DESIGNING LANDLINKS

Strategies for enhancing the natural and cultural heritage
along the edge of the Llanquihue Lake (Chile)

POLITECNICO DI TORINO

CORSO DI LAUREA MAGISTRALE IN
ARCHITECTURE CONSTRUCTION THE CITY

Tesis of Laurea Magistrale

A.A. 2022/2023

DESIGNING LANDLINKS

Strategies for enhancing the natural and cultural heritage along the edge of the Llanquihue Lake (Chile)

Relatore
Emma Paola Germana Salizzoni
Politecnico di Torino
DIST: Dipartimento Interateneo di Scienze, Progetto e Politiche del Territorio

Co-Relatrice
Gloria Saravia
Pontificia Universidad Católica de Chile
MAPA: Magister Arquitectura del Paisaje

Studente
Sofia Munoz Balbontin

Dedicatory

This thesis is dedicated to my parents and friends who always supported me and helped me in my studies during all these years in Chile and Italy.

Gratefulness

I express my gratitude to all the people who supported me throughout this extensive thesis process. Firstly, to my parents, for accompanying me and assisting me during moments of great uncertainty, making every effort to simplify the process for me. I am grateful to my guiding teacher, Emma Salizzoni, for her guidance and trust throughout the process. Special thanks to Gloria Saravia for her teachings in the Research workshop, which influenced my passion for research and landscape. To my friends in the field of architecture, who have been a constant presence from my early years to the present, offering unconditional friendship, companionship, and joy during both my moments of greatest learning and happiness, as well as the most challenging and uncertain ones. I extend my appreciation to my friends from school for their enduring friendship and unwavering support in believing in me and my studies. Lastly, I am thankful to my family in Torino for being with me throughout this year of studies, providing support and trust during the most challenging moments when I was away from Chile, and for showering me with their unconditional love.

- Agradecimientos -

Agradesco a todas las personas que me ayudaron en este largo proceso de tesis. Primero a mis padres y famlia por acompañarme y ayudarme en los momentos de mayor incertidumbre en cuanto a tomar decisiones y hacer todos sus esfuerzos para se me hiciese lo mas facil posible el proceso. A mi profesora guía Emma Salizzoni, por toda su enseñanza durante el proceso y confianza. A Gloria Saravia, por sus enseñanzas en el taller de Investigación que influyeron en mi gusto por la investigación y el paisaje. A mis amigos de arquitectura que desde los primeros años hasta hoy han estado presentes con su incondicional amistad, compañia y risas en mis momentos de mayor aprendizaje y felicidad, y también los mas dificiles y de incertidumbre. A mis amigas del colegio, por su su amistad duradera y su apoyo para creer en mi y mis estudios. Y por último a mi familia en Torino, por acompañarme este año completo en mis estudios y todo el apoyo y confianza que recibí para pasar los momentos más dificiles lejos de Chile y haber estado con su cariño incondicional.

"Los landlinks se definen como el paisaje no lineal, seriado, de movimientos, acontecimientos y espacios relacionados por redes capaces de favorecer el intercambio, la interrelación y la mixticidad, pero también capaces de ofrecer mayor libertad e indeterminación"

[1] Gausa, M. (2007). Landlinks. En Editorial Gustavo Gili, S.L. (Eds.), Landscape + 100 palabras para habitarlo (pp. 116-120). Gustavo Gili.

Llanquihue Lake, south of Chile. (Picture). by Samuel Ponce, 2014, Flickr (https://www.flickr.com/photos/samuelponce/19229706744).

INDEX

ABSTRACT

The following thesis aims to study the landscape on the Llanquihue Lake edge, situated in the North Patagonia of Chile. Therefore, the investigation analyzes the different systems that characterize the lake edge, focusing on facing the fragmentation of the natural and cultural heritage systems. This fragmentation is a discontinuity that produces the degradation of the heritage, due to its insolation or friction with other systems such as the rural and urban. The importance of reconnecting and reconciling them. Consequently, the thesis proposes a design strategy based on the operational concept of 'landlinks'. The strategy works on different scales, from the vast to the local one, to approach the fragmentation of the lake edge. It enhances abandoned spaces, fosters recreation, and makes accessible different kinds of landscapes. The design strategy does not oppose one system with another, it connects them, making them coexist in structured systems that allow a healthy transition.

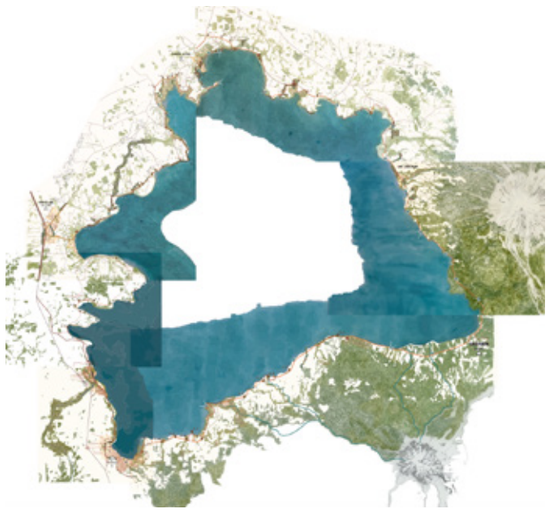
Lago Llanquihue. (Picture), by "dicks_in_vinegar", 2013, Flickr (https://www.flickr.com/photos/dicks_in_vinegar/12037166995).

INTRODUCTION

The investigation and project to be developed are situated on the edge of the Llanquihue lake, a lake full of history located in North Patagonia, Chile. This lake is hydraulically connected with 22 other lake edges, which together form a fundamental network and an existing natural heritage. Each of these lake edges is understood as a territory of mosaics, an integrating space of systems and processes that occur simultaneously and are defined by variable acts, activities, and usage dynamics within the same territory (Fernández, 2020). This territory is defined by many systems that characterize it, such as natural heritage, rural, urban, and cultural heritage. The investigation highlights that currently, these systems are fragmented and without a healthy relationship between them, which has produced the deterioration of the natural and cultural heritage, and the decline of the appreciation of its landscape. From this problem, the investigation took the 'landlink' concept from Manuel Gausa in "Landscape + 100 palabras para habitarlo" and transformed it into a design strategy to confront the fragmentation. The landlink is defined as a unifying space, that has the quality of making two systems coexist without one prevailing over the other. Therefore, the investigation and project will focus on the case of the Llanquihue lake edge as an example of a fragmented and unplanned lake edge, and how connecting its systems protects the existent heritage and gives the people better habitability. The thesis takes the Llanquihue lake as a case but also aims to foment the investigation of other lakes in North Patagonia, for starting designing strategies such as the ´landlinks´ to avoid fragmentation before the urbanization of the area, with the finality of protecting the heritage.

Hydrological network arround the Llanquihue lake

To achieve the definition of 'landlinks' as a strategy of design, and its potential to unify the lake edge, the investigation will first emphasize showing the history and defining the systems, explaining why it is important to preserve and define the lakeside landscape. The systems are divided into administrative systems, which consist of existing laws and regulations that organize the territory, and the physical ones that characterize the lake edge, as the following: 1. Natural Heritage, 2. Rural, 3. Urban, 4. Cultural Heritage. After defining all the characterization of the lakeside, fragmentation will be studied as the main issue that leads to landscape devaluation, heritage degradation, and a disjointed lakeside. Fragmentation is explained as the rupture or disconnection of a territory that used to be connected and that damages a series of fundamental processes. Normally this phenomenon occurs thanks to urbanization and ruralization without planning. This disconnection produces isolation of crucial elements inside the systems or friction between systems, resulting in a deterioration of the system as a whole. In territories where there are too many systems involved, friction is produced due to the lack of graduality, which produces instability in both. Therefore, the investigation is focused on showing how this unhealthy relationship has deteriorated the natural and cultural heritage by anthropic systems such as rural and urban, affecting the landscape perception.



Designing landlinks, masterplan

To study and illustrate the fragmentation through drawing surveys and eventually propose the project, two scales will be taken into account. One will consist of a vast scale, which works between cities and aims to unify the entire lake edge through a masterplan approach using the 'landlink' strategy through a landscape architecture intervention. On a local scale, the 'landlink' will be a more active infrastructure that seeks to address the most critical cases of fragmented heritage and unhealthy relationships with other systems, providing protection. The landlink will evolve from a theoretical concept to a design strategy, represented in various landscape infrastructures that revitalize the heritage and act as interfaces between systems, improving and providing people with a more comprehensive perception of the lakeside landscape. Therefore, the 'landlinks' will also sanitize the most degraded spaces within the cities, such as dumps, transforming them into opportunities for public use, which aids in completing the broken networks of systems. Along the same line, the 'landlinks' will always prioritize enhancing and protecting four dimensions: 1. Cultural, 2. Social, 3. Ecological, and 4. Visual. The objective is not only to benefit the ecological or cultural aspects but also to improve the habitability of the people. To delve deeper into the landlink design strategies, one of the pieces of the lakeside will be chosen as an example, where the project will be developed on a more detailed scale. Activating this area will demonstrate the feasibility of creating a system to unify the entire lake edge.

THESIS FORMULATION

Volcan Osorno depuis l'une des plages du village de Frutillar. (Picture), by "BikeTrippers", 2015, Flickr (https://www.flickr.com/photos/biketrippers/26400367910)

PROBLEM OF THE INVESTIGATION

The presence of natural and cultural heritage on the Llanquihue Lake edge is a fundamental characteristic in terms of its landscape value, and during the last decades, has been affected by their fragmentation and gradual deterioration. The edge of the Llanquihue lake began to be populated and urbanized with the arrival of the German colonies in 1852, which meant a series of German wooden architecture designed for a climate in the south of Chile with construction techniques of high potential and great current historical value (Biblioteca Nacional de Chile, 2023). On the other side, colonization also fomented the arrival of important industries and the railway. However, the development of the cities and changes in the uses of the lands had produced the fragmentation of the different pieces of colonial and industrial architecture among themselves, resulting in their isolation and friction. Insolation in terms of bad accessibility due to roads in a bad state or visually inaccessible. Friction, by its decontextualization concerning the environment and new uses, makes it difficult for people to value them and, therefore, for their maintenance. Many times, these pieces are in risky contexts such as extended abandoned properties or, on the contrary, adjacent to ultra-urbanized areas, which gradually degrades them and diminishes their cultural value and memory (Lobos, 2020). Moreover, the fragmentation of the natural heritage, considering it as the habitat and fluvial ecosystems, is produced by the absence of a gradual connection between the natural, rural, and urban systems. The non-existence of this gradualness has occurred due to the rapid occupation of soils around surfaces with high environmental value, which has implied the sharp relationship between surrounding edge systems. The removal of vegetation caused by humans, even if it is done in a limited way, produces islands of vegetation too small to ensure ecological viability, causing the progressive degradation of the forest environment and its habitat. Species that are adapted to their native environment are exposed to environmental changes, which often has the effect that they do not survive or abandon their habitat (Sánchez, 2002). Similarly, the establishment of barriers that interrupt the flow of water, sediments, and organisms is becoming more common in the water systems at the edge of the lake, often producing stagnation, contamination, and erosion. This is carried out especially by the elimination of waste on the edges of rivers that feed the lake (Ahmed et al., 2019). Along the same lines, it has been possible to identify as a common factor that most of the time the micro-dumps and ballast pits are located at the meeting point between the natural and urban, or urban and rural systems, which entail great environmental deterioration, but also social and solubility risk for the people who inhabit the edge of the lake. Even though the municipality has carried out surveys and investigations about both heritages and how it will protect them, the measures are in an initial step to be developed. A common strategy for all the lake edge becomes urgent in the existent planning. A design strategy that allows a transition between different systems, enhancing and protecting the heritage along the Llanquihue lake edge.

GOALS AND METHODS

How the 'landlink' concept become in a landscape architecure project that confronts the fragmentation of the landscape, connecting and protecting the natural and cultural heritage in the Llanquihue lake edge?

The connection of the natural and cultural heritage of the Llanquihue lake edge for its protection and reconciliation with the rural and urban systems would take place thanks to the design of the 'landlinks' strategies. This would be carried out with a landscape architecture project that works on different scales inside and between settlements. The masterplan will integrate landscape interventions and urban interventions, at the most critical meeting points between systems, confronting the degradation of the heritage and sometimes micro-dumps that worsen the quality of life of those who inhabit the area. Therefore, each piece chosen within this mosaic would be intervened with an infrastructure that acts under the strategy of a 'landlink', a mediator that reconciles the systems and values of these areas, to heal, protect, and visibility the existent heritage. Sometimes the strategies will be landscape infrastructure in areas very close to the city that slow down expansion and protect high-value areas. Other times it may be resilient urban and landscape infrastructure that allows for the regeneration of small, well-defined areas that contain native or cultural heritage and have been highly contaminated or degraded. Others may be networks of public space or a large landscape infrastructure that connects fundamental lost relationships for its maintenance or value. In addition to this type of intervention, it will be analyzed more strategies of other authors, to detail the function and use of the 'landlink' that manages to work with the natural heritage as the cultural heritage together. Eventually, to deepen the project, it will be detailed how the 'landlinks' work on a local scale in one of the pieces located between Puerto Varas and Llanquihue. The landscape project will seek to reestablish the memory of the cultural heritage lost highlighted by the abandoned trainrail, the ecological relationships for the natural heritage, and the accessibility between cities and to the lake.

CHAPTER 1

Lake edges: from fragmentation to ‘landlinks’

Solitude. Llanquihue Lake, south of Chile. (Picture). by Samuel Ponce, 2014, Flickr (https://www.flickr.com/photos/samuelponce/19628221450)

1.1 Lake edges as a mosaic of systems

The lakes are bodies of water, surrounded by land, that define the landscape of the territory around, which defines the perception of the space, imaginary and reality, for the people who inhabit the edge. “The control and appropriation of the water have been fundamental to the building of human cultures and civilizations”[1] .Eventually, it has been fundamental for the design of the landscape; has been an element that balances the healthy relationships between large bodies and the territory. Therefore, the project would focus on this kind of healthy relationships but also integrate the connections on the lake edge.

The lake edge is understood as an integrating space of systems and processes that occur simultaneously and are defined by acts, activities, and dynamics of use and variable interventions within the same territory (Fernández, 2020). For the purpose of this project, the integrating space would be between the water landscape and the terrestrial space. Delving into how these edges are structured, we would understand the land as mosaics of processes and systems involved that are evident at all scales (Forman, 1995). The systems that characterize the edge are “an a acquisition of meaning -stable, but also improvised, ephemeral or borrowed- transmissible to one or more sequences of elements and dimensions, communicable as values, which are “isolated” in a context continuum of events that characterize a place because they are factors of identities and predispositions with a vocation to evolve, otherwise they cannot be enunciated.”[2] In turn, each system is harmonically related to the others but also has its autonomous logic. It occupies and informs the space according to its own principles (Zagari, 2006).

When referring to systems in the context of the Llanquihue lake edge, we consider administrative systems and physical systems. With administrative ones, we refer to how it organizes the territory, in terms of politics, land planning, and design, and how this characterizes and influences the inhabitation of the Llanquihue lake edge. Secondly, the physical systems would be; 1. Natural Heritage system, 2. Rural system, 3. Urban system, 4. Cultural Heritage system. For the purposes of the investigation and its subsequent project, the edge of Llanquihue lake will be understood as a mosaic of systems that constitute it and characterize the landscape affecting the habitability of human beings within it. As mentioned before, it has been decided to analyze each system of this edge separately and their interactions with each other.

1 Cosgrove, & Petts, G. E. (1990). Water, engineering, and landscape: water control and landscape transformation in the modern period (Cosgrove & G. E. Petts, Eds.). Belhaven Press.

2 Zagari, F. (2006). Sistema. En Editorial Gustavo Gili, S.L. (Eds.), Landscape + 100 palabras para habitarlo (pp. 116-120). Gustavo Gili.

Llanquihue Lake. (Picture), by Rodemil Jose, 2019, Flickr (https://www.flickr.com/photos/rodemil/46601724475).

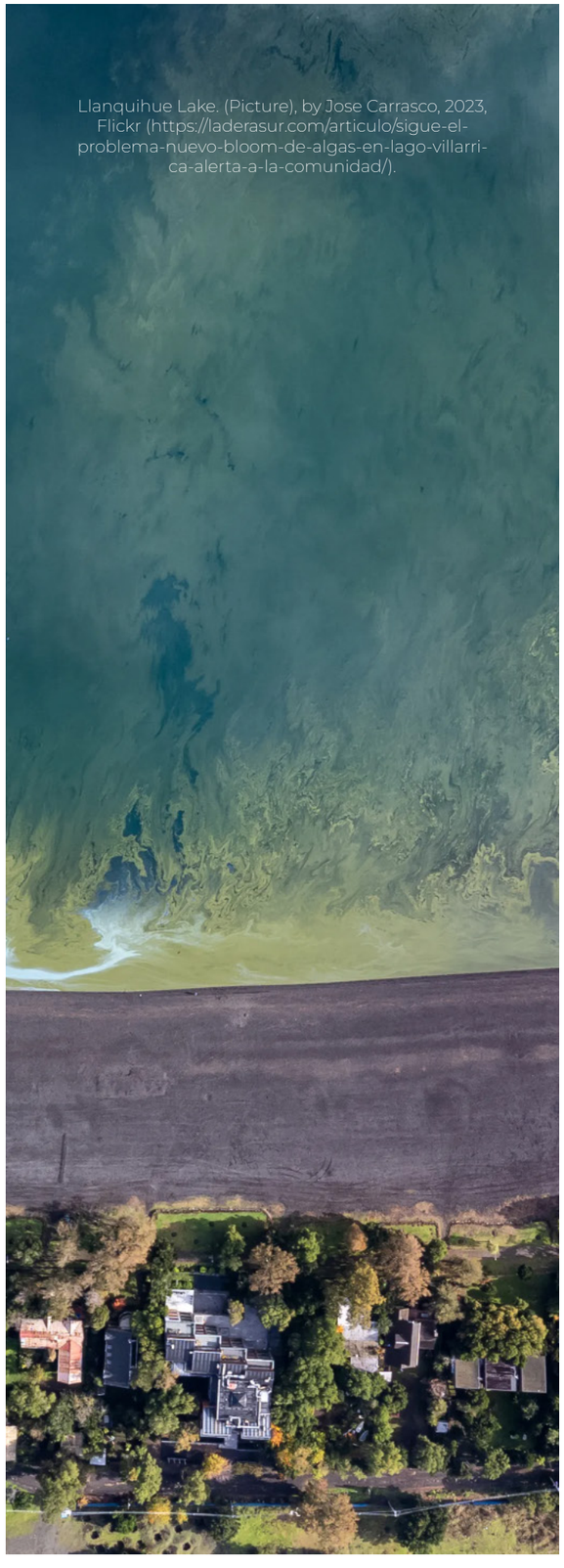
1.2 The fragmentation of the lake edges

If we consider the lake edges as a mosaic of interconnected systems that define its landscape, the fragmentation of them undermines essential processes and leads to the instability of the lake edge. Fragmentation entails a discontinuity or rupture in its proper functioning, severing what was once connected. The instability arises from significant changes in the territory caused by external or internal factors (Betsky, 2002). In the case of the Llanquihue lake edge and its heritage, the fragmentation of the landscape and heritage is produced due to the imbalance within the systems themselves, attributed to anthropic systems as rural and urban. The above is related to events such as urban extension, contamination, residual spaces, or change of uses of the land without safeguarding the essential connections of the heritage systems.

The rupture of this relationship has two important consequences: friction and isolation of the heritage, resulting in its degradation and bad habitability for the people that inhabit the area. Firstly, friction is defined as the abrupt and unhealthy transition between anthropic systems and heritage, leading to physical, visual, or symbolic deterioration. In the case of cultural heritage, friction will be understood as when the piece is decontextualized, this means that is situated in a context that devalues its history and memory. An example of this is micro-dumps or residual spaces next to it, architectural incoherence with the context, or a change of use of the piece itself (Lobos, 2020). On the other hand, the friction of the natural heritage is produced due to the length of boundaries between remaining patches and the surrounding use of land with exotic vegetation and animals. The biological and physical condition of the boundaries is normally different from the one in the interior, and when there is a hard contrast produces disruption of the forest floor, and soil layer, altered nutrient cycling and decomposition, changed evaporation, and altered pollen and seed dispersal. oration, and altered pollen and seed dispersal. In the case of the vegetation communities, the edge can affect reproduction, growth, seed dispersal, and mortality. Normally, the introduced plants adapt better to altered microclimatic conditions, which expel and damage the native vegetation with its dominance or plagues and diseases. Furthermore, in the animal community amphipod mortality grows on the edges due to the changes in wind, moisture, and temperature. At the same time, vertebrates avoid edges and develop in interior remanent spaces due to the risk of anthropic exterior depredators like dogs. The above generates an imbalance in the ecological pyramid affecting other species (Lindenmayer, D. B., &Fischer, J. 2006).

The isolation will be defined as the disconnection between pieces or their heritage context, undermining crucial relationships between them. The isolation of the cultural heritage is normally consequence of a poor accessibility. This could mean roads in a bad state or lack of visibility which breaks the connections between the pieces and unenhances them. Similarly, natural heritage isolation is the unconnectedness of remanent spaces, generating small patches of vegetation. They start to be problematic when the vegetation of those patches is too small to guarantee the ecological viability of the habitat, especially the animals that need big areas to survive (manifers). So, the fragmentation produces many different areas that don't have enough space and characteristics for their necessities. When a patch reduces to half of the original area, the number of species reduces also to half (Sánchez, 2002). Despite the above, almost all the species are affected in different levels, directly or indirectly thanks to the change of the species interactions and ecosystem process. However, when the fragmentation increases the distance between patches, generates isolation between the species, affecting animals and plants that have more continuous distribution. In the case of plants, the consequences may be related to limited movements of propagules such as spores, pollen, and seeds. Wheares, the animals could be affected by changing the natural movements on different scales; day-to-day movements, dispersal movements, movements of individuals in metapopulations, and large-scale movements like nomadic movements or seasonal migration., or range shifts in response to climate change.

Therefore, the thesis will focus on preventing and addressing the fragmentation of the landscape, where the natural and cultural heritage are the affected systems, of the Llanquihue lake edge. It is for this reason that connecting and conceiving the lake edge as a mosaic is proposed as the main measure. Comprehensive planning is needed, involving collaborative efforts among all administrative entities. In the case of the Llanquihue lake, where multiple municipalities are involved, a common design approach becomes essential to safeguard functionality, culminating in a masterplan proposal. A project that plans the entire lake edge in phases, not just some parts by different administrative entities.



