic spaces (Lefebvre, 1991, 2003, 2017).

For Lefebvre (2003), the achievement of the right to the city requires that practitioners with advanced technical skills serve as social catalysts to connect urban processes to social engagement. However, the right to the city approach has been criticised for the gap it leaves between its ideas and its feasibility. Finding concrete ways to connect plans with spatial urban forms is not only fundamental but also quite challenging (Marcuse, 2009, 2010). The right to the city is not only a political agenda but also a struggle for the possibility to have a place where all people have the freedom to enjoy urban life under the concept of universality.

Chile has signed the agreement of the New Urban Agenda and in its National Policy of Urban Development defines its aims to advance towards the right to housing and the right to the city. Given these compromises, the development of tools that enable this possibility needs to pass from goal to action. From a concrete perspective, in order to implement the right to the city, the city must first be understood as a whole; however, informal spaces remain underrepresented in official georeferenced data.

To assess these critiques, this research posits that the PPGIS could engage communities to recognise their own urban life on the map (Musungu, 2012) and also to appear in the map as active political actors, claiming access to the benefits of urban life. Thus, the PPGIS approach could also help slum-dwellers' communities to develop instruments that can be used to validate their knowledge and help them advance proposals on public policies for the whole city. All this work is based on data collected from the field. In such ways, the PPGIS is a useful tool for fostering the productive struggle for the right to the city by helping people to bridge gaps in technical knowledge in collaboration with urban development practitioners.

3 | METHOD: ANALOGUE PRODUCTION AND DIGITAL SYSTEMATISATION

This study presents the outcomes of a PPGIS experience in Los Arenales, in the city of Antofagasta (Figure 1). Antofagasta has a large migrant population in relation to Chile's national average. The 2017 Census showed that 12% of the population of Antofagasta are migrants, most of whom have come from Latin American countries such as Colombia, Bolivia, and Peru. Based on data from the regional government of Antofagasta (Kaplinsky, 1998), around 60% of slum-dwellers living in Antofagasta's informal settlements are foreigners. The high price of housing pushes families outside the formal housing market (Flores, 2016). Therefore, living in *campamentos* has become a survival strategy in a precarious economic condition. The biggest *campamento* in Antofagasta is Los Arenales, the city's only *macrocampamento*,[2] composed of 80% immigrants (GORE, 2016; TECHO PARA CHILE, 2016).

Nonetheless, these migrants have achieved a solid sense of belonging, a strong desire for overcoming their

FIGURE 1 Map of Chile indicating the location of the city of Antofagasta and the location of Los Arenales within this city. Source: Authors, based on Google Maps using QGIS

current difficulties, and, most importantly, a political organisation through which they aim to gain the right to the city in order to improve their quality of life. They have designed and implemented different strategies for such ends; these include (i) the first cooperative bakery in Chile to generate a steady income, (ii) a complex political body composed of 13 committees that organise decision-making processes in the settlement, (iii) a continuous presence in the local and national media, and (iv) a strong commitment to upgrading their slums and achieving dignified living conditions (Arias-Loyola & Vergara-Perucich, 2020; Vergara-Perucich & Arias-Loyola, 2019).

Hence, as part of their shift from short-term reactions to conditions of precarity and urgency to long-term strategies related to planning their future space, they designed a participatory map of the territory to recognise its conflicts, opportunities, and meanings as part of the KYC project. Besides, mapping the current situation of the *macrocampamento* is one of the reglementary requests for applying to the Social Fund Program for Housing.[3] As previously mentioned, the KYC project also consolidated the relationships built between the slum-dwellers, local NGOs, professionals, and academics who support and work with and for the *campamentos*, most of who were also engaged in the construction of the first cooperative bakery in a Chilean *campamento* (Arias-Loyola & Vergara-Perucich, 2020; Vergara-Perucich & Arias-Loyola, 2019).

The team that organised the PPGIS included an urbanist, an architect, three psychologists, an economic geographer, and well-established residents of Los Arenales, whose role was to put the spatial history of this informal settlement into the map. The team recruited 12 slum-dwellers who had been living in the *macrocampamento* the longest. In conducting the session, the roles of facilitators were assumed by the architect and the urbanist.[4] This session occurred after four prior planning meetings, which were carried out to determine the best way to implement the PPGIS process.

The focus was to indicate on the map how the residents interpreted the spatial evolution of the settlements, what they identified as the main conflicts, and what they felt were the key moments that led to the area's expansion from 2012 to 2018. The session was held at El Bosque, a community centre located inside Los Arenales. The set-up was simple. It consisted of a screen map on which ideas could be jotted and where an aerial photo of the *macrocampamento* was projected. There was also a central table, chairs, and a map for each participant on which they could make markings. Bread and tea were provided for all the participants by the cooperative

bakery to support this data creation process, perceived as crucial by the *macrocampamento's* inhabitants.

Before starting, the participants were carefully informed of the goals and methods of the session, and they all signed an informed consent form required as part of the ethics clearances received for the study FONDECYT #11180569. This process allowed the researchers to record audio and video, take photographs, and keep the maps for further analyses with an agreement in place to share those outcomes with the people of Los Arenales. The identity of each participant was later anonymised for the analysis. The session was designed in four stages:

1. *Debating the origins of Los Arenales*: The first stage was an open but guided discussion. It aimed to reveal the hidden history of the settlement, recall some of the history regarding its spatial formation, and discuss some of the conflicts that led to its current form. The debate was carried out in a cooperative and synergic way. Each participant helped fill the gaps that others could not, and disagreements were resolved through consensus. Even the shyest participants were friendly and were encouraged by their neighbours to contribute.
2. *Reconstructing the spatial history of Los Arenales*: This stage centred on the mapping process to spatialise the discussion held in the previous stage. Four high-quality aerial photos were projected onto a piece of white cardboard on the wall. One was a photo was from 2012 (with no *campamentos* in it); one was from 2014 (when the first *campamentos* appeared); one was from 2016 (with more consolidated areas in the settlement); and one was from 2018 (the current area). The goal was to understand the internal (to each *campamento*) logic and external context that influenced the decisions that shaped this *macrocampamento*, along with its spatial history.
   For each picture, we asked the participants to discuss what they believed caused the changes. We also asked them about the new configurations shown in the map (new houses, dumpsites, public spaces, and so on). Again, despite some minor dissent about details, the final explanation was built through consensus. These general agreements were then relayed to the urbanist so that he could draw the boundaries of the new spatial configurations on the projected map, using different colours to represent the different periods depicted.
3. *Mapping points of interest in the settlement*: Each participant received a current printed map of the *macrocampamento* and some coloured pens. They used these materials to indicate the 11 areas/spaces of interest that best represented certain concepts. Each concept was represented by a different number, as follows: (1) spaces of conflict, (2) spaces related to evictions, (3) best areas in relation to safety, (4) worst areas in relation to problematic relationships, (5) spaces with water sources, (6) spaces with energy sources, (7) vehicle accesses, (8) favourite places, (9) dangerous areas, (10) spaces with landslide risks, and (11) spaces where fires have happened or are likely to happen. Each participant gave their map to the organisers of the participatory mapping process.
4. *A posteriori socialisation of the principal outcomes*: Academics shared the maps and analyses with Los Arenales. This socialisation was part of the project KYC of Slum-Dwellers International.

