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# Landscapes and Identities in Transformation: Co-creation for Sustainable Territorial Planning in Pichilemu, Chile

## Abstract

In Chile, intermediate coastal cities face rapid changes driven by tourism, agricultural exploitation, and infrastructure development, often surpassing the capacity of regulatory frameworks and threatening ecological assets. This article analyzes Pichilemu, a coastal urban-rural municipality, to explore how green infrastructure (GI) planning can be co-created with local communities to enhance social cohesion and promote sustainable territorial development. The research uses qualitative and participatory methods, including residents' perceptions of the natural and cultural landscape. Findings show that local communities value ecological and aesthetic aspects of their environment and are genuinely willing to participate in long-term planning processes. The study demonstrates that participatory GI planning can offer practical solutions for territorial re-configuration in vulnerable urban-rural settings. It argues that successful participatory ecological planning requires adapting actions to territorial characteristics and community dynamics, defining roles, methods, and logistics that ensure equity and sustainability. This case contributes to the growing international discussion on GI implementation in intermediate cities, emphasizing the importance of co-creation to align ecological sustainability with local identity.

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## Keywords:

co-creation, citizen participation, participatory ecological planning, green infrastructure

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## 1 Introduction

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Over the past forty years, Chilean coastal cities have undergone dramatic transformations in their spatial configuration. Accelerated urbanization, agricultural exploitation, and tourism development have produced fragmented and disconnected urban landscapes. These processes not only outpace institutional and regulatory frameworks but also undermine ecological systems essential for providing ecosystem services, jeopardizing the long-term sustainability of settlements (Aguilera et al., 2020).

The lack of territorial management and planning by law (Márquez & Veloso, 2020) has resulted in deteriorated, constrained, and fragmented urban landscapes, particularly in coastal cities. The urban fabric does not recognize the urban-rural link with inner rural localities, which appear underdeveloped in comparison to the coastal tourist zone. Putting aside large metropolitan areas such as Greater Santiago, composed of 48 municipalities, the urban-rural relationship in single municipalities, which includes cities, small towns, and villages, becomes problematic as regulatory and planning instruments focused on urban areas are unable to adequately safeguard environmental assets and fragile ecosystems beyond the urban limit. Although Chile has had a National Coastal Border Use Policy since 1994, not all regions have their Coastal Border Zoning approved, and still, these policies do not cover inner rural areas.

Although intermediate cities have been historically underestimated in centralized contexts like Chile (Maturana & Rojas, 2015; Bolay & Rabinovich, 2004), the city scale has recently gained importance in the national urban system, providing opportunities to develop new ecological planning instruments through community engagement to protect environmental assets, particularly in places with high ecological value and subject to intense tourism-driven change, such as Pichilemu.

In this scenario, the co-creation of green infrastructure plans, both for its development and maintenance to ensure its sustainability (Vásquez, 2016), through a broad and continuous citizen participation process appears as an opportunity to address

development in urban-rural contexts. Green Infrastructure is a multifunctional tool that provides ecological, economic, and social services to people by conserving the environments that make life possible in the territory (Van der Jagt et al., 2019). It is also a process of collective interest and results in which municipalities, as the local space of encounters, can play a key role to run green infrastructure plans in coordination with traditional master planning. This study, focused on the urban-rural municipality of Pichilemu, highlights the importance of green infrastructure planning as an innovative approach to reconcile ecosystem health and community well-being (Hellmund & Smith, 2006), through participatory ecological planning.

This article aims to demonstrate that continuous and meaningful citizen participation is a key component of effective sustainable territorial planning in urban-rural contexts. Through a process of co-creation between the municipality of Pichilemu, local communities, and the support of the academia, the development of the city's green infrastructure plan reflects positive outcomes such as strengthening democratic processes in planning, ensuring social demands, ecological protection, and territorial identity are integrated into the GI proposal. The research highlights how co-created processes can address socio-environmental vulnerabilities in intermediate coastal cities, offering lessons for territorial planning beyond the Chilean context.

Pichilemu is located in the central coastal zone of Chile in the O'Higgins Region and represents a paradigmatic case of an "urban-rural coastal city", where urban functions coexist with agricultural activities and rural settlements, while simultaneously facing pressures associated with being a touristic coastal destination (Vásquez, 2016). Such hybrid characteristics increase exposure to socio-environmental vulnerabilities, including climate risks, land-use conflicts, and social inequalities. Pichilemu has an area of 749.1 km<sup>2</sup> and a population of 19,847 inhabitants, with a density of 26.5 inhabitants per km<sup>2</sup>. Around 21% of the population lives in rural areas (INE, 2024). The municipality is composed by the city of Pichilemu, next to the locality of Punta de Lobos, known as the 'Chilean Capital of Surf', and rural

towns such as Cahuil and Bulalemu According to the Ministry of Tourism, Pichilemu is one of the most visited municipalities by Chilean tourists.

The project unfolded in four major stages, with community participation and validation at its core. The first stage involved creating a shared diagnosis, where information about the territory was collected with the community through repeated workshops. In the second stage, a Strategic Development Plan (SDP) aimed to answer a key question: What is the fundamental idea that should guide Pichilemu's planning and territorial organization? It represents the collective effort to shape Pichilemu's future image, including objectives, guidelines, and strategies to steer the town's future territorial management. Using a collaborative design approach, the third stage involved developing a Green Infrastructure Plan (GIP), which serves as the operational instrument composed of key spatial initiatives and concrete projects designed to achieve the SDP's goals within a flexible timeframe. The GIP aims to promote balanced development of rural and urban areas, reconnect the urban fabric, and protect and provide access to valuable ecosystems. Finally, in the fourth stage, two strategic projects were collaboratively designed with the community to serve as pilots for implementation within the municipality.

In addition to the introduction, a theoretical framework is provided regarding community participation and green infrastructure co-creation. Then, the article elaborates on the methodological process of participation implemented in Pichilemu, Chile, highlighting the structure, steps, and processes involved in community engagement for the development of the Green Infrastructure Plan. After that, results are presented, showing how the participative process becomes materialized in projects and initiatives. Finally, the article presents conclusions regarding the process and the methods employed.