Llanquihue Lake. (Picture), by Jose Carrasco, 2023, Flickr (https://laderasur.com/articulo/sigue-el-problema-nuevo-bloom-de-algas-en-lago-villarrica-alerta-a-la-comunidad/).

1.3 ‘The Landlink’ concept

“Landlinks are defined as the non-linear, serial landscape of movements, events, and spaces related by networks capable of favoring exchange, interrelation, and mixticity, but also capable of offering greater freedom and indeterminacy”[3]

The ‘landlinks’ is a theoretical concept related to space features and the design practice taken from ‘Landscape + 100 Words to Inhabit It.’ The concept is recognized as encompassing all the spaces between systems in a territory, providing opportunities for creating more versatile relationships. Understanding urban extension and densification as one of the biggest challenges for architecture in the 21st century, the ‘landlinks’ aim to take advantage of residual spaces that are left as a consequence of it, such as interstices, residual land, edge spaces, and large voids transformed into micro-dumps. Therefore, Gausa proposes conceiving these negative spaces as their own systems and transforming them into places that allow for healing the relationships between other systems and connecting them.

If we define the territory as a mosaic, a network of heterogeneous living systems that exhibit structure, function, and change. The concept of ‘landlinks’ is employed to transform it into a design strategy that supports the green infrastructure, working in the systems that characterize the lake edge and its relationships between them, facilitating their connection and health. The above, through the sharing principle with the green infrastructure about multifunctionality, indicates the multiple functions that the ‘landlink’ can provide to benefit people and the ecosystem (Hansen et al., 2017). At the same time, with the versatility principle we refer to the ability to be used on different scales and in different systems such as in the Llanquihue lake case; urban, rural, visual, natural heritage, and cultural heritage. It aims to address fragmented systems that experience friction and isolation, by designing landscape architecture that enables their coexistence within structured and connected systems. Furthermore, these interventions would protect at-risk systems, such as natural and cultural heritage, from others like urban or rural systems.

Therefore, the intention throughout the development of this project is to explain how this theoretical concept can be adapted and transformed into a design strategy. It will explain how the ‘landlink’ works at different scales, serving on the vast scale to create a masterplan that connects the territory, unifying the lake edge. While, on the local scale improve the relationship with the other systems making a transition and also connecting them. The objective is to show that its utilization can change and define the landscape of the Llanquihue lake edge, improving the quality of life of the people.

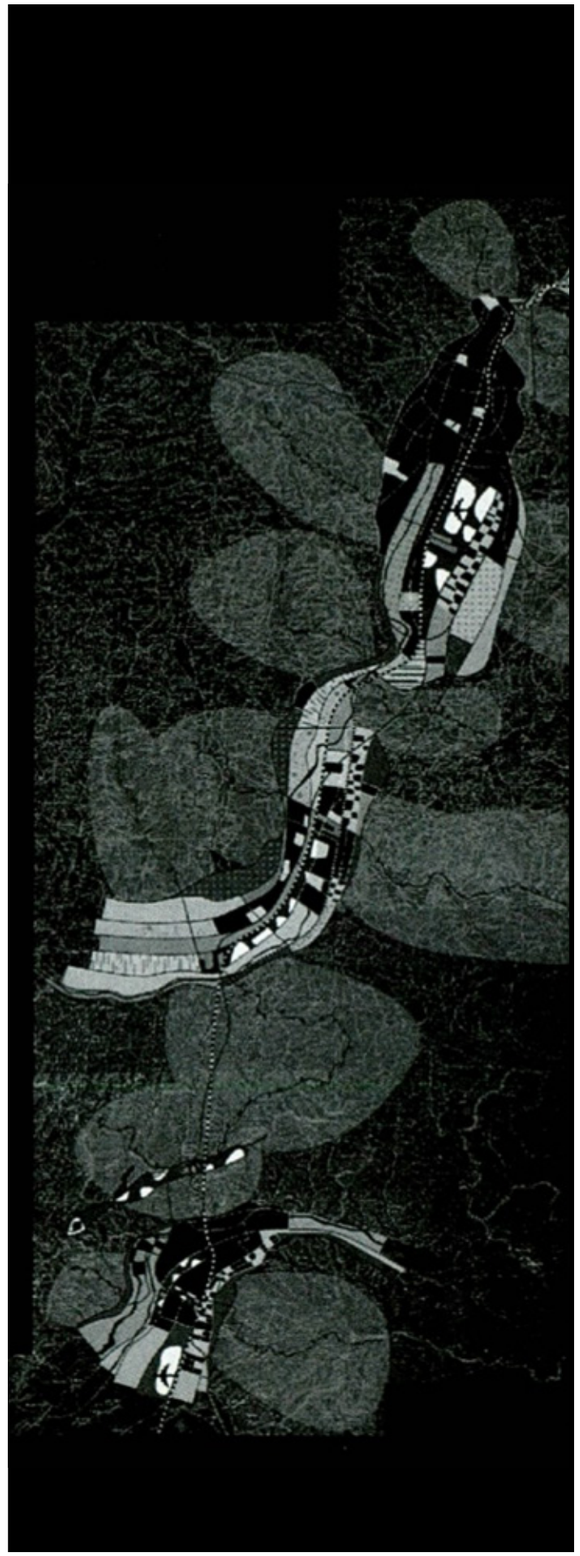
In Chile, the legal definition of landscape is not clearly established. This lack of clarity has posed challenges in terms of its protection. However, the country has taken into account different international protections, including those provided by UNESCO, which offer definitions and guidelines for its protection. As a result, the closest available definition of landscapes is *“Combined works of nature and human beings that reflect a longstanding and intimate relationship between people and their natural environment.”*[4]

Considering this, the thesis emphasizes the significance of all the systems that characterize the lake edge, including the natural and cultural heritage, as crucial elements for the preservation and safeguarding of the landscape.

Finally, the thesis asserts that implementing the ‘landlink’ as a design strategy in a landscape architecture project transforms people’s perception of the Llanquihue lake edge. The reconnected territory not only safeguards the landscape but also enhances individuals’ connection to its unique qualities. The project proposal that will be explained have a big scale, so is thought as a long-term project made in many phases and thanks to municipalities’ funds and donation, but also through big private incentives for buying lands or the transformation of some parts. It is clear that because of the big scale if the project had been done, it would have changed during the process or things wouldn’t been possible to do. However, it aims to investigate the Llanquihue lake edge and develop the ‘landlink’ strategy to also incentivize the investigation of the other 22 Nort Patagonian lake in Chile. The lakes in Chile are still unplanned and much of them unurbanized, so there is still time to design its lake edges. Explaining the ‘landlink’ and its potential as a design strategy, it searches also for its adaptability for broader applications in other contexts.

3 Gausa, M. 11(2002). Landscape + 100 palabras para habitarlo

4. United Nations Educational, Scientific and Cultural Organization (UNESCO), 2002.



Llanquihue, Volcan Osorno. (Picture), by Jairo Ruiz, 2015, Flickr (https://www.flickr.com/photos/130296671@N08/15857692804

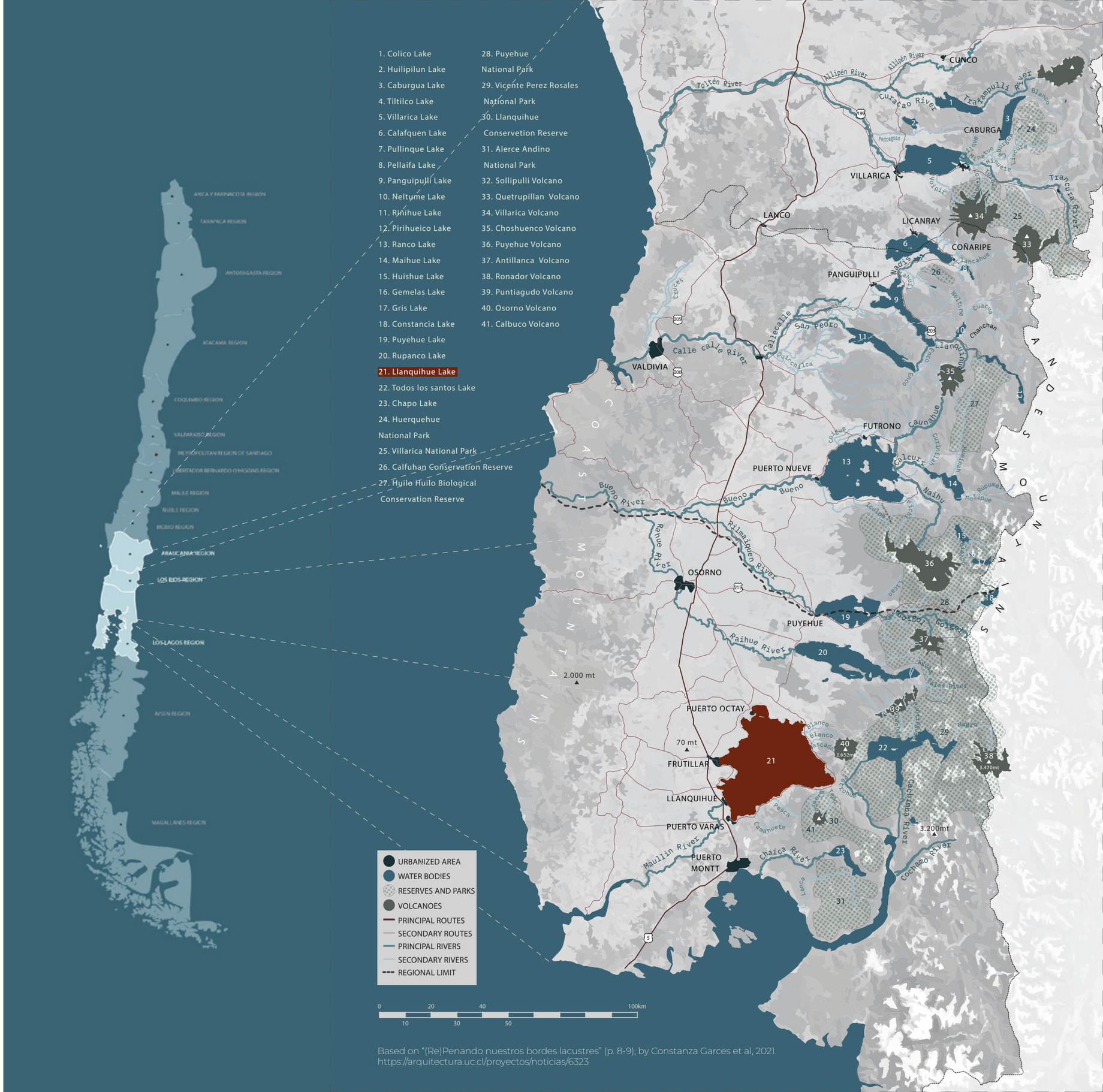
CHAPTER 2

The landscape of the Llanquihue lake edge

2.1 The North Patagonian lakes in Chile as a hydrological network

The North-Patagonian lakes are 23 lakes situated in the south of Chile, in the regions of "La Araucanía," "Los Ríos," and "Los Lagos." This zone is renowned as one of the most touristically attractive areas in Chile, thanks to its natural beauty, volcanoes, mountains, and the wide range of sports activities it offers, such as trekking, climbing, water sports, and sport fishing, among others. However, the zone also holds significant hydrological value, particularly in terms of water supply, due to its lakes and their importance for human consumption, agriculture, industry, and tourism. Additionally, the lakes serve as natural regulators of river flows. They store water during rainy periods and gradually release it during drier seasons, helping to maintain a consistent flow in rivers, thereby promoting ecological balance and sustainable use of water resources. Furthermore, the lakes contribute to biodiversity and its conservation. They provide habitats for a diverse range of aquatic species, including flora and fauna. Many of these lakes are crucial ecosystems for various species, including fish, waterfowl, and amphibians (Ministerio de Obras Públicas & Dirección General de Aguas, 2016).

It is interesting to analyze the direct hydrological connections between the lakes through rivers, which determine flow regulation and environmental conditions. An example of this is the connection between Llanquihue lake and Todos los Santos Lake. Their existence is interdependent, and in terms of landscape also, the hydrological network characterizes the area and creates a connection through the water that define the landscape of both edges. Ultimately, the developed project seeks to define the strategies understanding this entire zone as a hydrological network with unique ecological qualities, protecting its proceses. The strategies will be defined for the case of the Llanquihue lake, but with the intension of provide the guidelines for strating to investigate and if itsnecessary design 'landlinks' in other areas of the network.



Based on "(Re)Penando nuestros bordes lacustres" (p. 8-9), by Constanza Garces et al, 2021.
https://arquitectura.uc.cl/proyectos/noticias/6323

A praia da cidade com vista para Osorno (Picture), by Flavio Chan, 2009, Flickr (https://www.flickr.com/photos/flavs/4052876004).

2.2 The Llanquihue lake and its hydrology, topography, and climate

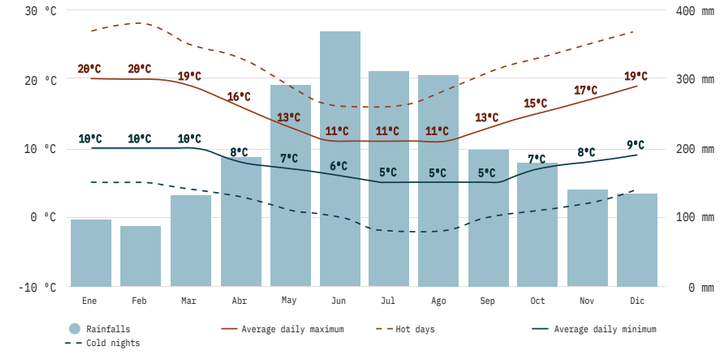
The Llanquihue lake is situated in the “Los Lagos” Region of Chile, between the provinces of Llanquihue and Osorno, which encompass the communes of Puerto Varas, Llanquihue, Frutillar, and Puerto Octay that border the lake. Its name is derived from the Mapudungun language, meaning “sunken place.” With a surface area of 871 square kilometers and a perimeter of 190 kilometers, it ranks as one of the largest lakes in Chile. It is nestled at the base of the Osorno and Calbuco volcanoes, which, along with numerous bays and peninsulas, contribute to the lake’s distinctive topography.

As was mentioned before, Llanquihue lake is a fundamental heritage for the hydrological network that consists the North Patagonia. The lake reaches a maximum depth of 317 meters and is fed by several rivers, including Blanco River, Arenal River, Pescado River, and Tepú River. These rivers then flow into the Maullín River. The lake’s crystal-clear waters, range of available aquatic sports, the presence of German architecture from the late 19th century, and the volcanoes as part of its topography have transformed Llanquihue lake into a popular destination for national and foreign tourists.

The lake is bordered by four important cities and several towns, including Puerto Varas, Frutillar, Llanquihue, and Puerto Octay, with a total population of 89,596 inhabitants. The region is accessible via several routes, such as “Ruta 5 Sur: Panamericana,” which traverses nearly all of Chile and is the most significant road in the southern part of the country. The “Inter Lagos” route covers all the lakes in northern Patagonia, while the “Circunvalación” route runs along the entire perimeter of Llanquihue Lake.

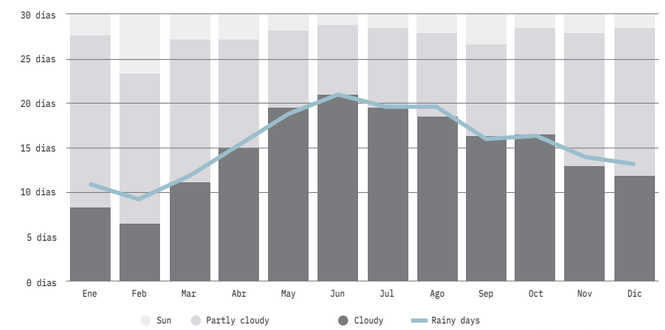
The region of “Los Lagos” has a temperate rainy climate. It is characterized by rainfall throughout the year, mostly cloudy or partly cloudy days, and moderate temperature variations between summer (8°C - 23°C) and winter (10°C - 10°C). This is attributed to the large body of water encompassing the lake and the sea, which mitigates sudden changes in temperature.

1. ANNUAL TEMPERATURES AND RAINFALLS GRAPH 2023



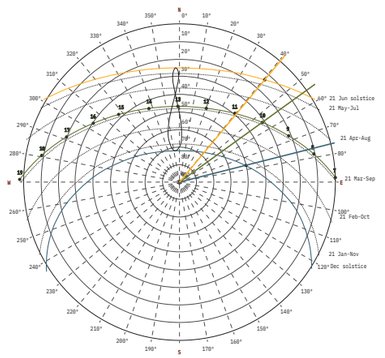
Information from meteoblue.com

2. CLOUD COVER - SUN - RAINFALLS GRAPH 2023



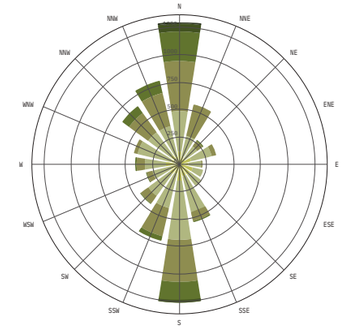
Information from meteoblue.com

3. SOLAR GRAPH 2023



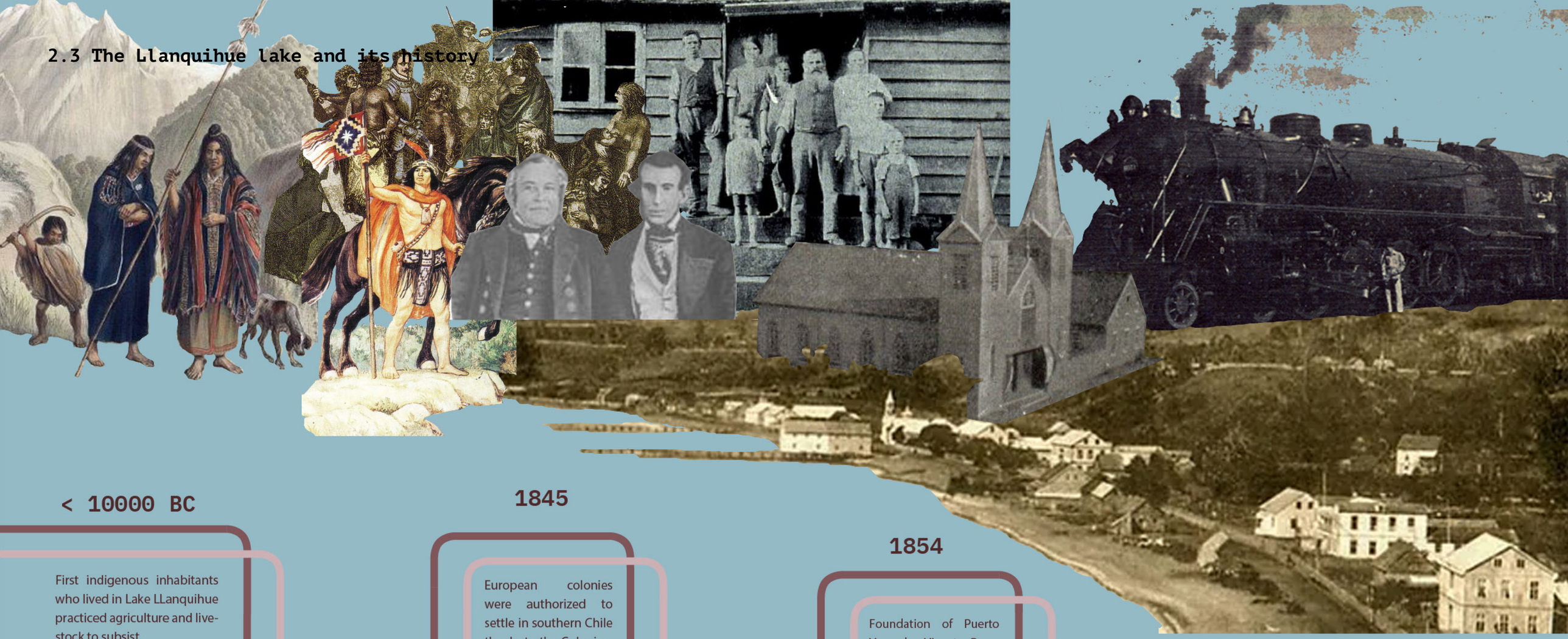
Information from SunEarthTools.com

4. WIND ROSE GRAPH 2023



Information from meteoblue.com

2.3 The Llanquihue lake and its history



< 10000 BC

First indigenous inhabitants who lived in Lake LLanquihue practiced agriculture and livestock to subsist

1541-1844

With the arrival of Pedro de Valdivia in Chilean territory, the period of the Spanish Conquest began. The sector of the lakes was predominantly indigenous belonging to the Mapuche people, recognized for their strong defense against the Spanish, preventing the conquest in the south for many years. The previously meant multiple wars that decreased the indigenous population in the area.

1845

European colonies were authorized to settle in southern Chile thanks to the Colonization Law.

1852

The expedition members Bernardo Phillipi and Vicente Perez Rosales decided to populate Lake Llanquihue with settlers brought from Germany. Once the colonization project was approved by the central government, the first shipment of German immigrants arrived in the current Puerto Montt, and gradually settled in the great Llanquihue Lake. During this same year, the City of Llanquihue and Puerto Octay were founded.

1854

Foundation of Puerto Varas by Vicente Perez Rosales as a lake navigation center and port of departure for trade from the lake to Puerto Montt.

1856

Foundation of the city Frutillar

1858

Subdivision of the land into properties for each settler family. The properties were located perpendicular to the shore of the lake and were distributed to the colonizing families. Then the first houses and farms arose on the edge of the lake.

1911

Inauguration of the Osorno - Puerto Montt railway, which produced an increase in population, more traditional Chilota architecture, tourism, and the start of important industries in the sector. Then the first houses and farms arose on the edge of the lake.

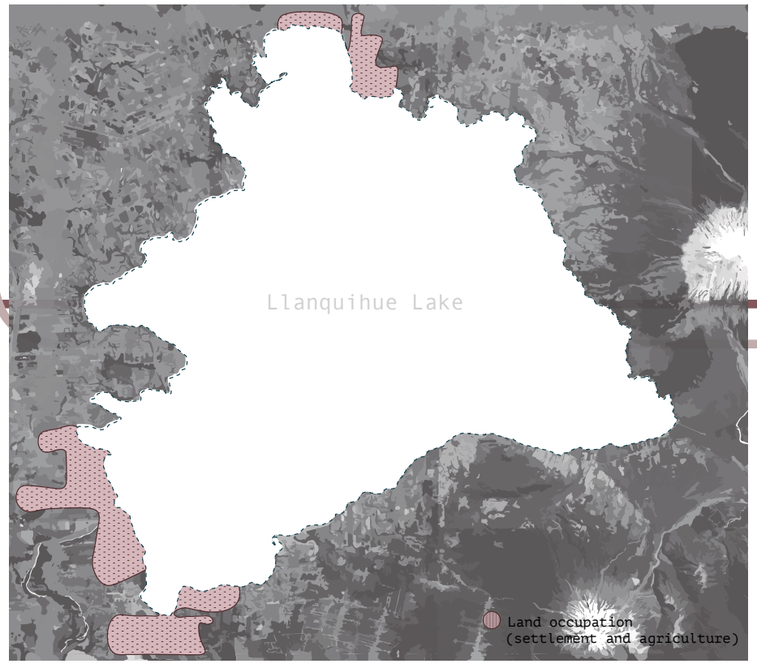
1950

Construction of the Pan-American highway and roads on the edge of the lake promotes the extension of the different cities on its edge.