Each of the first three stages lasted around 40 minutes. The information collected was registered in the form of audio, photographs, maps made on the cardboard, and the individual maps that each participant completed. At the end, the facilitators explained that these were the first of many other mapping sessions in which other actors would be involved.

During the sessions, the geographical information compiled was based on official GIS databases from the Chilean Government. The maps were printed, and the researchers digitalised the data in the software QGIS 3.2. Such an approach enabled the integration of the analogic information obtained from the session with a digital platform.; this increased the accuracy of the maps and organised the information, making it possible to produce a more comprehensive understanding of the meaning of the place for the slum-dwellers. The subjective information that participants gave about different areas of the *macrocampamento* had to be mapped. As such, the main ideas were transcribed and then integrated into the GIS platform to geographically map the meanings of their reflections.

4 | RESULTS: A GEOREFERENCED STORY OF LOS ARENALES

To identify the key themes raised in the sessions, the authors employed a qualitative approach based on a content analysis. We focused on arguments and counterarguments presented by the slum-dwellers in each session. During the analysis, the recorded audio from the discussions was coded, and the maps produced in the sessions were analysed. Throughout this process, the topics discussed were categorised, with special emphasis placed on the 11 concepts presented in the third stage.

The name of every participant has been anonymised for protection, because some of their opinions may be considered conflictive. Also, the information provided

was treated sensibly: in the consent form signed by the participants, the researchers explained that the data would never be used for any purpose other than for this study. The researchers also assured the participants that their data would not be connected to their names. When participants responded to questions posed by facilitators, they were asked to indicate on the map (Figure 2) where those responses were best represented in the space. This process helped the researchers to connect meaning with each of the territories.

The opening question of the session asked how the dwellers came to live in Los Arenales. Most of them cited the poor living conditions of low-income housing facilities in the formal city: “I didn't arrive here just because of the rent but also because of the bad conditions” (1). However, in many cases, their arrival to this informal settlement was not through land occupation; some people living near Los Arenales profited from assigning plots to new dwellers. As it was pointed out, “there were some people here controlling the *campamento* and selling houses or land” (3). The prices varied from CLP $100,000 (∼$150 USD) to $80,000 (∼$120 USD), and the payments included incorporation into the “committee for applying to [social] housing ownership” (4).

As indicated by the slum-dwellers, when they arrived, “a lot of people profited from [their] needs” (9), but then they “changed it so that people can't just sell land that does not belong to them. Those were public plots of land. I received death threats for ruining their business” (10). “We prohibited the business related to [selling] public plots of land, the selling of alcohol, cigarettes, and drugs. We established that in the *campamento*'s regulations” (11). To manage these potential abuses, the emerging organisation of dwellers in Los Arenales “created an internal regulation, and that's where the problem stopped. That was around 2016” (12). The democratic politics of land and the community organisation ensured that the settlement was developed peacefully.

After a certain number of dwellers settled in Los Arenales, the development of the settlement demanded a lot of time and dedication. “We, who were the first living here, lived in misery compared with now. Back then, there was no electricity or water. Now [to have both] is a luxury” (5). The community had to work painstakingly to

FIGURE 2 Map of Los Arenales with reference numbers associated with each indication elaborated during the reconstructing of the spatial story of Los Arenales. There is a buffer of 20 m from the original location for each register to preserve anonymous references for the contents. Source: Authors, based on the fieldwork with the community

build the *campamento* (6), especially to get water and electricity (8). This process started with the formalisation of a neighbouring settlement known as El Abra, which took place in 2012 (13). The first settlement of Los Arenales was the *campamento* named Eulogio Gordo, which was formed in 2014 (15). After Eulogio Gordo came El Bosque ("We named it El Bosque (The Forest) because we were going to plant trees" (18)) and then came the *campamento named* Desierto Florido. "We named it Desierto Florido (Flowery Desert) because, at that time, the hills were flourishing. It was a flowery desert, and we named the streets after flowers from the North of Chile" (19).

Members of the three initial *campamentos* had a meeting space at the south courtyard of Los Arenales, which was controlled by a person who was profiting from its use. This person was eventually expelled by the communities. "There was a Peruvian guy living here who charged us for using the football field. He charged us for using electricity, the water, and the football field. He wouldn't let us pass through the football field if we didn't pay him" (22). This courtyard was also significant because it had a water tap. People collected water from here for drinking, cooking, and cleaning. "The people from over there called the police on us every time we were getting water, but the people accusing us finally left" (23). The courtyard was "filled with garbage. It was just a trash dump, and people recovered it" (24). The efforts that the slum-dwellers put into cleaning the courtyard fostered a sense of community. "Now the football field belongs to Los Arenales" (26).

As the community started to organise the land, new ideas about the future of the emerging *macrocampamento* were shaping some of the functions assigned to each part of the area. "We agreed about not touching this zone in Nuevo Amanecer Latino (New Latin Dawn) because this was going to be a park for everyone. That is why there are no houses here" (29). As part of the collective organisation of land maintenance, the upkeep of the courtyard was scheduled by the communities. "The idea was that, between the two *campamentos*, we were going to clean this area to build the community centre" (31). Also, because the *campamento* was becoming complex, the leaders wanted to ensure that the area was secure for families. As such, the instalment of new houses was prohibited on some roads and exits to preserve access to the area. "The idea was to prevent [roadblocks] in case of an emergency. So, the cars could enter through here, turn around there and then leave" (33).

After a year of successful development, new people came to live in Los Arenales, and new *campamentos* were established. In 2015, these new slum-dwellers formed the *campamentos* of Union del Norte, Chilenos Villa el Sol (52), Rayito de Esperanza, Rayito de Sol, and Nuevo Amanecer Latino. Union del Norte is a large *campamento* whose "extension of Union del Norte moved towards the water pipeline by filling the holes and the garbage sites. There was a lot of sand that [people] came to get from there" (36). Union del Norte created a community centre (43) as a protected space, as well as a sort of public square for children.

