frontiers in Sustainable Cities

SYSTEMATIC REVIEW
published: 29 October 2020
doi: 10.3389/frsc.2020.572360

From "Government to Governance"? A Systematic Literature Review of Research for Urban Green Infrastructure Management in Latin America

Anya Breen[1], *Emanuel Giannotti*[2], *Muriel Flores Molina*[3] *and Alexis Vásquez*[3]*

[1] *Facultad de Ciencias Forestales y de la Conservación de la Naturaleza, Universidad de Chile, Santiago, Chile,* [2] *Departamento de Urbanismo, Facultad de Arquitectura y Urbanismo, Universidad de Chile, Santiago, Chile,* [3] *Departamento de Geografía, Facultad de Arquitectura y Urbanismo, Universidad de Chile, Santiago, Chile*

OPEN ACCESS

Edited by:
Stephan Pauleit, Technical University of Munich, Germany

Reviewed by:
Martina Artmann, Leibniz Institute of Ecological Urban and Regional Development (LG), Germany
Tenley M. Conway, University of Toronto Mississauga, Canada

***Correspondence:**
Alexis Vásquez
avasquez@uchilefau.cl

Specialty section:
This article was submitted to Urban Greening, a section of the journal Frontiers in Sustainable Cities

Received: *13 June 2020*
Accepted: *15 September 2020*
Published: *29 October 2020*

Citation:
Breen A, Giannotti E, Flores Molina M and Vásquez A (2020) From "Government to Governance"? A Systematic Literature Review of Research for Urban Green Infrastructure Management in Latin America. Front. Sustain. Cities 2:572360. doi: 10.3389/frsc.2020.572360

The concept of Urban Green Infrastructure (UGI) has emerged in response to the need to highlight and ensure access to the multifunctional benefits of green spaces in changing cityscapes. Recent literature reviews around UGI have focused on environmental benefits and services, and the management of these spaces has been comparatively neglected. In addition to this, the core conceptual and practical research around UGI management has been produced in the Global North, and far less research has been generated in Latin America, despite the contextual challenges and opportunities brought by this rapidly urbanizing and diverse region. In response, this trilingual systematic review asks: What are the research trends in terms of topics and case studies that characterize UGI management research in Latin America? Which management types are the focuses of this research? A total of 47 publications, found through Scopus, Web of Science, and SciELO, were subjected to both quantitative and qualitative assessment. The research was both geographically concentrated and predominantly recent. Government-led initiatives made up the highest proportion of the research, and more than half of the publications described local government as the principle actor in the management of the UGI studied. Community-run initiatives were consistent across the temporal span of the articles found, and their established presence was supported by the qualitative review. Findings also revealed a directional push toward governance practices but significant obstacles in the form of weak local government, divisions driven by a lack of context-sensitive approaches to informal settlements and socioeconomic segregation, and a management discourse that jarred with urban practices by indigenous communities. Through demonstrating the contribution of existing literature on UGI management in Latin America, this review highlights the need for further published research on the region.

Keywords: urban green infrastructure, systemic review, provision, greenspace, management, urbanization, Global South, governance

INTRODUCTION

We inhabit an increasingly urbanized world. By 2050, 68% of the world's population is projected to live in cities, a figure that Latin America has already surpassed with over 80% of its inhabitants currently in urban zones [United Nations Department of Economic and Social Affairs (UN DESA), 2018]. In response to the expansion and densification of cities, there has been increased recognition of the need to ensure continued and equitable access to urban green spaces, something that cannot be guaranteed without extensive urban planning, investment, and a focus on long-term management (Ferguson et al., 2018, p. 136; Vásquez, 2016, p. 70). In recent years, Urban Green Infrastructure (UGI) has emerged as a way to conceptualize the system of green spaces in urbanized areas and has achieved high visibility as a key strategy for increasing the sustainability and resilience of cities (Davies et al., 2015; Davies and Lafortezza, 2017; Badiu et al., 2019). Alongside the more general term "Green Infrastructure," UGI has been subject to different applications and diverse definitions, as a result of which there has been a concerted effort to map and consolidate usage of the term in previous years (Wang and Banzhaf, 2018; Badiu et al., 2019; Seiwert and Rößler, 2020). According to these reviews, multifunctionality and connectivity can be understood as the main characteristics associated with the concept. Therefore, UGI can be broadly defined as the network of natural, seminatural, and artificial green spaces within, around, and between urban areas, the infrastructural element of which provides a more utilitarian approach than that of "green spaces" or "urban greening" (Benedict and McMahon, 2002, p. 12; Diep et al., 2019, p. 555; Tzoulas et al., 2007, p. 169). The concept can refer to the network as a whole or its individual components such as parks, gardens, cemeteries, and urban forests and agriculture.

A significant quantity of the literature on UGI over the past two decades has focused on the ecosystem services that UGI provides, which range from environmental benefits including temperature regulation (Ballinas and Barradas, 2016; Tan et al., 2016), pollution mitigation (Vásquez et al., 2019), and water management (Ahern, 2007; Yang and Li, 2013) to social and health benefits (de Vries et al., 2003; Tzoulas et al., 2007). Some authors have also highlighted the impact that UGI can have on property values and energy costs (Chelleri et al., 2016, p. 278; Kim and Coseo, 2018). However, the practical origins of the term and its prevalent use as a concept in urban planning by local authorities have recently led to its intersection with analysis of management practices by a range of actors and, more recently the concept of governance as it pertains to management. Governance can be defined as the constellation of stakeholders, institutions, rules, and processes of collective decision-making that allows stakeholders to influence and coordinate their needs (Lemos and Agrawal, 2006). However, UGI governance has little consensus with regards to its definition (Dempsey and Burton, 2012), and what is more, the relationship between the concepts of management and governance lacks clarity and has been subject to conflicting or even opposing definitions (Jansson et al., 2019, p. 954).

Generally, in the literature pertaining to UGI management, governance encompasses the involvement of a diverse range of actors in decision-making processes, highlighting participatory practices, and "bottom–up" initiatives from citizens and civil society that are generally positioned at the opposite end of the spectrum to traditional, centralized, "top–down" government management. To this end, a number of authors across Europe acknowledge a shift "from government to governance" in the management of UGI or a "communicative turn" (Buizer et al., 2015, p. 8; Fox-Kämper et al., 2018, p. 59; Mattijssen et al., 2017a, p. 96; van der Jagt et al., 2016, p. 12). An increasing engagement of citizens in green spaces governance has been noted, where self-governance initiatives in Europe exhibit a large diversity of practices and are seen as a broad phenomenon (Mattijssen et al., 2017a). In practice, however, governments still play an important role in the management and planning of (large) green spaces (Mattijssen et al., 2015). The motivation behind the shift from government to governance has been attributed to a range of factors; Torres-Lima et al. (2018) speak of it "as a way to overcome conflicts among natural resource and development priorities" that arise within rapidly urbanizing environments "in order to improve resilience" (p. 45). The application of this concept to UGI has also been motivated by the need to address some of the primary issues produced by productivity-driven neoliberal practices and to move UGI management toward decisions made in the collective interest (Flores-Xolocotzi, 2012, p. 177).

In general, far less emphasis has been placed in both policy and literature on the management and long-term maintenance of UGI than on its design and implementation (Mattijssen et al., 2017b), and, in particular, influential research on the management of UGI has been geographically concentrated in the Global North. For example, the systematic literature review by Boulton et al. (2018) of urban greenspace provision found that 88% of articles were focused on Europe, Asia, and North America (p. 86), reflecting findings in the area of urban ecosystem services (Haase et al., 2014, Dobbs et al., 2019). In Latin America, the concept of governance within UGI management is of particular importance. "Good governance," meaning the facilitation of participation through the strengthening of legal regimes, has been pushed by the World Bank, the United Nations Development Program and the Inter-American Development Bank in previous years as a means to improve the effectiveness of international aid and investment (Zurbriggen, 2011). On the whole, however, the definition of key concepts, linkages, and large-scale case studies have primarily come from European authors and institutions (Zurbriggen, 2011, p. 41), and there is little knowledge with regards to if research and practice in Latin America is following patterns and trends in the Global North.

The Latin American context provides challenges and shapes priorities for environmental management, factors that include rapid urbanization, extreme privatization, high socio-spatial inequality, water scarcity, and lack of adequate waste disposal facilities (Heinreichs et al., 2009; Zurbriggen, 2011; Millington, 2018; Dobbs et al., 2019; Vásquez et al., 2019). These contextual factors provide contrast to some areas of the Global North but alignment with other areas in the Global South. The pressure of

development, for example, and the way this manifests in urban management is a factor that also needs to be considered for Sub-Saharan Africa (du Toit et al., 2018). Opportunities can also arise from shifting landscapes and pressures that are not present in Europe or North America (Lindley et al., 2018, p. 329). Despite the importance and applicability of Latin American research for UGI management, common pitfalls and shared challenges, if being researched, lack visibility due to linguistic barriers including English language bias and are not easily accessible.

In summary, there are a number of comprehensive quantitative and qualitative reviews on UGI, especially with regards to the provision of ecosystem services (Tzoulas et al., 2007; Haase et al., 2014; Molla, 2014; du Toit et al., 2018). On the contrary, comprehensive reviews of UGI management are still rare and much needed at a global scale and especially within the Global South regions. Governance, as it pertains to UGI management, has been researched far less in Latin America, despite being one of the most urbanized regions in the planet and a biodiversity hotspot (Heinreichs et al., 2009; Zurbriggen, 2011, p. 41; Vásquez et al., 2019). In this paper, we address this gap by conducting a systematic review of UGI management in Latin America to provide a baseline for a better understanding of research in the region based on a systematic review of the academic literature. This study addresses the following research questions: What are the research trends in terms of topics and case studies that characterize UGI management research in Latin America? Which types of management are the focuses of this research? A trilingual systematic review was conducted across three major academic databases. This review was positioned so as to also include all literature pertaining to both traditional, government-led management, and, in addition, those publications that focused on the governance of UGI networks and components by actors external to the state in order to best assess trends and avoid subjectivity in exclusion. Once identified, a quantitative analysis of the academic literature was used to identify trends and characteristics, followed by a deeper, qualitative analysis highlighting the key learnings provided by these publications. We hope, through this combined approach, not only to draw attention to the body of Latin American literature in this field but also to highlight the contributions brought by the study of UGI management in rapidly urbanizing regions.