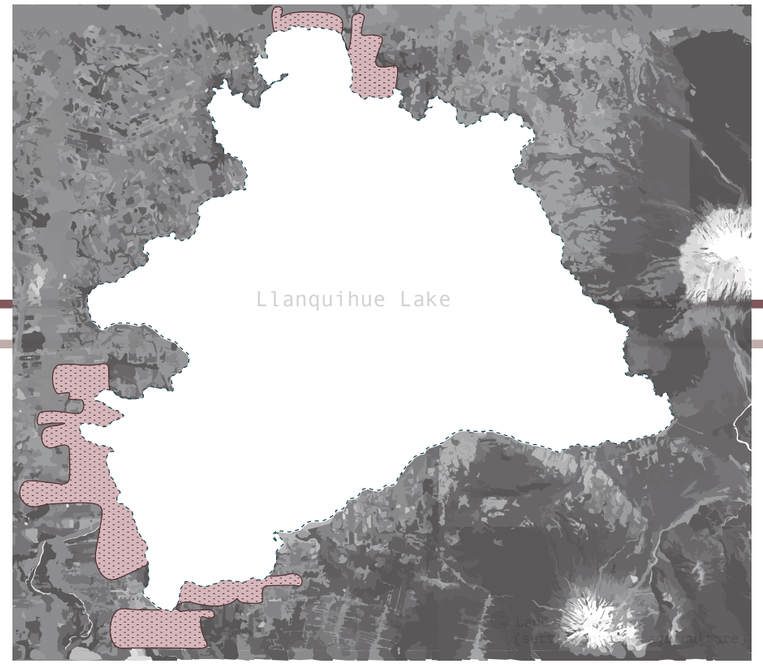
Information from: Acuña, F. et al, (2016). Frutillar Alto. Wixsite https://frutillaralto.wixsite.com/arq-uc
Information from: BIBLIOTECA NACIONAL DE CHILE. Puerto Montt 1853-2002. Memoria Chilena. Disponible en https://www.memoriachilena.gob.cl/602/w3-article-783.html.
BIBLIOTECA NACIONAL DE CHILE. Colonización alemana en Valdivia y Llanquihue (1850-1910). Memoria Chilena. Disponible en https://www.memoriachilena.gob.cl/602/w3-article-676.html .

Land use evolution: settlements and agriculture

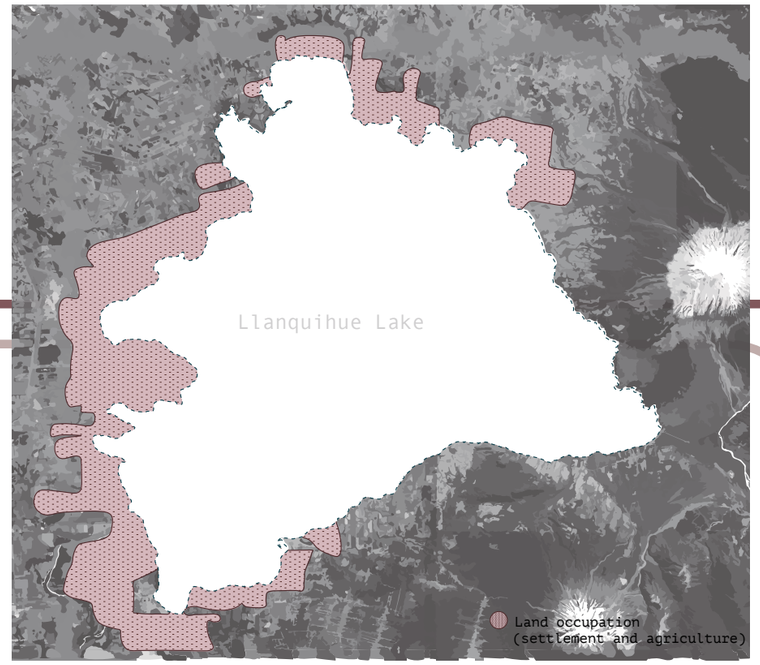
1852-1853: German arrival



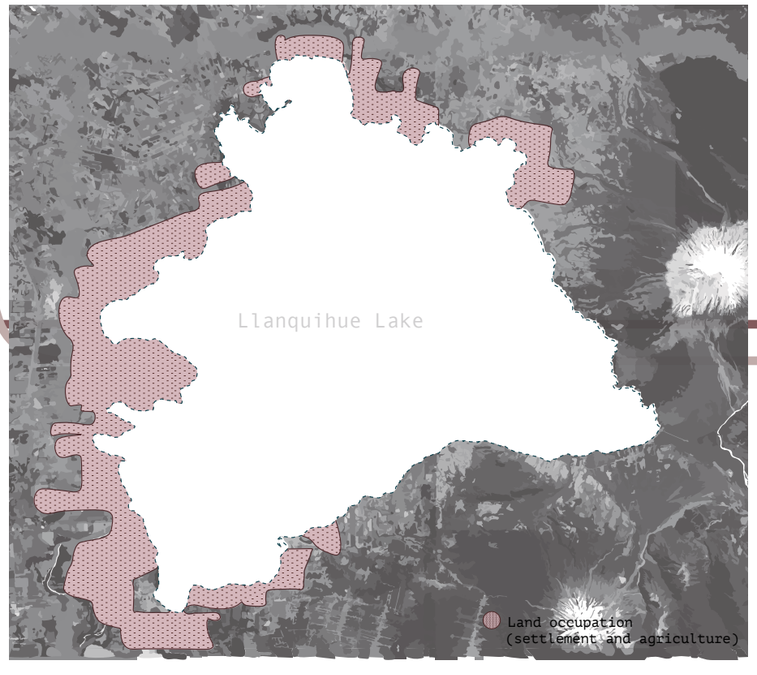
1854-1855: Fondation of the first cities



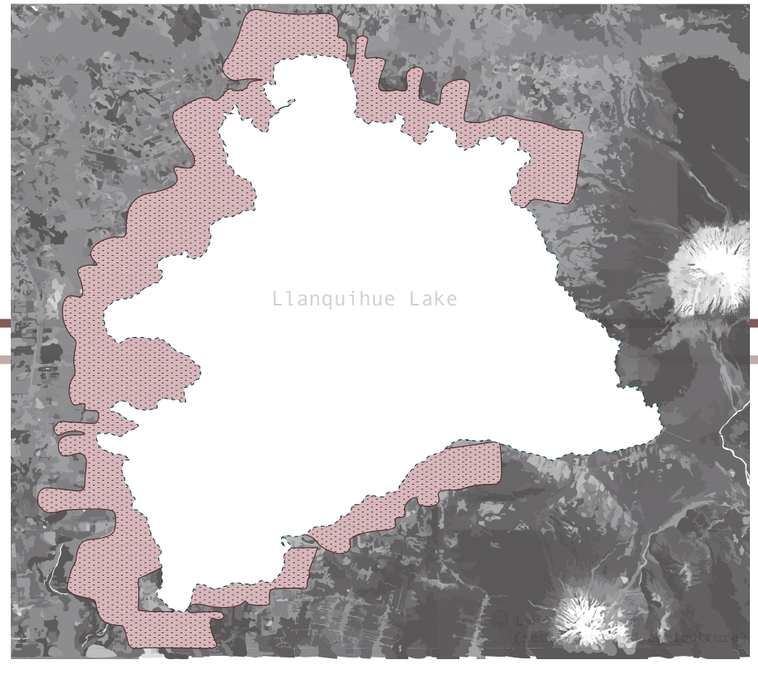
1856-1857: The industrial revolution begins



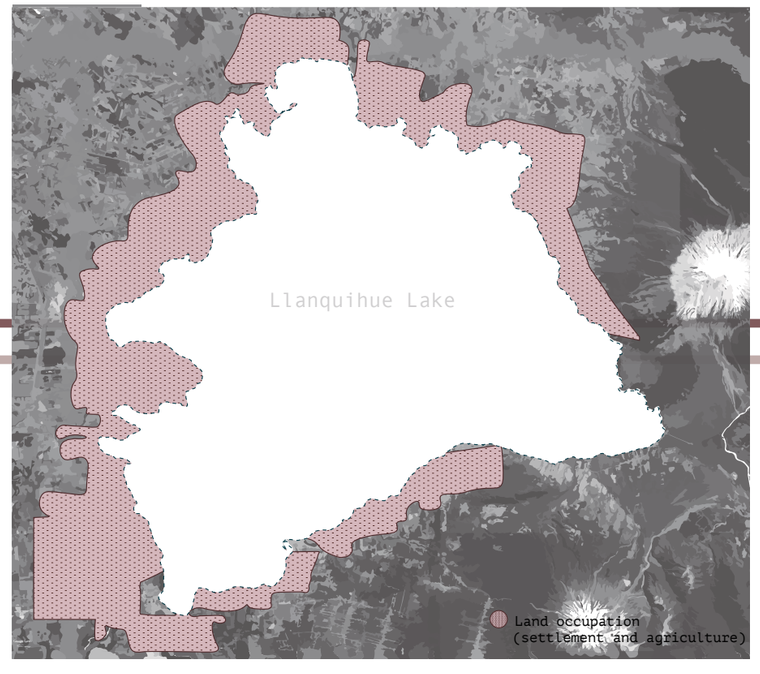
1870-1880



1860-1870

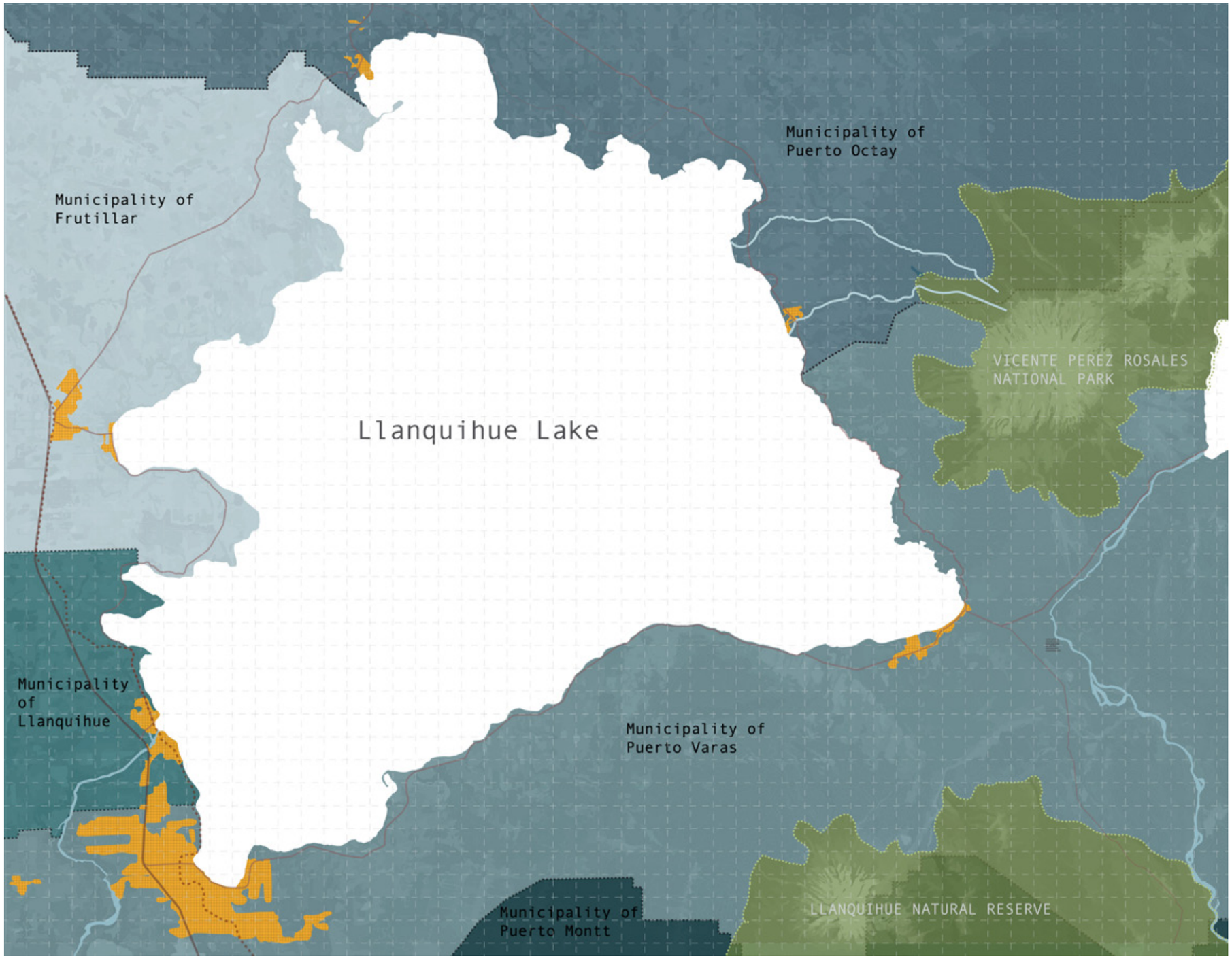


1880-1920: Arrival of the railway



Based on Plan from: Held W., E. (2018). Biblioteca y Archivo Histórico Emilio Held Winkler. Obtenido de Documentos sobre la colonización alemana del sur de Chile de la colección histórica de Emilio Held : https://www.dcb.cl/archivo-ehw.

2.4 The Llanquihue lake edge and its systems: administrative systems



The Llanquihue Lake, as we mentioned, is located in “Los Lagos” Region. This region has an area of 48,584 km², and its capital is the city of Puerto Montt. The current governor of the region is Patricio Iván Vallespin López, who is in charge of the regional government, which has as its main goal the social, cultural, and economic development of the region. At the same time, the congress has 10 deputies and 3 senators that represent the region for voting the laws. Also, the region has secretaries in different subjects, for this subject is important to mention the Regional Ministerial Secretariat for Housing and Urbanism which Fabián Nail Álvarez is in charge.

For purposes of government and internal administration, the land is divided into four provinces: Chiloé, Llanquihue, Osorno, and Palena. The lake belongs to two of them; Llanquihue and Osorno. Then, for local administration, the provinces are divided into municipalities. As can be seen on the map the lake involves the municipalities of Puerto Octay, Puerto Varas, Llanquihue, and Frutillar.

Each of these municipalities has its regulatory plan, which serves as an instrument for establishing standards related to land use or zoning, infrastructure, urban boundaries, and densities, among others. However, legally, no entity or urban plan considers the entire Llanquihue lake edge as a unified entity. There is no planning or design strategy for the development of the Llaqnuihue lake edge. This lack of integration has resulted in a lack of connectivity between localities and the lake edge in terms of accessibility, heritage protection, landscape continuity, inequality in terms of development due to the difference in income between municipalities, and other factors (Article 41 LGUC).

2.4 The Llanquihue lake edge and its systems: physical systems

LEGEND

1. NATURAL HERITAGE
2. RURAL
3. URBAN
4. CULTURAL HERITAGE

- VISUAL PERCEPTION
- WETLANDS
- PROTECTED AREAS
- PRINCIPAL ROUTES
- SECONDARY ROUTES
- TRAIN RAIL
- RIVERS

For the purposes of the investigation and subsequent project, the edge of Lake Llanquihue will be understood as a mosaic of syst that constitute it and characterize its habitability for human beings. As mentioned before, it has been decided to analyze each element of this edge separately and examine their interactions with each other.

1. NATURAL HERITAGE SYSTEM

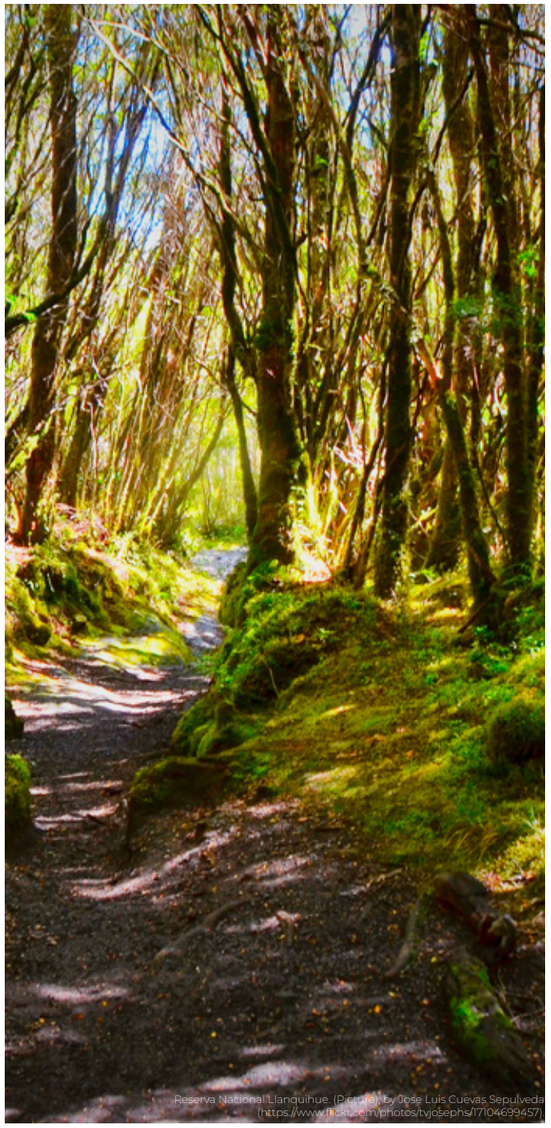
The term “nature” has always been part of the architectural discourse. There have been times when it was believed that nature is an inherent part of architecture, while in other instances, architecture has attempted to mimic or establish guidelines based on nature. There have also been arguments suggesting that nature is completely separate from architecture and purely a human discipline. Despite the current belief that nature does not exist in the landscape, as everything is at least partially influenced by human intervention, we will define it as a system named Natural Heritage. The definition will be everything that is characteristic of a place and existed before humans could appreciate these natural elements. This definition also includes biological biodiversity, which refers to “the variability among living organisms, which are part of all terrestrial and aquatic ecosystems” (Convention on Biological Diversity, 1992).


Volcan Osorno. (Picture), by Paul Barnouin (https://www.flickr.com/photos/133076781@N05/34393425345).


Laguna Cayutue - Vicente Perez Rosales N.P. (Picture), by Jorge Leon Cabello (https://www.flickr.com/photos/jorgeleoncabello/52879269743).

Lake Llanquihue in Chile is fortunate to have natural areas that remain untouched by human intervention and are abundant in water resources, flora, and fauna. The Natural Heritage system analyzed is divided into Valdivian Laurifolio Forest, Swamp or Riparian Forest, Deciduous Forest, Patagonian Evergreen Forest, Patagonian Andean Forest, Sclerophyll Forest, and Wetlands.

In terms of the protection of natural forests and wetlands, there are two major areas that are safeguarded by the government and private entities: Vicente Pérez Rosales National Park and Llanquihue National Reserve. Vicente Pérez Rosales National Park, established in 1926, is Chile’s oldest national park. It covers an area of 253,780 hectares and encompasses almost the entire Osorno volcano. On the other hand, the Llanquihue National Reserve, created in 1912 through collaboration between the government and private entities, spans 33,972 hectares and includes a portion of the Calbuco volcano. The following maps depict the diverse range of forests and the presence of nearly all the fauna within the studied territory. Additionally, the urban wetlands are protected under the new law (21,202) enacted in 2020.


Reserva Nacional Llanquihue. (Picture), by Jose Luis Cuevas Sepulveda (https://www.flickr.com/photos/tvjosephs/17104699457).


Reserva Nacional Llanquihue (Picture), by Nicolás Soto Guerra (https://www.flickr.com/photos/nicoignaciosg/24328504185).

2.4 The Llanquihue lake edge and its systems: physical systems

1.NATURAL HERITAGE SYSTEM

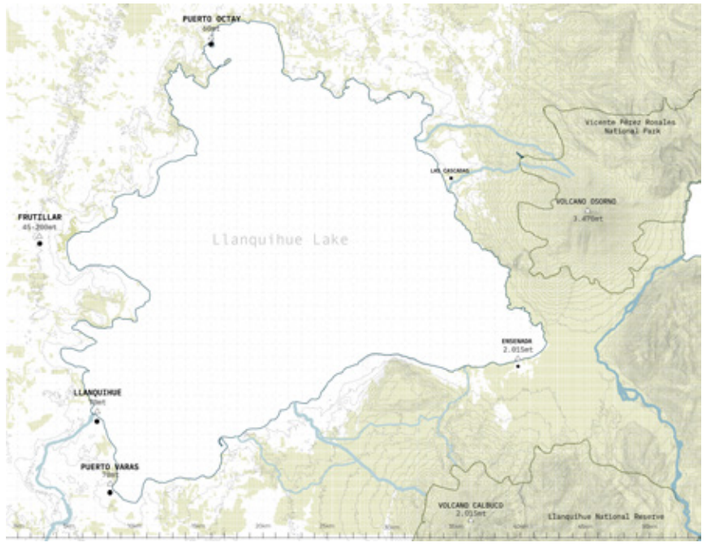
LEGEND

1. NATURAL HERITAGE

- VALDIVIAN LAURIFOLIO FOREST
- SWAMP OR RIPARIAN FOREST
- DECIDUOUS FOREST
- PATAGONIAN EVERGREEN FOREST
- PATAGONIAN ANDEAN FOREST
- SCLEROPHYLL FOREST
- WETLANDS
- PROTECTED AREAS
- RIVERS
- SETTLEMENTS

1. Valdivian Laurifolio Forest:

This type of forest is the most predominant in the area, due to the climatic conditions and the low demands it needs to grow. As can be observed on the map, it is constant in all types of topography.