Another *campamento* that emerged in 2016 was Chilenos Villa el Sol (Chileans Village Sun), where there "were more Chileans" (38). This *campamento* was composed of around 160 houses. A complex instalment was developed by Rayito de Esperanza (Beam of Hope) and Rayito de Sol (Little Sunbeam): "Here, there are Rayito de Esperanza and Rayito de Sol, but we don't know where the [territorial] division is" (40). The division line between these *campamentos* was not clear at all. However, the leaders identified the point (41) as Rayito de Sol, while Rayito de Esperanza was identified as the space between Rayito de Sol and the former allocation of Ratoncitos (42).

Nuevo Amanecer Latino was formed to the east of Los Arenales (44). This *campamento* is mostly composed of Latin American migrants. They live in the foothills and did not want to invade the territory of Union del Norte. So, they came to an agreement. "To locate near the water pipelines could generate some problems. So, we agreed that we would locate at least four metres away from the pipeline, but after a while, [some people] did not comply" (47). An open space was defined to remain untouched so that cars could pass through (50). Each of these *campamentos* that were settled between 2015 and 2016 built a community centre, open spaces, and emergency roads.

New developments have occurred since 2017. Eulogio Gordo was expanded (54) over unstable areas of the terrain close to Desierto Florido. These houses are "located above the filling, over sticks and sacks. This is Desierto Florido" (55). Community leaders warned about this area: "It was explained to them that it was dangerous to locate over there, that it was risky. However, they located there anyway" (56).

Another recent development is El Hoyo (The Hole), which is located within Los Arenales but is not recognised as part of it. "El Hoyo is not [part of] Ranchito. The Hoyo is just The Hoyo. It does not belong to Los Arenales. They don't have a committee [representing them]" (57). A more recent development near one of the limits of Los Arenales is Ranchito. "This, over here, is El Ranchito. This is where the fire happened the other day" (58). Figure 3 indicates which *campamentos* were officially recognised as part of Los Arenales by community leaders in 2018.

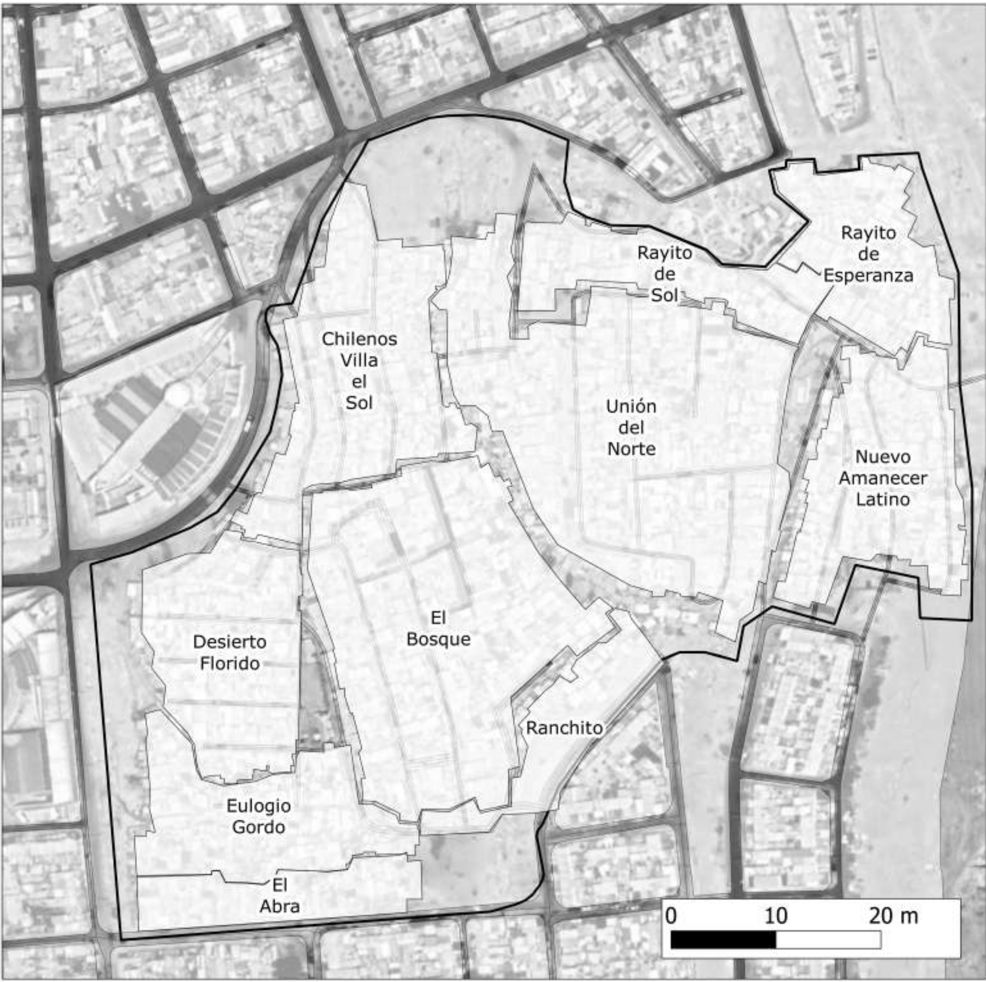


FIGURE 3 Map of Los Arenales indicating the location of each *campamento* and its boundaries, public spaces, and community centres. Source: Authors

After reconstructing the spatial story of Los Arenales, the session continued with a mapping process. Through this process, the types of areas specified in the following list were identified (Figure 4):

1. spaces of conflict
2. spaces related to evictions
3. best areas
4. worst areas
5. spaces with water sources
6. spaces with energy sources
7. vehicle access
8. favourite places
9. dangerous areas
10. spaces under the risk of landslides
11. spaces where fires have happened or could occur

The community leaders who participated in this mapping process are fully aware of the values and problems within their community. Likewise, they illustrated a learning process based on leadership, in which democratic politics of the space are fundamental to making this complex settlement sustainable. The act of registering how the politics of the space were shaped in the territory generated knowledge about new sites of resistance (Kudva, 2009). Rather than just a georeferenced history of the formation of Los Arenales as a *macrocampamento*, the results of this research are representations of people's capacity to politically organise themselves in their lived space under extreme scarcity.

The community aimed to collectively decide how to distribute accommodation and public spaces, rejecting coercive practices and taking care of each other while trying to ensure some sort of welfare within the drastic limitations of living on the margin of urban life. For instance, although many problems were indicated, the presence of violence and crime is relatively low despite the vulnerability and complexity of the social organisation within this huge urban form.

