Ecological Planning in Santiago, Chile. How Far Are We? Classification of Planning Initiatives Based on a Brief Literature Review

Planificación ecológica en Santiago de Chile. ¿Qué tan lejos estamos? Clasificación de iniciativas de planificación territorial basadas en una breve revisión bibliográfica

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Abstract

By the mid-twenty-first century, it is expected that over 65% of the world's population will live in urban areas. The shift will entail the conversion of natural areas into cities. The inclusion of these natural areas poses new challenges for spatial planning that can be addressed in a new approach to spatial planning that incorporates features of the natural environment. This new approach is appropriately called ecological planning. The purpose of this study is to understand the current planning trends in Santiago, capital of Chile, and evaluate how spatial planning initiatives are conducted in relation to concepts inherent to ecological planning. To achieve this, we conducted a general literature review on ecological planning and a study of the planning initiatives developed in Santiago. Our results indicate that urban planning in Santiago has so far focused on three sets of ecological planning concepts. First, within the urban area, there is a set of instruments and initiatives that narrow down the incorporation of ecology to the planning of green areas. The second group–implemented outside the urban area–focuses on planning biodiversity and nature. The third, a broader set of concepts, associates the aforementioned groups to concepts related to landscape ecology. It is not common to find initiatives that promote concepts such as corridors and natural environments to improve quality of life. Instead, there are unincorporated concepts such as resilience, urban infrastructure, sustainability, and climate change. Overall, we believe that the integration of contemporary concepts is needed to implement an ecological planning perspective in Santiago; defining it as an urban region with integrated urban and periurban ecosystems.

Keywords: urban planning, landscape, green spaces, ecosystem services, green infrastructure

Resumen

Para mediados del siglo XXI de espera más del 65% de la población mundial viva en áreas urbanas, situación que requerirá la conversión de áreas naturales en zonas urbanas. La inclusión de estas áreas naturales plantea nuevos desafíos para la planificación territorial que se pueden abordar por un nuevo enfoque que incorpora características del entorno natural. Este nuevo enfoque se denomina planificación ecológica. El objetivo de este estudio es comprender las tendencias de planificación actuales en la ciudad Santiago, capital de Chile, y cómo las iniciativas de planificación territorial se han desarrollan en relación a los conceptos inherentes a la planificación ecológica. Para lograr esto, realizamos una revisión bibliográfica general sobre planificación ecológica y un estudio de las iniciativas de planificación desarrolladas en Santiago. Nuestros resultados indican que la planificación urbana en Santiago se ha centrado en tres conjuntos de conceptos de planificación ecológica. Primero, dentro del área urbana, hay un conjunto de instrumentos e iniciativas que reducen la incorporación de la ecología a la planificación de áreas verdes. El segundo grupo, implementado fuera del área urbana, se enfoca en la planificación de la biodiversidad y la naturaleza. El tercero, un conjunto más amplio de conceptos, asocia los grupos antes mencionados a conceptos relacionados con la ecología del paisaje. No es común encontrar iniciativas que promuevan conceptos como corredores y entornos naturales para mejorar la calidad de vida. En cambio, hay conceptos no incorporados como resiliencia, infraestructura urbana, sustentabilidad y cambio climático. En general, creemos que la incorporación de conceptos contemporáneos es necesaria para poder implementar una planificación con enfoque ecológico en la ciudad de Santiago, ya que lograría comprenderla como una región urbana con ecosistemas urbanos y periurbanos integrados.

Palabras clave: Planificación urbana, paisaje, áreas verdes, servicios ecosistémicos, infraestructuras verdes

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Introduction

Currently more than 50% of the world´s population lives in urban areas and it is expected that in the near future it will most likely continue to grow, exceeding 65% by the mid-twenty-first century (UN 2014). This process will entail the incorporation of natural areas into cities, notwithstanding that global natural resources are limited. As a consequence of humanity's indiscriminate use of natural assets, quality of life in cities is decreasing. This development poses new challenges for modern, fast-growing cities, challenges such as: how to incorporate ecosystem services, how to return man-made areas to nature, and how to interpret contemporary green spaces and green infrastructure. Certainly, these challenges demonstrate our need to make our relationship with nature more symbiotic.

This paper suggests ecological planning as an approach that enriches traditional territorial planning and seeks to improve quality of life in cities by creating territories that reflect and merge both natural and cultural structures and processes (Steiner, 2011). This approach has emerged as a complementary normative instrument for territorial planning with a perspective focused on natural elements in cities, and on the benefits, that these elements could provide to the people living in them. Although there are various perspectives with an ecological scope that describe how to plan territories and urban areas, only some of them are classified as ecological planning.

Spatial or territorial planning initiatives undertaken in urban areas have somehow been influenced by urban trends and approaches rooted in scientific-technical literature. The purpose of this study is, on the one hand, to understand planning trends in Santiago, capital of Chile, and on the other, evaluate how spatial planning initiatives conducted in Santiago, are related to techno-scientific perspectives proposed by scholars. Based on a state-of-the-art examination of ecological-planning this study seeks to understand different fields with scopes that incorporate ecological planning, and hence, understand its influence on Santiago's urban development. To achieve this, a general literature review on ecological planning and a revision of the planning initiatives developed in Santiago was conducted. This revision was done with the aim of answering questions such as whether ecological planning could be a catalyst for profitable and resilient metropolitan development or not.

Ecological Planning

In recent years, interest in incorporating what we have learnt from disciplines related to nature and ecology into urban planning has increased. However, this is not a new idea. Nineteenth-century English-founder of the garden city movement and author of the publication "Garden City of To-morrow: A Peaceful Path to Real Reform" (Howard, 1898) Ebenezer Howard , in his time offered a new vision for urban development where residents could reap the benefits of both town and country (nature). During the same period pioneer-landscape architect Charles Eliot (1859-1897), submitted a radical proposal for the Boston Metropolitan Park System, which incorporated a geological, hydrological, and ecological framework. Yet these visionaries are just two examples of many, however, both are considered invaluable references worth mentioning.