Escenas del bosque - Region de Los Lagos (Chile). (Picture), by Jorge Leon Cabello (https://www.flickr.com/photos/jorgeleoncabello/7089342365)

Arrayán
(Luma apiculata)

Avellano
(Gevuina avellana Molina)

Canelo
(Drimys winteri)

Fuinque
(Lomatia ferruginea)

Luma
(Amomyrtus luma)

Mañio de hojas Cortas
(Saxegothaea conspicua)

Olivillo
(Aextoxicon punctatum)

Meli
(Amomyrtus meli)

Maqui (Aristotelia chilensis)

Palo Santo
(Dasyphyllum diacanthoides)

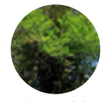
Pillo Pillo
(Ovidia pillopillo)

Pitrapitra
(Myrceugenia planipes)

Tepa
(Laureliopsis philippiana)

Tiaca
(Caldcluvia paniculata)

Tineo
(Weinmannia trichosperma Cav.)

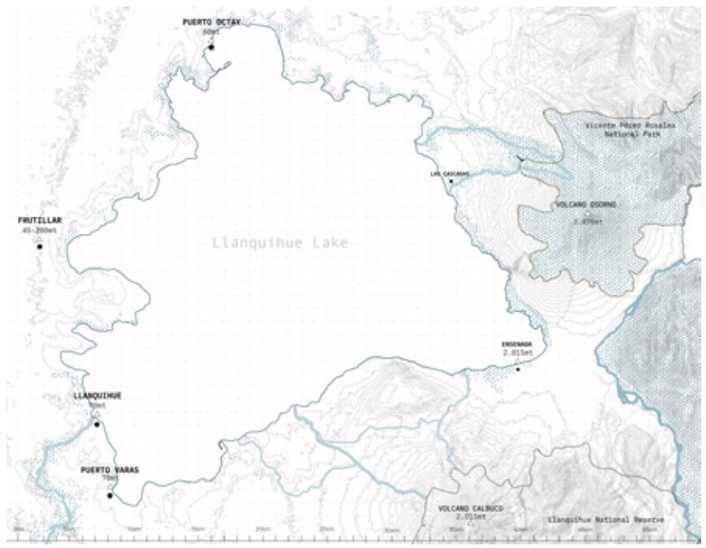


Sauco del Diablo
(Raukaua laetevirens)

Ulmo
(ucryphia cordifolia Cav.)

2. Swamp or Riparian Forest:

Este tipo de bosque se concentra en lugares ribereños o humedos, en areas especificas dentro de borde del lago como se puede apreciar en el mapa. Su conservación es esencial debido a que crea las condiciones de habitat especificas para ciertas especies



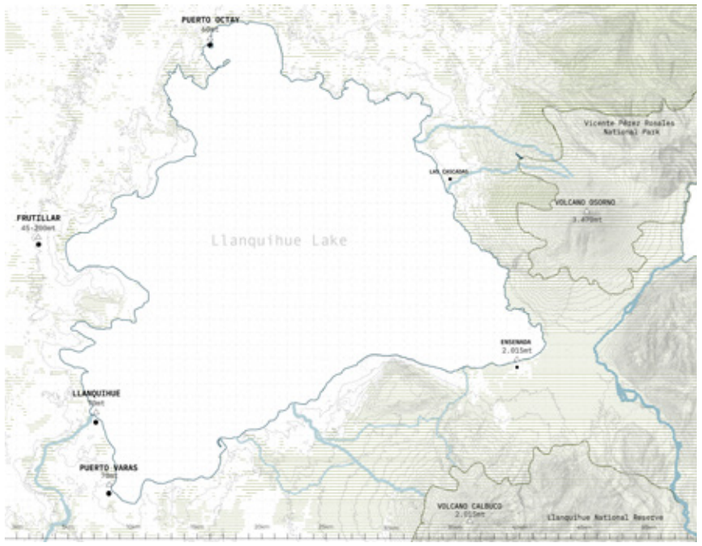
Maiten
(Maytenus boaria Molina)

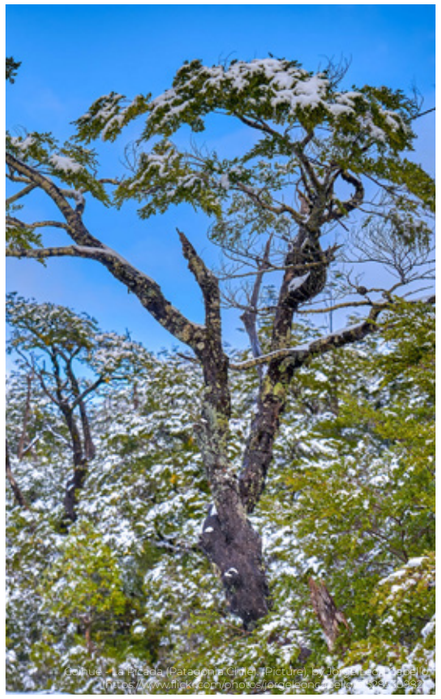
Pelú
(Sophora cassioides)

Río Maullín. (Picture), by Daniela Díaz (https://www.flickr.com/photos/entusmanosvacias/3480591061)

3. Deciduous Forest:

This type of forest is also present around the lake edge. It's characterized by trees that lose their leaves at the end of each growing season.




Alerzal. (Picture), by Tepualex (https://www.flickr.com/photos/35850058@N04/3442082265)


Radal
(Lomatia hirsuta)


Coihue
(Nothofagus dombeyi)

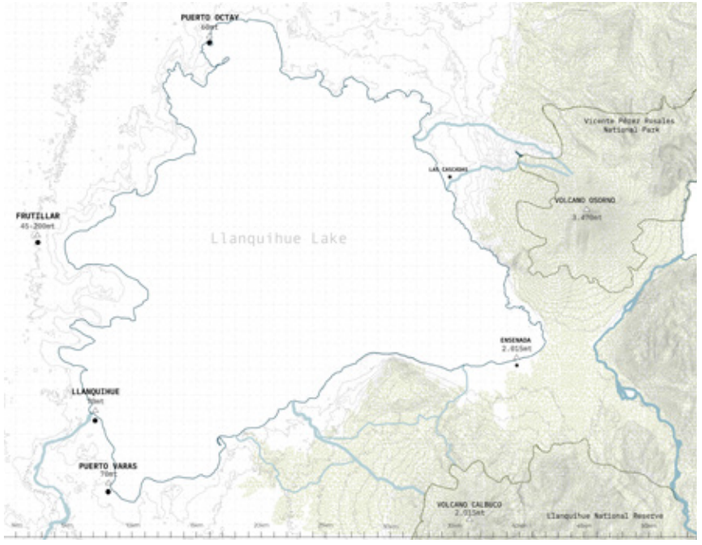

Laurel
(Laurelia sempervirens)

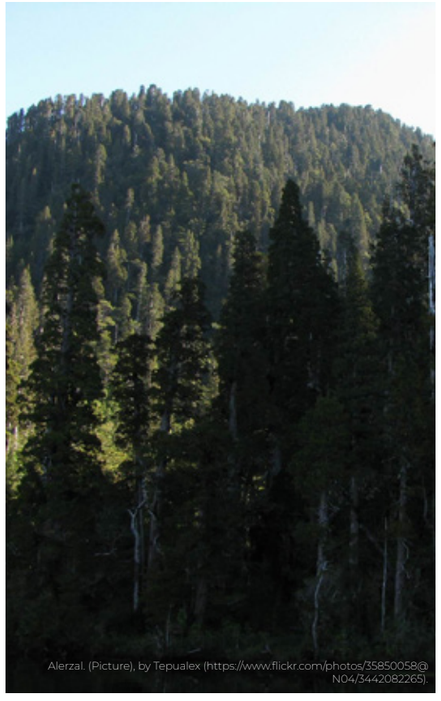

Lingue
(Persea lingue)

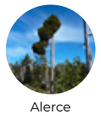

Roble
(Nothofagus obliqua)

4. Patagonian Evergreen Forest:

Also is present almost entirely in national parks due to it's protection and high topographic conditions it requires.



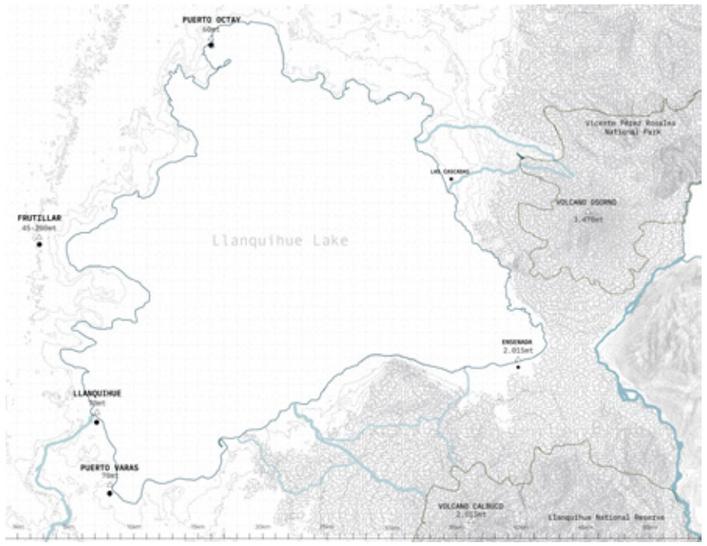

Alerzal. (Picture), by Tepualex (https://www.flickr.com/photos/35850058@N04/3442082265)

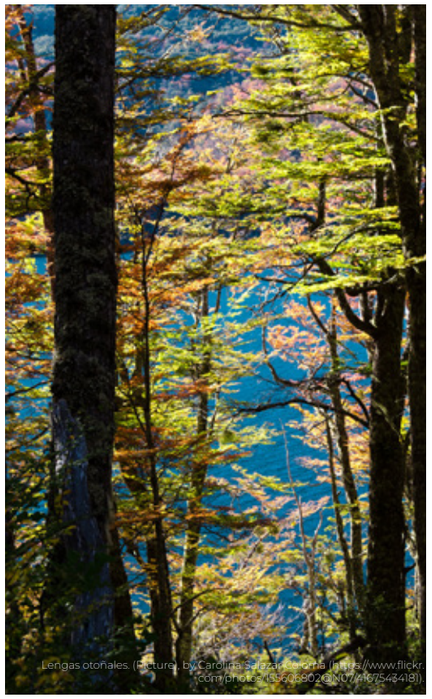

Alerce
(Fitzroya cupresoide)


Mañio de hojas punzantes
(Podocarpus nubigenus.)

5. Patagonian Andean Forest:

It's present almost entirely in national parks due to it's protection and high topographic conditions it requires.



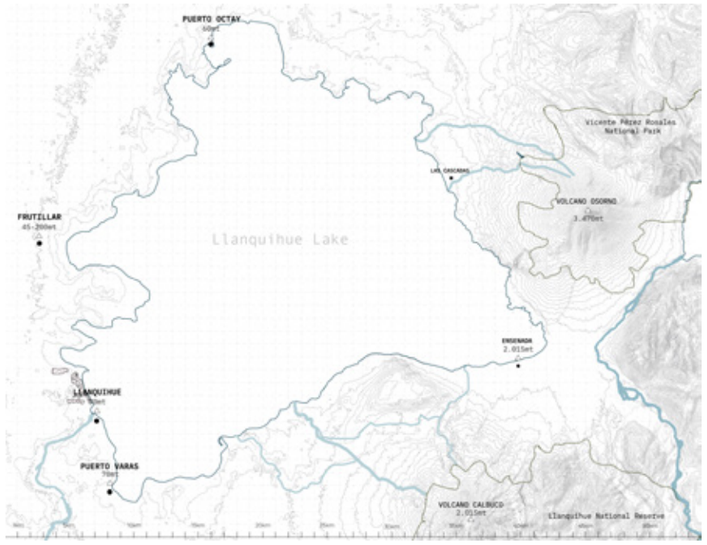

Lengas otoñales. (Picture), by Carolina Salazar Celorrio (https://www.flickr.com/photos/155608902@N07/46754841811)

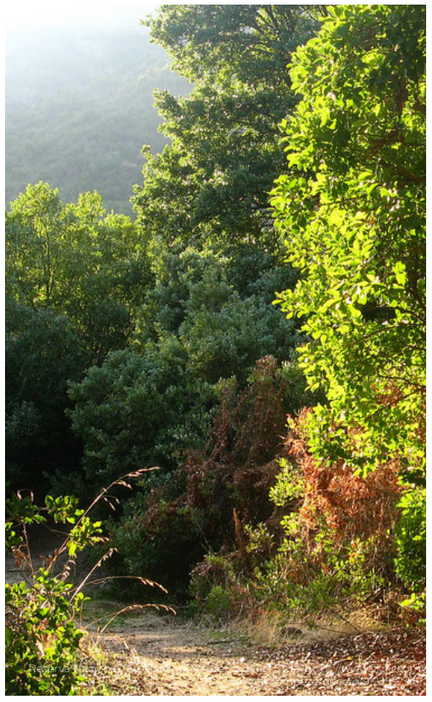

Lenga
(Nothofagus pumilio)


Notro
(Embothrium coccineum)

6. Sclerophyll Forest:

It is present in very specific areas because people encouraged its planting.

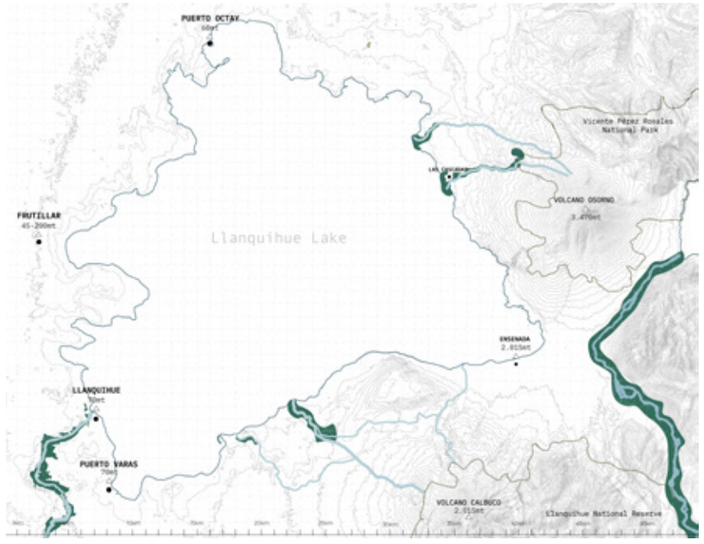


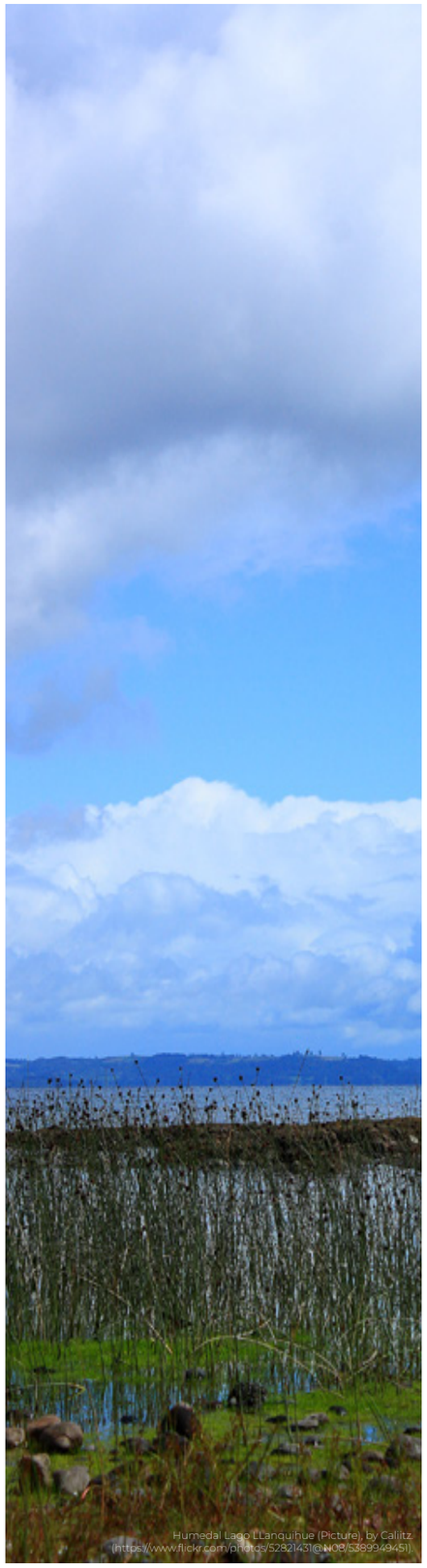

Bosque Nativo. (Picture), by Carolina Salazar Celorrio (https://www.flickr.com/photos/155608902@N07/46754841811)


Espino
Acacia caven)

7. Wetlands

Wetlands are aquatic ecosystems that serve as reservoirs for water storage. When located on sediment and permeable rocks, water seeps through the soil, sustaining biodiversity. Wetlands support various forms of life, from providing water resources for human consumption to serving as habitats for fish, crustaceans, amphibians, reptiles, migratory birds, and more. In terms of landscape, the wetlands bring nature inside the cities, with a low type of vegetation that generate panoramic views. Also, they connect the green landscape through a vertical relationship between the lake and the nature of the lake's edge. Chile is home to 18,000 wetlands. However, only 2% of have any form of protection. "Los Lagos" region is the second most abundant region in Chile in terms of wetland presence, with over 500 hectares of urban wetlands protected by law. In 2020, Chile enacted Law 21,202, which represents the first legal instrument specifically designed to protect urban wetlands from various threats, including urban expansion and pollution. Within the Llanquihue Lake area, several wetlands are protected by the government as La Gruta urban wetland, Picurio urban wetland, Nuco urban wetland, among others. Additionally, some wetlands, adjacent to the Mullin River, are currently in the process of being declared protected (Ministerio del Medio Ambiente, 2022). However, in Llanquihue, the are where the wetlands predomine is in Llanquihue city and its sorrounding areas. The wetlands had define the landscape of the city but also has posed the challenge of planning its urbanization, protecting it more and more.




Humedal Lago LLanquihue (Picture), by Caliitz (https://www.flickr.com/photos/52821431@N08/53899494511)

8. Hydrological resources:

As mentioned before, the hydrological resources of the Llanquihue lake are those that allow life and the ecosystem on the edge of the lake and are also the main element of the natural heritage system that defines its landscape.


Fishing / Lake Llanquihue. (Picture), by Hernán Castro (https://www.flickr.com/photos/miradas_compartidas/50911621396)


Lago Llanquihue, Frutillar, Chile. (Picture), by Cristian Alcázar C. (https://www.flickr.com/photos/cristian_alcazar/54427990426)


Fishing / Lake Llanquihue. (Picture), by Hernán Castro (https://www.flickr.com/photos/miradas_compartidas/50911621396)

FAUNA

Des Murs's wiretail (Sylviortho-rhynchus

Austral thrush (Turdus falklandii)

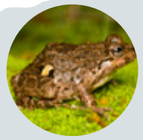
Olive grass mouse (Abrothix olivaceus)

Darwin's frog (Rhinoderma darwini)

Fire-eyed di-ucon (Xolmis pyrope)

White-crested elaenia (Elae-nia albiceps)

Grass wren (Cistothorus platensis)



Chilean Four-eyed Frog (Pleurodema thaul)

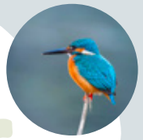
Chilean pigeon (Patagioenas araucana)

Black-crowned night heron (Nycticorax nycticorax)

Brown-hood-ed Gull (Larus maculipennis)

Slender-billed parakeet (Enicognatus leptorhyn-chus)

Black-throat-ed huet-huet (Pteroptochos tarnii)



Common kingfisher (Ceryle torquata)

Plain-mantled tit-spinetail (Leptasthenu-fa aegithaloi-des)

Cattle egret (Bubulcus ibis)

Chiloé wigeon (Anas sibi-latrix)

Black-chinned siskin (Carduelis barbata)

Yellow-billed teal (Anas flavirostris)

Great grebe (Podiceps major)

Red-gartered coot (Fulica armillata)

Black-necked swan (Cygnus melancory-phus)

Kelp gull (Larus domin-icanus)

Eared Dove (Zenaida auriculata)

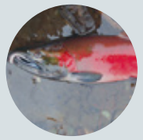
Cocoi heron (Ardea cocoi)

Great egret (Ardea alba)

The Patagon-ian tyrant (Co-lorhamphus

KING SALM-ON (Oncorhy-nchus)

Brown Trout (Salmo trutta fario)



Pejerrey (Odontesthes bonariensis)

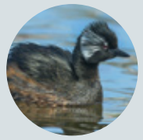
Rainbow trout (Oncorhyn-chus mykiss)

Silvery Grebe (Podiceps occipitalis)

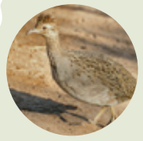
Dark-bellied cinclodes (Cinclodes patagonicus)

Emerald forest frog (Hylorina sylvatica)

Cinnamon teal (Anas cyanoptera)



White-tufted grebe (Rollan-dia rolland)

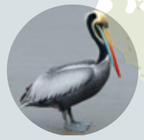


Thorn-tailed rayadito (Aphrastura spinicauda)

Black vulture (Coragyps atratus)

Long-tailed colilargo (Oligoryzomys longicanda-tus)

Chilean flicker (Colaptes pitius)



Peruvian pelican (Pelecanus thagus)

Neotropic cormorant (Phala-crocorax brasilianus)

Austral pygmy owl (Glaucidi-um nanum)

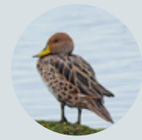
American kestrel(Falco sparverius)

Skunk (Conepatus chinga)

Crested cara-cara (Caracara plancus)

Patagonian sierra finch (Phrygilus patagonicus)

Snowy egret (Egretta thula)



Yellow-billed Pintail (Anas georgica chilensis)

Southern lapwing (Vanellus chilensis)

Chimango caracara (Milvago chimango)

South Amer-ica Gray Fox (Pseudalopex griseus)

Monito del monte (Dromiciops gliroides)

Striped woodpecker (Picoides lignarius)

Many-colored rush tyrant (Tachuris rubrigastra)

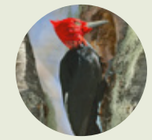
Black-faced Ibis (Theristicus melanopis)

Green-backed firecrown (Sephanoides sephaniodes)

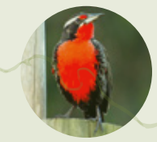
Austral black-bird (Curaeus curaeus)

PUMA (Puma concolor)

PUDU (Pudu pudu)



Black woodpecker(-Campephilus magellanicus)



Long-tailed meadowlark (Sturnella loyca)

Huillin (Lontra provocax)

Galvarinus chilensis (Tachymenis chilensis)

Wren-like Rushbird (Phleocryptes melanops)

2. RURAL SYSTEM

The process of German colonization during the 19th century in Lake Llanquihue, as we mentioned before, brought to the region a cultural heritage with particular and different economic and social characteristics than the rest of the country. One of the reasons why it had such development was the adoption of German practices in organizing the structure, which promoted and influenced regional economic growth (Turra, 1994). Despite the urban expansion that has occurred in recent decades, the land use on the edge of Lake Llanquihue remains predominantly rural, serving as a pillar for the economy of the existing cities. According to the 2017 census, among the four communes that make up Lake Llanquihue, there are a total of 89,596 inhabitants, of which 28,162 live in rural areas. This means that 30.4% of the population lives in rural areas (Census of Population and Housing, 2017).