## 2 Assessing participatory urban planning for green infrastructure development

Citizen participation is a fundamental human right that establishes the legitimacy of being part of public decision-making. It goes beyond the representative

democracy mechanisms such as voting in different elections opening a wide array of possibilities aimed at producing socially just collective policies (PNUD, 2022). Matters of public interest belong or should belong, to all citizens, with the state being responsible for managing these matters but not their owner. The diversity and heterogeneity of groups that inhabit a territory (Briata et al., 2020) and the scale of territorial planning intervention led to some communities being disadvantaged compared to other participating groups, reflecting clear power asymmetries in decisions about the territory (Delamaza et al., 2017). Differentiating factors can include geographic distance, language, technical language, limited availability of time, segregation, and social discrimination, among others (CEPAL, 2015). Mendez et al. (2021) recognized some of these differences and identified that levels of citizen participation and social cohesion are higher in groups with greater resources.

However, as the needs and requirements in cities become more complex, society becomes more active in demanding participation in decision-making processes (Paulsen, 2020). Citizen participation significantly contributes to the legitimization of public policies or interventions in the city, and it provides valuable knowledge that is not always identified by decision-makers (Arias-Loyola & Vergara-Perucich, 2021). In the context of ecological planning, this knowledge is essential to identify everyday practices, values, and perceptions that technical planning alone cannot capture.

The relationship between citizens and public or private institutions can encompass a wide range of options, from merely informative to more empowered and binding relationships, or even co-creation (Ambrose-Oji et al., 2017; Ma and Tao, 2020). Citizen participation, in broad terms, involves the active involvement of citizens in public decision-making processes that have direct or indirect implications for their lives.

According to the United Nations, to ensure that participation processes are meaningful and inclusive, a robust political system and its corresponding legality that encourage participation and the definition of rules and mechanisms to guarantee community participation and inclusion becomes crucial (UN-Habitat, 2009). To achieve this, territorial planning and management —the set of institutional actions and

practices taken in the territory to achieve the objectives of shaping forms of territorial development (Mondragón, 2017)— should lead to a balanced development of the territory, both in urban and rural areas, ensuring sustainable development. It should also ensure the common good and address collective needs over personal or sectoral ones, aiming for consensus-based results.

A key space for democratic exercise and encouragement of citizen participation has been linked to the local government level, due to its closeness with communities, becoming a relevant social space for participation (Fernández, 2014). The proximity spaces offered by the municipal scale (Gomá, 2018; Beveridge & Naumann, 2022) facilitate collaboration and even mutual learning between citizens and local government, having a key role in environmental politics (Harrington & Hsu, 2018). However, it is important not to take this scale as inherently the most democratic, nor to fall into the scaling trap (Russell, 2019), as local relationships are influenced by the significant role of the state, as well as transnational economic interests that may exist in a city (Pierre, 2014). Thus, while municipalities are strategic entry points for participatory GI planning, they cannot be idealized as neutral spaces; rather, they are arenas of negotiation where power relations are contested.

In the current context of Chile, the idea of merely representative democracy is at a turning point, showing clear signs of crisis (Akram, 2021). The political, administrative, and institutional system has been slow to incorporate citizen participation as a mechanism to address emerging demands (Garretón et al., 2017). People no longer trust their representatives or their political hegemony, and the voice of the people has gained strength, expressing political, social, and territorial demands from the local to the national level, in many cases protecting the territory from threatening projects or requesting the development of projects for their benefit (Delamaza et al., 2017).

Participatory planning is a type of planning that involves citizen participation, aiming to ensure the representation of all citizens' interests. It defines various objectives, strategies, and lines of action for the development of a project in a participative, collaborative, and comprehensive manner (CEPAL, 2015). Participatory planning aims to provide a platform for the

community to participate, share, and debate ideas, turning participation into a social and democratic act. Although criticisms argue that consensus building tends to depoliticize, it is recognized that community action can be influential regarding controversial initiatives (Legacy, 2016; Caimanque, 2023). In ecological projects such as GI plans, consensus must be complemented with mechanisms that also acknowledge conflict and negotiation, rather than reducing participation to harmony alone.

Green infrastructure projects can play a crucial role in the development of cities (Breen et al., 2020), especially in coastal cities, to ensure a balanced relationship between the city and the sea. This is manifested in a low-cost reduced risk of natural events such as floods, tsunamis, and landslides (García-Sánchez, 2019), and city planning effectively integrated with the environment. Additionally, green infrastructure systems can support the city in creating a network of public spaces and sustainable mobility systems, including scenic routes, hiking trails, and pedestrian and bicycle paths. Linking green infrastructure with active citizen participation can produce virtuous synergies, as it is spatially represented through a mosaic of green spaces (Buijs et al., 2019), in which communities can also engage.

Green infrastructure opens room for more democratic governance as it has the potential to create community inclusion in key city projects beyond the technocratic aspects of infrastructure (Finewood et al., 2019). While the literature on green infrastructure is wide, and increasingly influential in the global south, it is still insufficient (Breen et al., 2020), losing the opportunity for comparative research (Robinson, 2016). Moreover, by linking green infrastructure with community participation, cases can be even more scarce. Participation and co-creation of green infrastructure plans help engage different actors in their design and implementation, transcending traditional consultation (IUCN, 2020), and produce a strong sense of belonging and appropriation among communities, which in turn contribute their local knowledge and capabilities (Naumann et al., 2023). This also helps introduce progressive improvements that increase its effectiveness and sustainability over time (Raymond et al., 2017; Frantzeskaki et al., 2019). Participation in GI plans can align with state actions or be

self-managed, allowing diverse approaches to linking the green and urban-rural areas (Ambrose-Oji et al., 2017). Still, a multi-stakeholder approach involving public institutions, civil society, and the private sector appears to be important (Sekulova & Kotsila, 2017).

Recent participatory approaches for green infrastructure in Chile include cases such as *Santiago + Infraestructura Verde* (Vásquez et al., 2023) and the recently developed *Ciudades Verdes* National Strategy (MINVU, 2025). The first is a plan created for the metropolitan area of the capital and its hinterland, which was co-created with multiple institutions at different levels, including NGOs, the private sector, and community representatives. The latter is a national framework built with the participation of various stakeholders, which requires municipalities and regions to produce new infrastructure plans. In this scenario, the article highlights the importance of collaborative paths toward planning green spaces in a southern mid-sized coastal city, providing methodological lessons aimed at its realization, particularly relevant under a new national framework established after the development of the case analyzed.