Today, two centuries later, nature and ecology have become relevant components

for solving contemporary issues such as species extinction or climate change. As a result, many disciplines and/or authors have begun to explore these ideas at greater depth. Today, this ecological perspective exhibits an understanding of the environment and sustainability, where the reconstruction of natural landscapes and dynamics is profoundly more scientific (Rossetti, 2009). In this sense, urban parks and gardens are no longer just places of leisure, they have become key elements that can help regulate the urban environment, support biodiversity, and improve human well-being; which means that urban ecosystems cannot function as well as they could in the absence of large parks and reserves (Stott et al., 2015). The discussion stems from an encounter between different perspectives and has consequently led to more in-depth study of the issue. Our understanding of Ecological Planning is that it is an approach that contributes to spatial planning through the diagnosis and acknowledgement of the role of ecological elements in territorial dynamics. It provides guidelines for long-term planning of land use and infrastructure; ensuring the functionality of socio-ecological systems and, thus, the well-being of the people who inhabit it.

Spatial Planning in Santiago, Chile

In the last decades, spatial planning in Chile, more specifically in Santiago, has been driven by market-oriented planning pressures. This has led to a critically detrimental expansion of Santiago at the expense of the surrounding rural and natural areas. Santiago is in one of the world's five Mediterranean climate zones (Forray et al., 2012, De la Barrera & Moreira, 2013) and one of the planet's 34 biodiversity hotspots for conservation priorities (Myers et al., 2000), despite this only 5% of its area is protected (CONAMA, 2005). Concomitantly, it is the most populated urban area in Chile, 40% of 17 million (MacGregor-Fors & Ortega-Álvarez, 2013), and as such, it is highly vulnerable to land use changes that favor development (Díaz et al., 2002). As a result, and due to a lack of strong governance and management, important remnants of native vegetation have been lost (Schulz et al. 2010), there are developments and infrastructure being built on high-risk sites, and the territory has been fragmented.

Even though planning initiatives in Santiago have emphasized the importance of green and open spaces, and later incorporated ecological approaches, they have remained a concern throughout the greater part of the XX century; these ideas have still not been sufficiently taken into account. In fact, the planning process for the extension of Santiago led by Karl Brunner in the 1930s, which established the Plano oficial de urbanización de la comuna de Santiago, 1939 (official zoning plan for the urbanization of the municipality of Santiago 1939), proposed green areas and open spaces inside the city which joined with the surrounding landscape for sanitary and recreational purposes. Afterwards, during the urban planning initiatives of the 50s-60's, which in turn gave place to the Plan Regulador Intercomunal de Santiago (PRIS, The Inter-Comunal Regulation Plan for Santiago), urban development was considered a part of a regional system where ecological approaches were the centre of focus. Concepts like ecological matrixes, protected ecological and biological corridors, were included. The idea behind these concerns was the increase and diversification of green patches in urban space connecting with agricultural and natural matrixes surrounding the city (Pavez, 2009).

From the mid-1970s until the late 1980s government administrated real-estate development was market driven, and the role of spatial planning was drastically reduced, leaving out all together the design and implementation of green spaces. Under the principle that there was available land in the outskirts of the city, deregulation of land policies led to the disappearance of spatial planning and green space in urban planning, instead making way for an unprecedented consumption of agricultural and natural zones surrounding the urban area. Even if in the 1990s planning instruments trended toward controlling urban expansion, ecological issues came second in Santiago and the region´s urbanization processes.

Urban planning in the Metropolitan Area is currently carried out by various government agencies at two administrative levels: regional and local. The fragmentation of urban planning is due to two reasons: first, Chile lacks an integrated urban planning system, yet it has numerous fragmented regulations dispersed among the public agencies that govern it (Precht et al. 2016). Secondly, the Metropolitan area does not correspond to an administrative level (it is neither a Region, Province or Commune), so there is no metropolitan authority. Planning decisions are made at the regional and municipal (commune) level.

The PRMS (Plan Regulador Metropolitano de Santiago or Regional Metropolitan Regulation Plan for Santiago) is the only comprehensive planning instrument. This plan was created by the Regional Secretariat of Housing and Urbanism (SEREMI-MINVU its Spanish acronym), and applies to the entire Metropolitan Region (figure 1). The PRMS establishes zoning regulations, determines land-use, and sets the technical regulations for buildings. It also defines which areas are appropriate for urban expansion.

It is a binding instrument, and as such, all construction and urbanization projects must apply for a building permit granted by the SEREMI-MINVU after certifying that the project fulfils all of the conditions established in the PRMS. In addition, each municipality forming part the metropolitan area must have a local planning instrument called Plan Regulador Comunal (Municipal Land Use Plan), which establishes more detailed regulations for urban zones inside the respective administrative boundaries.

The PRMS also sets urban limits defining what are and are not urban areas. The latter are consequently defined as rural areas. Given municipalities are restricted to only plan urban areas, they are not able to manage or even regulate many of the uses for land present in rural areas, such as dispersed housing and industrial activities. The local government elaborates the municipal plan; as a result, there are 34 Municipal Land Use Plans in the AMS, with different planning objectives and very diverse considerations regarding ecological or sustainable development planning principles.

There are various spatial planning initiatives that operate in Santiago. The Política Regional de Áreas Verdes (Regional Government Policy for Green Spaces) is one of them, and it has established guidelines for green spaces, defining their amount and spatial distribution for the entire Metropolitan Region. Another case is the Estrategia Regional para la Conservación de la Biodiversidad (Regional Strategy for the Conservation of Biodiversity) which designates Priority Sites for Biodiversity Conservation within the region. The initiative determines whether public-land areas should or should not be

classified as protected, but even despite its protection mechanisms they are simply not as strong as those provided in official natural protected areas. These instruments are complementary to the PRMS, but due to the lack of any formal coordination, they are not always coherent.