METHODS

Study Design

In order to address the research question and provide replicable conclusions, a systematic review was conducted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) method as outlined in Moher et al. (2009), which has been used as a frequent reference in urban green space revisions in previous years (Boulton et al., 2018; Ordóñez-Barona et al., 2020). This method is based on the 1996 QUORUM statement that laid out guidelines for the reporting of meta-analyses for clinical trials in health care and is designed to improve the quality and scientific credibility of systematic reviews (Moher et al., 2009, p. 1,006). Additionally, the guidelines for systematic review in the field of environmental management specified in Pullin and Stewart (2006) were consulted in the orientation of the research. Due to Spanish and Portuguese being the dominant languages in the region, and English being a common language of publication for the region, a trilingual Boolean search was carried out across Scopus, Web of Science, and SciELO, using search terms in English, Spanish, and Portuguese. These databases were chosen for their size and known inclusion of relevant journals and regional significance in the case of SciELO. This review was limited to work in published books or academic journals with a research focus within Latin America, and due to the low number of relevant work found in the geographic area specified, no limit was applied to the age, language, or methodology of publication.

Search and Selection

Two types of search were carried out from April to May 2020 for each language within each database. The first was a narrower Boolean search within the title, abstract, and keywords of the articles, and the second was a much wider Boolean search carried out only within the titles of the publications. The full range of search terms included in the Boolean strings are specified in Appendix 1 (**Supplementary Material**) and were selected by a review of the titles and abstracts of known international literature in this field. Synonyms and gendered variations were considered where necessary, and where specific synonyms had no direct translation, as in the case of "huerto" in Spanish, these terms were excluded from the English language search. The searches also comprised of geographic terms in each of the languages that were included both as nouns (e.g., "Latin America"/"Argentina") and as adjectives (e.g., "Latin American"/"Argentinian"); in both Spanish and Portuguese, gendered variations were considered. The restriction to these three languages was a limitation of the search and not the analysis, and therefore, articles identified were not excluded based on language of publication. Additionally, there was no limit on the publication year in order to allow for observation of temporal distribution. In total, 627 results were received from 18 searches across the three databases.

A flow diagram of the screening process undertaken is included in **Figure 1** and follows the PRISMA process detailed in Moher et al. (2009). Once identified, duplicates were removed, and the remaining articles ($n = 464$) were screened by title and abstract and filtered for relevance to exclude any articles that did not make reference to the management or governance of urban or periurban green spaces in Latin America. The remaining 74 articles were read in detail, and the criteria were more strictly applied: those that did not center on both management and green spaces that aligned with Urban Green Infrastructure, as earlier defined, were discarded. Recognizing this spectrum of usage, the research did not limit the articles found to those that had explicitly employed UGI as a term but rather applied the wider, and frequently cited, definition from Benedict and McMahon (2002) that designates green infrastructure as "an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations" (p. 12) within urban and periurban spaces. Publications were therefore defined as pertaining to UGI

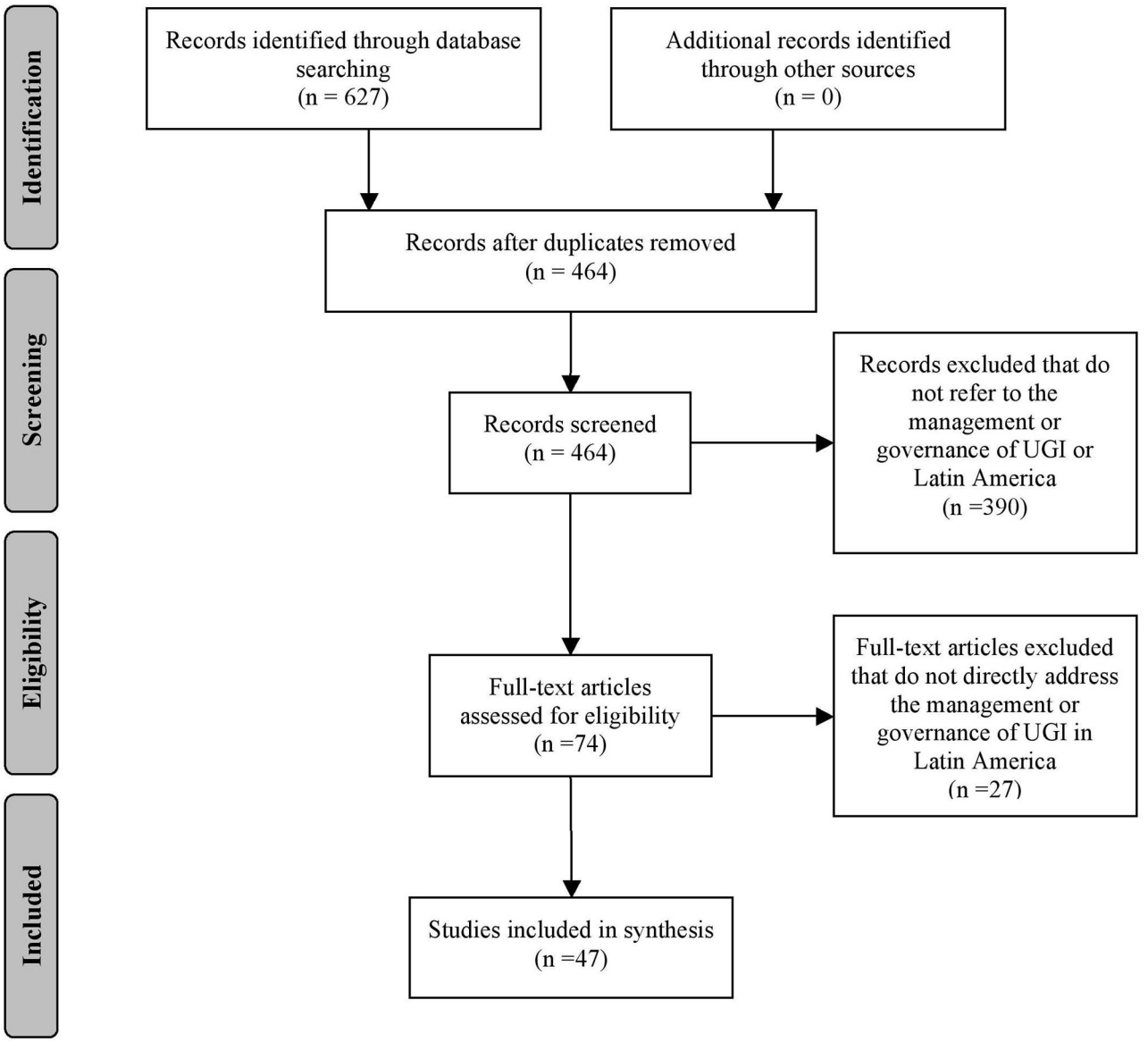

FIGURE 1 | Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) flow diagram—adapted from Moher et al. (2009).

if they centrally addressed one or more components, such as parks, gardens, cemeteries, and urban forests and agriculture, or this network as a whole.

As a result of this, detailed discussion was primarily over the centrality of the topic, whether UGI management was the focus of the research or mentioned peripherally and whether the geographical location of the study could be considered urban or periurban. For the latter, the definition of periurban area was taken from Forman (2014) as "the zone containing some urban-related structures just beyond the continuous built metro area" (p. 39). The two-step funnel approach allowed for the exclusion of articles at the first stage that were clearly irrelevant from the abstract and a deeper assessment of the remaining 74, where each author left their opinion on its inclusion or exclusion and those without consensus were discussed until an agreement was reached. Examples of articles excluded focused on natural sciences, rural areas, ecosystem services, or more on the management of gray infrastructure than green infrastructure. As a result of this process, 47 articles remained for detailed assessment, which are listed in Appendix 2 (**Supplementary Material**) of this paper.

Analysis

A quantitative content analysis of the selected articles was carried out based on the criteria detailed in **Table 1**. General classification groupings were developed with reference to other systematic reviews in the field of urban green infrastructure and ecosystem services (Haase et al., 2014; Boulton et al., 2018; Ordóñez-Barona

TABLE 1 | Predetermined and emergent classifications used for quantitative analysis.

Classification grouping	Classification item	Definition	Categories	Determination
Temporal	Publication Year	The year in which the article or book chapter was published	1994…2020	Emergent
Geographic	Scale	The scale at which the research was focused	Regional, Country–country, Country-wide, City-wide, Program, Individual case, N/A	Predetermined
	Focus	The country or countries that were the focus of study	Argentina, Brazil, Chile, Colombia, Costa Rica, Guatemala, Ecuador, Mexico, Peru, Multiple, Latin America	Emergent
	Origin	The country or countries from which the research originated	Argentina, Brazil, Chile, Chile/USA, Colombia, Ecuador/USA, Mexico, Mexico/USA, Venezuela Outside Latin America	Emergent
Language	Type	The language in which the study was written	English, Spanish, Portuguese, French	Emergent
Management	Type	The type of management or governance employed in the studied initiative(s)	Government-led, Cogovernance, Market-led, Self-governance	Predetermined
	Lead actor	The lead-actor involved in the studied initiative(s)	Transnational Organization, National Government, Local Government, Private Enterprise, University, Community	Emergent
	Other actors	Any other actors involved in the studied initiative(s)	Transnational Organization, National Government, Federal Government, Local Government, Nongovernmental Organization, Research Institute, Private Enterprise, Community	Emergent
UGI	Type	The type of UGI studied, as worded by the author(s)	Cemeteries, Gardens, Green Belt, Green Roofs, Parks, Plazas/Squares, Protected Areas, Urban Forests, Urban Agriculture, Open Green Space, General	Emergent

et al., 2020). While categories such as the geographic scale and management type were predetermined, further categories were emergent in that they were a product of a deeper review of the publications. Regardless of the differing methods used across the studies, categories were chosen that allowed for broader pattern recognition and the clear identification of trends, a method that has been previously used by Boulton et al. (2018) and Ordóñez-Barona et al. (2020) in systematic reviews in the field of urban greening. The final assessment criteria included the date of publication, journal and authors, geographic scale, location of study, origin of research, language, type of management, the lead actor, further actors involved, and the type of UGI studied.