Therefore, the article argues that understanding the current and potential green infrastructure systems in Chilean coastal urban areas, as well as incorporating them into urban territorial planning, has enormous potential to contribute to (1) reducing environmental degradation caused by urbanization, (2) improving the quality of life for the population, and (3) increasing the resilience levels of these urban-ecological systems to ensure the diversity and quality of Chilean landscapes in the long term. To reach that aim, ensuring the representation of all citizens' interests becomes fundamental to developing an inclusive, co-produced project comprehensively, as a collaborative network of green spaces that contribute to the general well-being of people, communities, and local economies. Ultimately, the goal is to build an inclusive and co-produced GI network that enhances ecological connectivity while strengthening local identity and social cohesion.

### 3 Methodology: towards a collaborative territorial project

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The Green Infrastructure Project for the municipality of Pichilemu was developed through a citizen participation process as part of a collaboration between the Landscape Group of the Faculty of Architecture and Urbanism at the University of Chile, the *Territorios Solidarios* Association of Switzerland, and an agreement with the municipality of Pichilemu. It involved the creation of a collaborative network of green spaces that contribute to the general well-being of people, communities, and local economies based on the recognition of conservation and nature care elements, such as bodies of water, dune systems, coastal areas, and biodiversity in general. This agreement outlines the responsibilities, methodologies, logistics, and general processes, with the overarching goal of serving as a tool to promote a democratic process of equitable and sustainable development. The methodological design followed an action-research approach, where academics, local institutions, and citizens co-produced knowledge and planning instruments simultaneously.

In broad terms, the main objective was to formulate a development project for Pichilemu structured through a green infrastructure plan, which is primarily based on the knowledge and expectations provided by the citizen participation processes carried out in conjunction with the local community. To achieve this, the project sets objectives aimed at cooperating with the sustainable development of the municipality concerning the future of those who inhabit and will inhabit the territory, always seeking social, economic, environmental, territorial, and landscape well-being.

Post agreement sign-in, the project was divided into four major stages, with each one building upon the results of the previous stage, always with the participation and validation of the community (Figure 1).

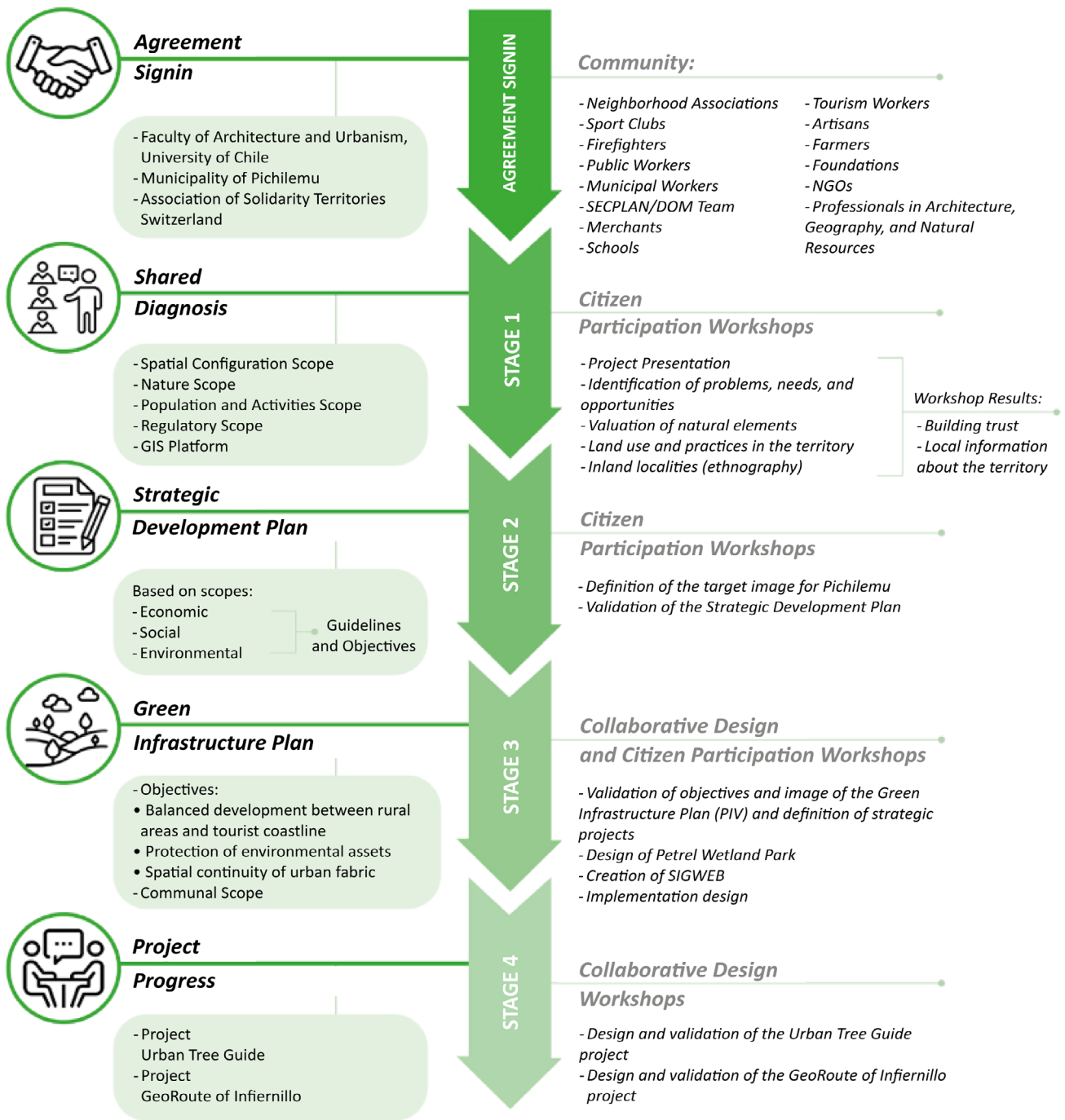


Figure 1. Conceptual map of project stages.