This experience of using the PPGIS has served to elaborate cartographies of the life history for the biggest slum in northern Chile. Recalling how each *campamento* was formed strengthened a shared historic narrative and a sense of pride and belonging. It also depicted how this process empowered the community. After the socialisation of these cartographies, the

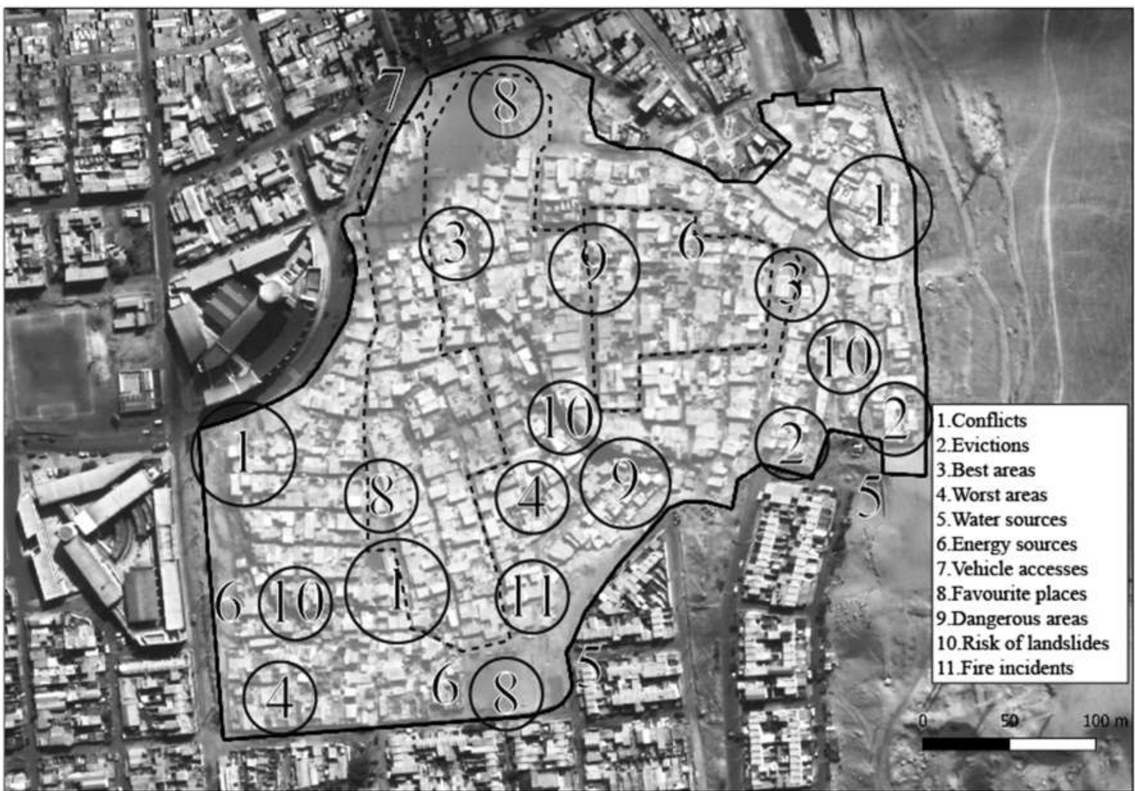


FIGURE 4 Map of Los Arenales indicating specific areas based on their meanings for the community leaders who participated in the sessions. Source: Authors

macrocampamento had the tools to discuss the possibility of their own urban form and defined areas for development (Vergara-Perucich, 2020). For people left out of the official urban maps, to see their own informal city as a representation of histories and possibilities was key for increasing their self-esteem and strengthening their will to continue their struggle. The PPGIS allowed Los Arenales' inhabitants to have a better grasp of their own shared history and to convince themselves of their right to be heard, recognised as part of the city.

From a more practical perspective, the experience provided a useful and novel cartography, relevant for bargaining with authorities about the possibilities of establishment within the site and determining how to urbanise this space based on the priorities, meanings, and expectations of the community. It also allowed for better organising of the relational and lived spaces, specifically regarding the *macrocampamento's* decision-making processes, which now prioritise local improvements and future political actions by considering the specific features and needs of each sector of the settlement. Further, the experience facilitated building a stronger sense of belonging to the territory and the space the community has produced.

The informality of the *macrocampamento's* life and the sense of urgency in ensuring the everyday survival of its inhabitants had impeded a moment of communal reflection on their own history, dynamics, spaces, and relations. Thus, when they were able to look backwards, they valuated their efforts made through time and recognised the immense obstacles overcome to gather more than 1,300 families to live in one of the largest informal settlements in Chile. Constructing this shared history during the mapping sessions was not a frictionless process, but it served to help understand the positionality of each community leader and the different imaginaries active in Los Arenales.

When the session finished, the participating community leaders hugged each other and even agreed to resolve some long-unresolved issues, given that the PPGIS process literally visualised and mapped their conflicts. The cartographies were the results, but the most important aspect of this exercise was the process of producing them. In this way, the method presented here based on the PPGIS may also foster political agreements between community leaders and facilitate conflict resolution, which will help every Los Arenales' inhabitant in their struggle for bringing their ideal city closer into existence.

5 | CONCLUSION

The application of GIS technology in participatory mapping processes in the case depicted gave evidence of the increasing understanding the inhabitants, participant academics, and professionals have of the informal settlements. The comprehensive data collection allowed for the discussion and interpretation of the shared history of the Los Arenales' community, while also recording its spatial unfolding for the first time. Furthermore, the democratic and participatory character of the PPGIS facilitated an increased sense of belonging and problem solving among the participant community leaders.

The mapping process and the findings obtained through the PPGIS are useful for the advancement of an informal area into an urbanised area and are a valuable outcome in the *macrocampamento's* political struggle for their right to the city. Los Arenales' bargaining position when facing Chilean authorities regarding housing issues for the most impoverished was strengthened by inhabitants' better comprehension of the shared territorial history, issues, and expectations, and the maps were a useful technical input for validating their proposals and demands. In this sense, the mapping process deepened the way in which the community assigns meaning to each area they inhabit, as they assigned positive and negative feelings to each sector (Manzo, 2005). This helped in the development of a master plan for the area, led by—and created for—the community.

However, the national state and governmental representatives are still highly suspicious of any community-produced outcomes, especially those arising from the urban displaced. Specifically, they perceive the *campamentos'* inhabitants' proposal for incorporation into the formal city as a free-rider attitude, aimed to "skip the line" for the flawed Chilean social housing system process. For the strict Chilean neoliberal state, grassroot co-production of technical inputs are also perceived as remnants of a frowned-upon communitarianism, especially if they support struggles for broader socio-economic and spatial rights, such as the right to the city (Arias-Loyola & Vergara-Perucich, 2020; Mitlin et al., 2020).