The multiple changes that have affected spatial planning instruments and policies in Santiago coincide with a dynamic history of territorial and economical changes, making Santiago an interesting case study, where neoliberal policies have had a great impact on the territory.

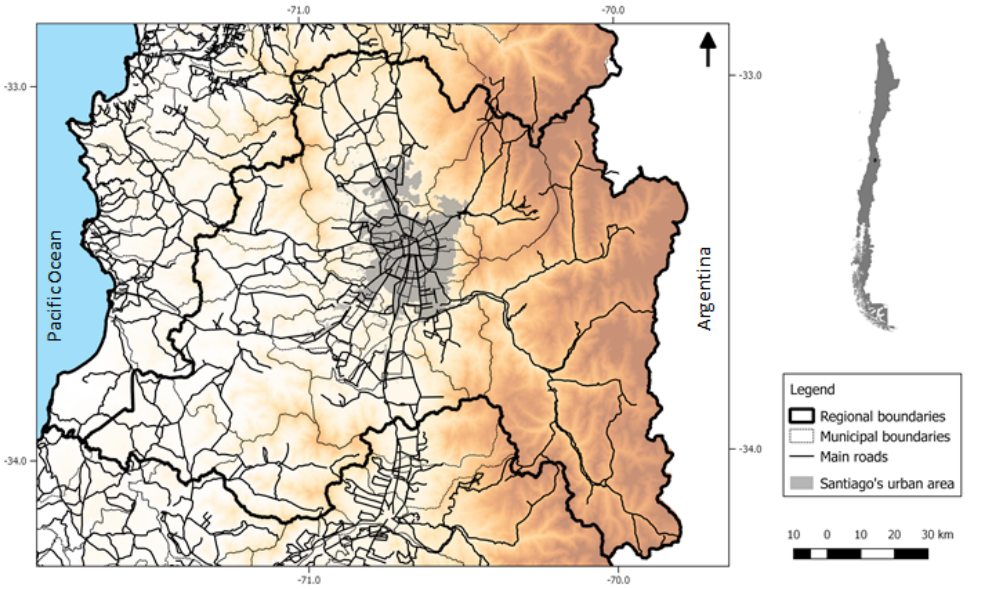

Figure 1. Administrative division of the Santiago Metropolitan Region. Source: Own elaboration (2017)

Figura 1. División político administrativa de la Región Metropolitana de Santiago. Fuente: Elaboración propia (2017)

To date, urban planners and decision makers have been working on solving territorial fragmentation, brought about by significant economic changes in the 80's and 90's, by designing new ecological plans that could revert the loss of native vegetation, and increase the amount of green areas; however these new urban policies have not been enough. Regulatory laws in Santiago have been enacted to control the city's expansion. However, considering its rapid expansion, the solution goes beyond containing Santiago's growth; it should instead focus on resilient development. Indeed, Santiago has a low ratio of green spaces per inhabitant, between 3 and 6 m2 of green space per person, compared to developed countries (20m2 according Wang, 2009). In addition, these open spaces are unequally distributed within the urban area (Forray et al., 2012); in many cases, they are of low quality with limited accessibility given they are isolated within the urban fabric. The result is increasing environmental and social inequities, ecological fragmentation, poor quality of life, and vulnerability. Nevertheless, in spite of a fairly advanced state of degradation in some areas, there is still time to prevent further damage.

In this sense, the idea of incorporating concepts related to ecological planning into urban planning for Santiago, and hence, exploring the idea of ecological planning as a catalyst for resilient metropolitan development, seems like the right path to take.

Methods and materials

This study seeks to evaluate concepts of ecological planning and, how spatial planning initiatives have incorporated them. To achieve this, a set of papers were selected for extraction of concepts associated with ecological planning and detailed analysis. They included techno scientific sources (articles and books), government reports and policy proposals with an ecological scope. The scope of the selection covered as much literature as possible so as to achieve a complete review and a thorough understanding of the issue. The reviewed literature was selected by author and said authors were the key creators of several approaches such as: Urban Ecology, Landscape Ecology, Green Urbanism, Landscape Architecture, Green Infrastructure, Resilience, Regional/Territorial Planning, Environmental Planning, Landscape Conservation, Landscape and Urban Planning and Government reports and policy proposal. With this selection, we exhausted search options (using Google Scholar) for concepts to the point of redundancy, i.e. no new concepts will emerge as relevant if new papers are included. After this literature review, 39 papers and 24 of the most relevant instrumental and territorial-planning initiatives for Santiago were used for the following analyses.

On the basis of these 39 papers and 24 initiatives the researchers extracted the concepts associated with ecological planning (e.g. green spaces, ecological corridors, ecosystems, land use, etc.) to identify the most common conceptual links between texts. The objective of the cluster analysis was to get an impression of urban planning trends in Santiago and understand how the concepts extracted from all the documents clustered into groups. To achieve this, researchers created a matrix for the concepts and documents. In order to create a database useful in statistical analysis, concepts repeated in 10 or more documents were kept, and documents containing less than 5 of the aforementioned concepts were not considered in the analysis.

Table 1
Example matrix of analysed documents. Source: Own elaboration (2017)

Tabla 1
Matriz ejemplo de documentos analizados. Fuente: Elaboración propia (2017)

	Concept 1	**…**	**Concept n**
Document 1	1	0	1
…	1	1	0
Document n	0	1	0

Employing concepts as variables, a k-means cluster analysis was used to group the documents with the highest number of concepts in common. As a result, each document was assigned to a group of associated concepts. Subsequently, a hierarchical cluster analysis based on the grouping distances was performed to interpret the relationship between documents. For a concept to belong to a group the cluster´s centre value had to be greater than 0.7. A similar analysis was performed by Meerow et al. (2016) using exclusively Elsevier's Scopus and Thompson Reuters Web of Science (WoS) citation databases.