**Stage 1: shared diagnosis**

The shared diagnosis was the first and most fundamental stage, as it incorporated local knowledge and the community’s territorial vision in the process of collecting and systematizing existing information. This stage combined technical, spatial, and experiential knowledge. Information was organized into four analytical dimensions:

- I. Spatial configuration: context, history, settlement and urban growth process, communal and intercommunal connectivity, accessibility, populated centers, facilities, green areas, neighborhoods, coastal areas, land value, urban grid, and public spaces.
- II. Natural environment: scenic routes and natural viewpoints, beaches and dunes, land cover analysis, groundwater, priority conservation sites, natural and anthropogenic risks, and forest fires.

- III. Population and activities: economic activities (primary, secondary, tertiary), demographic evolution and mobility, and occupational and productive structures.
- IV. Regulatory framework: macro-zoning of the coastal area, the local Masterplan, and the Intercommunal Masterplan.

The process was a democratic endeavor involving ongoing group work, with invitations extended to neighborhood associations, sports clubs, public workers, municipal employees, environmental foundations or NGOs, local tourism workers, artists, and firefighters, among others (Figures 2 and 3). A multidisciplinary team consisting of academics and students in architecture, geography, and natural resources collaborated on this project. This diversity of actors ensured that both formal and informal voices were included, avoiding the capture of planning by institutional or private elites.



**Figure 2.** Activity of citizen participation. Collective mapping to identify landscape components.

The group work conducted of three participatory workshops using methodologies based on collaborative mapping, collective valuation, and narrative exercises. Participants worked with maps, blueprints, and posters to design and propose guidelines to help make Pichilemu a better city and territory. A short, instinctive individual activity complemented this work, where participants described (i) the “soul” or essence of the city, (ii) the landscape of Pichilemu, and (iii) how they imagined the city in 20 years. The responses were later subjected to discourse analysis, which revealed recurring categories: environment,

landscape, future visions, perceptions of real estate development, and cultural and social dimensions.

Two additional tasks consolidated the diagnosis. First, working within the four thematic areas (natural environment, population and activities, spatial configuration, and regulatory framework), participants co-produced maps that visually synthesized the diagnosis. Second, environmental and cultural assets were identified and systematized into valuation sheets that included criteria such as conservation status, pollution levels, legal protection, vegetation condition, and landscape contribution. These sheets provided both qualitative and quantitative assessments of territorial values.



**Figure 3.** Rural territory workshop involving potters, millers, salt producers, and farmers in Pañul, self-compiled.

The significance of mapping was linked to the valorization of collective wisdom, which can be used to diagnose the territory and identify solutions to complex social issues (Surowiecki, 2005). Participatory cartography not only documented local knowledge but also served as a political tool, legitimizing community perspectives in territorial debates often dominated by technical actors.

### **Stage 2: Strategic Development Plan (SDP)**

Based on the shared diagnosis, the project advanced into a strategic dimension. The Strategic Development Plan (SDP) established objectives and guidelines related to the environmental needs of the territory, protecting natural and landscape resources identified by residents, and creating a collective vision of the city’s future. Key factors were consid-

ered such as (i) improving the quality of life for residents, (ii) increasing economic, social, cultural, and environmental opportunities, (iii) aligning development with territorial organization, (iv) promoting technological innovation for an interconnected city, (v) supporting multiple development centers within the city, and (vi) ensuring stakeholder commitment to responsibilities for design, implementation, and maintenance.

At this stage, scenario-building workshops allowed participants to compare alternative futures, identifying risks (e.g., speculative urban expansion) and opportunities (e.g., eco-tourism, agroecology). This methodological step ensured that the Strategic Plan was not only descriptive but also prospective.

### Stage 3: Green Infrastructure Plan

The Green Infrastructure Plan was co-designed based on the SDP and validated in participatory workshops. Its main purpose was to translate strategic objectives into spatial strategies and multi-scale projects. The plan adopted a landscape ecology perspective, emphasizing connectivity between ecosystems and their integration with urban functions

The co-design process involved stakeholders at various levels, including government agencies, civil society organizations, and community members. The main outputs were:

- A local-scale GI proposal, including strategies and actions.
- The definition of multi-scale strategic projects, ensuring alignment across communal, urban, and neighborhood scales.
- A process of community legitimation and appropriation, ensuring that the plan would not remain solely as an academic exercise but as a collectively owned tool.

### Stage 4: pilot projects

In the final stage, the plan was operationalized through concrete pilot projects, designed at three scales (communal, urban, and city center) to address diverse territorial realities and needs. This stage reflected the principle of “learning by doing”: the pilots tested methodologies, governance mechanisms, and technical solutions in real contexts, creating precedents for replication.

## 4 The co-creation of the Green Infrastructure Plan of Pichilemu

While urban growth and tourism have been seen as positive for the city’s economic development, the changes that have occurred in the last decade have affected the entire territory. These changes include explosive population growth in rural areas, expansion into risk and ecologically fragile areas, soil erosion, unregulated building typologies, irregular land appropriation, the transformation of agricultural landscapes into forested and urbanized areas, social segregation, and limited inclusion of environmental resources—all of which were recognized as negative by the community. The coastal landscape has also undergone changes, primarily due to land speculation, densification of coastal land, and rising property values that have displaced residents into informal settlements in ravines. These dynamics pose significant threats to natural resources and landscapes, undermining ecosystem services that form the basis of tourism interest. The community expressed concern that the same assets that sustain the local economy and cultural identity are precisely those being eroded by unplanned growth and speculative practices.

Current planning instruments in Pichilemu, namely the Communal Development Plan (a non-binding indicative plan) and the City Masterplan, are limited to the urban area and do not provide comprehensive management of the urban–rural territory. Planning in Chile is mainly normative and regulatory rather than project-based, and Pichilemu lacks a project and a vision for the future. The weakness is also linked to participation as those instruments do not fully incorporate citizen validation or opinion. Citizen participation is regulated by Law 20,500, which states that “the State recognizes the right of individuals to participate in its policies, plans, programs, and actions”, yet formal planning practice continues to offer limited space for this right. Therefore, developing a comprehensive green and strategic project that strengthens the community in dialogue with current authorities appears as a fundamental way of fostering local empowerment in a country characterized by centralized territorial management, both geographically and sectoral. Furthermore, territorial projects involve short-, medium-, and long-term

temporalities that do not align with political timelines.