At the local level, governmental representatives severely lack technical know-how in participatory planning and PPGIS tools. Pivotal decision makers share a strong bias towards official reports, which usually reduce their scope to just the physical and economic conditions of a *campamento* to determine its official incorporation into the city. These reports are constructed in a non-rigorous way, by statistically expanding census data instead of gathering primary information in the informal settlements with the help of its inhabitants. Furthermore, local governmental representatives usually follow centralised "one size fits all" policies made in the Chilean capital city of Santiago, adding a secondary barrier for the *campamentos'* struggle.

Likewise, the SDI project's transparent right-to-the-city agenda created an unfavourable perception among local right-wing politicians (both the nation and the city are ruled by them), because it challenged the patronising ways in which the local and regional state used to handle *campamentos*. Co-created products, such as the one presented here, were dismissed as irrelevant for the hypertechnical, one-sided bargains local and regional authorities are used to coordinating with *campamentos*.

However, the mapping activity provided valuable outcomes for Los Arenales' struggle. Even though the mapping occurred during a period of conflict between community leaders, it helped reduce their frictions, allowing them to recognise the common goals that brought them together in first place. Mapping their experiences and conflicts served as a reminder that their objective is to become a solid community with a strong political organisation and to bargain for adequate solutions for their needs. After the series of events related to the SDI project, including this PPGIS process, the community leaders strengthened their decision-making processes and aimed to collectively build a political agenda for the right to the city. Although they are still waiting for definitive solutions, they are better prepared for the negotiation.

The process also helped strengthen the relational ties of Los Arenales' inhabitants with the participating academics, professionals, and NGOs. This outcome led to a strong network, in which the latter publicly supported Los Arenales' struggle for their right to the city by actively participating in their negotiations with local and national authorities, defending in local and national newspapers the co-produced products and cooperative processes taking place within the *macrocampamento*, and writing academic pieces—such as this one—to register the highs and lows of the processes for future similar endeavours (Arias-Loyola & Vergara-Perucich, 2020; Vergara-Perucich & Arias-Loyola, 2019).

Once the SDI project was finished, Los Arenales representatives were able to force negotiations with the local representative of the Ministry of National Goods, pushing for their *radicación* (incorporation to the formal city). They also celebrated meetings with the Minister of Housing and several members of the Chilean parliament to raise issues related to life in Los Arenales in particular and in Chilean *campamentos* in general. Formal residents of Antofagasta, as well as other, informal city dwellers, have also recognised Los Arenales as an

example of a community-based social co-construction of an urban utopia, due to the persistence and diversity of its work towards becoming part of the city.

Finally, it is important to highlight the fundamental nature of the role practitioners play as facilitators between grassroots information and GIS. In the case of Los Arenales, the slum-dwellers' struggle for the right to the city has been based on community engagement and sharing agendas. However, the *macrocampamento's* inhabitants lacked the spatial proposal needed to give the politics of the space an urban form and a shared image of their desired type of city. Although a defined formal urban proposal did not appear in this application of the PPGIS, the documentation and maps created during this process provided valuable input for their internal and external political processes. The experience serves as empirical evidence that recording knowledge on maps may lead slum-dwellers to make better decisions and, in turn, to devise a feasible slum-upgrading plan for achieving the decency each human life deserves as well as the recognition of their right to the city.

ACKNOWLEDGEMENT

This research was funded by the Chilean government through the National Commission for Scientific and Technological Research (CONICYT), by the Project FONDECYT (Fondo Nacional de Desarrollo Científico y Tecnológico) 11180569.

ORCID

Francisco Vergara-Perucich https://orcid.org/0000-0002-1930-4691
Martin Arias-Loyola https://orcid.org/0000-0001-8740-6326

ENDNOTES

[1] Even though the term "slum-dweller" usually has a pejorative connotation suggesting illegality that could legitimate eviction, we use it because its equivalent in Chilean Spanish is *habitante de campamento* and is how neighbours living in informal settlements proudly identify themselves. Likewise, it is how they are officially recognised both in the literature and most official reports and policies.

[2] Macro in the sense that it comprises at least 13 other *campamentos*.

[3] Reglementary requirements are defined in the Supreme Decree number 49 of 2011 by the Housing and Urban Planning Ministry, which was updated for these specific cases related in the Supreme Decree 105 of 2014. In Spanish: Fondo Solidario de Elección de Vivienda fijador por el D.S. 49 de 2011 y por el D.S. 105 de 2014 del Ministerio de Vivienda y Urbanismo.

[4] For ethical reasons, we did not share the name of the practitioners or community leaders involved.

REFERENCES

Alston, L. J., Libecap, G. D., & Mueller, B. (2000). Land reform policies, the sources of violent conflict, and implications for deforestation in the Brazilian Amazon. *Journal of Environmental Economics and Management*, *39*(2), 162–188.

Arias, M., Atienza, M., & Cademartori, J. (2014). Large mining enterprises and regional development in Chile: Between the enclave and cluster. *Journal of Economic Geography*, *14*(1), 73–95.

Arias-Loyola, M., & Vergara-Perucich, F. (2020). Co-producing the right to fail: Resilient grassroot cooperativism in a Chilean informal settlement. *International Development Planning Review*. Advanced online publication. https://doi.org/10.3828/idpr.2020.13

Banks, N., Lombard, M., & Mitlin, D. (2020). Urban informality as a site of critical analysis. *The Journal of Development Studies*, *56*(2), 223–238.

Bradlow, B. H. (2015). City learning from below: Urban poor federations and knowledge generation through transnational, horizontal exchange. *International Development Planning Review*, *37*(2), 129–142. https://doi.org/10.3828/idpr.2015.12

Brown, G., & Kyttä, M. (2014). Key issues and research priorities for public participation GIS (PPGIS): A synthesis based on empirical research. *Applied Geography*, *46*, 122–136.

Brown, G., & Raymond, C. M. (2014). Methods for identifying land use conflict potential using participatory mapping. *Landscape and Urban Planning*, *122*, 196–208.

Brown, G., Raymond, C. M., & Corcoran, J. (2015). Mapping and measuring place attachment. *Applied Geography*, *57*, 42–53.

Brown, G., Weber, D., & de Bie, K. (2015). Is PPGIS good enough? An empirical evaluation of the quality of PPGIS crowd-sourced spatial data for conservation planning. *Land Use Policy*, *43*, 228–238. https://doi.org/10.1016/j.landusepol.2014.11.014

Bryan, J. (2011). Walking the line: Participatory mapping, Indigenous rights, and neoliberalism. *Geoforum*, *42*, 40–50. https://doi.org/10.1016/j.geoforum.2010.09.001

Cabannes, Y., & Lipietz, B. (2018). Revisiting the democratic promise of participatory budgeting in light of competing political, good governance and technocratic logics. *Environment and Urbanization*, *30*(1), 67–84. https://doi.org/10.1177/0956247817746279

Casgrain, A., & Janoschka, M. (2013). Gentrificación y resistencia en las ciudades latinoamericanas el ejemplo de Santiago de Chile. *Andamios*, *10*(22), 19–44.