Results

From an initial list of 39 techno scientific papers and 24 initiatives, 29 papers and 12 initiatives (table 2) were classified into clusters. These clusters were constructed using 25 concepts as variables. These are**:** biodiversity, climate change, corridors, design, ecology, ecosystems, ecosystem services, habitats, green infrastructure, green spaces, landscape, landscape ecology, land use, natural environment, natural resources, nature, parks, planning, quality of life, urban areas, urban ecosystem, urbanization, resilience, system, and sustainability.

Table 2

List of selected literature for cluster analyses. Source: Own elaboration (2017)

Tabla 2

Lista de la literatura seleccionada para el análisis clúster. Fuente: Elaboración propia (2017)

N	Reference	N	Reference
1	Cadenasso & Pickett (2008)	22	MMA-Colombia (1998)
2	Forman (2014)	23	Williams (2011)
3	Forman (2008)	24	McKinney et al. (2010)
4	Macgregor-Fors & Ortega-Álvarez (2013)	25	Bonsignore (2003)
5	Grimm & Redman (2004)	26	Chiesura (2004)
6	Niemelä et al. (2011)	27	European Commission (1990)
7	Niemelä (1999)	28	HM Government (2011a)
8	Stott et al. (2015)	29	HM Government (2011b)
9	Pickett et al. (2001)	30	GORE-RMS (2011)
10	Forman (2004)	31	MMA-Chile (2011)
11	Forman & Godron (1986)	32	CONAMA RM (2004)
12	Romero & Vásquez (2005)	33	GORE-RM (2014)
13	Botequilha-Leitão, 2012 (= T35 and T45)	34	CPP-UC (2015)
14	Lehmann (2010)	35	MINVU (2014)
15	McHarg & Mumford (1969)	36	MINVU (2013)
16	Spirn (1985)	37	CPP-UC (2011)
17	Mayor of London (2014)	38	MINVU (2016)
18	Mayor of London (2011)	39	MINVU (1998)
19	Alberti & Marzluff (2004)	40	MINSEGPRES-Chile (1994)
20	Spirn (2011)	41	Ilustre Municipalidad de La Reina (2014)
21	Andrade et al. (2007)		

The k-means cluster analysis resulted in ten groups (i.e. cluster with centre values > 0.7). Then, interpretation of the hierarchical cluster analysis (figure 2) led to the identification of five different groups of papers and initiatives based on the most common concepts. Figure 2 is tagged with the codes presented in table 2. A diagram (figure 3) was drawn up to facilitate reading the results.