To address this gap, the project developed a Geographic Information System (GIS), later handed over to the municipality. Municipal staff received training to use the gathered information for future territorial management, ensuring continuity beyond the project's timeframe (Figure 4). This technical transfer reinforced the capacity of local institutions to monitor, update, and apply the Green Infrastructure Plan.

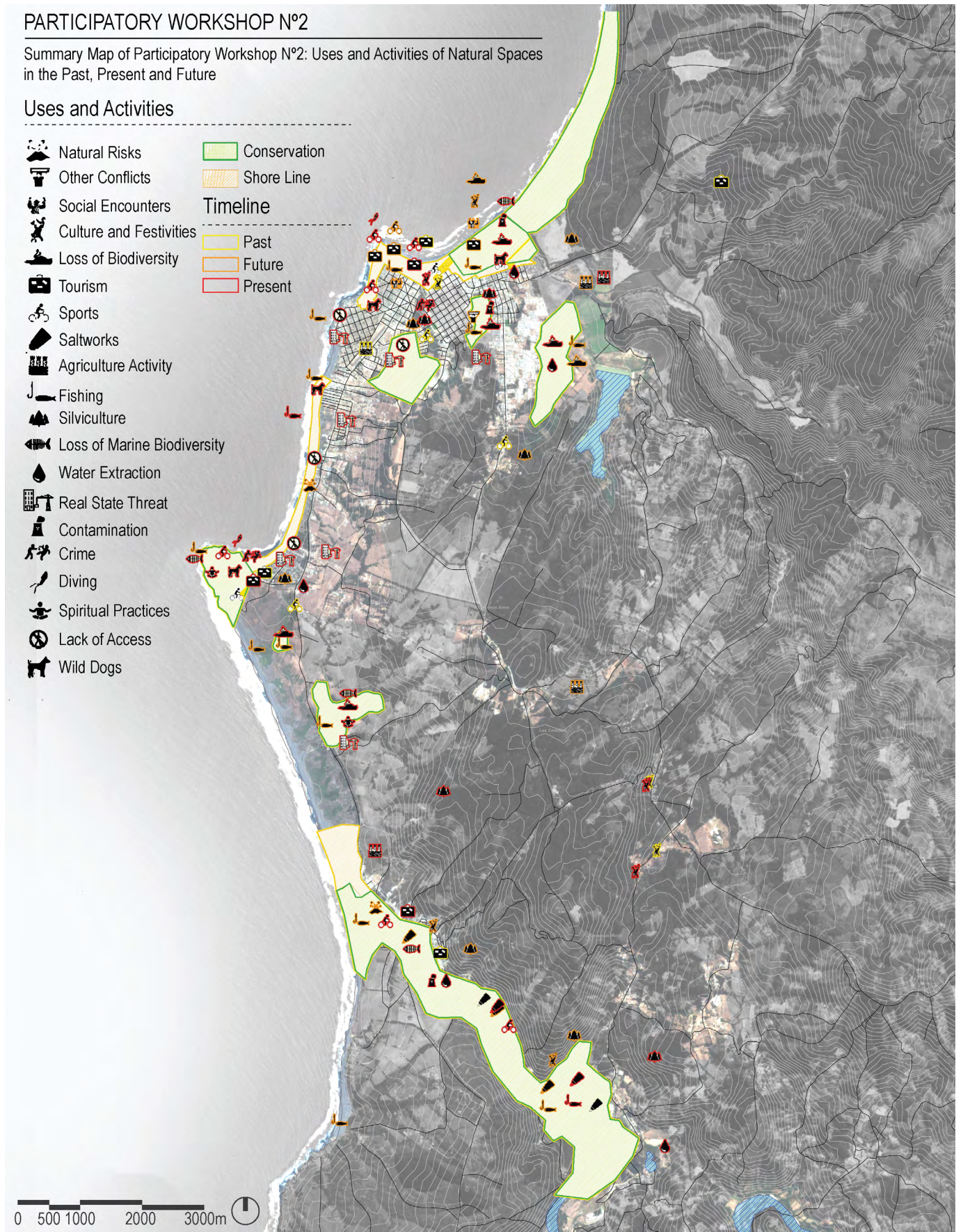
All of these actions sought to address current issues logically and strategically, aimed at prospective futures allowing the development of a viable and sustainable project for Pichilemu and lay the groundwork for the Strategic Development Plan (SDP). The formulation process was enriched by participatory responses to open-ended questions, which helped frame the community's priorities:

- I. Quality of life: Planning should lead to improvements in living conditions, prioritizing equity and environmental sustainability as essential factors of collective and individual well-being.
- II. Greater opportunities: Expanding economic, cultural, social, and environmental opportunities, while positioning Pichilemu as a driver of provincial development.
- III. Correspondence between development and territorial planning: Ensuring that social, economic, productive, and environmental axes align with the commune's geographic and landscape diversity, with mobility and accessibility as key elements.
- IV. Innovation towards the interconnected city: Leveraging technological tools, participatory dialogue, digital platforms, and collaborations with academia.
- V. The multiple sub-centres of Pichilemu: Fostering polycentric development with multiple poles of services, jobs, and facilities within walkable distances, supported by improved transportation networks.
- VI. Agreements and responsibilities: Establishing collective responsibility among stakeholders for design, implementation, and maintenance of projects.

Based on these priorities, the project defined a set of guidelines to shape the plan's objectives. These were defined through key themes such as sustainable development, tourism, mobility, and urban development. The defined guidelines are as follows:

- I. Create a future image with the community and municipality, focusing on sustainable development.
- II. Confirm the landscape's identity through policies and instruments that protect environmental heritage and promote tourism based on natural assets.
- III. Improve road connectivity and resource hierarchy, including differentiated routes, new access points, and sustainable mobility systems.
- IV. Create a more compact and balanced city, through urban regulation reform and zoning, promoting diversity, inclusiveness, sustainability, and spatial integration.
- V. Promote a sustainable and participatory city by activating citizen processes for SPD management and consensus building.
- VI. Integrate digital platforms (GIS and GISCloud) for territorial modeling and monitoring.
- VII. Optimize public and private investments to enhance landscape identity, quality of life, and sustainable territorial development.
- VIII. Foster compatibility between land uses, balancing densification with ecological considerations, and strengthening sustainable tourism, small-scale agriculture, and cultural heritage.