Date of publication was considered of high importance in determining the relevance of this research topic within Latin America and in turn the relevance of this systematic review. Additionally, a number of geographic categories of analysis were chosen. The geographic scale of the research was analyzed to give an indication of how siloed the research was and whether there were cross-border cooperation or perspectives; multicountry studies within Latin America were classified as "multiple;" and in cases of multicountry studies where only one case study was within Latin America, these were attributed to that country. Location of study was recorded to view geographic spread and whether, for example, this aligned with population as found in Ordóñez-Barona et al. (2020). The "origin of research" by country was determined by the institutional affiliations of the lead author, with the aim of providing insight into the ratio between research generated within and outside of Latin America; similarly, the language of publication was also recorded in order to view the international influence on academia in this space and identify any clear bias in the searches carried out.

In conducting this systematic literature review, as previously mentioned, management was treated as an umbrella term for both traditional management practices and governance, understood as the involvement of actors external to the state. As a result, four types of UGI management were considered, with reference to the governance classifications laid out by Buizer et al. (2015). These included "governmental-led," encompassing both top–down management and "soft" participatory governance; "market-led," whereby private actors adopt a leading role; "co-governance," whereby multiple actors share more or less equally in the maintenance of the space; and "self-governance," indicating initiatives that prioritize bottom–up decision-making from communities. These categories were used in order to visualize temporal trends and therefore identify those management practices that have been traditionally studied in Latin America and those that have attracted attention more recently. For example, a shift from "government to governance" has been highlighted in the international literature (Buizer et al., 2015, p. 8; Fox-Kämper et al., 2018, p. 59; Mattijssen et al., 2017a, p. 96; van der Jagt et al., 2016, p. 12), which would, if present, be reflected in the results as a change through the years from "government-led" practice to other types of management.

Along a similar vein, the lead actor was classified according to emergent categories (see **Table 1**) as the body, institution,

TABLE 2 | Initial emergent classifications used for qualitative analysis.

Classification grouping	Emergent keywords and phrases
Factors for success	Environmental Education, Open Access, Scientific Interest, Strength of Local Government, Community Participation, Democratic Decision Making, Efficient Planning and Processes, Contribution to Food Security, Climate Sensitivity, Guidelines and Training, Transdisciplinary and Sectorial Collaboration, Alignment with Local Policy, Evaluation and Assessment
Factors contributing to failure	Lack of Communication, Weak Local Government, Excessive Decentralization, Displacement, Exacerbation of Environmental Inequalities and Vulnerabilities, Lack of Participation, Lack of Access/Exclusion, Informality, Lack of Resources, Lack of Efficiency, Short-Term Planning, Power and Information Asymmetries, Security, Lack of Water, Conflict with Local and Indigenous Communities, Lack of Monitoring and Evaluation, Lack of Facilities and Infrastructure
Benefits of the practice or initiative	Investment, Aesthetics, Tourism, Recreation, Leisure, Environmental Education, Biodiversity, Food Security, Social Capital, Climatic Stability, Soil Improvements, Water Management, Air Quality, Social Capital, Climate Change Adaptation, Increased Property Values, Cultural and Religious Reinforcement and Preservation, Easing the Urban–Rural Transition, Health and Wellbeing, Postconflict Peacebuilding, Community Empowerment
Other keywords	Indigenous Communities, Informal Communities, Siloed Management, Volunteer Programs, Modernity, Permaculture, Rights, Public Mismanagement

or group that was described as taking the primary role in the management of the UGI described. This was regardless of the primary focus of the publication and provided nuance to the management-type groupings in that it permitted oversight of the actors driving the co-governance initiatives and which level of government was steering those that were government-led. Further actors involved were also noted as an emergent category in case of significant involvement of any that were unforeseen and in order to better understand the spread of the range of actors involved. The type of UGI was classified according to the wording used by the authors; therefore, although there is considerable overlap, for example, between what constitutes a "garden" and what constitutes "community agriculture," these are considered as mutually exclusive categories. Data collection and classification took place in an alphanumeric database.

Throughout this process of quantitative data collection, a qualitative content analysis was carried out with reference to the "general inductive approach" outlined in Thomas (2006). Information was gathered on the emerging trends and topics across the body of literature, of which key themes were chosen as relevant to the region by the research team, and this was then used to guide the qualitative review. Keywords or phrases were assigned to the articles through a full-text review; then, they were organized within the quantitative database under the headings "factors for success," "factors contributing to failure," "benefits of the initiatives or practices mentioned," and "other key words." The words or phrases that applied to multiple articles were then color coded in order to allow for quantification and to view trends. Subsequently, the articles were re-read, and information and extracts were collected and organized under emergent headings that aligned with these identified themes (**Table 2**). Duplicates were removed, and similar words or phrases were grouped; this left broader headings such as "indigenous communities" and "public practice." The qualitative review was written using this collated information and quantifiable organization of the keywords and headings in **Table 2**; this allowed for a comprehensive oversight and representation of the information within the articles found and confidence in the identification of qualitative patterns and trends.

RESULTS

Overview of the Research

A total of 47 publications were identified in this study, including 46 articles across 40 journals and 1 book chapter; 42 involved original research. The majority of the research was in English (57.4%), followed by Spanish (34.0%) and Portuguese (6.4%), and one French language article was also found through its English abstract. Geographically, the case studies and research focuses were concentrated in Brazil (29.8%), Mexico (19.1%), and Colombia (17.0%), followed by Chile (8.5%) and Argentina (8.5%). Additional studies focused on Ecuador, Guatemala, Peru, and Costa Rica (**Figure 2**). Of the publications found, all but seven were limited in focus to one country; three compared a Latin American country to one or more countries outside of the region; two focused on multiple cases within Latin America; and two focused on Latin America as a whole. In terms of the origin of research (**Figure 3**), over a quarter (27.7%) of the 47 publications came from lead authors based outside of the region. These involved a diverse range of case studies, spanning eight of the nine countries specified in **Figure 2**. Of these lead authors based outside of Latin America, five were affiliated to North America, six to Europe, and one to Africa. Brazil (23.4%) and Mexico (21.3%) were the two countries within Latin America producing the most research in this field (**Figure 3**); Colombia, Chile, and Argentina also contributed between 5 and 10% of research each.

With reference to the relation between geographical spread to the temporal trends shown in **Figure 4**, the few publications on UGI management before 2003 were from, and centered on, Brazil. Although being the sole focus of almost 20% of the research, the first study on Mexico within the articles found was a comparative study of Brazil, Mexico, Chile, Spain, and the US in 2010 (Flores-Xolocotzi and González-Guillén, 2010). The first studies to focus on Mexico alone were not published until 2015, showing a recent rise in academic interest in UGI management in the country. As **Figure 4** shows, research focusing on the management of green space in the region has gathered momentum only in the past 5–10 years, and in the 5-year period between the 1st of January 2015 and the 1st of January

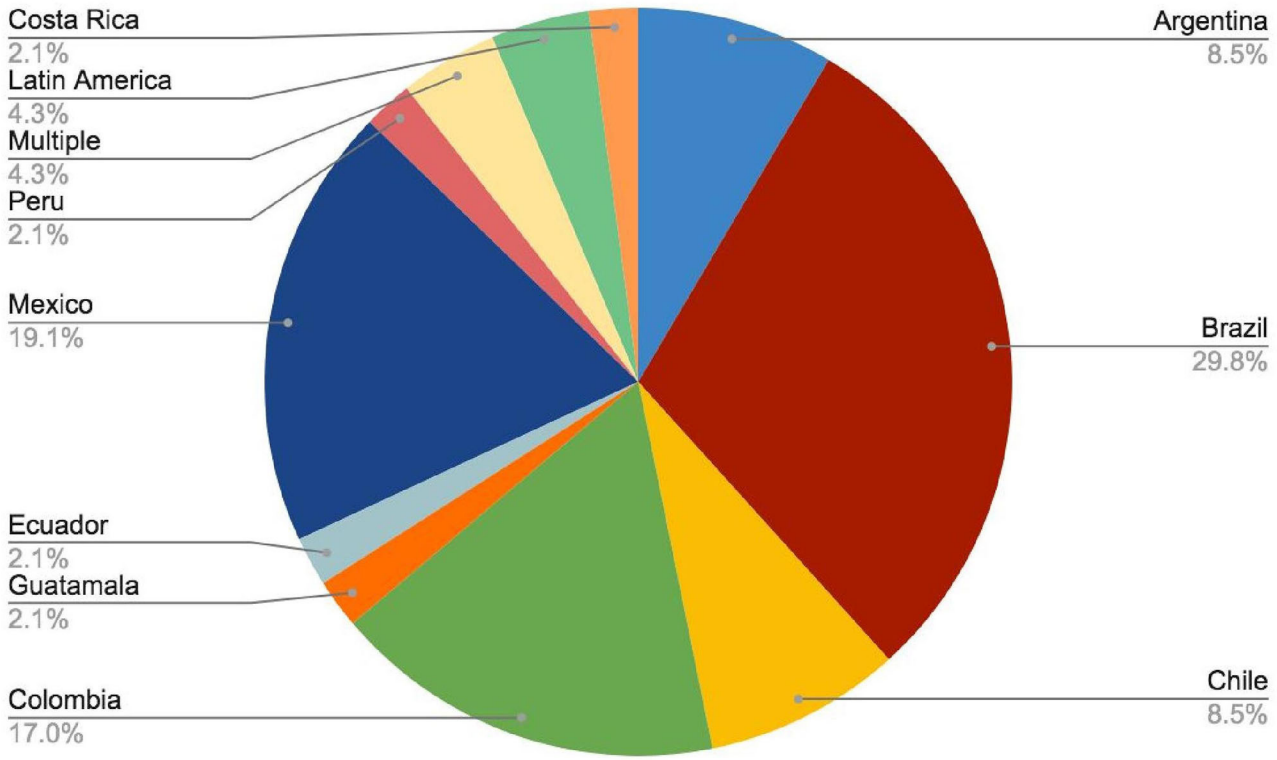

FIGURE 2 | Country of study (% of 47 publications).

2020, 29 articles or 61.7% of the found works were published. Of the total research, 80.9% was published in 2010 or later. This research reached a peak in 2019, with 10 articles and 1 book chapter published in this year. It is worth highlighting that this systematic review took place in May 2020, meaning numbers for 2020 are not representative of publications in that year.