Furthermore, according to studies, the main economic activities in the area continue to be agriculture, livestock industries, and horticulture. In the Llanquihue commune, cattle industries hold the first place with 20.8% of the market size, while crops, cultivation, and horticulture rank fifth with 4.1%. Agricultural production combined with cattle industries occupies the sixth place with 3.5%. In Frutillar, animal husbandry accounts for 20.7%, food product manufacturing for 13.4%, and crops with horticulture for 7.6%. Puerto Octay, being the smallest city, relies on agriculture, livestock, and fishing, which contribute to 69% of its earnings. However, the commune of Puerto Varas is the only one in which its main earnings do not depend on rural areas but rather on motor vehicle and motorcycle repairs, accounting for 22.9%. Agriculture, livestock, forestry, and fishing follow in second place with 12.8% (Center for Natural Resources Information, 2021).

Therefore, it is important to understand how the rural physical system works and the type of landscape created along the lake border. To understand this, it is necessary to study the agrarian structure established and developed in this region, from its colonization beginnings to the present day. During colonization, land distribution consisted of symmetrical properties, divided into two parts: one for immediate exploitation and the other to be exploited later. This concept of private rural property development led to a perception and valuation of the land that differed from the Iberian latifundia structure implemented in the rest of the country. The German settlers embraced the idea of artisan farmers working with their families and producing a variety of crops, considering their land as a multi-productive farm. Over time, this region became the only one without the Iberian latifundia structure and witnessed more technological advancements in land exploitation. Regarding cultivated crops, different species were introduced, but some were not successful due to the lake's climate. Agricultural records from 1860 indicate that the main crops were potatoes, wheat, rye, oats, barley, chickpeas, corn, and beans (Díaz, 1994). Currently, agriculture in the area includes permanent and rotational cultivation, mainly focusing on cereal crops such as potatoes, bread wheat, oats, triticale, rye, and fodder barley, among others. Fruit trees such as blueberries, hazelnuts, cranberries, raspberries, red sarsaparilla, cherries, gooseberries, maqui berries, and black sarsaparilla are also cultivated, along with various leguminous plants, tubers, nurseries, and vineyards.

Regarding livestock development on the lake edge, historical data from 1860 indicate that cattle, horses, mules, sheep, goats, and pigs were mainly raised (Díaz, 1994). Presently, there are local livestock industries and farms characterized by grazing or mixed prairies, where both agriculture and livestock rearing occur in the same area. The animals raised in the region include dairy cows, beef cattle, sheep, horses, and poultry.

The following maps will show the density of the rural land use on the LInaquihue lake edge, and how is the relationship between the topography and the type of rural use of land. Also, it will show the different types of land treatment, which define the rural landscape: 1. Rural land use mix use (crops and grazing), 2. Rural land for livestock (grazing), Rural land for crops (Intensive and rotative use), and 4. Rural land for crops (permanent use.

Vacas lago Llanquihue. (Picture), by "tunquen", 2010, Flickr (https://www.flickr.com/photos/marcellito/11161243475)

Escena rural - Loncotoro (Patagonia - Chile). (Picture), by Jorge Leon Cabello, 2015, Flickr (https://www.flickr.com/photos/jorgeleoncabello/17073991863)

2.4 The Llanquihue lake edge and its systems: physical systems

2. RURAL SYSTEM

LEGEND

2. RURAL

RIVERS

SETTLEMENTS

1. Rural land with mix use (crops and grazing)


Papa
(Solanum tuberosum)


Trigo harinero
(Triticum aes-tivum)


Avena
(Avena sativa)


El Centeno
(Secale cereale)


La Cebada
(Hodeum vulgare)


Arándano
(Vaccinium corymbosum)


Avellanas
(Corylus avellana)


Caballos
(Equus caballus)


Aves de corral
(Gallus gallus domesticus)

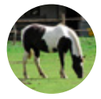

Vaca lechera
(Bos taurus)


Oveja
(Ovis orientalis aries)

2. Rural land for livestock (grazing)


Vaca lechera
(Bos taurus)


Oveja
(Ovis orientalis aries)


Caballos
(Equus caballus)


Aves de corral
(Gallus gallus domesticus)

3. Rural land for crops (Intensive and rotative use)


Papa
(Solanum tuberosum)


Trigo harinero
(Triticum aes-tivum)


Avena
(Avena sativa)


El Centeno
(Secale cereale)


La Cebada
(Hodeum vulgare)

4. Rural land for crops (permanent use)


Arándano
(Vaccinium corymbosum)


Avellanas
(Corylus avellana)


Frambuesas
(Rubus idaeus)


Zarzaparrilla Roja
(Muehlenbeckia


Cerezas
(Prunus avium)


Grosellas
(Phyllanthus acidus)


Maqui
(Aristotelia chilensis)


Zarzaparrilla Negra
(Ribes nigrum L.)

3. URBAN SYSTEM

The Llanquihue Lake, as mentioned above, has four urban areas where the cities of Puerto Octay, Frutillar, Llanquihue, and Puerto Varas are located. Out of a population of 89,596 inhabitants, 61,434 are concentrated in these four urban areas (68.57%). The region is also known as a popular national and international tourist destination. During the first semester of 2022 (the summer vacation period), the “Los Lagos” Region was the third region with the highest number of tourists in Chile. It recorded a total of 415,976 accumulated arrivals, representing a 167.7% year-over-year increase, and the occupancy rate was 39.9% (Instituto Nacional de Estadísticas Chile, 2022).

Delving into the social characteristics of each commune, Puerto Octay is a city with 2,053 inhabitants out of a total of 8,999 (2017 Census). The distribution of the population by age range indicates that 29% of its population is between 45-64 years old. In terms of identity with a native group, 33% identify themselves as Mapuche. The poverty records in the commune show that 14% of the population has low incomes, and 27.4% experience multidimensional poverty. In summary, in 2020, 46.4% of the population was identified as lacking basic services. This includes access to drinking water from the public network or distribution system from underground or surface sources (Biblioteca del Congreso Nacional, 2021).

In second place, Frutillar has 12,952 inhabitants out of a total of 18,428 (2017 Census). The distribution of the population by age range indicates that 26% of its population is between 45-64 years old. 24.6% identify themselves as Mapuche, a native group. In terms of poverty records in the commune, the income-based poverty rate is 10.4%, and the multidimensional poverty rate is 19.9%. In summary, in 2020, 12.9% of the population was identified as lacking basic services (Biblioteca del Congreso Nacional, 2021).

In third place, Llanquihue has 14,222 inhabitants out of a total of 17,591 (2017 Census). The distribution of the population by age range indicates that 26% of its population is between 45-64 years old. 30% identify themselves as Mapuche, a native group. In terms of poverty records in the commune, the income-based poverty rate is 13.7%, and the multidimensional poverty rate is 13%. In summary, in 2020, 13.4% of the population was identified as lacking basic services (Biblioteca del Congreso Nacional, 2021).

Finally, Puerto Varas has 32,210 inhabitants out of a total of 44,578 (2017 Census). The distribution of the population by age range indicates that 29% of its population is between 45-64 years old. 33% identify themselves as Mapuche, a native group. In terms of poverty records in the commune, the income-based poverty rate is 14%, and the multidimensional poverty rate is 27.4%. In summary, in 2020, 46.4% of the population was identified as lacking basic services (Biblioteca del Congreso Nacional, 2021).

For a more comprehensive analysis of the cities on the lake edge, the following pages will study the morphology and functional distribution of each city. This means the types of existent accessibility between cities and to the lake edge, the zonification, and present natural and cultural heritage. When comparing the maps the difference will become visible between the cities in terms of development and density.

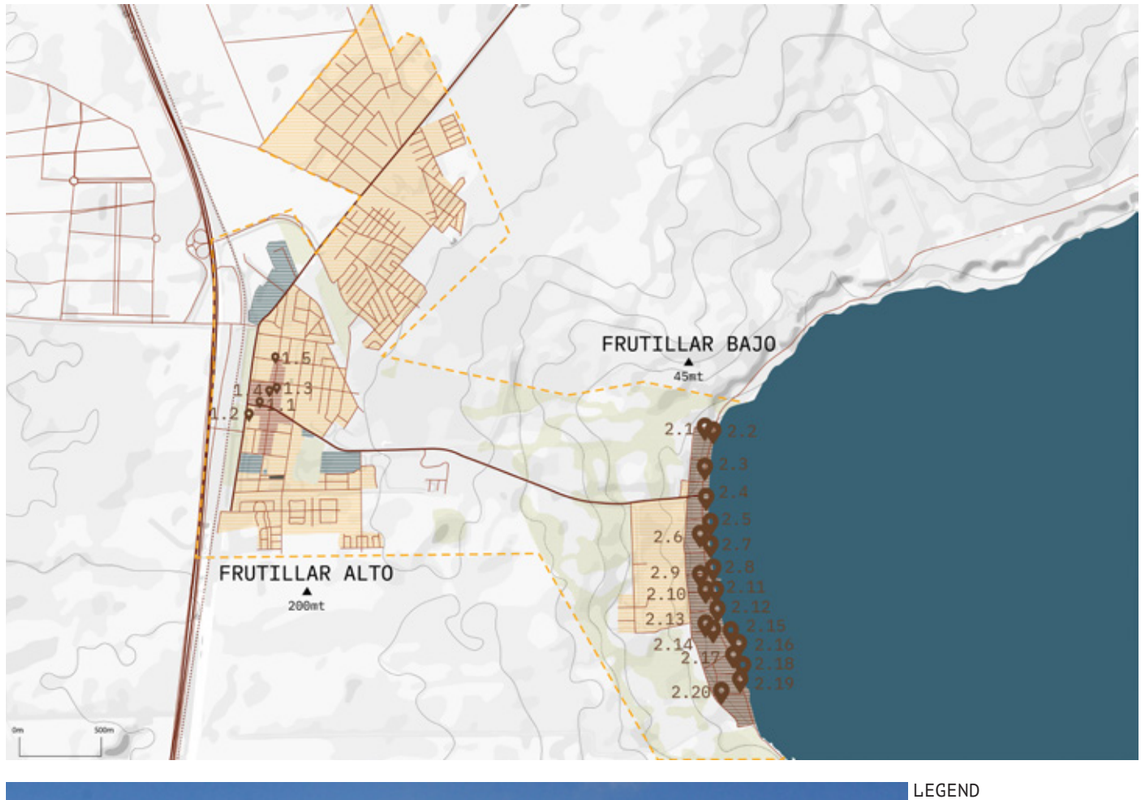
Frutillar , la ciudad de la musica (Chile). (Picture), by Antonio Martin, 2018, Flickr (https://www.flickr.com/photos/15200836@N02/46474544882).

2.4) The Llanquihue lake edge and its systems: physical systems
3. URBAN SYSTEM

LEGEND

3. URBAN
- PROTECTED AREAS
- PRINCIPAL ROUTES
- SECONDARY ROUTES
- TRAIN RAIL (NOT IN USE)
- TRAILWAYS
- PRIVATE NAVEGATION
- KAYAC
- RIVERS

1. FRUTILLAR CITY

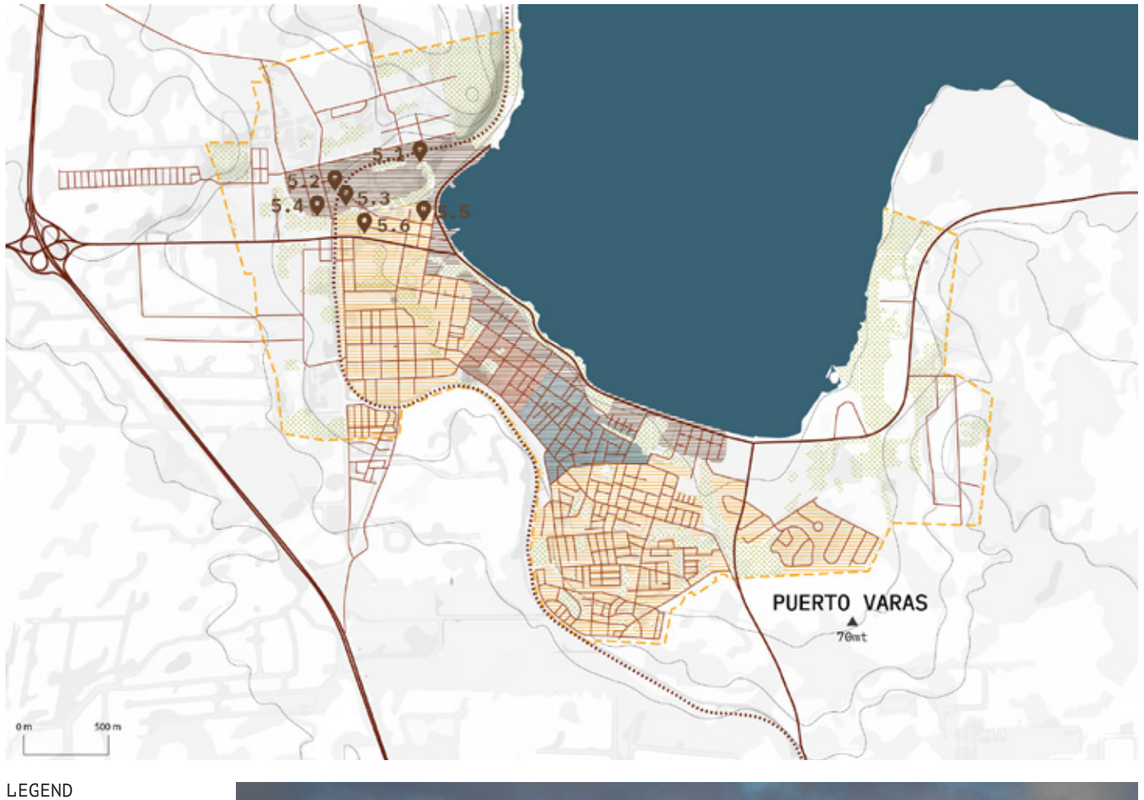


Frutillar , la ciudad de la musica (Chile). (Picture). by Antonio Martin, 2018, Flickr (https://www.flickr.com/photos/15200836@N02/46474544882).

LEGEND

3. URBAN
   - PRINCIPAL ROUTES
   - SECONDARY ROUTES
   - TRAIN RAIL
   - RESIDENTIAL ZONE
   - COMMERCIAL ZONE
   - INDUSTRIES AND SERVICES
   - GREEN AREAS
   - HISTORICAL CENTER
   - CULTURAL HERITAGE
     1. FRUTILLAR ALTO
        - 1.1 TRIO AVENIDA RICHTIER
        - 1.2 MOLINO
        - 1.3 CORDONERIA AINIL
        - 1.4 TRIO AVENIDA WINKLER
        - 1.5 WINKLER HOUSES
     2. FRUTILLAR BAJO
        - 2.1 DAETZ-NANNING HOUSEC
        - 2.2 EDMUNDO WINKLER HOUSE
        - 2.3 KLOCKER HOUSE
        - 2.4 RICHTER HOUSE
        - 2.5 PARROQUIAL HOUSE
        - 2.6 NIKLITSCHEK-WESTER
        - 2.7 PINNINGHOFF HOUSE
        - 2.8 DOM HOUSE
        - 2.9 PHILIPPI 811 HOUSE
        - 2.10 SCHEEL-KLESSE HOUSE
        - 2.11 HECHENLETNER-KAHLER
        - 2.12 PHILIPPI 989 HOUSE
        - 2.13 WULF HOUSE
        - 2.14 KROHMER-HELN HOUSE
        - 2.15 PASTORAL LUTERANA
        - 2.16 WINKLER-FUCHSLOCHER
        - 2.17 HITSCHFELD-WINKLER
        - 2.18 HORNIG HOUSE
        - 2.19 BISCHOFFSHAUSEN
        - 2.20 NANNING I HOUSE

2. PUERTO VARAS CITY

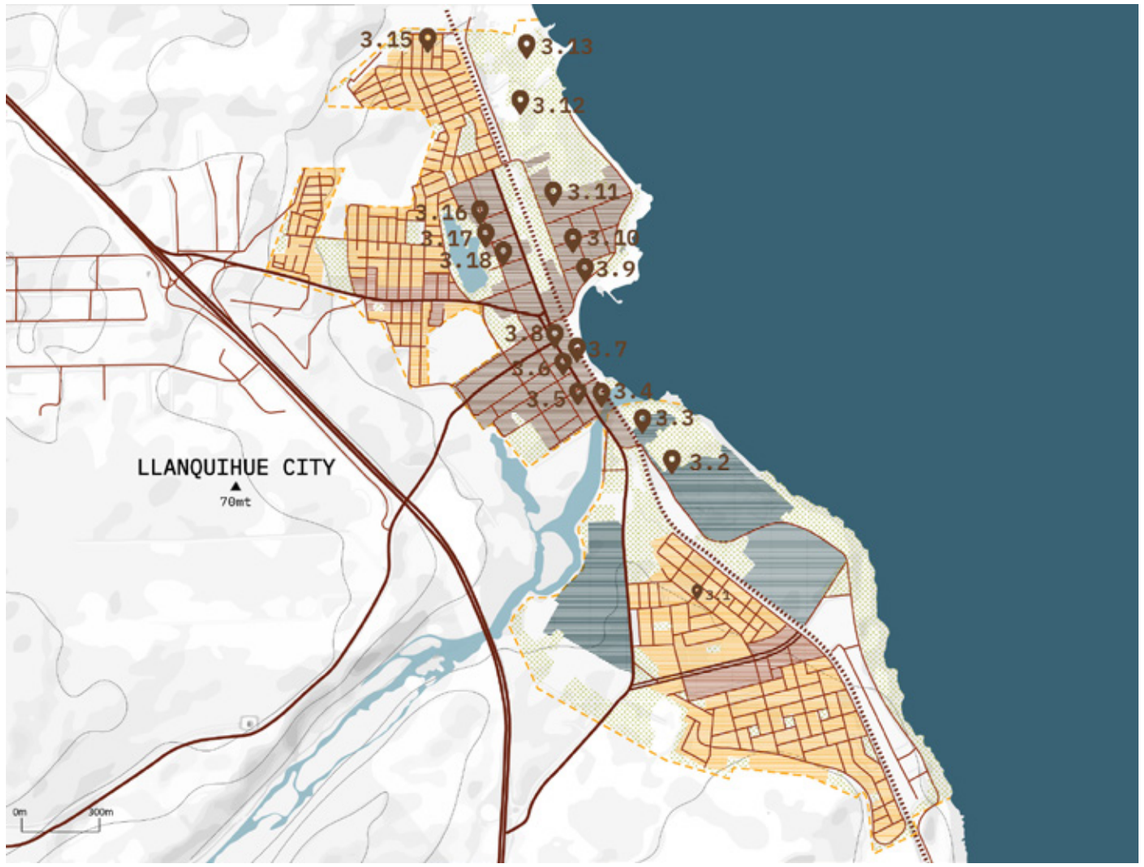


LEGEND

3. URBAN
   - PRINCIPAL ROUTES
   - SECONDARY ROUTES
   - TRAIN RAIL
   - RESIDENTIAL ZONE
   - COMMERCIAL ZONE
   - INDUSTRIES AND SERVICES
   - GREEN AREAS
   - HISTORICAL CENTER
   - CULTURAL HERITAGE
     5. PUERTO VARAS
        - 5.1 KUSCHEL HOUSE
        - 5.2 GERMAN HOUSE
        - 5.3 JUPTNER HOUSE
        - 5.4 MALDONADO HOUSE
        - 5.5 GOTSCHLICH HOUSE
        - 5.6 YUNGLE HOUSE

Puerto varas. (Picture). by Cristian Alcazar (https://www.flickr.com/photos/cristian_alcazar/16734538853).

3. LLANQUIHUE CITY

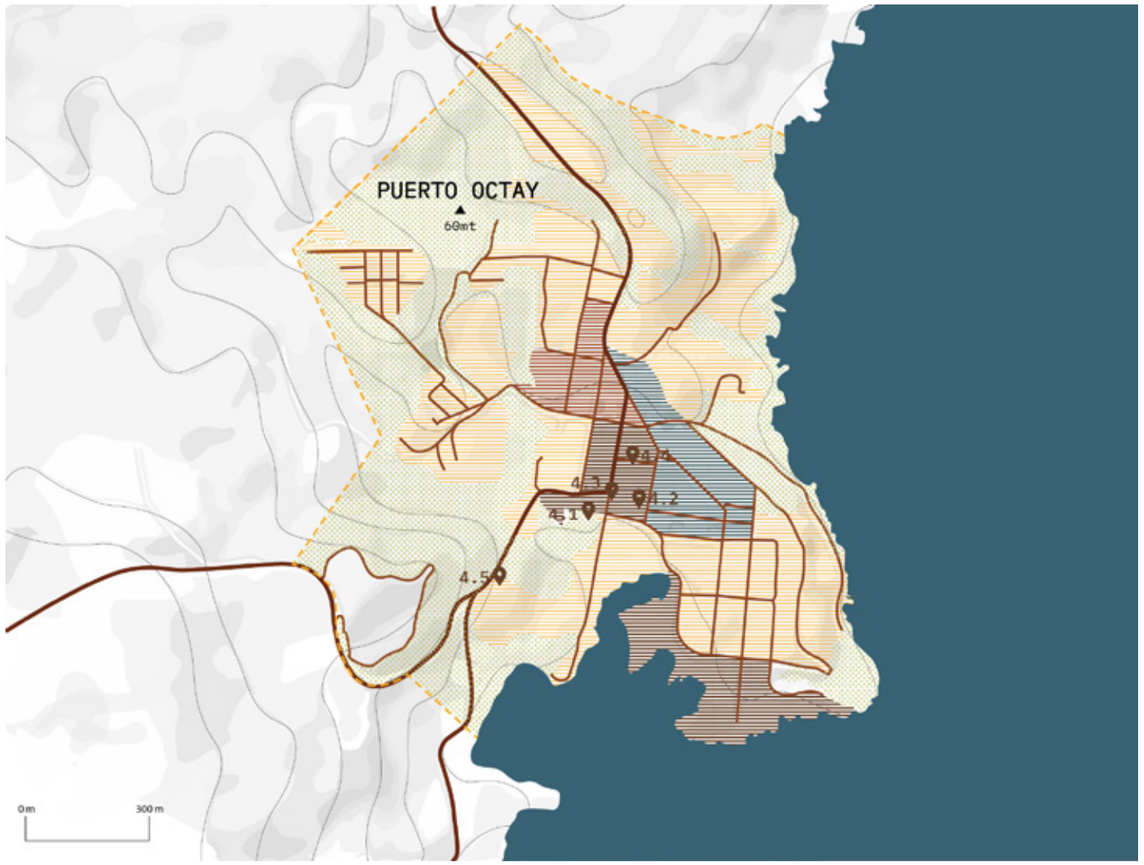


Ciudad y territorio. (Picture), by gmovillegas, 2017. Flickr (https://www.flickr.com/photos/gmovillegas/24030954778).