Finally, the SDP addressed major deficiencies identified in the shared diagnosis, including unbalanced inland-coastal development, urban discontinuities, threats to environmental assets from tourism pressure, and the lack of connection between countryside and sea. In short, the SDP provided the first comprehensive framework to guide Pichilemu's growth under clear environmental, social, and spatial criteria, fundamental for the construction of the Green Infrastructure Plan (Figure 5).



**Figure 4.** Mapping of practices from the past, today, and future related to environmental assets, self-compiled resulting from participatory mapping.

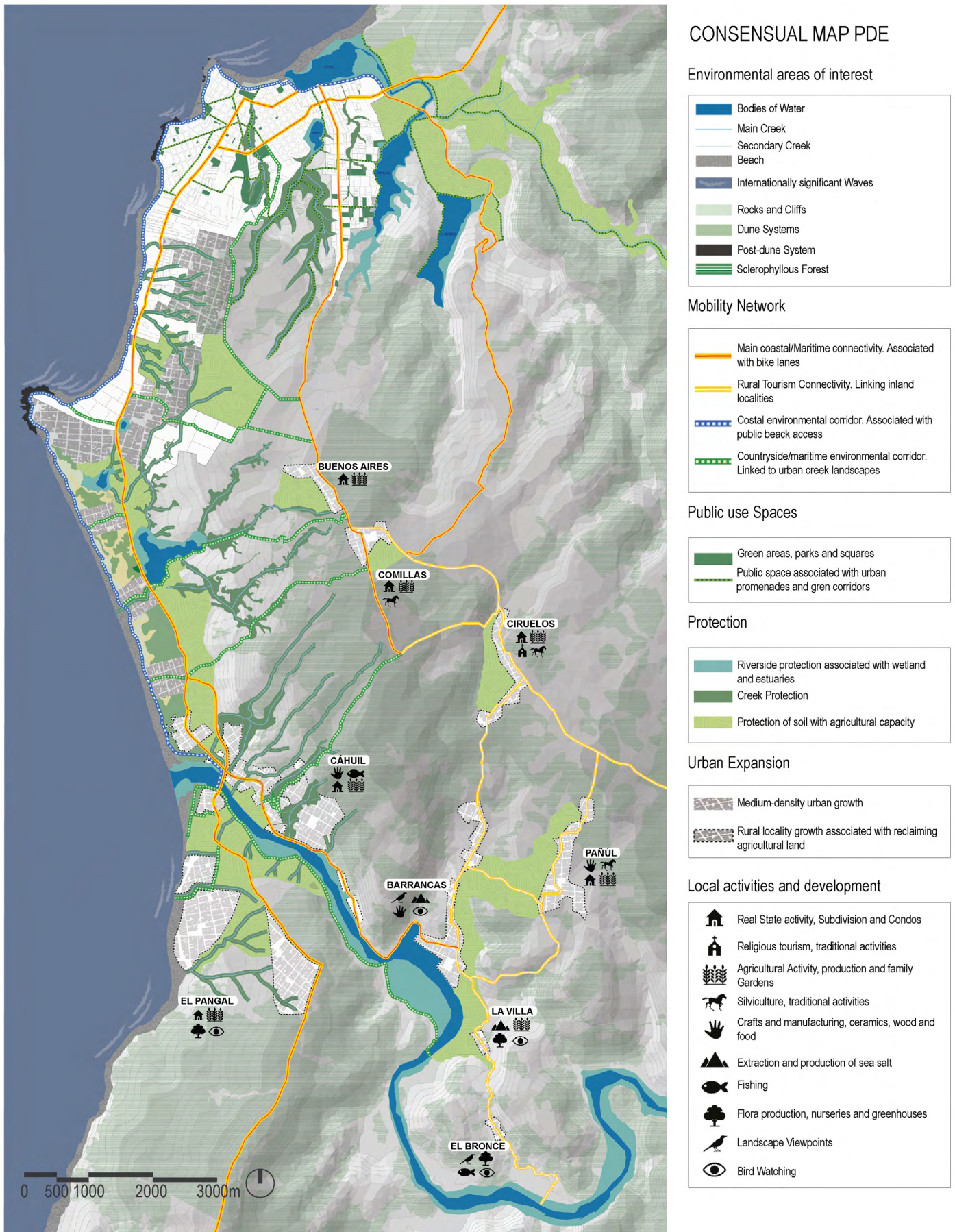


Figure 5. Consensual Map SDP.

Based on the SDP, three main objectives were defined: (1) Provide protection and access to environmental assets and green spaces to enhance biodiversity, water, and soil management; (2) Create spatial continuity and reconnection of the urban fabric through green spaces connectivity and the implementation of a sustainable mobility system and, (3) Promote balanced development between rural inland areas and the tourist coastline (Table 1). In the first workshop, the “Gullies Network Plan: Countryside-to-Sea Landscape Corridors” was agreed upon and named to highlight the value of the ravines as structuring environmental assets within the communal territory, emphasizing both the ecological and cultural relevance of the gullies as connectors between countryside and sea. Currently, they tend to be negatively perceived due to their association with informal developments, waste, insecurity, and natural hazards.

The strategies derived in several projects comprising the foundation of the Green Infrastructure Project (Figure 6) outlined in a Strategic Development Plan for the Pichilemu commune. The realization of these community-driven projects, along with others defined in the plan, is crucial to address the rapid urban growth experienced by the commune and to transform Pichilemu into a model coastal urban

area capable of mitigating its environmental impact through landscape protection and valorization.

The validated name for the Green Infrastructure Plan was “*Network of Ravines Plan: campo-mar landscape corridors*”.