The category of government-led, top–down state management with minimal interaction and involvement of non-state actors was consistent throughout time (**Figure 4**). Interestingly, self-governance initiatives were present in the literature as early as 2003 and did not appear to be a new focus. Co-governance initiatives involving actors outside of both the state and communities (such as universities, NGOs, and research institutes), and initiatives involving more equally weighted partnerships between state and community actors, have only emerged in the literature found in the past 6 years. Market-led initiatives, headed up by private actors, were surprisingly absent from the research, given the long history of privatization of green spaces in Latin America: one publication in 2019 addressed the privatization of an open green space in Cali, Colombia (Nail and Erazo, 2018). A total of nine publications (19.1%) contained multiple case studies and were classified as "various."

A predominance of local state actors for UGI management in Latin America was presented in the publications found (**Figure 5**); more than half (51.1%) of all the publications identified local government as the lead actor for the management of the UGI described, in comparison to national government that was the principal actor in only one article (2.1%). Federal government was mentioned as a participating actor in one of the texts but did not take a leading role. It was not possible to attribute a single principal actor to over a fifth of the publications (21.3%) classified as "various," either because these publications spoke about multiple management practices from a theoretical perspective (although a couple of theoretical publications very clearly addressed a certain management or governance type) or because multiple lead actors were identified for different projects. **Figure 6** shows the relationship between the type of UGI studied within the articles and management type. A wide range of UGI components were discussed. Fifteen articles (31.9% of those found) spoke of UGI as a whole within urban spaces without reference to a specific component, and these were classified under "general." The large amount of government-led practice centered in this category reflects the difference in reach of government actors. Self-governance initiatives were, perhaps for this reason, concentrated in their focus on gardens and small public spaces with local reach, whereas co-governance and government-led practices were widely distributed across the UGI typology.

Qualitative Review

From "Government to Governance"?

In general, community organizations tended to have arisen as a coping mechanism (Nail and Erazo, 2018, p. 93) or a

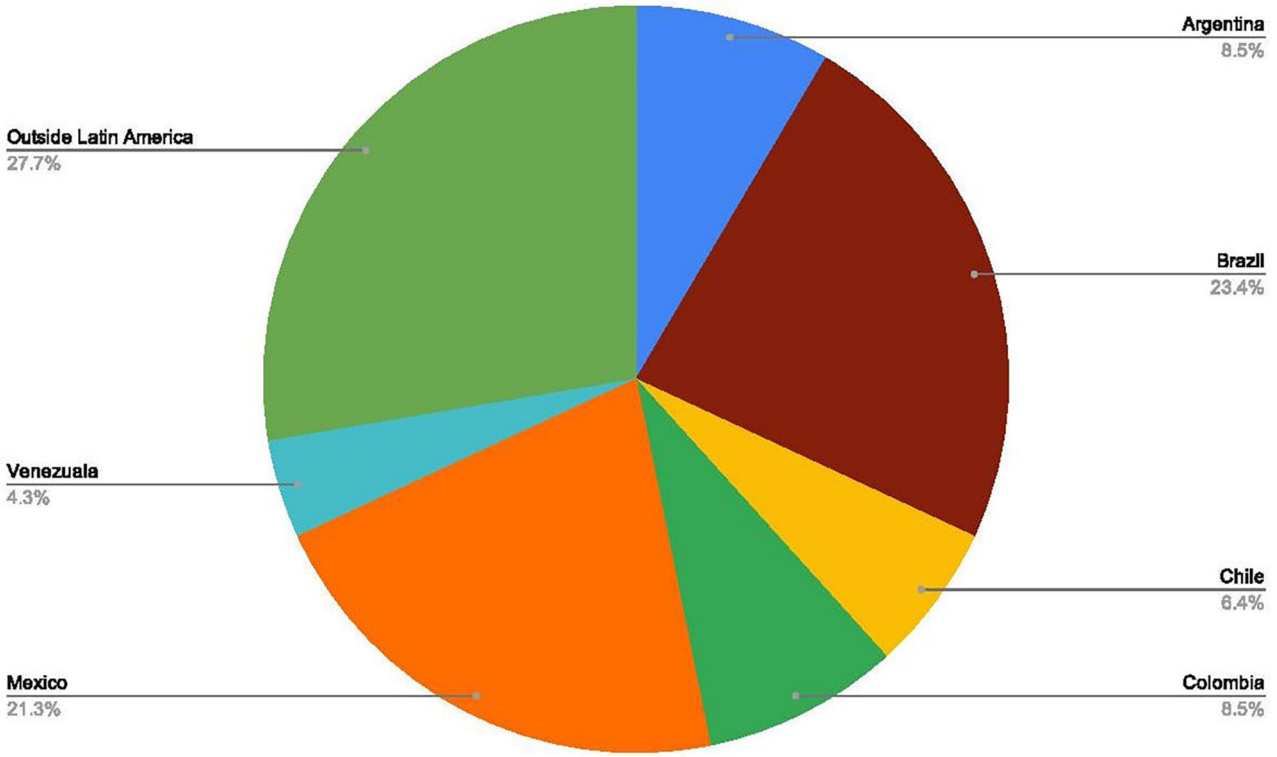

FIGURE 3 | Lead author institutional affiliation by country (% of 47 publications).

response to state neglect (Chelleri et al., 2016, p. 2; Millington, 2018; Diep et al., 2019) as opposed to active efforts by local authorities. A number of publications referenced long traditions of bottom–up community management in Chile and in Mexico that had been sidelined by government or market-led management practices in previous decades; these historical initiatives tended to be either a product of early twentieth century urban policies (Gurovich Weisman, 2003; Yáñez Andrade and Deichler, 2018) or longstanding indigenous traditions (González and Guillen, 2015; Pabello and Nasupcialy, 2019). The fact that co-governance initiatives are more recent in the literature (**Figure 4**) reflects claims in a number of the publications that government initiatives and community initiatives tend to be siloed, and there is a general lack of interaction and communication between them (Chelleri et al., 2016; Betancurt et al., 2017; Diep et al., 2019; Vieira and Panagopoulos, 2020). For example, Anguelovski et al. (2019) explored the construction of an urban belt as an "antisprawl" measure in Medellin, during the process of which the municipality directly destroyed community gardens and relocated residents, before creating its own "community" schemes with the aim of supplying high-income markets in other parts of the city (p. 150). Additionally, both Betancurt et al. (2017) and Vieira and Panagopoulos (2020) highlighted differences in community and state decision-making in urban planting, and the impact that a lack of coordination can have on species richness in flora and UGI resilience.

There appeared to be a directional push within the literature toward cooperative governance mechanisms; despite the dominance of local state actors within the initiatives and cases addressed, a large number of the publications criticized top–down management practices (González and Guillen, 2015; Babilonia et al., 2018) and lack of participation (Pérez-Medina and López-Falfán, 2015, p. 23; Flores et al., 2019) and called for the inclusion of non-state actors (Flores-Xolocotzi, 2012; Barroso and Mesquita, 2014). Chelleri et al. (2016) spoke of increasing interest in participatory and bottom–up management practices in the region, as a direct result of technological advances that have meant better dissemination of information and the rise of online communities (p. 2). On the whole, the literature reflected a heavy presence of self-governance initiatives in many Latin American countries. Betancurt et al. (2017) found that 77% of urban parks in Bariloche, Argentina were neighborhood run (p. 7), and Contesse et al. (2018) made reference to a range of community initiatives for urban agriculture in Santiago de Chile. The problem was not, therefore, a shortage of bottom–up governance initiatives, but rather their integration into government planning in the literature found and apparent lack of representation within academic research.

Key Challenges in the Shift to Participative Practice

The Latin American context brings its own specific challenges to discussions on governance for UGI, four of which were

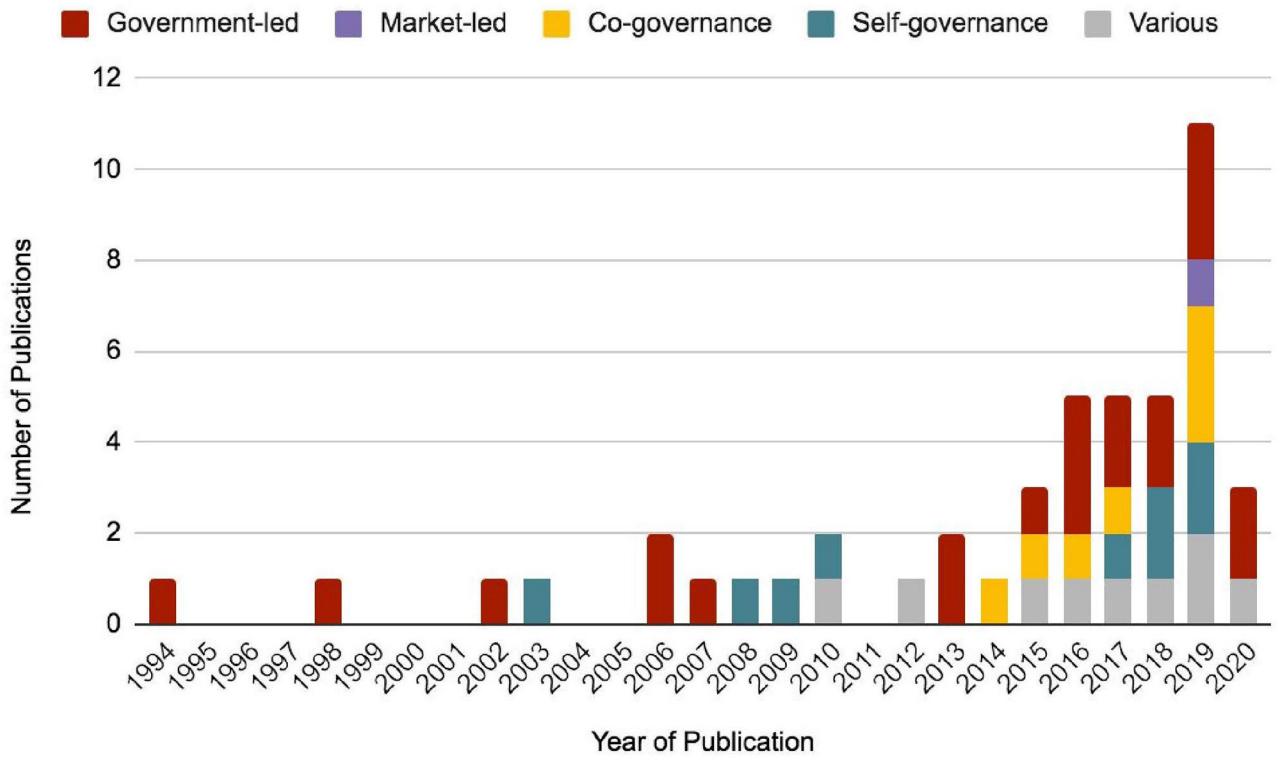

FIGURE 4 | Temporal distribution of articles as of May 2020.