LEGEND

3. URBAN
- PRINCIPAL ROUTES
- SECONDARY ROUTES
- TRAIN RAIL
- RESIDENTIAL ZONE
- COMMERCIAL ZONE
- INDUSTRIES AND SERVICES
- GREEN AREAS
- HISTORICAL CENTER
- CULTURAL HERITAGE
  - 3. LLANQUIHUE CITY
    - 3.1 IANSA FABRIC
    - 3.2 INDEPA FABRIC
    - 3.3 PORVENIR WINDMILL
    - 3.4 OLD PIER
    - 3.5 SCHOBITZ HOUSE
    - 3.6 LLANQUIHUE TRAIN STATION
    - 3.7 KUSCH HOTEL
    - 3.8 EIFFEL BRIDGE
    - 3.9 SAN JOSE CHURCH
    - 3.10 PETERS HOUSE
    - 3.11 CARDENAS OYARZO
    - 3.12 GERMAN GIMNASTIC
    - 3.13 HELD HOUSE
    - 3.14 CAMPING WERNER HOUSE
    - 3.15 WESTERMAIER HOUSE
    - 3.16 WERNER & RADDATZ HOUSE
    - 3.17 ERNER HOUSE
    - 3.18 DE LA CULTURA HOUSE

4. PUERTO OCTAY CITY



LEGEND

3. URBAN
- PRINCIPAL ROUTES
- SECONDARY ROUTES
- TRAIN RAIL
- RESIDENTIAL ZONE
- COMMERCIAL ZONE
- INDUSTRIES AND SERVICES
- GREEN AREAS
- HISTORICAL CENTER
- CULTURAL HERITAGE
  - 4. PUERTO OCTAY
    - 4.1 NIKLITSCHEK HOUSE
    - 4.2 HAASE HOTEL
    - 4.3 WULF HOUSE
    - 4.4 AÑAZCO HOUSE
    - 4.5 WERNER HOUSE

Vista ciudad de Puerto Octay. (Picture), by Tiago Chaves (https://www.flickr.com/photos/tiagohomack/2820851644).

4. CULTURAL HERITAGE SYSTEM

LEGEND

4. CULTURAL HERITAGE
- RESIDENTIAL TYPOLOGY
- INDUSTRIAL TYPOLOGY
- RELIGIOUS TYPOLOGY

1. FRUTILLAR ALTO
- 1.1 TRIO AVENIDA RICHTER
- 1.2 MOLINO
- 1.3 CORDONERIA AINIL
- 1.4 TRIO AVENIDA WINKLER
- 1.5 WINKLER HOUSES

2. FRUTILLAR BAJO
- 2.1 DAETZ-NANNING HOUSEC
- 2.2 EDMUNDO WINKLER HOUSE
- 2.3 KLOCKER HOUSE
- 2.4 RICHTER HOUSE
- 2.5 PARROQUIAL HOUSE
- 2.6 NIKLITSCHEK-WESTER HOUSE
- 2.7 PINNINGHOFF HOUSE
- 2.8 DOM HOUSE
- 2.9 PHILIPPI 811 HOUSE
- 2.10 SCHEEL-KLESSE HOUSE
- 2.11 HECHENLEITNER-KAHLER HOUSE
- 2.12 PHILIPPI 989 HOUSE
- 2.13 WULF HOUSE
- 2.14 KROHMER-HELN HOUSE
- 2.15 PASTORAL LUTERANA HOUSE
- 2.16 WINKLER-FUCHSLOCHER HOUSE
- 2.17 HITSCHFELD-WINKLER HOUSE
- 2.18 HORNIG HOUSE
- 2.19 BISCHOFFSHAUSEN HOUSE
- 2.20 NANNING I HOUSE

3. LLANQUIHUE CITY
- 3.1 IANSA FABRIC
- 3.2 INDEPA FABRIC
- 3.3 PORVENIR WINDMILL
- 3.4 OLD PIER HOUSE
- 3.5 SCHORITZ HOUSE
- 3.6 LLANQUIHUE TRAIN STATION
- 3.7 KUSCH HOTEL
- 3.8 EIFFEL BRIDGE
- 3.9 SAN JOSE CHURCH
- 3.10 PETERS HOUSE
- 3.11 CARDENAS OYARZO
- 3.12 GERMAN GIMNASTIC
- 3.13 HELD HOUSE
- 3.14 CAMPING WERNER HOUSE
- 3.15 WESTERMAIER HOUSE
- 3.16 WERNER & RADDATZ HOUSE
- 3.17 ERNER HOUSE
- 3.18 DE LA CULTURA HOUSE

4. PUERTO OCTAY
- 4.1 NIKLITSCHEK HOUSE
- 4.2 HAASE HOTEL
- 4.3 WULF HOUSE
- 4.4 AÑAZCO HOUSE
- 4.5 WERNER HOUSE

5. PUERTO VARAS
- 5.1 KUSCHEL HOUSE
- 5.2 GERMAN HOUSE
- 5.3 JUPTNER HOUSE
- 5.4 MALDONADO HOUSE
- 5.5 GOTSCHLICH HOUSE
- 5.6 YUNGLE HOUSE
- 5.7 S.C. DE JESUS CHURCH

6. SOUTH-WEST PIECE
- 6.1 GRIS HOUSE
- 6.2 WERNER-DOHRING HPUSE
- 6.3 TOTORAL HOUSE
- 6.4 LUNA AZUL HOUSE
- 6.5 LAS ENCINAS SET
- 6.6 LAS CHACRAS HOUSE
- 6.7 BIFURCACION HOUSE
- 6.8 RURAL SET
- 6.9 EX MUEBLERIA SET
- 6.10 WETZEL SET
- 6.11 WEIL-WOHLKE SET

7. NORTH-WEST PIECE
- 7.1 GALLE HOUSE
- 7.2 STRAUCH HOUSE
- 7.3 NANNING WETZEL HOUSE
- 7.4 EL SOCIO HOUSE
- 7.5 WOHLKE HOUSE
- 7.6 SCHEEL HOUSE
- 7.7 KLOCKER HOUSE
- 7.8 HECHENLEITNER HOUSE
- 7.9 HELD WINKLER HOUSE
- 7.10 EX POST HOUSE
- 7.11 LA MOROCHA HOUSE
- 7.12 NIKLITSCHEK HOUSE
- 7.13 LOEBEL HOUSE
- 7.14 NEUMANN HOUSE
- 7.15 TANTE VALY HOUSE
- 7.16 VOLKE HOUSE
- 7.17 OPITZ HOUSE

8. NORTH-EAST PIECE
- 8.1 APPEL HOUSE
- 8.2 WULF HOUSE
- 8.3 SCHMIDT SET
- 8.4 LOS GUINDOS HOUSE
- 8.5 PUERTO FONCK HOUSE

9. SOUTH-EAST PIECE
- 9.1 BITTNER II HOUSE
- 9.2 LOS RISCOS HOUSE
- 9.3 RIO PESCADO SET
- 9.4 RADDATZ HOUSE
- 9.5 PLAYA VENADO HOUSE
- 9.6 EL COPIHUE HOUSE
- 9.7 VON BISCHOFFS HOUSE
- 9.8 MIRADOR HOUSE
- 9.9 LA FABRICA HOUSE
- 9.10 VYHMEISTER HOUSE

- PRINCIPAL ROUTES
- SECONDARY ROUTES

Modified plan obtained from the original: Höpfner, H. et al. (2021). Guía de arquitectura tradicional en madera del Lago Llanquihue. Editorial: Ediciones Universidad San Sebastían. URL: https://arquitectura.uss.cl/guias_post/guia-de-arquitectura-tradicional-en-madera-del-lago-llanquihue.

4. CULTURAL HERITAGE SYSTEM

The cultural heritage discovered along the edge of Llanquihue Lake is regarded as a vital system that reflects the lake's unique history and shapes its landscape. When we refer to the landscape, we encompass elements that we consider crucial in defining our visual perception and cultural identity. To identify the cultural heritage present at the lake's edge, extensive research was conducted on the legal protection of cultural heritage in Chile and the specific pieces safeguarded by the laws governing the lake area. It was determined that the State of Chile has employed two laws or decrees to protect cultural artifacts within the lake's vicinity. Firstly, the National Monument Law (Law 17.288/1970) encompasses a comprehensive set of principles and regulations that establish guardianship over cultural and natural heritage designated as National Monuments. This legislation comprises articles and provisions aimed at identifying, protecting, conserving, and enhancing assets that society as a whole has chosen to safeguard. Secondly, Decree No. 259/1980 promulgates the Convention on the Protection of World Heritage, Cultural and Natural, signed by UNESCO, Paris in 1972 (Consejo de Monumentos Nacionales de Chile, 2019).

Of these two legal frameworks, the one that is most used is the first one, the National Monument Law. However, there are two ways in which it has been applied on the lake's edge to protect the heritage: considering a single piece as a National Monument or declaring a specific area as a National Monument based on its typical or picturesque features. Both approaches encompass protection, conservation, and valorization, although the latter has resulted in greater ambiguity regarding the protection of specific historical houses. The existing legal protections for each city are as follows: In Frutillar, the "Templo Luterano de Frutillar" has been declared a National Monument of Chile. Additionally, "Frutillar Bajo" has been designated as a National Monument under the category of Typical or Picturesque Zone. However, in Llanquihue, there is no legal protection for the cultural heritage. Moving on to Puerto Octay, the Historical Center (a specific area) has been declared a National Monument under the category of Typical or Picturesque Zone. Likewise, in Puerto Varas, the Historical Center (also a specific area) has been designated as a National Monument under the same category. Furthermore, the following properties have been declared as National Monuments of Chile: Raddatz House, Gotschlich House, Yungle House, Maldonado House, German House, Angulo House, Kusche House, the Sagrado Corazón Church, and the Luterano Temple (Consejo de Monumentos Nacionales de Chile, 2019).

During the research, it was discovered that there is a significant amount of existing cultural heritage on the edge of Llanquihue Lake. This heritage has been recognized by entities such as municipalities, urban plans, foundations, and architectural investigations. However, it's not protected by law or either its restoration and maintenance. The book "Guía de arquitectura tradicional en madera del lago Llanquihue" (Guide to traditional wooden architecture of Llanquihue Lake) serves as a fundamental resource for investigation, providing historical information and detailed surveys. The book aims to showcase the architectural pieces and their history, which have contributed to the spirit of the place. To achieve this, the book presents the cases in a non-linear manner, creating a guide that is useful for visiting the places and learning about them. Due to the limited value that the traditional architecture of Lake Llanquihue currently holds for people and its state of deterioration, the book seeks to provide information about these cases and demonstrate their importance. It serves as an educational tool that can be used for future investigations or restoration projects (Höpfner, 2021).

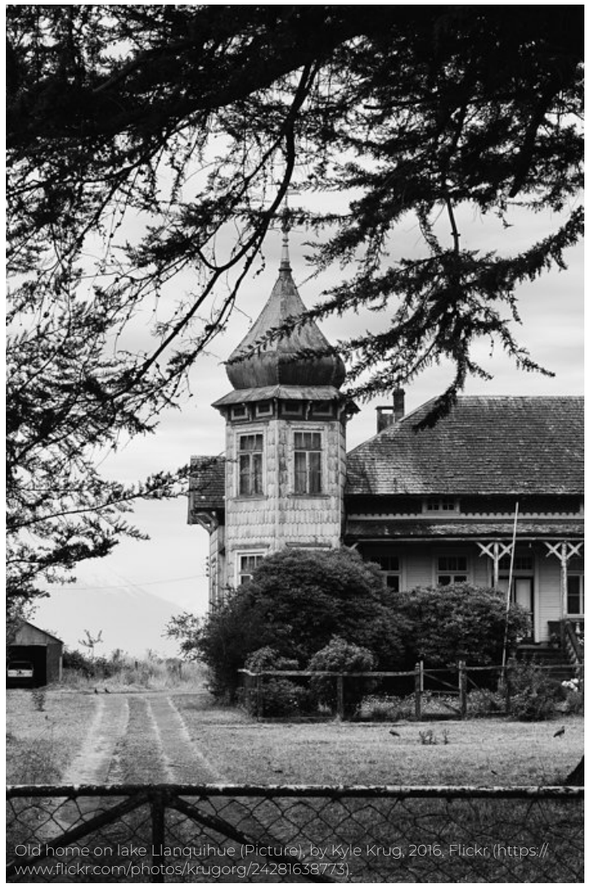
Based on the above, it was possible to develop a map that illustrates the cultural heritage system around the lake's edge. Therefore, the following pages will showcase different typologies of cultural heritage: residential, industrial, or religious. Also, it will show cases of study with different levels of deterioration and maintenance, materiality, style, and history. The goal is to learn about these cases and their value in terms of architectural techniques and their contribution to the memory of Chilean history and culture.

Iglesia luterana, Frutillar, Chile. (Picture), by Gary Moore, 2015, Flickr. https://www.flickr.com/photos/40234291@N07/17347221645)

CASE 3.5:
SCHÖBITZ HOUSE - LLANQUIHUE

Localization: Salomón Negrín 1014, Llanquihue.
G.C: 410 15´04´.2”S. 73000’19.1”W
Date of construction: Ca. 1920
Style: Eclectic (historicist), chalet
History: Was built by the first generation of German settler descendants. It is estimated that its construction was asked by Otto Schobitz to Juan Hitschfeld.

Materiality: Wooden

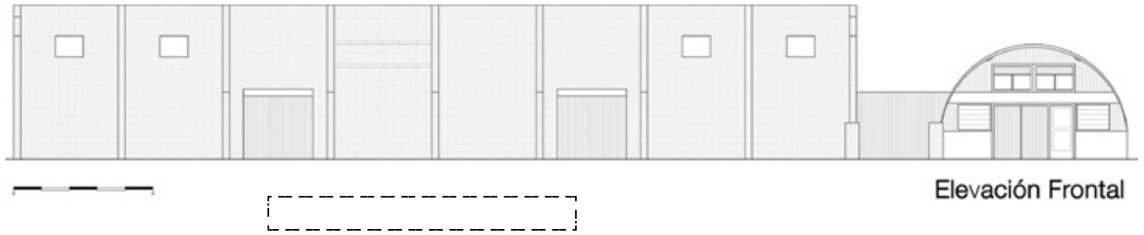


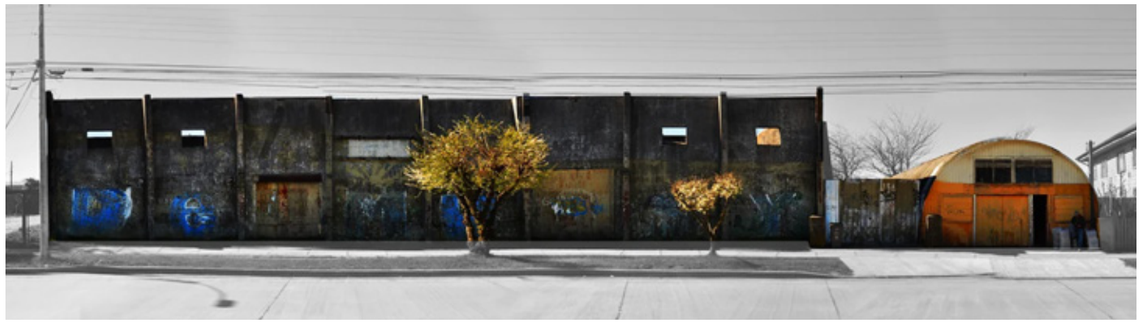
Old home on lake Llanquihue (Picture), by Kyle Krug, 2016, Flickr, (https://www.flickr.com/photos/krugorg/24281638773).

Information from: Höpfner, H. et al. (2021). Guía de arquitectura tradicional en madera del Lago Llanquihue. Editorial: Ediciones Universidad San Sebastían. URL: https://arquitectura.uss.cl/guias_post/guia-de-arquitectura-tradicional-en-madera-del-lago-llanquihue/

CASE 1.2:
MOLINO FROM MADOLF RITCHER, AN EX COMPANY - FRUTILLAR ALTO

Localization: In the intersection of the avenues Arturo Alessandri Palma y Carlos Richter, in front of the abandoned train station.
G.C: 400 58´ 27.984” S 730 3’ 39.1” W
Date of construction: 1925, with the beginning of the train line next to it.
History: “The Molino” company was one of the first industries that opened with the start of the train line in 1925. It started as a storage of wheat, and then in 1946, it was bought by the “Teofilo Brob S.A” company to become a supplier of flour to other regions thanks to the facility of being next to the train. Finally, in 1949 “the Molino” ceased its activity because a fire was produced. Currently, there is its structural construction which is totally abandoned and degraded.
Materiality: Wooden and concrete.





Note. Information from “ Activando el Paisaje de Frutillar Alto, by Acuña, F, et al. 2016. https://frutillaralto.wixsite.com/arq-uc.

CASE 8.7:
SAGRADO CORAZÓN DE JESÚS CHURCH - PUERTO VARAS

Location: Verbo Divino 499, Puerto Varas.
G.C: 41°19’15” S 72°59’10” O.
Date of construction: 1915 - 1918.
Style: Neo-Romanesque style with influences from German and Chilota architecture.
History: In 1915 the community of Puerto Varas put in charge to the architects Eduardo Niklitschek and Bernardo Klenner to design and build the main church of the city. To achieve the above, they inspired the Marienkirche Church, in Berlin, Germany. As a result, in 1918 the church was inaugurated and in 1992 was declared a historical monument, heritage. (Consejo de monumentos nacionales de Chile, 2022).
Materiality: Wooden structure, interior cladding in wood, and exterior in corrugated galvanized steel.


Iglesia Catedral de Puerto Varas (Picture), by Jose Luis Oliver, 2012, Flickr (https://www.flickr.com/photos/oliver_rodonas/8092372097).


Iglesia Catedral de Puerto Varas (Picture), by Jose Luis Oliver, 2012, Flickr (https://www.flickr.com/photos/oliver_rodonas/8092372097).

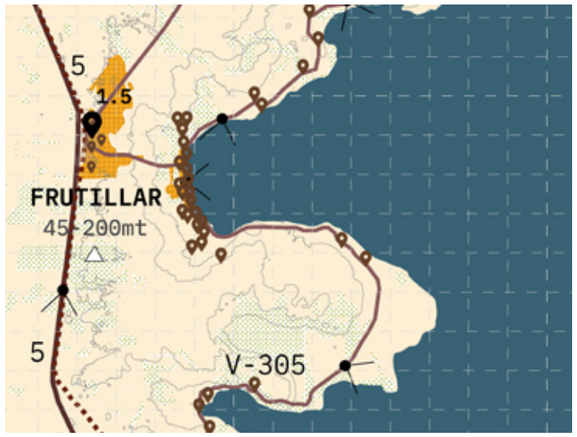

Iglesia de Puerto Varas. II (Picture), by Francisco López, 2015, Flickr (https://www.flickr.com/photos/fotosfcolopez/17129784000).


Iglesia Sagrado Corazón de Puerto Varas (Picture), by Alejandra Escandar, 2017, Flickr (https://www.flickr.com/photos/118919453@N06/32526477864).


Iglesia del Sagrado Corazon (Picture), by Kate, 2018, Flickr (https://www.flickr.com/photos/kmitterga/26618960621).

CASE 1.5:
CHILE EXPRESS - WINKLER HOUSES - FRUTILLAR ALTO

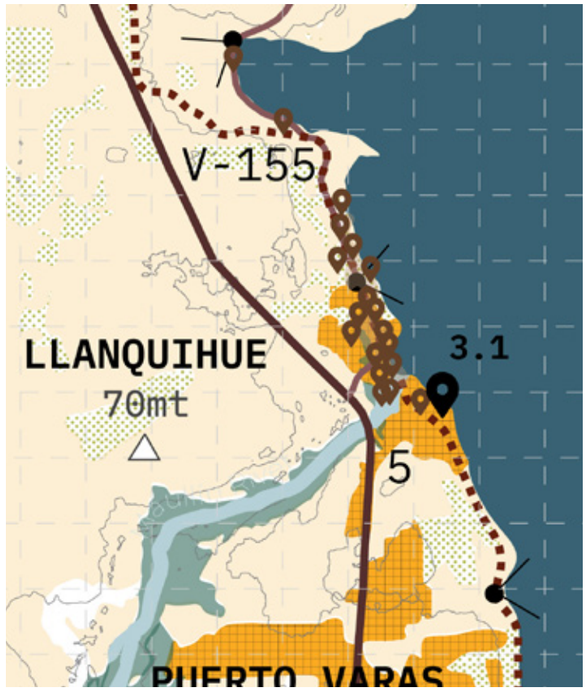
Location: Cristino Winkler 4201, Frutillar Alto.
G.C: 410 7 ´ 16.909” S O 730 3’ 27.483” O
Date of construction: Unknow, the arrival of Christiano Winkler to Frutillar in 1856.
Style: chalet
History: The Winkler House trio is one of the oldest architectural ensembles in the zone. It’s estimated that there are descendants of the family of Christiano Winkler German settlers, and it is recognized by its horizontal wooden shed. Currently in order to maintain the state of the house, the owners use it as both housing and business.
Materiality: Wooden and concrete.



Picture from streetview

Information from “ Activando el Paisaje de Frutillar Alto, by Acuña, F, et al. 2016. https://frutillaralto.wixsite.com/arq-uc.

CASE 3.1:
IANSA FAFBRIC - LLANQUIHUE



Location: In the intersection of Teniente Merino and Pedro Aguirre Cerda, Llanquihue.
G.C: 410 16´ 1.3” S 720 59’ 37.1” W
Date of construction: 1958
History: During the ‘30 the state of Chile started to generate more productive independence to overcome the international crisis (I.S.I model). Thanks to the above, its good localization between Puerto Montt and Osorno, and the train line next to it, Llanquihue was chosen as a fundamental industrial town. In fact, in 1958 was selected for having the biggest national sugar industry: IANSA. Thanks to the industry, and its social and economic importance, the town started to grow around the fabric. This brought the development of an important city in the south of Chile, with a good school for the necessities at that time named School n49: IANSA, until now. The end of the industry thanks to the end of the trainline because of the earthquake in 1960, meant also the abandonment of the city by many persons and the infrastructure until now (Matus, R. 2020).