Finally, the projects that compose the Plan were prioritized and among multiple alternatives envisioned, three reached a more advanced level of design and implementation: (1) the ‘Ecological Park Petrel Wetland’ which is a strategic project directly linked to the GI Plan. The project aimed at the creation of low impact routes to protect the wetland, integrating visits without altering the natural ecosystem. Two short-term projects derived from strong collective interest in materializing visible interventions: (2) the ‘GeoRoute Infiernillo’, connecting the Caletilla and Playa beaches, through terraces, walkways and esplanades for community use, providing a scientific educative path, and (3) the ‘Street and Urban Tree Design’, which is focused in addressing hydrological, environmental and social matters through a planned system of green areas and public spaces, with local vegetative species, a sustainable drainage system, strategic irrigation through rainwater and the use of filtering pavements. These projects (Table 2) show the communities’ strategic approach to materialize the plan from the short to the long-term. These

**Table 1.** Summary of objectives, strategies and actions.

Objectives	Strategies	Actions
1. Protection and accessibility of environmental asset.	Define boundaries and areas of influence for environmental assets.  Design/consolidate public spaces that preserve the natural characteristics of environmental assets.	Regulatory framework for recognition and protection. Ecological restoration plans. Regulate construction in restricted or protected areas. Environmental asset development plan. Formalization and design of access points to environmental assets. Design buffer zones between the city and environmental assets.
2. Urban integration in social and spatial contexts.	Promote a system of mobility corridors. Equitable distribution of green spaces. Improve land, water and biodiversity management.	Sustainable mobility network. Green space system with various scales and functions. Rainwater drainage system for the urban area. Define maximum percentage of private soil impermeabilization. Guide for the design of public and private green spaces for Pichilemu.
3. Balanced territorial development.	Connect the costal border territory with the rural interior, highlighting the landscape diversity. Enhance local activity, consolidating rural identity. Safeguard the use of agricultural land. Complement the various zones and settlements in the commune.	Design an ecological tourism circuit.  Commerce infrastructure (markets and fairs).  Small-scale agricultural activity development programs. Pichilemu tourism guide.

projects were developed in collaboration with the community and the SECPLAN (Municipal Planning Department) team of the Municipality, involving several activities for engagement, such as a diagnostic

phase, on-site recognition of the characteristics of the areas to be intervened, and the development of collective proposals for improving and creating new spaces for the city.

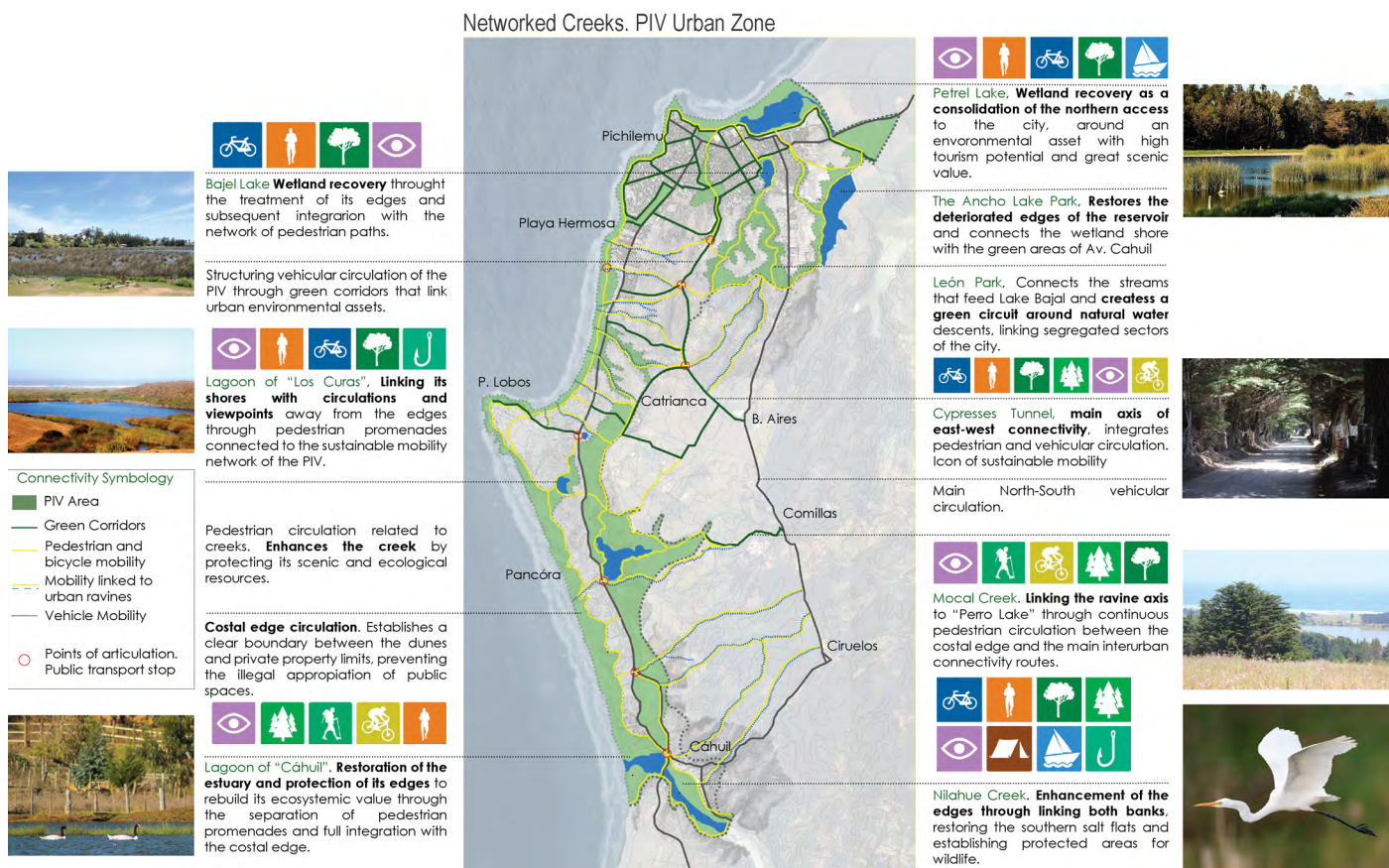


Figure 6. Green Infrastructure Plan: Network of Ravines Plan: campo-mar landscape corridors.

Table 2. Projects with a higher degree of development.