CIS TECHO-Chile (2016). *Catastro de Campamentos 2016*. TECHO Chile.

Cortés, A. (2014). El movimiento de pobladores chilenos y la población La Victoria: Ejemplaridad, movimientos sociales y el derecho a la ciudad. *EURE*, *40*(119), 239–260. https://doi.org/10.4067/S0250-71612014000100011

De Sousa Santos, B. (2009). *Una epistemología del sur: la reinvención del conocimiento y la emancipación social*. Siglo (Vol. XXI).

de Vries, P. (2016). Participatory slum upgrading as a disjunctive process in Recife, Brazil: Urban coproduction and the absent ground of the city. *Singapore Journal of Tropical Geography*, *37*(3), 295–309. https://doi.org/10.1111/sjtg.12156

Del Romero, L. (2018). Cartografías de la desigualdad: Una década de conflictos de vivienda y nuevas resistencias en

Santiago de Chile. Análisis del conflicto de la Maestranza de San Eugenio. *EURE*, *44*(132), 47–66. https://doi.org/10.4067/s0250-71612018000200047

di Girolamo, G. (2015). Revolucionarios de la vivienda social*: La historia de lucha de Ukamau*. El Desconcierto. http://www.eldesconcierto.cl/2015/10/07/revolucionarios-de-la-vivienda-social/

Emmel, N. (2008). Participatory Mapping: An innovative sociological method. National Centre for Research Methods.

Flores, P. (2016). Los Campamentos en el Chile de Hoy. *Revista CIS*, *1*(20), 7–10. http://www.techo.org/paises/chile/wp-content/uploads/2016/12/CIS21-Editorial.pdf

Friedmann, J. (1992). *Empowerment: The politics of alternative development*. Blackwell.

Gasic, I. (2018). Inversiones e intermediaciones financieras en el mercado del suelo urbano. Principales hallazgos a partir del estudio de transacciones de terrenos en Santiago de Chile, 2010–2015. *EURE (Santiago)*, *44*(133), 29–50. https://dx.doi.org/10.4067/s0250-71612018000300029

GORE (2016). Catastro y encuesta a familias de campamentos, ciudad de Antofagasta, año 2015. Antofagasta.

Hamdi, N. (2004). *Small change: About the art of practice and the limits of planning in cities* (pp. 26–156). Routledge.

Han, S. S., & Peng, Z. (2003). Public participation GIS (PPGIS) for town council management in Singapore. *Environment and Planning. B, Planning & Design*, *30*(1), 89–111. https://doi.org/10.1068/b12938

Handelman, H. (1975). The political mobilization of urban squatter settlements. Santiago's recent experience and its implications for urban research. *Latin American Research Review*, *10*(2), 35–72.

Harrison, C., & Haklay, M. (2002). The potential of public participation geographic information systems in UK environmental planning: Appraisals by active publics. *Journal of Environmental Planning and Management*, *45*(6), 841–863. https://doi.org/10.1080/0964056022000024370

Harvey, D. (2008). The right to the city. *New Left Review*, *53*(53), 23–40. https://doi.org/10.1080/13604819608713449

Heinelt, H., & Hlepas, N. K. (2006). Typologies of local government systems. In H. Reynaert, M. Cabria, A. Magnier, & H. Heinelt (Eds.), *The European mayor: Political leaders in the changing context of local democracy* (pp. 21–42). Springer.

Inzulza-Contardo, J. (2016). Contemporary Latin American gentrification? Young urban professionals discovering historic neighbourhoods. *Urban Geography*, *37*(8), 1195–1214.

Jankowski, P., & Nyerges, T. (2001). GIS-supported collaborative decision making: Results of an experiment. *Annals of the Association of American Geographers*, *91*(1), 48–70.

Kahila-Tani, M., Broberg, A., Kyttä, M., & Tyger, T. (2016). Let the citizens map—Public participation GIS as a planning support system in the Helsinki master plan process. *Planning Practice and Research*, *31*(2), 195–214.

Kaplinsky, R. (1998). *Globalisation, industrialisation and sustainable growth: The pursuit of the nth rent*. Institute of Development Studies.

Kudva, N. (2009). The everyday and the episodic: The spatial and political impacts of urban informality. *Environment and Planning a: Economy and Space*, *41*(7), 1614–1628. https://doi.org/10.1068/a41101

Lefebvre, H. (1991). *The production of space*. Blackwell.

Lefebvre, H. (2003). *The urban revolution* (1st ed.). The University of Minnesota Press.

Lefebvre, H. (2017). *El derecho a la ciudad*. Capitán Swing.

Livengood, A., & Kunte, K. (2012). Enabling participatory planning with GIS: A case study of settlement mapping in Cuttack, India. *Environment and Urbanization*, *24*(1), 77–97. https://doi.org/10.1177/0956247811434360

Manzo, L. C. (2005). For better or worse: Exploring multiple dimensions of place meaning. *Journal of Environmental Psychology*, *25*(1), 67–86.

Marcuse, P. (2009). From critical urban theory to the right to the city. *City*, *13*(2–3), 185–197. https://doi.org/10.1080/13604810902982177

Marcuse, P. (2010). In defense of theory in practice. *City*, *14*(1), 4–12. https://doi.org/10.1080/13604810903529126

MBBNN (2006). Crea el sistema nacional de coordinacion de informacion territorial.

McFarlane, C. (2004). Geographical imaginations and spaces of political engagement: Examples from the Indian Alliance. *Antipode*, *36*(5), 890–916. https://doi.org/10.1111/j.1467-8330.2004.00460.x

Mitlin, D., Bennett, J., Horn, P., King, S., Makau, J., & Nyama, G. M. (2020). Knowledge matters: The potential contribution of the coproduction of research. *The European Journal of Development Research*, 1–16.

Musungu, K. (2012). Maps and blocks: Using GIS to enhance community participation in planning informal settlements. GISSA Ukubuzana, 1–10.