IANSA (Picture), by Tania Molier. Camina Llanquihue (http://caminallanquihue.cl/hito/1).

IANSA (Picture), by Tania Molier. Camina Llanquihue (http://caminallanquihue.cl/hito/1).

SECTION 8.3:
SCHMIDT SET - FROM PUERTO OCTAY TO LAS CASCADAS

Location: Ruta U-925, a 12,8 km from the Puerto Fonck crossing in the Playa Maitén sector.
G.C: 400 57´6.90” S. 72050’53.68”O
Date of construction: Ca. 1882.
Style: Primitive, extended.
History: The house would be built in 1882. It is located on land that originally belonged to Joseph Schmidt, an immigrant from Landeck in Silesia. It has remained in the family until the present and is currently occupied by Maria Elena Appel, widow of Osvin Schmidt.
Materiality: Wooden.

Information from: Höpfner, H. et al. (2021). Guía de arquitectura tradicional en madera del Lago Llanquihue. Editorial: Ediciones Universidad San Sebastían. URL: https://arquitectura.uss.cl/guias_post/guia-de-arquitectura-tradicional-en-madera-del-lago-llanquihue/

2.5 The Llanquihue lake edge and its perception

The systems that characterize the Llanquihue Lake edge are appreciated by human beings due to the possibility of being conscious of them. This consciousness is achieved through the construction of an imaginary representation. The process involves perceiving the landscape and the cultural influences of the place (Muñoz, 2019). In other words, the identity formed with the place, through architecture, history, experiences, and our perception, defines our landscape.

Simultaneously, various physical factors influence this perception. Accessibility, as an infrastructure, is closely related to the ability to perceive things and the way we perceive them. The perception of the landscape varies depending on the means by which it is experienced. Whether traveling by car, on foot, or by bicycle, the speed of the images changes, thereby altering the perception and overall experience. In addition to the visual field, other sensory effects and the culture embedded in the context contribute to this perception.

Additionally, perception can be studied in terms of the relationship between elements, elements that are decontextualized, elements that hinder visibility, or the field of visibility. An analysis of these characteristics will allow us to have a more complete project through interventions for a better perception of the landscape. Therefore, the following map will show a study about the perception at the Llanquihue lake edge and a repository of photographs that help us understand better the Llanquhue lake landscape and perception.

2.5 The Llanquihue lake edge and its perception

LEGEND

- VISUAL PERCEPTION
  - Focus point
  - Panoramic point
  - Panoramic pathways
  - Intervisibility
  - Focus view to a external element
- PROTECTED AREAS
- PRINCIPAL ROUTES
- SECONDARY ROUTES
- TRAIN RAIL
- RIVERS

1. Ruta V-69

2. Ruta 255, Saltos Petrohue

3. Lookout Ensenada

4. V-555 rute

5. Lookout in the end of the V-555 rute

6. From Ensenada to Las cascadas

7. Las cascadas

8. From Las Las cascadas to Puerto Clocker

9. From Puerto Clocker to Puerto Octay

10. U-99-V Rute

11. Maiten Beach, Puerto Octay.

12. Puerto Octay

13. Going out from Puerto Octay

14. Between Puerto Octay and Frutillar

15. V-155 Rute

16. V-155 Rute II

17. Arriving to Frutillar

18. Down Frutillar

19. Arriving to Frutillar from Llanquihue

20. 5 Sur Rute

21. Punta Larga, LLanquihue

22. From Frutillar to Llanquihue

23. Down Llanquihue city

24. Punta Larga, LLanquihue

25. From Llanquihue to Puerto Varas train rail

26. From Llanquihue to Puerto Varas train rail

27. Puerto Varas

28. From Puerto Varas to Ensenada I

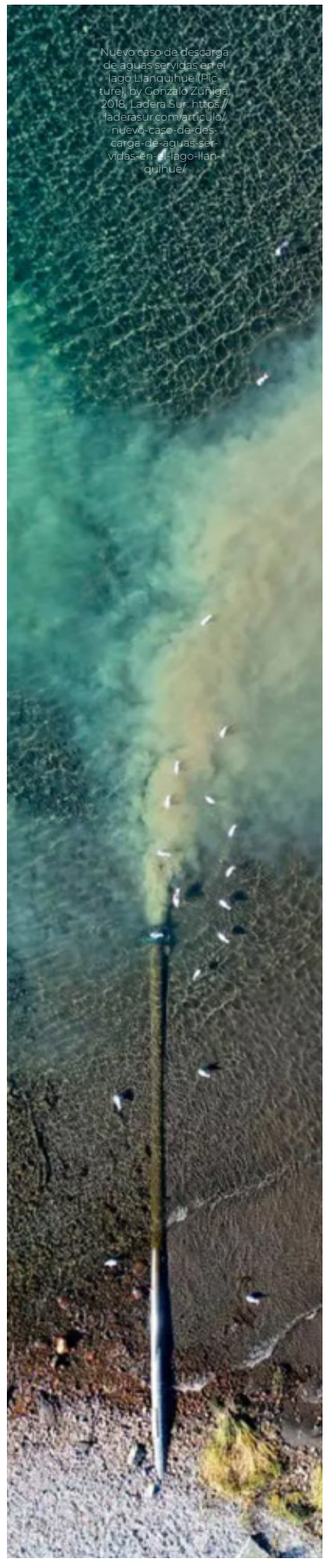
29. From Puerto Varas to Ensenada II

30. From Puerto Varas to Ensenada III

31. Looking to Ensenada

2.6 Fragmentation, friction, and degradation of the Llanquihue lake´s systems at the edge

Understanding the network of systems that characterize the Llanquihue Lake edge, it is possible to highlight the importance of the natural and cultural heritage for the identity of its landscape. 170 years after the German colonization, a time when the natural system had not been intervened yet and the first wooden constructions for habitation were built, one can still see the remnants and footprints of it as an important memory of history. However, over time, they have suffered different degradations due to human habitation that affect the quality of life itself and, at the same time, the characterization of the lake edge landscape. One of the biggest reasons that has caused the destruction of natural and cultural heritage on the lake's edges is its fragmentation. Defining fragmentation as a process of change that implies the division or discontinuity of the elements that were originally a continuous surface (Estades, 2003), it can be understood that these two systems have been interrupted by friction with other systems or the isolation of some pieces. The discontinuity produced by the friction can be seen on the Llanquihue lake edge when is missing an adequate transition and healthy relationship between the heritages and the rural and urban systems. It has been identified that in the worst cases of friction, the bordering spaces are used for micro-dumps, ballast pits, or contamination of hydrological sources. This not only destroys the heritage, its value, and memory, but it also worsens the quality of life of the inhabitants of the place, takes away spaces for meeting with nature, and puts their health at risk. In the same way, the isolation is reflected in the bad accessibility to the heritage or between the heritages. In this case, it has been identified roads that are in a bad state of conservation, missing roads to the lake or between settlements, and unconnected patches of vegetation with high potential. The fragmentation and its consequences can be seen at different scales, depending on what is intended to be protected. To address it and be able to conserve remaining spaces that manage to take care of different elements and thus preserve the ecological and cultural quality of the lake, it is necessary to first design interventions on a masterplan scale. The above means to design the 'landlinks' around the lake edge making an interconnected territory and focusing between cities to unify the edge. Then, would be possible to address the 'landlink' on a smaller scale, which considers the biggest frictions between systems in the cities and unifies it to the bigger scale interventions between cities.

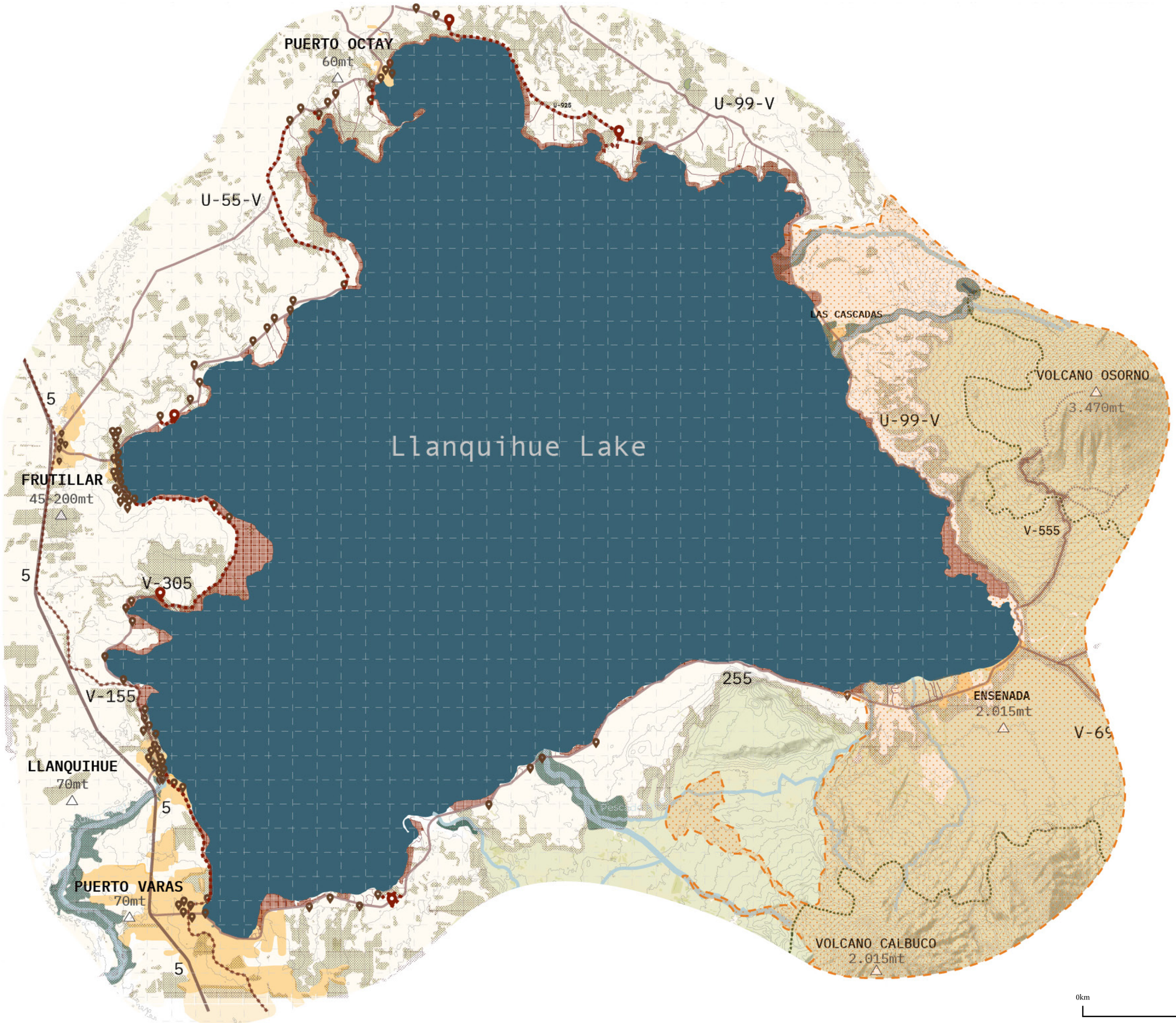


Nueva caso de descarga de aguas grises en el lago Llanquihue (Picture), by Gonzalo Zúñiga, 2018, Ladera Sur. https://laderasur.com/articulo/nuevo-caso-de-descarga-de-aguas-servidas-en-el-lago-llanquihue/

Lago Llanquihue, above Puerto Octay (Picture), by Duncan_and_Gladys, 2003, Flickr (https://www.flickr.com/photos/duncan_and_gladys/15503771023).

El Llanquihue (Picture), by Fundación Terram, 2022, Fundación Terram (https://www.terram.cl/2022/04/relleno-sanitario-la-laja-recibe-el-doble-de-la-basura-domiciliaria-para-lo-que-fue-construido/).

Ex Fabrica INDEPA (Picture), by Tania Molier, XX, Camina Llanquihue (http://caminallanquihue.cl/hito/2).



LEGEND

1. Fragmentation of the cultural heritage by isolation, due the lack of accessibility:
   - a) Extremely isolated cases
   - b) Pathways in bad statewith
2. Fragmentation of the natural heritage by isolation and friction
3. Lack of accessibility to the lake
4. Volcanoes risk zone (low, medium and high risk)

- Natural Heritage
- Rural
- Urban
- Cultural Heritage
- Wetlands
- Protected Areas
- Principal routes
- Secondary routes
- Tain rail
- Rivers

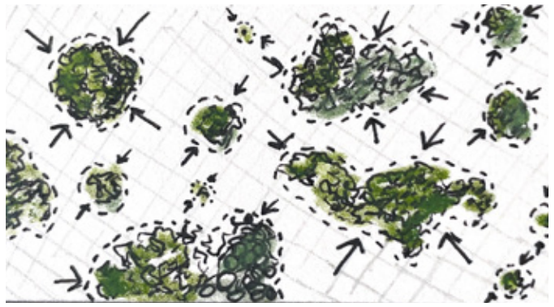
THE FRAGMENTATION OF THE NATURAL HERITAGE

"The landscape change often results in discontinuities, in remaining land cover and a decrease in the amount of native vegetation".[5]

The Llanquihue Lake is the most urbanized lake in Chile, and with the planimetric survey, it can be seen that over the years, the natural heritage system has fragmented into a mosaic of patches due to anthropic actions, resulting in the removal and destruction of it (Gomez et al., 2019). The biggest reaons of its fragmentation and degradation as it was show on the map, are the urban and rural expansion without protecting big patches, esential connections or borders. According to different studies, the fragmentation of habitat and fluvial ecosystems were the two most frequently studied processes threatening animal and plant species' persistence (Lindenmayer, D. B., & Fischer, J., 2006). The rupture of the ecological processes of a continuous territory has different phenomenons, which normally in the natural heritage are produced together. "The natural heritage has ended in a decrease in the average size of remaining vegetation patches, an increase in the average distance between these patches, a decrease in landscape connectivity between patches, and an increase in the ratio of patch edges to patch sizes"[6]. The phenomenos mentioned before will be explain in how they affect the Llanquihue lake edge:

1. Small Patches

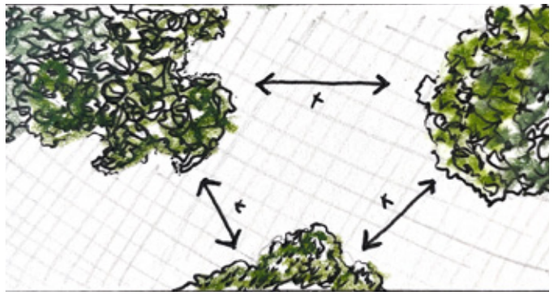
The fragmentation generate many small patches, whitout the charachterisitics to guarantee the ecological viability of the habitat, especially the animals that need big areas to survive (manifers). An example of this in the Llanquihue lake edge is the puma, an animal that require a estimated habitat of 60-500 square kilometers to live. Therefore, by fragmenting their habitat, they are forced to move from place to place or be more exposed, which has put them in more and more danger (De la Vega, 2020).



South American Cougar (Puma concolor concolor) (Picture), by Gregory "Slobirdr" Smith, 2022, in Flickr (https://www.flickr.com/photos/slobirdr/52486741044).

2. Increased spices isolation

The habitat isolation due to the fragmentation of the natural system is when the distance between patches start to increase afecting the habitat that have more extended and continuous distribution, and needs the connection. In the Llanquihue lake edge we could see before that there is a big amount of different spieces of birds. This spieces are especially sensitive to habitat fragmentation as their abundance declines in small, isolated, and disturbed forest fragments surrounded by open fields (Vergara & Armesto, 2009). An investigation called "Responses of Chilean forest birds to anthropogenic habitat fragmentation across spatial scales" studied the different effects of habitat fragmentation in birth from the south of Chile, and as a conclusion states that "It becomes imperative to protect landscapes with a large percentage of forest cover and large forest patches (see above) and to maintain their connectivity in order to provide habitat corridors for birds across the central depression of southern Chile."[7]



Revoloteando. (Picture), by Joaco Almona, 2020, in Flickr (https://www.flickr.com/photos/joaco_a/49758195242).

3. Friction and degradation of the patch's edges

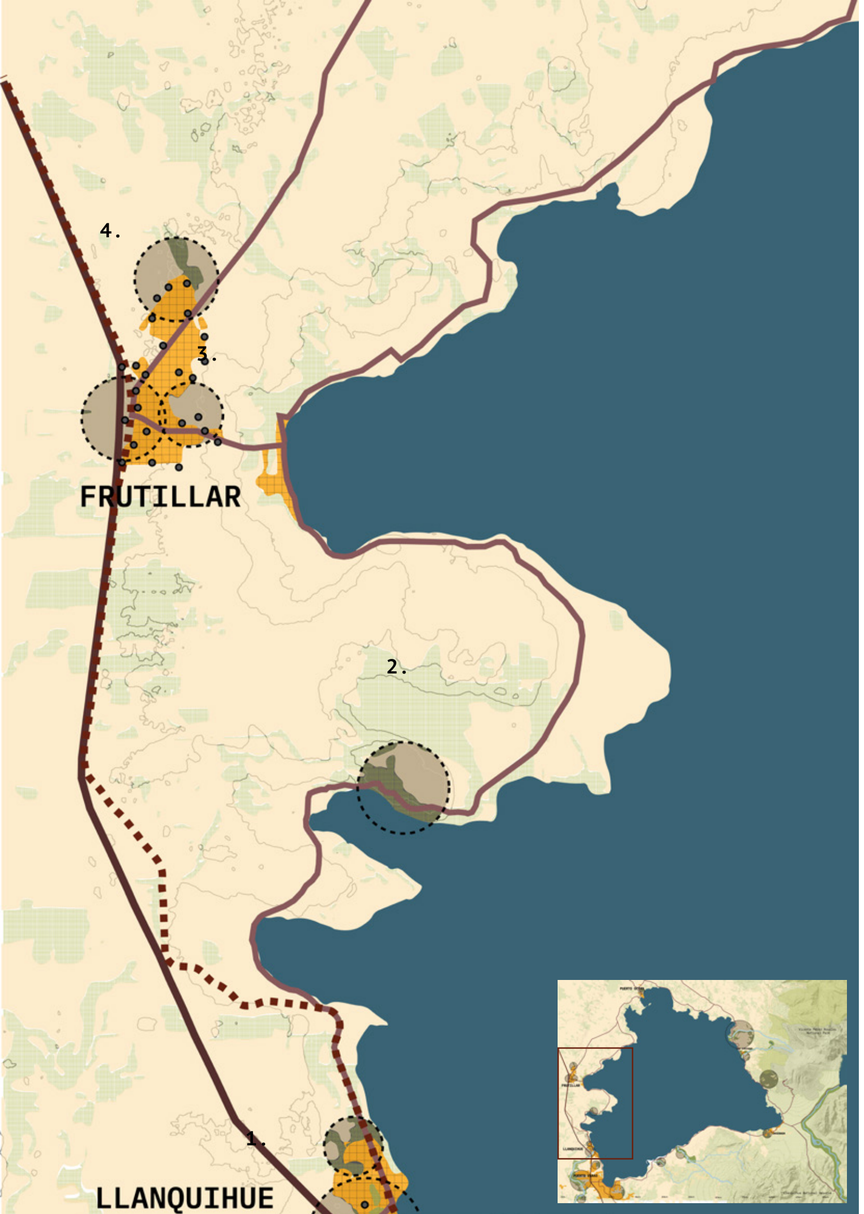
In the natural heritage the main alteration due its fragmentation is the increase in the length of boundaries between remaining patches and the surrounding use of land with exotic vegetation and animals. The changes that experiment the bourderes of the patch generate an imbalance in the all ecological pyramid affecting almost all the species (Lindenmayer, D. B., & Fischer, J., 2006). As mentioned before, it has been identified in some of these borders ballast wells and micro dumps have thanks to abandoned spaces during the transition of systems. These places are considered by the municipalities as vulnerable areas because the extractive activity generates a depressed surface, that creates a contaminated space and with high risk of solubility for the population. The presence of dumps or micro-dumps in unused spaces further accentuates the social vulnerability of people living on their edges, since there is the possibility of burning garbage and criminal situations (INEA Frutillar 2018).

Basura en el borde de la línea de tren entre Llanquihue y Puerto Varas.

5. Lindenmayer, D. B., & Fischer, J. (2006). Habitat fragmentation and landscape change: An ecological and conservation synthesis. Island Press]

6. Lindenmayer, D. B., & Fischer, J. (2006). Habitat fragmentation and landscape change: An ecological and conservation synthesis. Island Press]

7. Vergara, P., & Armesto, J. J. (2009). Responses of Chilean forest birds to anthropogenic habitat fragmentation across spatial scales.



THE FRAGMENTATION OF THE NATURAL HERITAGE ON A LOCAL SCALE

1.

A) Micro dump El Sarao

B) Urban-Rural friction

Fragmentation of the wetlands (Natural Heritage) in Llanquihue City. The high ecological value that has the wetlands and the river in Llanquihue is at risk due to the urban extension towards it. It can be seen that there is missing a transition and protection between these two systems. Also, it has been found a micro dump on the border between the city and the "El Sarao" wetland.

Section a-a'

3.

A) Micro dump Frutillar

B) View of the site

This patch is a large green area dividing the urbanization of "Frutillar Alto". Although the city hasn't expanded into this area due to legal land protection, it has unfortunately turned into microdumps. Consequently, the degradation of nature is still occurring.

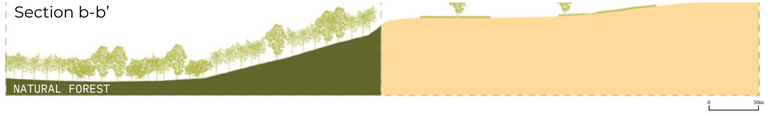
Section c-c'

2.

A) Rural-Natural patch friction

Fragmentation of the forest. The patch identified is one of the last ones on the lake edge, between Llanquihue and Frutillar. The rural lands in this sector are predominant, and it can be seen the friction between them. Here is shown the importance of protecting the patch and using it for connect the ecosystem between cities.

Section b-b'



4.

A) Highly contaminated risk area.

B) Urban area arrivng to the patch.

The plans show one big patch of vegetation at risk by the urban extension, on the border of "Frutillar Alto". Also, there is a place indicated nearby highly contaminated with garbage and contaminated hydrological sources. The above is putting at risk the health of the residential area and the natural heritage around it.