repeatedly highlighted in the literature: weak local government, informal settlements, pronounced socioeconomic inequalities, and clashes with indigenous community practices. These challenges intersected with UGI governance in different ways, and all but the first presented a considerable source of local conflicts in the cases studied. A number of publications highlighted weak local government management (Escobedo et al., 2006; Flores-Xolocotzi, 2012; Serra-Llobet and Hermida, 2017, p. 3) or a general lack of state resources (Guerrero and Culós, 2007; Silva-Sánchez and Jacobi, 2016; Millington, 2018; Ojeda-Revah et al., 2020) as a barrier to effective governance, transparency, and participation. These factors were not universal, geographic variation in budgets, capabilities, and resources between municipal managers in the same city, and competition for investment meant dependence on private entities and a shift in priorities when considering UGI provision (Escobedo et al., 2006; Andrade et al., 2013; Babilonia et al., 2018). One publication mentioned the division of large urban green spaces between competing local authorities (Andrade et al., 2013, p. 10). This lack of adequate means to effectively administer UGI at the state level is a considerable obstacle in the shift to formalized governance practices that, whether centered in participation or empowerment, require responsive and capable leadership or oversight at a citywide level. This was backed up in the literature by the fact that heavy decentralization of responsibilities at the state level was linked to a lack of communication between government actors and even calls for consolidation in decision-making (Andrade et al., 2013; Benchimol et al., 2017; Serra-Llobet and Hermida, 2017, p. 3).

Like underresourced and overly decentralized local governments, informal settlements are not unique to the Latin American context but are frequently present in rapidly urbanizing cities. Three of the articles found centered on informal settlements, two in São Paulo, Brazil (Millington, 2018; Diep et al., 2019) and one in Medellin, Colombia (Anguelovski et al., 2019). All three highlighted, either centrally or peripherally, the issue of displacement and the conflicts and issues that arose from this. Millington (2018) detailed the construction of a linear park in São Paulo that required the resettlement of roughly 40,000 people (p. 871). The issue of displacement in itself was not necessarily a cause of conflict, but resettlement plans were often badly executed and increased the vulnerabilities that the communities in these settlements faced, even when risk reduction was the primary reason for relocation (Millington, 2018, pp. 871, 873; Anguelovski et al., 2019, p. 154). Even if residents understood the need to move, it was the lack of details and consistent follow-up that generated resistance, accompanied by the ethical implications of moving already heavily disadvantaged individuals to locations where they were worse off (Millington, 2018, p. 873). Diep et al. (2019) highlighted discourse used by local government actors in São Paulo that framed communities as polluters and harmful to nearby protected areas. The community initiatives that had recently emerged were a response to this and aimed to counteract this perception but were not sanctioned

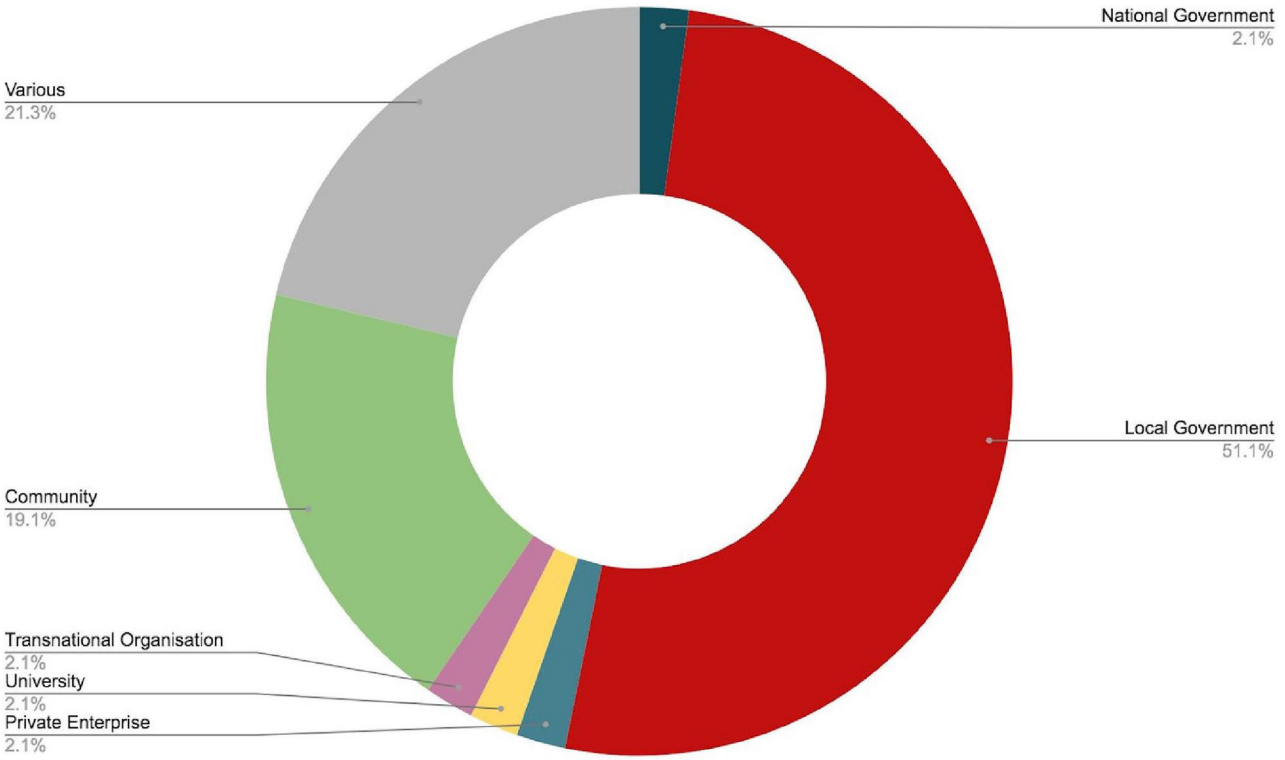

FIGURE 5 | Principle actor distribution (% of 47 publications).

by the state authorities; the result of this was a clear disconnect between objectives for the area and a negative impact on both the government-led and self-governance practices (p. 566). This dynamic positions informal local communities as the enemy of UGI provision and heavily influences the "siloed" nature of government-led and self-governance practices within cities as previously discussed. These and other generated conflicts are both a clear indication of the lack of participation and inclusion of actors within the construction and management of urban green spaces and a barrier to future engagement in governance initiatives.

The contrast between the avant-garde buildings present in many Latin American megacities, with the informal settlements and social housing developments that occupy their peripheries, is a clear representation of the market socioeconomic inequalities that have a particularly strong hold over the more neoliberal economies in the region. Inequitable distribution of green space according to socioeconomic bracket was highlighted in a number of articles (Chelleri et al., 2016, p. 279; Escobedo et al., 2006, p. 113; Contesse et al., 2018, p. 566) and, in general, presented a significant challenge in effective UGI governance. Vásquez et al. (2019) found, in their assessment plans and strategies for green infrastructure across multiple Latin American countries, a lack of focus on social and environmental inequality (p. 340). The displacement mentioned in the articles was linked with concepts of "environmental gentrification" (Anguelovski et al., 2019, p. 154). Diep et al. (2019) characterized linear parks as "slum upgrading projects" (p. 562), reflecting the statement by Anguelovski et al. (2019) that green infrastructure projects "render low-income residents disposable; they represent the collateral damage to Medellin's 'highest aspiration' of becoming a globally recognized 'sustainable city'" (p. 154). Once more, the conflicts and divisions generated as a result of these circumstances and the positioning of actors within this dynamic presented considerable challenges for the collaborative co-creation of green spaces within cities.

Finally, a further three studies (González and Guillen, 2015; Pulido-Salas et al., 2017; Pabello and Nasupcialy, 2019) centered on indigenous communities in Mexico and the interface between these communities and governance both as a concept and in practice. Pulido-Salas et al. (2017) explored self-governance of the "solar" or Mayan community garden in the small city of José María Morelos, Quintana Roo, and highlighted the strong cultural traditions that accompany this practice and its history within these communities. González and Guillen (2015) focused on a dispute over cemeteries that took place between 2001 and 2007 in Mexico City around the handing over of the rights to these cemeteries to local government. The authors criticize the "ideals of progress and development" that prioritize the needs of growing cities over culture, traditions, and subjectivity (González and Guillen, 2015, p. 359). Similarly, Pabello and Nasupcialy (2019) use indigenous community gardens in

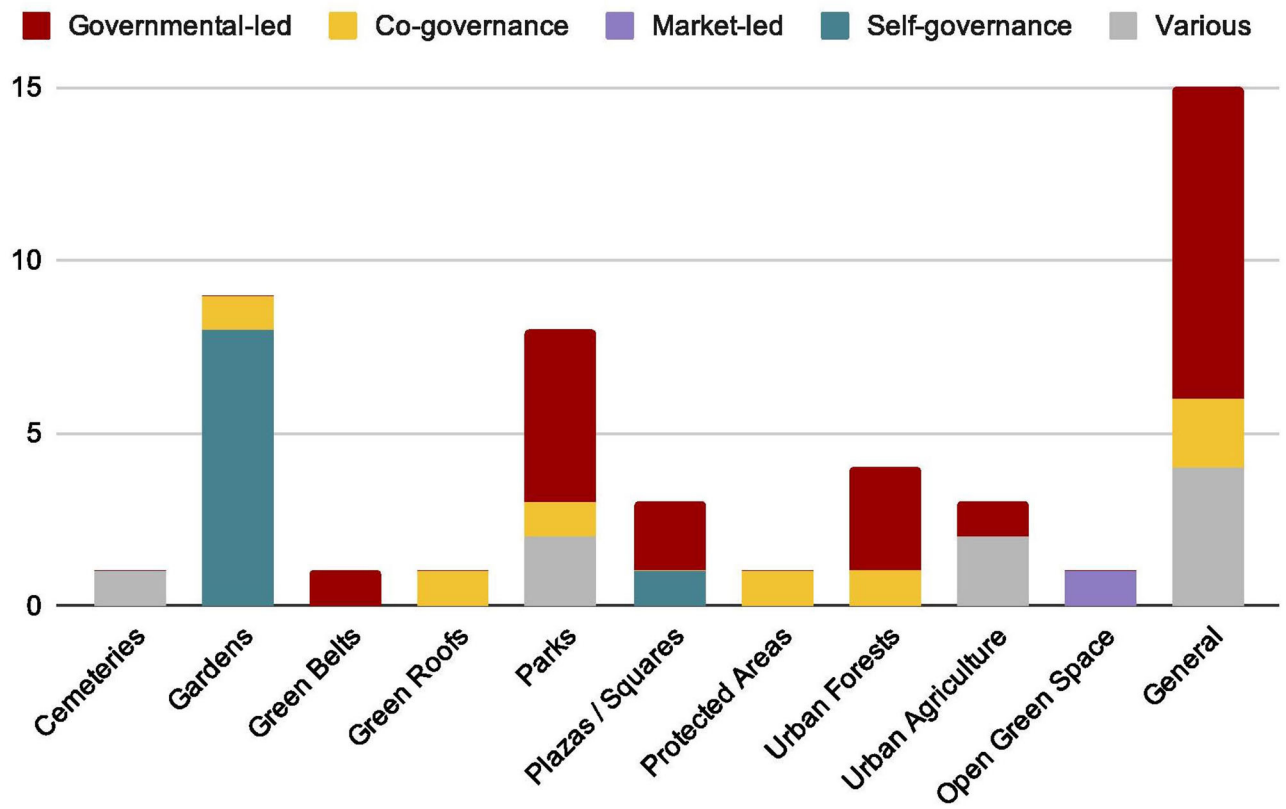

FIGURE 6 | Urban green infrastructure types by management type.