Ndou, V. D. (2004). E - government for developing countries: Opportunities and challenges. *The Electronic Journal of Information Systems in Developing Countries*, *18*(1), 1–24. https://doi.org/10.1002/j.1681-4835.2004.tb00117.x

Patel, S., Baptist, C., & D'Cruz, C. (2012). Knowledge is power—Informal communities assert their right to the city through SDI and community-led enumerations. *Environment and Urbanization*, *24*(1), 13–26. https://doi.org/10.1177/0956247812438366

Patel, S., D'Cruz, C., & Burra, S. (2002). Beyond evictions in a global city: People-managed resettlement in Mumbai. *Environment and Urbanization*, *14*(1), 4637–4645. https://doi.org/10.1177/095624780201400113

Phelps, N. A., Atienza, M., & Arias, M. (2015). Encore for the enclave: The changing nature of the industry enclave with illustrations from the mining industry in Chile. *Economic Geography*, *91*(2), 119–146.

Phelps, N. A., Atienza, M., & Arias, M. (2018). An invitation to the dark side of economic geography. *Environment and Planning A: Economy and Space*, *50*(1), 236–244.

Salas-Serrano, J. (2009). Evaluation of the occupation and evacuation of Peñalolen settlement, Santiago de Chile. *Open House International*, *34*, 5–18.

Salcedo, R. (2010). The last slum: Moving from illegal settlements to subsidized home ownership in Chile. *Urban Affairs Review*, *46*(1), 90–118. https://doi.org/10.1177/1078087410368487

Sieber, R. (2006). Public participation geographic information systems: A literature review and framework. *Annals of the Association of American Geographers*, *96*, 491–507. https://doi.org/10.1111/j.1467-8306.2006.00702.x

TECHO (2018). In C. d. I. S. TECHO-Chile. (Ed.), *Informe final actualización del catastro nacional de campamentos 2018*. Chile: TECHO.

TECHO PARA CHILE (2016). *Catastro de campamentos 2016*. CHILE: Centro de Investigación Social TECHO.

USGS. (2018). *Minerals comodities summaries 2018*. U.S. Geological Survey.

Vargas, M. (2016). Tacit collusion in housing markets: The case of Santiago, Chile. *Applied Economics*, *48*(54), 5257–5275.

Vergara-Perucich, F. (2020). Participatory action planning as transductive reasoning: Towards the right to the city in Los Arenales, Antofagasta, Chile. *Community Development Journal*, bsaa002. https://doi.org/10.1093/cdj/bsaa002

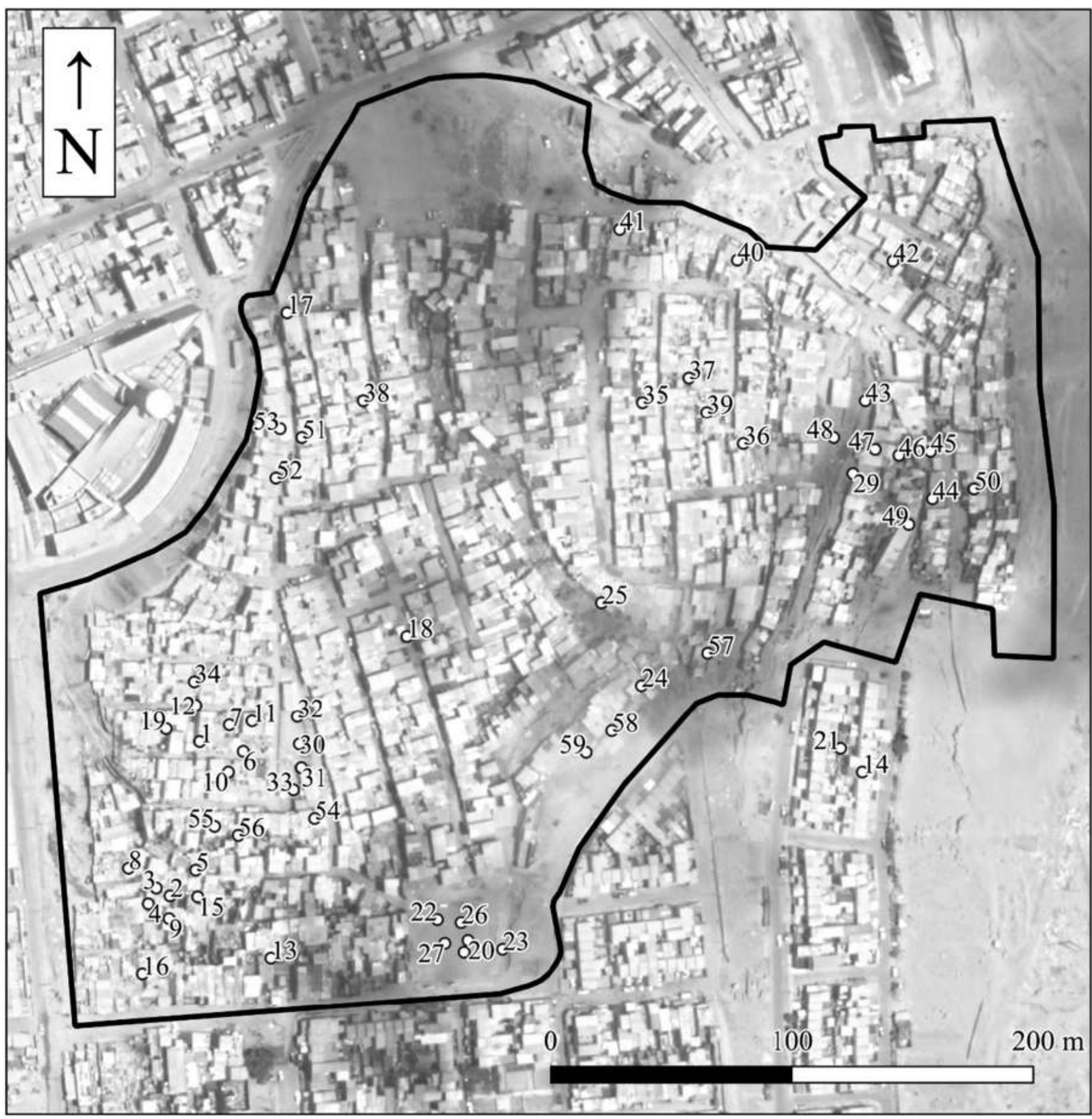
Vergara-Perucich, F., & Boano, C. (2019). El precio por el derecho a la ciudad ante el auge de campamentos en Chile. *AUS [Arquitectura/Urbanismo/Sustentabilidad]*, *2019*(26), 51–57.