	Ecological Park Petrel Wetland	GeoRoute Infiernillo	Street and Urban Tree Design
<b>Description</b>	<ul style="list-style-type: none"> <li>Creation of a Low-Impact Natural Public Space</li> </ul>	<ul style="list-style-type: none"> <li>Creation of a coastal geopark (linear route). Relationship between the coast and the city.</li> </ul>	<ul style="list-style-type: none"> <li>Planned system of green areas and public spaces, with species that ensure a natural hydrological cycle.</li> </ul>
<b>Type of Participation</b>	<ul style="list-style-type: none"> <li>Workshop open to the community</li> </ul>	<ul style="list-style-type: none"> <li>Open calls to interest groups (working groups).</li> </ul>	<ul style="list-style-type: none"> <li>Open calls to interest groups (working groups).</li> </ul>
<b>Participation Activities</b>	<ul style="list-style-type: none"> <li>Definition of project boundaries</li> <li>Wetland name</li> <li>Planting of species</li> <li>Co-creation of informative panels</li> </ul>	<ul style="list-style-type: none"> <li>Workspaces between involved actors (community - municipality)</li> <li>Field visits</li> <li>Participatory design with communities and technical actors: Materiality of viewpoints, site programs</li> </ul>	<ul style="list-style-type: none"> <li>Workspaces between involved actors (community - municipality)</li> <li>Field visits</li> <li>Participatory design with communities and technical actors: tree planting and interventions</li> </ul>
<b>Project Value</b>	<ul style="list-style-type: none"> <li>Strategic location</li> <li>Heritage, landscape, and ecosystem value</li> </ul>	<ul style="list-style-type: none"> <li>Promote tourism, innovation, and control of private appropriations.</li> <li>Strengthen local identity in the project.</li> </ul>	<ul style="list-style-type: none"> <li>Commitment and engagement of communities in the project (quality of life, property valuation).</li> <li>Replicability.</li> </ul>

Currently, the municipality of Pichilemu is in the process of evaluating and estimating the costs of the project. In accordance with the established guidelines and the agreements reached during the participatory process, the project will eventually be implemented under the shared responsibility framework between the municipality of Pichilemu, the Landscape Team of the Faculty of Architecture and Urbanism, and *Territorios Solidarios* of Switzerland. This would guarantee the project's continuity and execution, respecting community validation and institutional commitments throughout the entire process.

## 5 Discussion and conclusions

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Pichilemu has experienced rapid urban and population growth, mainly due to the real estate business associated with tourism, directly impacting the natural environment and affecting the municipality's capabilities to respond to ongoing urban-rural challenges. In this scenario, the elaboration of a Green Infrastructure Plan evidence multiple benefits for the city and surrounding areas, particularly when urban masterplans are not capable to address more dynamic forms of development. Through the case explored, the link between public spaces and landscape assets appears as the starting point for a new city vision for Pichilemu, not only as environmental infrastructure, but as a social contract to guarantee intergenerational well-being. Habitat services, related to biodiversity protection; supply services, referring to water management, food production, and territorial security; regulation services, including climate change adaptation and mitigation; and cultural services, encompassing recreational, well-being, health, cultural, and community aspects, are key benefits linked to ecosystem services enhanced.

The collaborative project developed over the past three years, proved that a co-creation of new urban-rural imaginaries is possible, strengthening relationships between communities and local institutions (Ambrose-Oji et al., 2017), through plans aimed at reducing the impact of Pichilemu's rapid changes and ensuring long-term urban sustainability for future generations. The project development through

a partnership between public and private sector stakeholders also provided steps forward intended to serve as a tool for future territorial management in the commune. The technical information collected, along with community inputs and engagements regarding their territorial knowledge, led to a shared diagnosis which served as the basis for the SDP proposal. After community validation and collective adjustments, the general project proposal, along with the design of strategic projects, was developed and validated by the community. The active participation of the community was highly valuable throughout every stage of the project, and its success depended on continuous citizen participation and collaborative design processes. This experience evidences that territorial sustainability cannot be decreed solely by institutions; it must be co-produced with the inhabitants who give meaning and value to the landscape.

A noteworthy aspect of the process was the adaptation of workshops and participation activities for rural communities who did not attend meetings in the urban center. The need for an ethnographic approach tailored to smaller rural communities became clear. This method was highly effective, aligning better with the scales and lifestyles of these communities, producing as Bujis et al. (2019) state, a diverse mosaic of green spaces along situated processes of definition. The participants transformed the process into a democratic and participatory endeavor that exceeded expectations and enriched everyone's experiences. The participatory workshops and involvement of residents became the spaces in which residents-built trust, ownership, and empowerment of the project. Community members actively engaged in the project and even demanded the local authorities to maintain continuity and consistency with what was already being worked on. A notable example of this was the local community's rejection of a project by the Directorate of Port Works to create a GeoBotanical Park in the Infiernillo sector. They considered it invasive, oversized, and not in line with the principles outlined in the SPD/GIP, successfully preventing the project from moving forward.

However, while the process of co-creating a Green Infrastructure Plan involves coordinating collective interests, efforts, and reaching a consensus on its results, municipalities remain primarily responsible for

urban planning. The commitment of the local government to green infrastructure is an essential factor in advancing urban-territorial planning in a more integrated manner, beyond merely regulating urban areas. This is especially important when territories such as Pichilemu are in a fragile condition regarding their landscape, environmental assets, and natural resources. Therefore, green infrastructure should be implemented by the municipality, considering the objectives and strategies developed in the SDP. This coordination between planning instruments and community-based visions ensures that the project is not only technically feasible but also socially legitimate. In this way, natural and scenic values can enhance the quality of life of the population, and the agricultural, scenic, ecological, and water environments characteristic of the commune can be restored.

The participatory process demonstrated that planning, designing, and managing the territory in collaboration with the community is a highly effective approach to addressing various problems, needs, and desires related to the territory. Community members play a vital role in supporting projects with environmental impact and ensuring their sustainability, especially in the context of municipal political shifts, to prevent changes that may affect institutional and legal responsibility for maintaining these projects. Overall, community and institutional engagement depend on a willingness to cooperate, trust, and develop a sense of belonging regarding the project. Cities with more advanced and established environmental policies encourage or require community participation in the maintenance of the project, emphasizing the protection of natural resources. A participatory process involving the local community and a wide range of stakeholders transforms the project into a space for community and democratic development. Co-creation processes, viewed from a long-term perspective and recognizing urgency and incremental features (Frantzeskaki et al., 2019), help build a shared vision among various territorial actors, despite requiring economic, professional, and time resources. Ultimately, the Pichilemu experience demonstrates that co-created green infrastructure planning becomes a transformative tool to integrate ecological, social, and political

aspects of the territory, setting a precedent for other intermediate Chilean cities and serving as a best practice in the ongoing national strategy on Green Infrastructure.

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### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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