Veracruz to more broadly critique the notions of productivity and individualism in western green space management discourse and the accompanying dismissal of the alternative, communal, rationalities that accompany the long history of "self-governance" practices by indigenous peoples (p. 210). They make the call for more original research from Latin America in order to strengthen understanding of the existence of social collectives in which the central preoccupation does not lie with resources or "collective goods" but "the recovery, restoration, expansion or defense of spaces for the reproduction of collective life or communal environments" (Pabello and Nasupcialy, 2019, p. 211).

Benefits of Successful Governance

The benefits of successful governance for UGI mentioned in the research found included environmental education (Ferrer et al., 2010; Barroso and Mesquita, 2014; Costa Cardoso et al., 2015; Benchimol et al., 2017; Pabello and Nasupcialy, 2019), recreational opportunities and tourism (Sanchotene, 1994; García and Guerrero, 2006; Guerrero and Culós, 2007; Flores-Xolocotzi and González-Guillén, 2010), investment (Flores-Xolocotzi, 2012; Babilonia et al., 2018), easing the transition of the urban–rural interface (Gurovich Weisman, 2003), and environmental benefits such as climate change adaptation and reduced flood risks (Granados-Olivas et al., 2016; Millington, 2018; Flores et al., 2019; Giner et al., 2019). Nail and Erazo (2018) made the case for state-initiated self-governance initiatives for post-conflict peace building, a link between UGI and social capital that was also made by Ferrer et al. (2010), Costa Cardoso et al. (2015), Sánchez (2019), and Visoni and Nagib (2019, p. 88). There was some grouping in the focus of articles that mentioned specific benefits: recreation and tourism was almost exclusively highlighted within articles that focused on local government, and, somewhat predictably, the topic of social capital was aligned with community-led initiatives. Interestingly, food security was mentioned in 13 of the publications, 8 of which contained case studies on community-led initiatives. In studies where local government was the primary actor, it was highlighted as a benefit provided by the infrastructure studied, a measure of success in gardens and urban agriculture, and as an enabler of success in the planning and implementation of urban forests (Sanchotene, 1994; Lafontaine and Olivier, 2017). It is likely, however, that these mentioned benefits reflect the bias of the authors of the articles and do not echo the priorities of the actors involved in the cases studied.

DISCUSSION AND CONCLUSIONS

With an aim to fill the knowledge gap around UGI management publications in Latin America, this study has centered on the research questions: What are the research trends in terms of

topics and case studies that characterize UGI management research in Latin America? Which management types are the focuses of this research? An extensive trilingual systematic review was conducted using a wide range of search terms, and 47 publications were identified and subjected to both quantitative and qualitative analysis. The research that was found was predominantly recent, and the temporal trends identified were more pronounced than those seen by Boulton et al. (2018), in a review of research on global greenspace provision, and Ordóñez-Barona et al. (2020) on urban forestry research in Latin America: over 80% of the studies were published between January 2010 and May 2020. Aligning with expectations based on population size, Mexico and Brazil were the principal areas of study for almost 50% of the publications and were the largest producers of research within the region. The fact that over a quarter of the work found originated from lead authors based outside of Latin America likely reflects either high external interest in the region, low regional interest in this topic, or bias from the databases used.

A true picture of UGI management in practice is likely to extend beyond what was observed within the academic literature, but the trends identified provide an interesting reflection of academic priorities and visibility of respective management practices in Latin America. The fact that local government was the principal actor for the management of the UGI studied in over half of the total research found reflects the European literature (van der Jagt et al., 2016); this was followed by local communities at just over 20%. While government-led and self-governance initiatives had a fairly consistent temporal distribution, co-governance initiatives were recent, appearing only from 2014, and were the focus of a comparatively small proportion of the research. The transition from "government to governance" has been frequently cited in European publications (Buizer et al., 2015, p. 8; van der Jagt et al., 2016, p. 12; Mattijssen et al., 2017a, p. 96; Fox-Kämper et al., 2018, p. 59), but a movement from traditional government-led management to empowered self-governance initiatives was not apparent in the publications found. The results of the qualitative review aligned with this: community initiatives were described as having an established presence and history within the region, but governmental-led and self-governance practices tended to be siloed, leading to a lack of coordination and, in some cases, competition between management practices. Counterintuitively, it may be that a strengthening of local government is needed in order to allow for the types of cooperative and communicative management practices that are present in governance publications from other parts of the world. There was a notable absence of "market-led" initiatives in the research identified, which was at odds with expectations within the literature and high levels of privatization within the region (Vásquez et al., 2016).

Notable research trends within the publications related to weak local governance, informal settlements, marked socioeconomic inequalities, and conflicts with traditional indigenous practices. These are not challenges that have substantial representation in the international literature but are clearly applicable across Latin America and possibly in other countries within the Global South. Indigenous practices, although they fall under the category of self-governance initiatives, clash with the very concept of governance in their intent, history, and discourses used (Pabello and Nasupcialy, 2019). The juxtaposition between the idea of UGI as the primary motivator for a self-governance initiative and the conception of cooperative management and way of life as a means in itself raises the interesting question of how to integrate western management concepts with practices that predate colonialism in Latin America. It can be hoped that with the demonstrated acceleration of governance research in the countries studied, new knowledge and conceptual research can bridge these gaps and result in improved practices for UGI management.

The frequent presence of food security as both a benefit and a factor for success within UGI management was aligned with North American literature and practice in the area of community initiatives (Wekerle, 2004; Rosol, 2012). This tended to emerge out of necessity as opposed to food justice "movements," reinforcing the notion that community initiatives are often the product of an obligation to fill the gaps left by inadequate state provision. The focus on the post-conflict benefits of successful and supported self-governance in Colombia in (Nail and Erazo, 2018) was interesting, as it presented an example of one of the ways in which both UGI and governance practices impact upon social capital in a way that has a direct benefit on fragmented societies and cities. Although benefits provided by successful initiatives were clearly mentioned, the factors needed for this success in the case of co-governance and self-governance initiatives, such as formal recognition and funding, were scarcely addressed. It would therefore be interesting to see future studies in the region that look to the similarities and differences in challenges faced at the community level with those initiatives in Europe and North America.

A mixed quantitative and qualitative methodology was employed for this review in order not only to view the characteristics, patterns, and trends of research for UGI management in Latin America more broadly but also the key learnings of the research content. In the focus on management type and actors involved, the results of the qualitative section corroborated that of the quantitative analysis. On reflection, however, a greater qualitative focus on the contextual factors affecting UGI management, aligned to the economic and political regimes of the countries in which the initiatives are situated, would have perhaps gone further to explain whether the geographical concentration of the research was connected to the desirability and feasibility of certain practices. This review was restricted to the literature present in Scopus, Web of Science, and SciELO. The former two have a strong bias toward English language journals and are the larger of the three databases searched. Despite this, the fact that over 40% of the articles were not in English indicates the body of research in this field in Spanish and Portuguese and the benefits of conducting a trilingual review. These databases were chosen, as it was possible to replicate the same searches across them, in terms of fields searched and Boolean strings used, but it is likely that this review does not exhaustively cover publications on this topic in the region. More research would likely be identified by measures such as using additional regional databases or conducting a bibliographic reference search of the research found. One of

the articles identified made reference to a large number of undergraduate, masters, and doctorate level research papers within the area of Urban Forestry in Brazil that have not been published within scientific journals (Vieira and Panagopoulos, 2020, p. 9), and this is a claim that aligns with our anecdotal experience within the area of UGI management. Despite the challenges of conducting an extensive search of research within universities in the region, a review including thesis papers and gray literature more broadly, such as policy papers and municipal plans, would provide a more accurate picture of management for UGI in Latin America in practice.

In conclusion, this review has presented 47 publications that center on UGI management in Latin America and in doing so has also looked to achieve a better understanding of investigations in the region. This is the first systematic review of UGI management research in Latin America, to our knowledge. Considering the breadth of the search terms used and the minimal exclusion criteria, there is a shortage of research, particularly in the areas of cogovernance, market-led practice, and self-governance. The evident asymmetries between this region and Europe and North America, where much of the literature on green space provision is originating, indicate that there is much that the Latin American experience can offer that would also assist in research in other areas of the Global South. Echoing calls from Ordóñez-Barona et al. (2020), there is a need for funding that will allow more transnational and regional cooperation in order to better recognize the unique political and economic contexts within Latin America and the variation that this brings. In general, the "good governance" mechanisms promoted by multilateral organizations have ignored the complex differences between and challenges faced by countries in Latin America (Zurbriggen, 2011), and the lack of "context-sensitive" approaches was noted in the literature with reference to informal settlements (Diep et al., 2019, p. 566). Interesting areas for further research could look to answer how clear socioeconomic inequalities and socio-spatial segregation in Latin American cities affect management of UGI, how differences in economic and political regimes impact the introduction of governance practices, or to look more comparatively at the differences between research priorities in this region and the European and North American contexts. With reference to the challenges of applying western concepts to the Latin American context, one can also hope to see new conceptual frameworks emerging in the coming years that center on traditional and indigenous cooperative practices, emphasizing the centrality of cultural, social, and spiritual motivators for community management of UGI.

DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the article/**Supplementary Material**.

AUTHOR CONTRIBUTIONS

AV and EG conceived the study. AB executed the methodology, wrote the first drafts, and the final manuscript. AV and EG conducted the revision. All authors read and approved the final version of the manuscript and contributed to the study design and methodology.

FUNDING

This research was provided by the project Planificación de Infraestructura Verde Urbana en Chile: Santiago como caso de estudio (Stgo+ Infraestructura Verde), part of the MINVU (Ministry of Housing and Urbanism) applied research fund.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/frsc.2020.572360/full#supplementary-material

REFERENCES

Ahern, J. (2007). "Green infrastructure for cities: the spatial dimension," in *Cities of the Future: Towards Integrated Sustainable Water and Landscape Management,* ed V. B. P. Novotny (London: IWA Publishing) 267–283.

Andrade, G. I., Remolina, F., and Weisner, D. (2013). Assembling the pieces: a framework for the integration of multi-functional ecological main structure in the emerging Urban region of Bogota, Colombia. *Urban Ecosyst.* 16, 723–639. doi: 10.1007/s11252-013-0292-5

Anguelovski, I., Irazábal-Zurita, C., and Connolly, J. J. T. (2019). Grabbed urban landscapes: socio-spatial tensions in green infrastructure planning in Medellín. *Int. J. Urban Region. Res.* 43, 133–156. doi: 10.1111/1468-2427.12725

Babilonia, R., Sánchez, R., Caldera, J. J., and Durango, G. (2018). Planificación Urbana Estratégica a través de macroproyectos urbanos: percepción ciudadana sobre el parque lineal "La Ronda del Sinú" en la Ciudad de Montería, Colombia. *Revista de Urbanismo* 39, 1–12. doi: 10.5354/0717-5051.2018.48727

Badiu, D. L., Nita, A., Ioja, C. I., and Nita, M. R. (2019). Disentangling the connections: a network analysis of approaches to urban green infrastructure. *Urban For. Urban Green.* 41, 211–220. doi: 10.1016/j.ufug.2019.04.013

Ballinas, M., and Barradas, V. L. (2016). The Urban tree as a tool to mitigate the Urban heat island in Mexico city: a simple phenomenological model. *J. Environ. Qual.* 45, 157–166. doi: 10.2134/jeq2015.01.0056

Barroso, A. L. F., and Mesquita, R. D. C. G. (2014). Subsídios para a Gestão de Jardins Botânicos no Brasil – o Caso do Jardim Botânico Adolpho Ducke de Manaus. *Rodriguésia* 65, 791–805. doi: 10.1590/2175-7860201465316

Benchimol, J. F., Lamano-Ferreira, M. L., Cortese, T. T. P., and Ramos, H. R. (2017). Decentralized management of public squares in the City of São Paulo, Brazil: implications for urban green spaces. *Land Use Policy* 63, 418–427. doi: 10.1016/j.landusepol.2017.02.004

Benedict, M. A., and McMahon, E. T. (2002). Green infrastructure: smart conservation for the 21st century. *Renew. Resour. J.* 20, 12–17.

Betancurt, R., Rovere, A. E., and Ladio, A. H. (2017). Incipient domestication processes in multicultural contexts: a case study of Urban parks in San Carlos de Bariloche (Argentina). *Front. Ecol. Evol.* 5:166. doi: 10.3389/fevo.2017.00166

Boulton, C., Dedekorkut-Howes, A., and Byrne, J. (2018). Factors shaping urban greenspace provision: a systematic review of the literature. *Landsc. Urban Plan* 178, 82–101. doi: 10.1016/j.landurbplan.2018.05.029

Buizer, M., Elands, B., Mattijssen, T., van der Jagt, A., Ambrose, B., Geroházi, É., et al. (2015). "The governance of urban green spaces in selected EU Cities," in *European Union. GREEN SURGE Project. D6.1 EU FP7-97* (Copenhagen).

Chelleri, L., Kua, H. W., and Sánchez, J. P. R. (2016). Are people responsive to a more sustainable, decentralized, and user-driven management of urban metabolism? *Sustainability* 8:275. doi: 10.3390/su8030275

Contesse, M., van Vliet, B. J. M., and Lenhart, J. (2018). Is urban agriculture urban green space? a comparison of policy arrangements for urban green space and urban agriculture in Santiago de Chile. *Land Use Policy* 71, 566–577. doi: 10.1016/j.landusepol.2017.11.006

Costa Cardoso, C. L., Vasconcellos Sobrinho, M., and Vasconcellos, A. M. (2015). Gestão Ambiental de Parques Urbanos: o Caso do Parque Ecológico do Município de Belém Gunnar Vingren. *Urbe. Revista Brasileira de Gestão Urbana* 7, 74–90. doi: 10.1590/2175-3369.007.001.AO05

Davies, C., Hansen, R., Rall, E., Pauleit, S., Lafortezza, R., deBellis, Y., et al. (2015). *Green Infrastructure Planning and Implementation*. The status of european green space planning and implementation based on an analysis of selected European city-regions. GREEN SURGE Project. Report 5.1. FP7-ENV.2013.6.2-5-603567; 2013–2017.

Davies, C., and Lafortezza, R. (2017). Urban green infrastructure in Europe: is greenspace planning and policy compliant? *Land Use Policy* 69. 93–101. doi: 10.1016/j.landusepol.2017.08.018

de Vries, S., Verheij, R. A., Groenewegen, P. P., and Spreeuwenberg, P. (2003). Natural environments — healthy environments? an exploratory analysis of the relationship between greenspace and health. *Environ. Plan.* 35, 1717–1731. doi: 10.1068/a35111

Dempsey, N., and Burton, M. (2012). Defining place-keeping: the long term management of public spaces. *Urban For. Urban Green.* 11. 11–20. doi: 10.1016/j.ufug.2011.09.005

Diep, L., Dodman, D., and Parikh, P. (2019). Green infrastructure in informal settlements through a multiple-level perspective. *Water Alternat.* 12, 554–570.

Dobbs, C., Escobedo, F. J., Clerici, N., de la Barrera, F., Eleuterio, A. A., MacGregor-Fors, I., et al. (2019). Urban ecosystem services in Latin America: mismatch between global concepts and regional realities? *Urban Ecosyst.* 22, 173–187. doi: 10.1007/s11252-018-0805-3

du Toit, M. J., Cilliers, S. S., Dallimer, M., Goddard, M., Guenat, S., and Cornelius, S. F. (2018). Urban green infrastructure and ecosystem services in Sub-Saharan Africa. *Landsc. Urban Plan.* 180, 249–261. doi: 10.1016/j.landurbplan.2018.06.001

Escobedo, F. J., Nowak, D. J., Wagner, J. E., Luz de La Maza, C., Rodriguez, M., Crane, D. E., et al. (2006). The socioeconomics and management of santiago de Chile's public urban forests. *Urban For. Urban Green.* 4, 105–114. doi: 10.1016/j.ufug.2005.12.002

Ferguson, M., Roberts, H. E., McEachan, R. R. C., and Dallimer, M. (2018). Contrasting distributions of urban green infrastructure across social and ethno-racial groups. *Landsc. Urban Plan.* 175, 138–148. doi: 10.1016/j.landurbplan.2018.03.020

Ferrer, G., Varela, F., Saal, G., Gatica, M., and Barrientos, M. (2010). Los promotores en la metodología de intervención del programa pro-huerta Córdoba, Argentina. *Revista de la Facultad de Ciencias Agrarias Univ. Nacional de Cuyo* 42, 39–54.

Flores, C. C., Crompvoets, J., Vineigra, M. E. I., and Farelly, M. (2019). Governance assessment of the flood's infrastructure policy in San Pedro Cholula, Mexico: potential for a leapfrog to water sensitive. *Sustainability* 11:7144. doi: 10.3390/su11247144

Flores-Xolocotzi, R. (2012). Incorporando desarrollo sustentable y gobernanza a la gestión y planificación de áreas verdes urbanas. *Revista de Frontera Norte* 24, 165–190.

Flores-Xolocotzi, R., and González-Guillén, M. (2010). Planificación de Sistemas de Áreas Verdes y Parques Públicos. *Revista Mexicana de Ciencias Forestales* 1, 17–24. doi: 10.29298/rmcf.v1i1.649

Forman, R. T. T. (2014). *Urban Ecology: Science of Cities*. Cambridge: Cambridge University Press.

Fox-Kämper, R., Wesener, A., Münderlein, D., Sondermann, M., McWilliam, W., and Kirk, N. (2018). Urban community gardens: an evaluation of governance approaches and related enablers and barriers at different development stages. *Landsc. Urban Plan* 170, 59–68. doi: 10.1016/j.landurbplan.2017.06.023

García, S., and Guerrero, M. (2006). Indicadores de sustentabilidad ambiental en la gestión de espacios verdes. parque urbano monte calvario, Tandil, Argentina. *Revista de Geografia Norte Grande* 35, 45–57. doi: 10.4067/S0718-34022006000100004

Giner, M. E., Córdova, A., Vázquez-Gálvez, F. A., and Marruffo, J. (2019). Promoting green infrastructure in Mexico's Northern border: the border environment cooperation commission's experience and lessons learned. *J. Environ. Manage.* 248:109104. doi: 10.1016/j.jenvman.2019.06.005

González, O. C., and Guillen, D. (2015). ¿Derechos comunitarios vs. modernidad Urbana? La UPBCDF y su Disputa por los Panteones Vecinales de la Ciudad de México. *Mexican Studies/Estudios Mexicanos* 31, 343–366. doi: 10.1525/mex.2015.31.2.343

Granados-Olivas, A., Alatorre-Cejudo, L. C., Adam, D., Serra, Y. L., and Esquivel-Ceballos, V. H. (2016). Runoff modeling to inform policy regarding development of green infrastructure for flood risk management and groundwater recharge augmentation along an Urban Subcatchment, Ciudad Juárez, Mexico. *J. Contemp. Water Res. Educ.* 159, 50–61. doi: 10.1111/j.1936-704X.2016.03229.x

Guerrero, M., and Culós, G. (2007). Indicadores ambientales en la Gestión de espacios verdes. *El Parque Cerro La Movediza.* Tandil. Revista Espacios 28, 57–73.