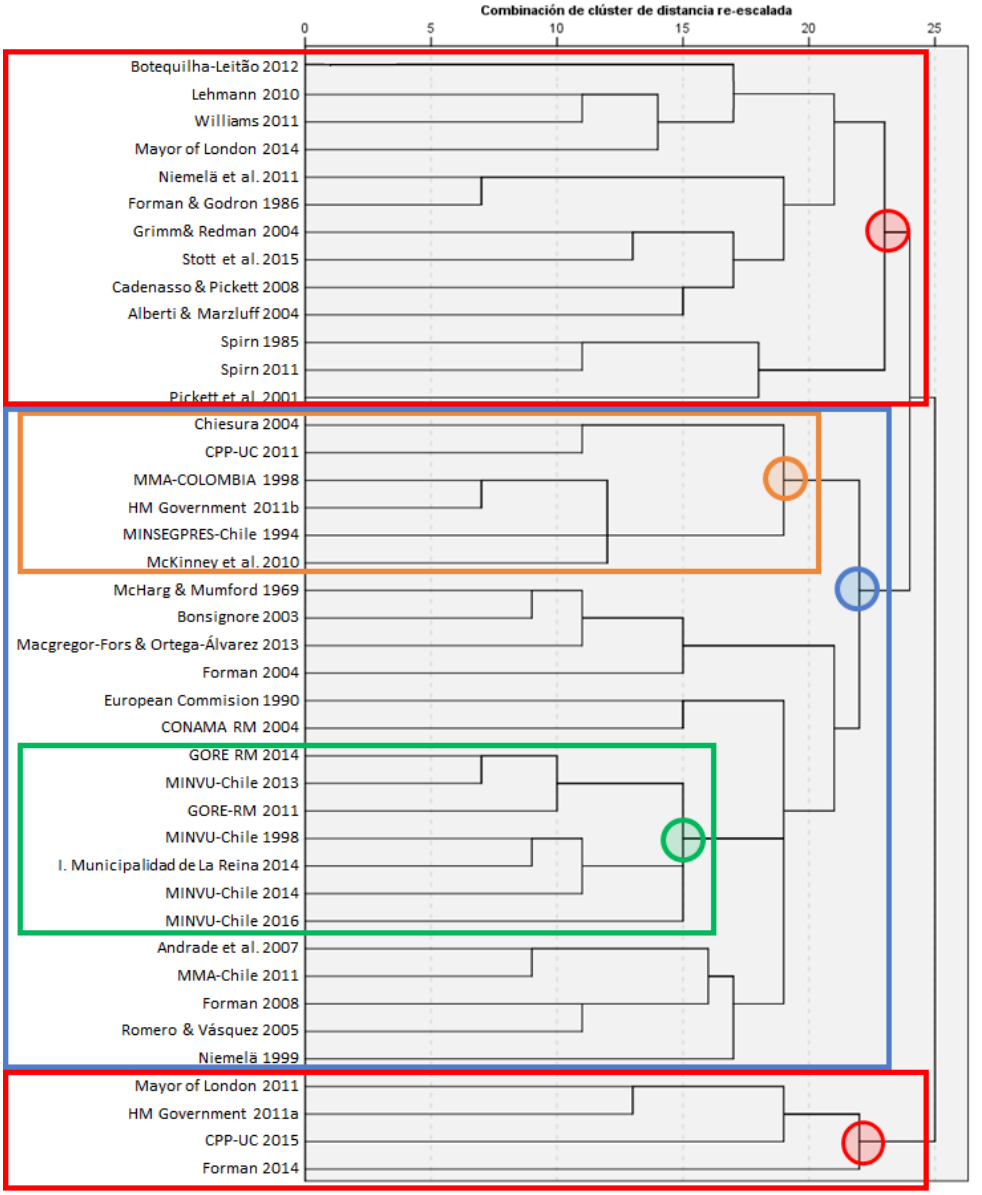

Figure 2. Hierarchical clustering of scientific papers and initiatives based on the most common concepts. Numbers in the vertical axis (x-axis) indicate the coding of the analysed document, grouping joined clusters. Coloured circles and boxes were used to build figure 3. Horizontal axis (y-axis) represents the level of clustering (rescaled distance cluster combine) of the dendrogram. Source: Own elaboration (2017)

Figura 2. Agrupamiento jerárquico de los documentos científicos e iniciativas en base a los conceptos más comunes. Los números en el eje vertical (eje x) indican la codificación del documento analizado, agrupando los clústeres unidos. Se usaron círculos de colores y cajas para construir la figura 3. El eje horizontal (eje y) representa el nivel de agrupamiento (combinación de clúster de distancia re-escalada) del dendrograma. Fuente: Elaboración propia (2017)

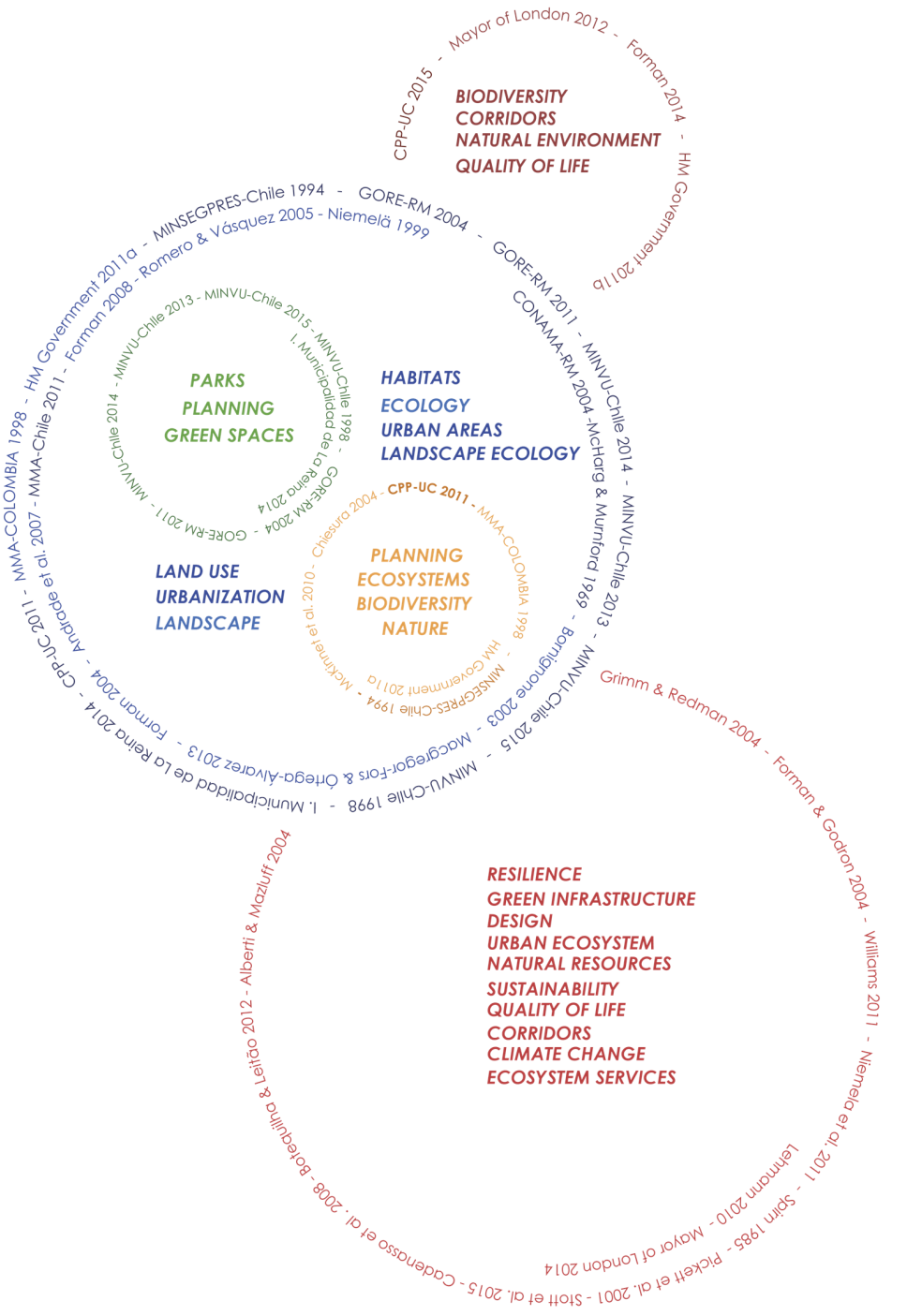

Figure 3. Graphical diagram. Association of concepts used in the analysed techno scientific papers and initiatives for Santiago de Chile. Source: Own elaboration (2017)

Figura 3. Diagrama gráfico. Asociación de los conceptos utilizados en los documentos científicos e iniciativas tecnológicas analizadas para Santiago de Chile. Fuente: Elaboración propia (2017)

The analysis of the y-axis of the hierarchical dendrogram shows that the association between documents analysed in this review was tenuous (value lower than 25), however, it can be pointed out that:

Based on the concepts used in the review and their relationship with the previously analysed techno scientific articles, the planning initiatives associated with ecological planning can be organised into 3 groups. Two are different, and a third one integrates both given it contains some of the shared concepts in both groups but at a lower clustering coefficient. Firstly, the majority of the planning initiatives (7 of 12) form a homogenous group (or cluster) and have little relation with the techno scientific literature. The most important concepts within these initiatives are: parks, planning and green spaces; which are associated with the planning of parks and green areas. These initiatives are: GORE-RMS (2011, 2014), MINVU-Chile (1998, 2013, 2014, 2016) and the Ilustre Municipalidad de La Reina (Illustrious Municipality of La Reina) (2014). Secondly, two of the initiatives (CPP-UC, 2011) and MINSEGPRES-Chile (1994) are closely associated with three papers (Chiesura, 2004; MMA-Colombia, 1998 and HM Government, 2011a) and relate only slightly with the paper written by McKinney et al. (2010). The analysis showed that the strongest concepts in this group were: ecosystems, biodiversity, nature, and planning. These concepts are associated with topics related to nature and biodiversity in the city; in other words, they relate to the most biological issues in the urban area. Finally, the third group linked the previously mentioned Santiago planning initiatives plus two other initiatives (CONAMA RM, 2004 and MMA-Chile, 2011) to 8 other papers, but at a lower degree of clustering (higher rescaled distance cluster) while integrating the first two groups. The papers are: McHarg & Mumford (1969), Bonsignore (2003), Forman (2004, 2008), European Commission (1990), Andrade et al. (2007), Romero & Vásquez (2005), and Niemelä (1999). These articles offer the following concepts: habitats, ecology, landscape, landscape ecology, land use, urbanization, urban areas; they include two new concepts: landscape and urbanization.

A set of 13 other papers have almost no relationship with the analysed planning initiatives and were classed into a separate group with a low level of clustering. This means that the following concepts: resilience, green infrastructure, design, urban ecosystem, natural resources, sustainability, quality of life, corridors, climate change, ecosystem services – named in those papers– are absent or rarely found in these initiatives. These papers are: Cadenasso & Pickett (2008), Grimm & Redman (2004), Niemelä et al. (2011), Stott et al. (2015), Pickett et al. (2001), Forman & Godron (1986), Botequilha-Leitão (2012), Lehmann (2010), Spirn (1985), Mayor of London (2014), Alberti & Marzluff (2004), Spirn (2011), Williams (2011), Mayor of London (2011), HM Government (2011b) and Forman (2014).

Moreover, it is worth pointing out that more than half of the planning initiatives have been left out of the concept analysis due to the low incidence of the

aforementioned concepts. However, these initiatives seem to be closer to the group that contains the following concepts: ecosystems, biodiversity, nature, and planning, where most of the initiatives are grouped.

Discussion

Literature review

In general, the revised literature, and hence the different approaches, sought to improve cities´ ecological quality. Many of them (MacGregor-Fors & Ortega-Álvarez, 2013; Lehman, 2010; among others) recommend the creation of integral plans with holistic environmental and social sustainability; of necessity, these require the incorporation of multi-dimensional approaches and multidisciplinary teams. Some argue that it is necessary to restore ecological processes, ensure the supply of basic ecosystem services for economic and social development, prevent disasters and ensure the maintenance of biological and cultural diversity (MMA-Colombia, 1998). Others delve still further into how to achieve this objective. For instance, the work of Stott et al. (2015) demonstrates that land sparing is crucial for sustaining ecosystem services and that it may also be necessary to ensure people receive benefits from urban green spaces.

Climate change, desertification and air pollution, are some of the many problems that cities are facing today. These issues cannot be confronted on a local scale; large connected ecosystems need to be protected to make them more resilient in the long term. Moreover, Williams (2011) suggests that protecting bigger places will sustain more species, and, the fragmentation of habitat into smaller islands is the leading cause of species decline and loss.

The general literature review revealed that Colombia is one of the most advanced Latin American countries in ecological planning and has developed various plans such as the Plan estratégico para la restauración y el establecimiento de bosques en Colombia: plan verde (MMA-COLOMBIA, 1998); Strategic Plan for Ecological Restoration and Forest Foundations in Colombia: The Green Plan; and the Estructura ecológica principal y áreas protegidas de Bogotá Andrade et al. 2007; Main Ecological Structure and Protected Areas of Bogota to achieve sustainable development.

Furthermore, after reviewing Santiago´s planning initiatives, it can be concluded that, until now, Chile´s urban planning approach has focused little on ecology. Indeed, decision makers and urban planners have only delved deeper into this approach in the last 10 to 20 years.

Although the discarded texts, techno scientific papers and planning initiatives, were not selected for the analysis, they did have some of the selected concepts and could have been part of the three aforementioned groups. Some could have been part of the planning of green spaces and landscape ecology groups, even part of the cluster where no planning initiatives classified (see table 3 for details). The same happens with other new plans or instruments as the new Plan de adaptación al cambio climático para ciudades (Plan for the adaptation of cities to climate change) or Santiago Humano y Resiliente (Human and Resilient Santiago).