Vergara-Perucich, J.-F., & Aguirre Nuñez, C. (2019). Inversionistificación en América Latina: problematización del mercado de arriendo para el caso chileno. *Hábitat y Sociedad*, *12*, 11–28. https://doi.org/10.12795/HabitatySociedad.2019.i12.02

Vergara-Perucich, J.-F., & Arias-Loyola, M. (2019). Bread for advancing the right to the city: Academia, grassroots groups and the first cooperative bakery in a Chilean informal settlement. *Environment and Urbanization*, *31*(2), 533–551. https://doi.org/10.1177/0956247819866156

How to cite this article: Vergara-Perucich F, Arias-Loyola M. Community mapping with a public participation geographic information system in informal settlements. *Geographical Research*. 2021;59:268–284. https://doi.org/10.1111/1745-5871.12458

APPENDIX A: TRANSCRIPTION ON MAP SPOTS



1. “I didn't arrive here just because of the rent but also because of the bad conditions.”
2. “I bought a house here for CLP $100,000 (150 USD). It just had the basic structure. I had to complete it. First, I considered one [house] for $80.000 CLP (120 USD), but I preferred the other one.”
3. “There were some people here controlling the *campamento* and selling houses or land.”
4. “They offered to incorporate you into the ‘committee for applying to [social] housing ownership’ if you paid for a house at the *campamento*.”
5. “We, who were the first living here, lived in misery compared with now. Back then, there was no electricity or water. Now [to have both] is a luxury.”
6. “This [process] wasn't a luxury, neighbour. We had to work really hard to build our *campamento* too.”
7. “We had to relieve ourselves [or to defecate] in a bucket and then put it in a bag and take it with the rest of the garbage.”
8. “At the beginning we were alone, and we had to do a lot in order to get water and electricity.”

9. "When we arrived, a lot of people profited from our needs."
10. "We changed it so that people can't just sell land that does not belong to them. Those were public plots of land. I received death threats for ruining their business."
11. "We prohibited the business related to [selling] public plots of land, the selling of alcohol, cigarettes, and drugs. We established that in the *campamento*'s regulations."
12. "We created an internal regulation, and that's where the problem stopped. That was around 2016."
13. "The first *toma* [informal occupation of land] took place in 2012, and it was at [the *campamento*] *El Abra*."
14. "This was also *campamento*, but they were formally settled around 2012."
15. "This is [the *campamento*] *Eulogio Gordo*, we are the first after *El Abra*, by around two years or more."
16. "*El Abra* is a bad sector. We have bad relations. Drugs were sold there, and we didn't want that because we had children. They [*El Abra*] were from before we arrived."
17. "There is a mound here, which had to be cleaned in around 2015 to allow mobility and to be able to build."
18. "We named it *El Bosque* (The Forest) because we were going to plant trees."
19. "We named it *Desierto Florido* (Flowery Desert) because, at that time, the hills were flourishing. It was a flowery desert and we named the streets after flowers from the North of Chile."
20. "This football field is from before the *campamento*. But we take care of it, and we keep it clean. We feel like it's ours."
21. "This was a *campamento*, but they were just relatives and families who organised in order to settle there, and there they stayed."
22. "There was a Peruvian guy living here who charged us for using the football field. He charged us for using electricity, the water, and the football field. He wouldn't let us pass through the football field if we didn't pay him."
23. "The people from over there called the police on us every time we were getting water, but the people accusing us finally left."
24. "That sector was filled with garbage. It was just a trash dump, and people covered it. It was located from here to the tip of the ravine."
25. "There was just garbage in here."
26. "Now the football field belongs to *Los Arenales*."
27. "People living in the next neighbourhood believed we were going to build houses at the football field, but we didn't want that. We were cleaning the field so the children could play because it was filled with garbage."
28. "This football field reunites the people from the *campamento* with the people living in the [adjacent] neighbourhood, adults, and children. We even have had [football] championships."
29. "We agreed about not touching this zone in *Nuevo Amanecer Latino* (New Latin Dawn) because this was going to be a park for everyone. That is why there are no houses here."
30. "We had all this with black pipes, not to divide but to protect this sector around here for the community centre and to leave a space."
31. "The idea is that between the two *campamentos*, we were going to clean this area to build the community centre."
32. "I remember that, at that point, there was a conflict between foreigners and Chileans with some *choros* [crooks] that were [living] here and who didn't want to receive people from outside."
33. "The idea was to prevent [road blocks] in case of an emergency. So, the cars could enter through here, turn around there and then leave."
34. "In *Desierto Florido* arrived several Chileans coming from other *tomas*. Those were *choros*, who arrived with arrogance."
35. "*Unión del Norte* (Northern Union) is big but started around here because there was too much garbage in the rest [of the available space]."
36. "The extension of *Unión del Norte* moved towards the water pipeline by filling the holes and the garbage sites. There was a lot of sand that [people] came to get from there."
37. "There was everything, not just foreigners. There were a few Chileans too."
38. "In *Chilenos Villa el Sol* (Chileans Village Sun), there were more Chileans."
39. "By the next year, in 2016, there were around 160 houses."
40. "Here there are *Rayito de Esperanza* (Beam of Hope) and *Rayito de Sol* (Little Sunbeam), but we don't know where the [territorial] division is."
41. "This one here is *Rayito de Sol*."
42. "Up here there is *Rayito de Esperanza*, but before that, there was *Ratoncitos* (Little Mice), who were formally settled."
43. "This is the community centre of *Unión del Norte*."
44. "All this is *Nuevo Amanecer Latino*."
45. "We have had to work for this land in order to clean and build."
46. "The government promised us that *Nuevo Amanecer Latino* would stay [where it is]."

47. "To locate near the water pipelines could generate some problems. So, we agreed that we would locate at least four meters away from the pipeline, but after a while, [some people] did not comply."
48. "The neighbours from *Unión del Norte* also agreed to locate away from the [water] pipeline, to avoid problems with the authorities."
49. "We arrived in *Nuevo Amanecer Latino* in July of 2015, the day of the Assumption of the Virgin Mary."
50. "We wanted to leave space so one car could pass through. A lot just think about the present, but we were thinking about the future from the start."
51. "*Chilenos Villa el Sol* was built next to *El Bosque* and *Desierto Florido* by the beginning of 2015."
52. "Here is where the construction of *Chilenos Villa el Sol* started."
53. "I participated in this construction with my daughter, who later abandoned me because she sold my house at *Chilenos*, and I had to move to *Desierto Florido*."
54. "This is a recent expansion of *Eulogio Gordo*, from 2017 or early 2018."
55. "Over here there are houses located above the filling, over sticks and sacks. This is *Desierto Florido*."
56. "It was explained to them that it was dangerous to locate over there, that it was risky. However, they located there anyway."
57. "*El Hoyo* is not [part of] *Ranchito*. The Hoyo is just The Hoyo. It does not belong to *Los Arenales*. They don't have a committee [representing them]."
58. "This, over here, is *El Ranchito*."
59. "This is where the fire happened the other day."