Gurovich Weisman, A. (2003). Conjugando los Tiempos del Verbo Idealizar: Los Huertos Obreros y Familiares de La Pintana, Santiago de Chile. *Cuad. CENDES* 20, 65–76.

Haase, D., Larondelle, N., Andersson, E., Artmann, M., Borgström, S., Breuste, J., et al. (2014). A quantitative review of urban ecosystem service assessments: concepts, models, and implementation. *Ambio* 43, 413–433. doi: 10.1007/s13280-014-0504-0

Heinreichs, D., Nuissi, H., and Rodriguez Seeger, C. (2009). Dispersión Urbana y Nuevos Desafíos para la Gobernanza (Metropolitana) en América Latina: El Caso de Santiago de Chile. *Revista Eure* 104, 29–46. doi: 10.4067/S0250-71612009000100002

Jansson, M., Vogel, N., Fors, H., and Randrup, T. B. (2019). The governance of landscape management: new approaches to urban open space development. *Landsc. Res.* 44. 952–965. doi: 10.1080/01426397.2018.1536199

Kim, G., and Coseo, P. (2018). Urban park systems to support sustainability: the role of urban park systems in hot arid urban climates. *Forests* 9, 439–455. doi: 10.3390/f9070439

Lafontaine, M., and Olivier, A. (2017). Intérêt des Collectivités pour L'Implantation D'Arbres Nourriciers dans les Parcs Urbains: Le Cas de Villa El Salvador, au Pérou. *Tropicultura* 35, 39–50. doi: 10.25518/2295-8010.1147

Lemos, M. C., and Agrawal, A. (2006). Environmental governance. *Annu. Rev. Environ. Resour.* 31, 297–325. doi: 10.1146/annurev.energy.31.042605.135621

Lindley, S., Pauleit, S., Yeshitela, K., Cilliers, S., and Shackleton, C. (2018). Rethinking urban green infrastructure and ecosystem services from the perspective of Sub-Saharan African cities. *Landsc. Urban Plan* 180. 328–338. doi: 10.1016/j.landurbplan.2018.08.016

Mattijssen, T., Buijs, A., Elands, B., and Arts, B. (2017a). The 'green' and 'self' in green self-governance - a study of 264 green space initiatives by citizens. *J. Environ. Plann. Manage.* 20, 96–113. doi: 10.1080/1523908X.2017.1322945

Mattijssen, T., van der Jagt, A., Buijs, A., Elands, B., Erlwein, S., and Lafortezza, R. (2017b). The long-term prospects of citizens managing urban green space: from place making to place-keeping? *Urban For. Urban Green.* 26. 78–84. doi: 10.1016/j.ufug.2017.05.015

Mattijssen, T. J., Behagel, J. H., and Buijs, A. E. (2015). How democratic innovations realise democratic goods. *Two case studies of area committees* in the Netherlands. *J. Environ. Plann. Manage.* 58, 997–1014. doi: 10.1080/09640568.2014.905460

Millington, N. (2018). Linear parks and the political ecologies of permeability: environmental displacement in São Paulo, Brazil. *Int. J. Urban Region. Res.* 42, 864–881. doi: 10.1111/1468-2427.12657

Moher, D., Liberati, A., Tezlaff, J., and Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *J. Clin. Epidemiol.* 62, 1006–1012. doi: 10.1016/j.jclinepi.2009.06.005

Molla, M. B. (2014). The value of urban green infrastructure and its environmental response in urban ecosystem: a literature review. *Int. J. Environ. Sci.* 4, 89–101.

Nail, S., and Erazo, L. (2018). Waving the green flag for peace. public spaces as peacebuilding places in Colombian cities. *Opera Colombia* 22, 83–103. doi: 10.18601/16578651.n22.05

Ojeda-Revah, L., Ochoa González, Y., and Vera, L. (2020). Fragmented urban greenspace planning in major Mexican municipalities. *J. Urban Plan. Dev.* 146:04020019. doi: 10.1061/(ASCE)UP.1943-5444.0000573

Ordóñez-Barona, C., Devisscher, T., Dobbs, C., Aguilar, L. O., Baptista, M. D., Navarro, N. M., et al. (2020). Trends in urban forestry research in latin America and the Caribbean: a systematic literature review and synthesis. *Urban For. Urban Green.* 47:126544. doi: 10.1016/j.ufug.2019.126544

Pabello, G. M., and Nasupcialy, K. N. N. (2019). Comunalidad y transmodernidad en las Prácticas Organizativas de la Red de Huertos Educativos en México. *Revista Eletrônica de Administração* 25, 203–222. doi: 10.1590/1413-2311.275.97638

Pérez-Medina, S., and López-Falfán, I. (2015). Áreas verdes y arbolado en Mérida, Yucatán. *Hacia una sostenibilidad Urbana. Economía, Sociedad y Territorio* 15, 1–33. doi: 10.22136/est002015552

Pulido-Salas, M. T., Ordóñez Díaz, M. D. J., and Cálix de Dios, H. (2017). Flora, usos y algunas causales de cambio en quince huertos familiares en el municipio de josé maría morelos, quintana roo, México. *Península* 12, 119–145. doi: 10.1016/j.pnsla.2017.01.006

Pullin, A. S., and Stewart, G. B. (2006). Guidelines for systematic review in conservation and environmental management. *Conserv. Biol.* 20, 1647–1656. doi: 10.1111/j.1523-1739.2006.00485.x

Rosol, M. (2012). Community volunteering as neoliberal strategy? Green space production in Berlin. *Antipode* 44, 239–257. doi: 10.1111/j.1467-8330.2011.00861.x

Sánchez, H. Á. (2019). Agricultura urbana y periurbana: reconfiguraciones territoriales y potencialidades en torno a los sistemas alimentarios urbanos. *Investigaciones Geográficas* 98, 1–21. doi: 10.14350/rig.59785

Sanchotene, M. C. C. (1994). Aspects of preservation, maintenance and management of the urban forest in Brazil. *J. Arboric.* 20, 61–67.

Seiwert, A., and Rößler, S. (2020). Understanding the term green infrastructure: origins, rationales, semantic content and purposes as well as its relevance for application in spatial planning. *Land Use Policy* 97:104785. doi: 10.1016/j.landusepol.2020.104785

Serra-Llobet, A., and Hermida, M. A. (2017). Opportunities for green infrastructure under ecuador's new legal framework. *Landsc. Urban Plan* 159, 1–4. doi: 10.1016/j.landurbplan.2016.02.004

Silva-Sánchez, S., and Jacobi, P. R. (2016). Implementation of riverside parks in the city of São paulo – progress and constraints. *Local Environ.* 21, 65–84. doi: 10.1080/13549839.2014.922060

Tan, Z., Lau, K., and Ng, E. (2016). Urban tree design approaches for mitigating daytime urban heat island effects in a high density urban environment. *Energy Build.* 114, 265–274. doi: 10.1016/j.enbuild.2015.06.031

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *Am. J. Eval.* 27, 237–246. doi: 10.1177/1098214005283748

Torres-Lima, P., Lee Pinal, S., and Conway-Gómez, K. (2018). "Adaptive governance for resilience of peri-urban socioecological systems," *in Urban Resilience for Risk and Adaptation Governance: Theory and Practice.* eds G. Brunetta, O. *Caldarice, N. Tollin, M. Rosas-Casals,* and *J. Morató (Cham: Springer*), 43–58.

Tzoulas, K., Korpela, K., Venn, S., Yli-Pelkonen, V., Kazmierczak, A., Niemela, J., et al. (2007). Promoting ecosystem and human health in urban areas using green infrastructure: a literature review. *Landsc. Urban Plan* 81, 167–178. doi: 10.1016/j.landurbplan.2007.02.001

United Nations Department of Economic and Social Affairs (UN DESA). (2018). *World Urbanization Prospects: The 2018 Revision [Key Facts].*

van der Jagt, A., Elands, B., Ambrose-Oji, B., Geroházi, É., Møller, M., and Buizer, M. (2016). Participatory governance of urban green spaces: trends and practices in the EU. *Nordic J. Arch. Res.* 3, 11–40.

Vásquez, A. (2016). Infraestructura verde, servicios ecosistémicos y sus aportes para enfrentar el cambio climático en ciudades: el caso del corredor ribereño del río mapocho en santiago de chile. *Revista de Geografía Norte Grande* 63, 63–86. doi: 10.4067/S0718-34022016000100005

Vásquez, A., Devoto, C., Giannotti, E., and Velásquez, P. (2016). Green infrastructure systems facing fragmented cities in Latin America - case of santiago, Chile. *Procedia Eng.* 161, 1410–1416. doi: 10.1016/j.proeng.2016.08.602

Vásquez, A., Giannotti, E., Galdámez, E., Velásquez, P., and Devoto, C. (2019). "Green infrastructure planning to tackle climate change in Latin American Cities," in *Urban Climates in Latin America,* eds C. Henríquez, and H. Romero (*Cham: Springer*), 329–354. doi: 10.1007/978-3-319-97013-4_13

Vieira, T. A., and Panagopoulos, T. (2020). Urban forestry in Brazilian Amazonia. *Sustainability* 12:3235. doi: 10.3390/su12083235

Visoni, C., and Nagib, G. (2019). Reappropriating urban space through community gardens in Brazil. Field actions science reports. *Spe. Iss.* 20, 88–91.

Wang, J., and Banzhaf, E. (2018). Towards a better understanding of green infrastructure: a critical review. *Ecol. Indic.* 85, 758–772. doi: 10.1016/j.ecolind.2017.09.018

Wekerle, G. R. (2004). Food justice movements: policy, planning and networks. *J. Plan. Educ. Res.* 23, 378–386. doi: 10.1177/0739456X04264886

Yáñez Andrade, J. C., and Deichler, C. (2018). Los huertos obreros y la agricultura familiar. Santiago de Chile: 1930-1945. *Mundo Agrario.* 19:e095. doi: 10.24215/15155994e095

Yang, B., and Li, S. (2013). Green infrastructure design for stormwater runoff and water quality: empirical evidence from large watershed-scale community developments. *Water* 5, 2038–2057. doi: 10.3390/w5042038

Zurbriggen, C. (2011). Gobernanza: una Mirada desde América Latina. *Perfiles Latinoamericanos* 9, 39–64.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.