Table 3
Discarded texts because not enough cases of concepts

Tabla 3
Textos descartados porque no hay suficientes conceptos

N	References	Concepts	Related groups
1	Mathur & Da Cunha (2001)	landscape, ecology, dynamic landscape, natural disaster	3
2	Rossetti (2009)	landscape, sustainability, landscape architecture, naturalism, humanism, territoriality, abstraction, historical memory, cultural memory, phenomenology, environmental variables, social variables, political variables, urban variables, economic variables	3,4
3	Hough (2004)	urban climate, urban liveability, city's energy, urban environments, non-urban environments, urban heat islands, macro-climate moderated by landform, plant metabolism, vegetation, water, green lungs, energy conservation, natural climatic control, healthy climates, biological diversity, urban processes, natural processes, local scale	-
4	Regional Plan Association (2015) Spatial Planning and Inequality Fourth Regional Plan Rountable: White Paper	quality of life, Regional plan, natural environment, built environment, climate-resilient region, environmentally sustainable region, income inequality, economic segregation, racial segregation, spatial analysis, social equity, livable neighborhood, vulnerability, resilient built systems, resilient natural systems	4
5	Council of Environmental Quality Executive Office of the President. (2007)	Environmental policies, human environment, environmental assessment, environmental impact assessment	-
6	Rodiek (2009)	landscape, urban planning, low impact development, LID, stormwater management, SWM, Combined sewer overflows, CSO, low impact development rapid assessment, LIDRA, Green roofs, porous pavement, stormwater treatment wetland scheme	3
7	Howard (1965)	planning, garden cities,	1
8	Reyes (2013)	Green corridor, park system, urban sustainability, green areas, landscapes, plaza, green continuity, social movement, park hills, green mass continuity	1,3
9	Commission of the European Comunities & European Space Agency (2003)	land use planning, nature, policies, environmental protection, sustainable development, space technologies	1,2,3
10	Comisión Europea. (2013)	resilience, natural disaster, anthropogenic disaster	4

N	Code	References	Concepts	Related groups
11	I2	GORE-RMS (2004)	green areas, planned urban parks, plazas, parks, region, carbon credits	1
12	I5	Reyes (2007)	green areas, resilience, fragmentation of landscape structures, ecosystem services, quality of life, fragmentation of ecosystems, sustainable development, ecology, biodiversity, natural resources, territory, territorial occupation, urban sprawl, ecological, sustainable territorial approach, urban bioregion, landscape ecology, regional scope, territorial system, strategic network integrated, territorial planning, territorial identity , urban growth, rural areas, natural areas, urban space, decentralized territorial development, sustainable territorial development, rural landscapes, natural landscapes, globalization, urban limit, environmental development, landscape, cultural identity, protected areas, territorial equity, polycentric regions, natural environment, renaturing degraded environmental systems, ecological networks, territorial mosaic, geography, territorial perspective, ecological functions, spatial analysis, ecosystem, ecological support structure, land management, policies, management of ecological connectivity, regional scale , patches of vegetation, corridors, landscape connectivity, landscape diversity, complexity, landscape multifunctionality, territorial management, synergetic approach, environmental value, landscape value, metropolitan parks, intercommunal parks	1,2,3,4
13	I7	MINSEGPRES-Chile (2009)	air quality, environmental quality, environmental management, environmental education, instruments for environmental management, territorial planning, territorial environmental objectives, strategic environmental assessment.	-
14	I11	SUBDERE-Chile (2011)	landscape impacts, sustainable development, urban areas, sustainable development of the territory, territorial management, planning instruments, territorial, regional processes, ecological, ecological, regional territory, rural analysis, urban analysis, spatial structure, cultural heritage, natural heritage, territory, order the territory, territorial equity, land management, geographical conditions, territorial processes, regional planning, territorial systems, regional cooperation, territorial integration, territorial domains, geographical parts, territorial units, region, structures, networks	3,4

N	Code	References	Concepts	Related groups
15	I12	Contreras-Alonso et al. (2005)	ecological corridors, green areas, quality of life, sustainable development, green corridors, territorial planning, social inequalities, region, regional ecological planning, public policy, interdisciplinary approach, balanced development, natural risk areas, natural areas, territorial balance, social equity, ecological planning, preservation areas, island hills, intra-urban green corridors	1,4
16	I14	MINVU-Chile (2015)	parks, public space, urban planning, instrument of urban planning, geographic area, unplanned territories, territorial planning, national urban planning, regional urban planning, intercommunal urban planning, intercommunal plan, communal urban planning, territory, communal territory, urban limit, rural areas, urban territory.	1
17	I18	MINDES, Chile & MINAGRI, Chile (2014)	quality of life, sustainability, plants, tree planting, native species	4
18	I19	PROTEGE (1993)	quality of life, biodiversity, ecological, ecosystem, conserve, ecological reserve, natural park, environmental protection, environmental education, outdoor life, flora, fauna	2,4
19	I20	SUBDERE-Chile (2006)	territory, communal plan, regional plan, national plan, natural disasters, environmental standards, environment, planning, citizen participation, territorial character.	-
20	I21	SUBDERE-Chile, 2005	land use planning instruments, region, territory, regional governments, natural disasters, national territory, regional land use plan, Regional Plan for Urban Development, Spatial planning, comprehensive development, harmonious development, protection, conservation, environment, rural, regional instruments, environmental regulations, territorial framework for regional planning system, territorial planning, regional council, regional regulations	3
21	I22	Ministerio de Tierras y Colonización, 2008	landscape, tree species, conservation, forest reserves, national parks, sanitation, plantations, woodlands, native shrubs	3
22	I23	MINAGRI-Chile, 2014	landscapes, natural ecological diversity, natural hydrological systems, natural scenic resources, natural environment, wilderness reserves, national parks, natural monuments, national reserves, preservation, restoration, natural environment, natural resources, conservation, protection, heritage.	3

Successful implementation of a territorial/ regional spatial plan for cities should be associated with local execution, and Chile has failed in this regard. Although the intention has been to increase the amount of green areas, their quantity, quality, and accessibility have not been the most appropriate to supply the deficit of green areas; due to the lack of formal coordination procedures. In this sense, the London Infrastructure Plan 2050 (Mayor of London, 2014) and the London Green Grid (Mayor of London, 2011) are fine examples and worthy references to take into account. With plans to incorporate 9,000 ha of accessible green space the first seeks to create a strategic network of green infrastructure. It will be regarded as vital to the capital's economy, affording benefits that cannot be provided by other infrastructure and services that can be delivered more efficiently and more sustainably (Mayor of London, 2014). The second seeks to look at London's green spaces in a joined-up way, making sure the contribution they make to the quality of life, to the environment and to the economy are maximized (Mayor of London, 2011). It starts by recognising that the best way to value and manage green infrastructure is to see it as a network that spreads across the city (Mayor of London, 2011). The objective of this approach is to strategically plan and manage networks of natural and cultural landscapes and open spaces so as to conserve ecosystem functioning and provide a range of benefits such as flood control, cooling urban environments, air purification, local food production; and to promote sport and leisure, ensure space for fauna and flora, provide connection, encouraging walking, cycling, showcase the landscape and support the local economy for people and cities (Mayor of London, 2011).

Both international cases previously mentioned (Bogota and London) have been successful because they have a metropolitan authority that not only coordinates, but also plans big and complex cities that include ecological planning.

Concept analysis

In a nutshell, the analysed planning initiatives can be classified into three big groups of concepts. The first group is oriented on planning urban parks and green spaces; most initiatives fall in this group. A second group is associated with planning biodiversity, nature, and ecosystems. The third group is linked to landscape ecology, and contains concepts such as habitat, ecology, landscape, land use, and urbanization. Of the three the last two groups relate to only a few planning initiatives. Lastly, the fourth group lists concepts that have no relation with the planning initiatives. These concepts are: resilience, green infrastructure, design, urban ecosystems, natural resources, sustainability, quality of life, corridors, climate change and ecosystem services.

The chosen literature was an attempt to cover different key authors representing different approaches to ecological planning. However, the concept analysis demonstrated that even though certain authors are grouped into different perspectives, in some cases, boundaries are not as clear as we thought. For example, the studies of urban and landscape conducted by ecologist Richard Forman we analysed can be classified under different concept clusters (Forman 2004, 2008, 2014; Forman & Godron 1986). The same is true for the work of landscape architect Anne Whiston Spirn that can be classified under approaches oriented on Landscape Architecture and Resilience. In the same way, many concepts are used in a lot of the aforementioned approaches; bringing different disciplines closer.

The concept analysis demonstrated that planning initiatives in Chile are clearly concerned with incorporating urban parks and green spaces within the urban area of Santiago, therefore it is understood that they are considered necessary to reach suitable quality of life in cities.
Fortunately, concepts such as ecosystems,

biodiversity, nature, and planning, are present within some of Santiago´s planning initiatives (CPP-UC, 2011 and MINSEGPRES-Chile, 1994), both the aforementioned linked to environmental plans developed by the government.

Other concepts such as ecology, landscape ecology, urbanization, and land use, among others, have begun to subtly appear in planning initiates. It is important to point out that the concept of ecology is not only applied at a local scale, but at a regional scale too.

However, recent concepts like resilience, green infrastructure, urban ecosystem, climate change, ecosystem services, corridors or others related to people´s well-being such as sustainability and quality of life are rarely found in these initiatives. In many documents these concepts are used without fully understanding or developing them. A potential explanation could be that disciplines that study and have delved deeper into these concepts and their usefulness in urban planning, progress faster than government systems. These government systems need more time to discuss them, to be convinced, and to draft legal and administrative agreements. In addition, the lack of resources makes it difficult to design better urban planning instruments based on scientific studies; instruments capable of including ecological planning approaches.

The lack of official communication between the different agencies involved in city planning also plays an important role in conjunction with a general poor attitude and lack of political willingness to actually plan the city.

Conclusions

For the question of how far has Santiago advanced in implementing an ecological planning perspective? We can affirm that various ecological approaches, at different levels of intensity, have been incorporated. We can also say that these approaches are complementary and that they have been gradually evolving.

In this sense, the first ecological planning perspective for Santiago focused on urban green spaces, and the second on conservation of biodiversity around the city; both perspectives have been executed by the PRMS, the planning instrument proposed for Santiago.

Although a metropolitan system of green spaces has been defined, it lacks true systemic vision and, in practice, it consists of a disjointed sum of green spaces dispersed throughout the urban area that fails to form a real system (or a network) that could be recognized as such. Their spatial distribution has no relation to water movement or urban microclimatic conditions, although both are critical environmental issues in Santiago.

The third ecological planning perspective introduced concepts of landscape ecology to facilitate connections among valuable landscape elements; elements such as habitats for flora and fauna, but it has only been developed recently, and poorly at that. Urban planning instruments do not contain concepts related to landscape ecology. For example, the concept of connectivity is only used in reference to transport infrastructure. In contrast, some plans and strategies for rural areas, such as the Biodiversity Conservation Plan, refer to connectivity between ecosystems but barely refer to urban ecosystems. This may be a case of institutional fragmentation reinforcing landscape fragmentation.

Finally, the last perspective is the most complex and least developed in Santiago´s planning initiatives. It is intended as a form of city planning based on the structure and/or the normative use of urban and peri-urban elements. But it's a perspective that strives to interpret the urban ecosystem and its surroundings as elements to plan and

design grounded in processes that go beyond the proper spatial distribution of land use. Instead of green spaces it suggests focusing on green infrastructure. It also argues that natural resources should be planned and managed to provide ecosystem services, and as a result make them more resilient and adaptable to hazards caused by climate change.

In sum, solid ecological planning should include a proper network of green infrastructure (urban parks, green spaces, natural parks and natural elements within the city that are closely related to rural environments) to preserve regional biodiversity. Its premise should consider sustainability through the provision of ecosystem services, and therefore urban planning and design capable of integrating nature and society that ultimately bolsters resilience and increases quality of life.

Chile is on route to leading the discussion on how to implement ecological planning in Latin America. This is mainly because of great efforts made to create new urban parks, the existence of consolidated research groups, and the new spatial planning perspectives under discussion in the country.

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