Section d-d'

FRAGMENTATION OF THE NATURAL HERITAGE ON A LOCAL SCALE

5.

A) Micro dump Puerto Octay

B) Lake-rural friction

Puerto Octay stands out as a city with untouched natural heritage, but it has begun to degrade it along the borders where the urban and natural heritage intersect. Micro-dumps can be found in these places. However, social indicators reveal that the city faces significant poverty in terms of basic services. So, there is an opportunity to protect it and enhance the residents' quality of life.

Section e-e'

6.

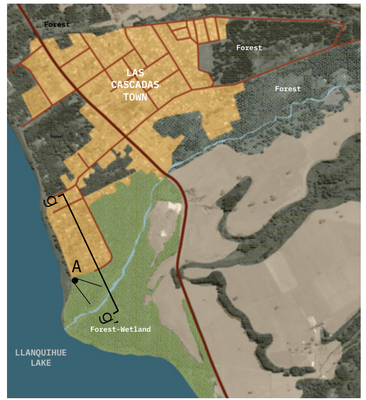
A) Lake´s contamination

B) Rural-Natural friction

Here it can be seen a corridor of vegetation from the Vicente Perez Rosales National Park to the lake, that goes along the Blanco Arenal River. The friction is produce by the rural lands to the natural heritage.

Section f-f'

7.

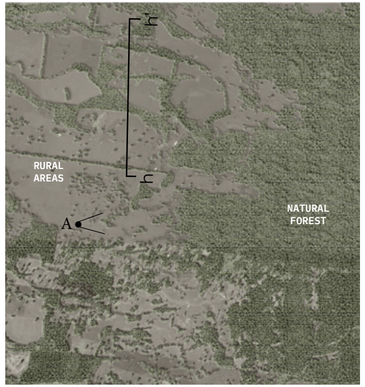


A) River and forest, natural heritage

The plans reveal important wetlands and forests, while the "Las Cascadas" town experiences growth, allowing for the implementation of legal and urban measures to protect its heritage. The interplay between rural, urban, and natural heritage systems generates noticeable tension. This presents an opportunity to design a barrier, as a ´landlink´, to prevent further urban expansion and preserve the area's significance.

Section g-g'

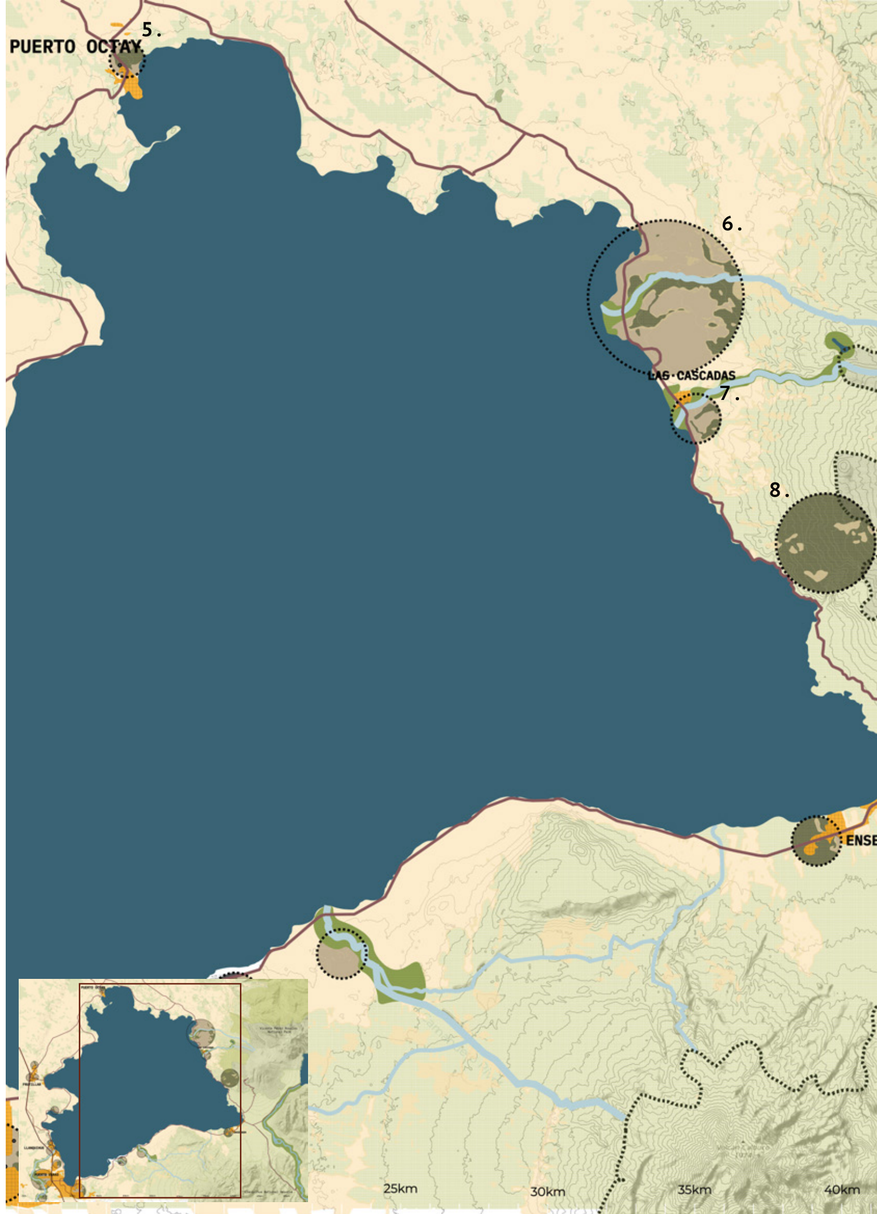
8.



A) Natural forest-rural land friction

In this case, we can observe the degradation of the ecologically rich forest extending from the Vicente Perez Rosales National Park due to unrestricted rural land use. By designing a "landlink," it becomes possible to preserve certain corridors and patches of land while allowing for rural development, ensuring the continuation of vital ecological processes.

Section h-h'



As previously shown, the cultural heritage of the Llanquihue Lake is unique in terms of wooden architecture and historical significance, resulting from the circumstances of its foundation and subsequent development, in contrast with other North Patagonian lakes. A total of 107 different cultural heritage elements were identified, including residential wooden German houses, industries, and churches, distributed along the lake's edge. These pieces play a crucial role in defining the landscape of the lake edge, unifying it, enhancing its value, and creating a sense of identity. However, currently, the cultural heritage system is fragmented, and the circuit is no longer connected. There are some important stretches where the historical pieces are dissociated from each other, leading to difficulties in their conservation, resulting in undervaluation by the inhabitants and sometimes degradation.

The fragmentation in the cultural heritage can be seen between cities, where the circuit has a rupture, normally due to a lack of accessibility, or in specific cases, highly fragmented. In contrast with the natural heritage, the phenomenon of fragmentation occurs without a duality. It will be recognized some cases that experience extreme isolation due to visual or physical lack of accessibility, and other cases where there is friction with itself by an inconsistent change of use or a decontextualization with its environment. Above all, there is no urban planning by the municipalities along the lake's edge that considers the cultural heritage as a connected circuit and provides legal protection for it. The entities recognize their heritage and not the total circuit. There is a lack of educational and cultural strategies that would unite and educate the people about its history, thus preventing the loss of collective memory.

To address the fragmentation of cultural heritage on a smaller scale, it was decided to analyze case by case if the pieces are fragmented and with which phenomenon. In general, it was identified that some cases are more fragmented than others, resulting in discontinuity in the circuit. Furthermore, it was studied the isolation and friction that each case experiences. Isolation refers to a significant distance between elements without symbolic or physical connections. It also encompasses situations where there is poor physical accessibility, such as badly maintained roads or visual elements that hinder appreciation. On the other hand, fragmentation can also occur due to friction between cultural heritage and anthropic interventions, such as inappropriate changes of use or decontextualization. Inappropriate changes of use refer to new uses that do not allow for adequate appreciation or the telling of the heritage's history. Although decontextualization means that the environment surrounding the heritage does not value or appropriate it, often due to visual conflicts with neighboring elements. An example of this could be heritage sites located next to abandoned places that have become micro-dumps or sites with vastly different architectural styles nearby. Ultimately, when an element experiences friction with the environment or itself and is no longer valued by the population, it often leads to degradation and fragments of the connected circuit of cultural heritage (Lobos, 2020).

REGION	NUMBER	NAME	LOCATION	STATE OF CONSERVATION	ORIGINAL USE / ACTUAL USE	FRAGMENTATION (ISOLATION / FRICTION)
Frutillar	1.1	Trio Avenida Richter	(-41.126531, -73.059139)	Partial deteroration	Original use: habitational / Actual use: comercial and habitational	**Friction** by decontextualization, next property abandoned with trush. This put in risk and devalues the heritage.
Frutillar Alto	1.2	Molino	(-41.127368, -73.060320)	Advanced deterioration (abandoned)	Original use: almacenamiento de comida / Actual use: abandoned	**Friction** by decontextualization, train rail and train station abandoned in front of the heritage. This put in risk and devalues the heritage.
Frutillar Alto	1.3	Cordoneria Ainil	(-41.126020, -73.058555)	Partial deteriorated	Original use: habitational / Actual use: abandoned	**Friction** by change of use. Firstly it was used half market and half habitational, but passing the time the owner couldn't afford the maintenance, so now is abbandoned.
Frutillar Alto	1.5	Winkler East House	(-41.123818, -73.058044)	Partial deteriorated	Original use: habitational / Actual use: habitational and comercial	**Friction** by decontextualization, 50% of the propery has became in a space for debris of materials from the house and neighboring houses.
Frutillar Bajo	2.16	Winkler-Fuchslocher House	(-41.140588, -73.025476)	Good state of conservation	Original use: habitational / Actual use: hostel	**Friction** by change of use to an hostel. The ownes have done multiple extensions without following the architectural aesthetic.
Llanquihue	3.1	Iansa Fabric	(-41.266998, -72.993528)	Advanced deterioration (abandoned)	Original use: industry / Actual use: abandoned	**Friction** by change of use and decontextualization. The ex fabric is abandoned and the territory arround its also abandoned with trush.
Llanquihue	3.2	Indepa Fabric	(-41.260524, -73.000767)	Advanced deterioration (abandoned)	Original use: industry / Actual use: abandoned	**Friction** by change of use and decontextualization. The ex fabric is abandoned and the territory arround its also abandoned with trush.
Llanquihue	3.5	Schobitz House	(-41.251237, -73.006214)	Partial deteriorated	Original use: habitational / Actual use: habitational	**Friction** by decontextualization, train rail and train station abandoned in front of the heritage. This put in risk and devalues the heritage.
Llanquihue	3.6	Llanquihue Train Station	(-41.252969, -73.006532)	Advanced deterioration	Original use: train station / Actual use: abandoned	**Friction** by change of use and decontextualization. All the area is abandoned.
Llanquihue	3.7	Kusch Hotel	(-41.255201, -73.007052)	Partial deterioration	Original use: hotel / Actual use: abandoned	**Friction** by decontextualization, wetland in front with an undesign border. Risk of trush.
Llanquihue	3.8	Eiffel Bridge	(-41.259747, -73.002291)	Partial deterioration	Original use: bridge for trains / Actual use: abandoned	**Friction** by change of use and decontextualization. Heritage abandoned and trush next to it.
Llanquihue	3.10	Peters House	(-41.257732, -73.004975)	Partial deterioration	Original use: school / Actual use: market	**Friction** by change of use, from a hotel to a market for maintenance costs.
Llanquihue	3.11	Cardenas Oyarzo House	(-41.257732, -73.004975)	Low deterioration	Original use: habitational / Actual use: habitational	**Friction** by decontextualization, train rail and train station abandoned in front of the heritage. This put in risk and devalues the heritage.
Llanquihue	3.12	German Gimnastic	(41.252769, -73.005371)	Partial deterioration	Original use: gimastic / Actual use: unknown	**Friction** by decontextualization, train rail and train station abandoned in front of the heritage. This put in risk and devalues the heritage.
Llanquihue	3.13	Held House	(-41.254340, -73.006386)	Partial deteriorated	Original use: gimastic / Actual use: unknown	**Friction** by decontextualization. The continuous façade is a fabric, which does not follow the architectural esthetic. Also, in front of it there is the train rail and train station abandoned in front of the heritage. This put in risk and devalues the heritage.
Puerto Octay	4.1	Niklitschek House	(-40.975077,-72.884082)	Partial deteriorated	Original use: habitational / Actual use: habitational, unknow if its in use	**Friction** by decontextualization, expose to a empty land.
Puerto Varas	5.2	German House	(-40.975077,-72.884082)	Good State	Original use: habitational / Actual use: habitational	**Friction** by decontextualization. Train rail abandoned next to it, risk of trush.
South-West Piece	6.6	Las Chacras House	(-41.1931583,-73.025889)	Advanced deterioiration	Original use: habitational / Actual use: abandoned, use as storage.	**Friction** by change of use, the house now is use as a storage for rural needs.
South-West Piece	6.8	Rural Set	(-41.1886472,-73.003741)	Advanced deterioiration	Original use: habitational / Actual use: habitational	**Isolation** by its localization and educational visibility.
North-West Piece	7.2	Strauch House	(-41.1160917, -72.9998416)	Partial deterioiration	Original use: habitational / Actual use: habitational	**Isolation** by its localization and educational visibility.
North-West Piece	7.16	Volke House	(-40.9864028,-72.90905)	Partial deterioiration	Original use: habitational / Actual use: Storage (Abandoned)	**Friction** by change of use, the house is abandoed and use as a storage for rural needs.
North-West Piece	8.1	Appel House	(-40.9472028, 72.875197)	Advanced deterioiration	Original use: habitational / Actual use: rural storage	**Friction** by change of use, the house now is use as a storage for rural needs.
North-West Piece	8.3	Schmidt House	(-40.9519167,-72.848244)	Advanced deterioiration	Original use: habitational / Actual use: rural storage	**Isolation** by its localization and educational visibility.
North-West Piece	8.4	Los guindos House	(-40.9994472,-72.756947)	Low deterioration	Original use: habitational / Actual use: habitational	**Isolation** by its localization and educational visibility.
North-West Piece	9.3	Rio Pescado Set	(-41.2548167,-72.7965388)	Partial deterioration	Original use: habitational / Actual use: storage and studio	**Friction** by change of use, the house now is use as studio and storage for rural needs.
North-West Piece	9.6	El Copihue House	(-41.3131,-72.8784083333)	Good state	Original use: habitational / Actual use: habitational	**Isolation** by its localization and educational visibility.
North-West Piece	9.7	Von Bischoffs House	(-41.3115167,-72.88899722)	Low deterioration	Original use: habitational / Actual use: habitational	**Friction** by change of use. The ownes have done multiple extension without following the architectural aesthetic.

FRAGMENTATION OF THE CULTURAL HERITAGE ON A LOCAL SCALE

The following cases were chosen as the most fragmented cultural heritages. The maps will show how they experience friction with the rural or urban system, or isolation due its bad accessibility. The heritage will be marked with a line of a different color depending on the phenomenon that experiment as can be seen in the legend and also according to the relationship with a specific space.

LEGEND

- CULTURAL HERITAGE
- FRICTION OF THE HERITAGE
- ISOLATION OF THE HERITAGE

1.1) Trio Avenida Richter

- Abandoned area with trush and parking
- Cultural heritage

1.2) Molino

- Abandoned area (train rail)
- Cultural heritage

1.3) Cordoneria Ainil

2016
Used half as a house and the other half as a market due economical cost of maintenance.

2023
Abandoned

1.5) Winkler East House

Debris of materials in the yard.

2.16) Winkler-Fuchslocher House

2012
Use as a house, without to many interventions.

2023
Use as a Hostel, bazar, spa and market. Many interventions for the

3.1) Iansa Fabric

- Abandoned area (train rail - industrial)
- Cultural heritage

3.2) Indepa Fabric

- Abandoned area (train rail - industrial)
- Cultural heritage

3.5) Schobitz House

- Abandoned area (train rail and station)
- Cultural heritage

3.6) Llanquihue Train Station

- Abandoned area (train rail - industrial)
- Cultural heritage

3.7) Kusch Hotel

- Abandoned area (train rail - industrial)
- Cultural heritage

3.8) Eiffel Bridge

- Abandoned area (train rail - industrial)
- Cultural heritage

3.10) Peters House

It was in its origins a House and then from 1933 to 1934 it works as the n°11 school of Llanquihue. After, the school moved to another place and the house worked again as a House. Currently, to be able to stay in the house and pay the maintenance costs, its a market. However, its in partial deteroration.

3.11) Cardenas Oyarzo House

- Abandoned area (train rail and station)
- Cultural heritage

3.12) German Gimnastic

- Abandoned area (train rail and station)
- Cultural heritage

3.13) Held House

- Abandoned area (parking and train rail)
- Cultural heritage

4.1) Niklitschek House

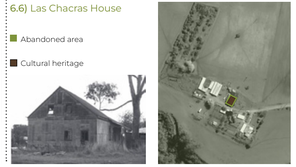
- Abandoned area
- Cultural heritage

5.2) German House

- Abandoned area (train rail)
- Cultural heritage

6.6) Las Chacras House

- Abandoned area
- Cultural heritage



6.8) Rural Set

- Cultural heritage

7.2) Strach House

- Cultural heritage

7.16) Volke House

- Rural Area
- Cultural heritage

8.1) Appel House

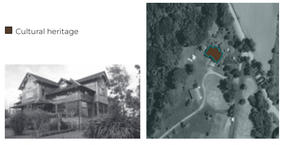
- Abandoned area
- Cultural heritage

8.3) Schmidt Set

- Cultural heritage

8.4) Los Guindos House

- Cultural heritage



9.3) Rio Pescado Set

- Abandoned area
- Cultural heritage

9.6) El Copihue House

- Cultural heritage

9.7) Von Bischoffs House

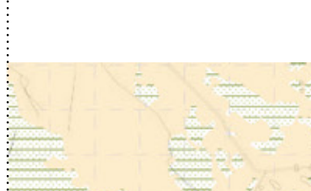
- Abandoned area
- Cultural heritage

THE FRAGMENATION OF THE HERITAGE IN THE LLANQUIHUE LAKE EDGE

Rural-urban friction, plus micro-dumps in the border.

1.1) Av. Richter House: Degradation by decontextualization.

1.2) Molino: Degradation by change of use (abandoned) and decontextualization.



Natural Forest-Rural friction

1.3) Cordoneria Ainil: Degradation by change of use

Wetland - Urban friction

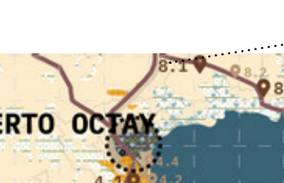
Wetland - Urban friction

3.12) Germina Gimnastic: Degradation by decontextualization.

3.13) Held House: Degradation by decontextualization.

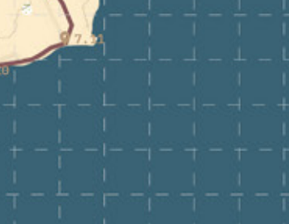
Natural forest-urban friction, plus micro-dumps in the border

1.5) Winkler East House: Degradation by decontextualization



3.8) Eiffel Bridge: Degradation by change of use and urban friction.

3.10) Peters House: Degradation by change of use



3.11) Cardenas Oyarzo House: Degradation by decontextualization.

7.2) Strauch House: Degradation by friction with rural system, plus decontextualization.

7.16) Volke House: Degradation by change of use and friction with rural system.

3.5) Schobitz House: Degradation by decontextualization, urban friction.

3.6) Llanquihue train station: Degradation by change of use and decontextualization.

3.7) Kusch Hotel: Degradation by decontextualization.

4.1) Niklitshek House: Friction by decontextualization (abandoned territory next to it).

Natural forest-Urban friction, plus micro-dumps in border.

5.2) German House: Risk of degradation by decontextualization

3.1) Iansa Fabric: Degradation by change of use and decontextualization.

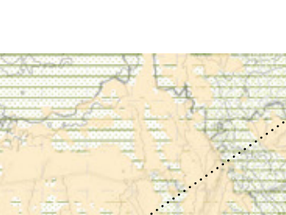
3.2) Indepa Fabric: Degradation by change of use and decontextualization.

8.1) Apple House: Degradation by change of use

8.3) Schmidt Set: Degradation and extreme isolation by bad accesibility.

8.4) Los Guindos House: Degradation and extreme insolarion by bad accesibility.

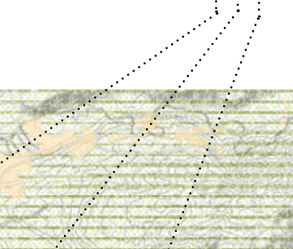
Natural forest - Urban friction



Natural forest and river - Urban friction

Natural forest - Urban friction

9.3) Rio Pescado Set: Degradation by change of use



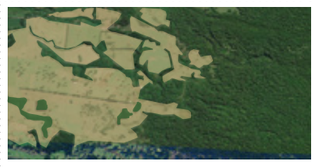
9.6) El Copihue House: Degradation by extrame isolation for bad accesibility.

9.7) Von Bischoffs House: Degradation by interventions.

Natural Rich Forest - Rural friction

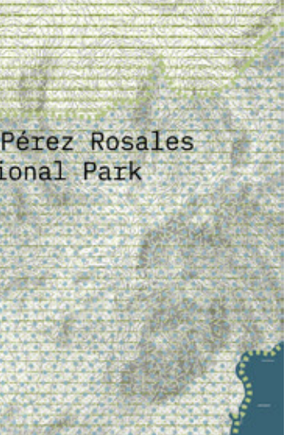
Natural Forest-Urban friction

Natural Rich Forest - Rural friction.



Natural Forest and hidrological system - Rural friction

Natural Forest - Rural friction and Natural Forest - Urban friction



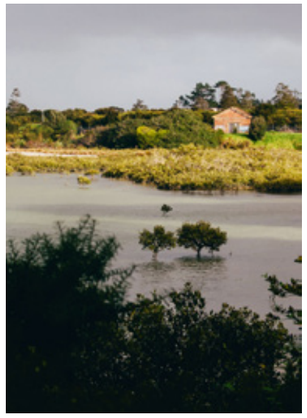
CHAPTER 3

Learning from other projects and design strategies

The case studies were chosen mainly due to its work with natural and cultural heritage together or in some cases just one, its delicate approach about landscape architecture and its masterplan scale

3.1 “Te Ara Manawa” Masterplan - Auckland, New Zealand
Design by Isthmus

“Te Ara Manawa” (Pathway among the Mangroves) is a green necklace spanning five kilometers along the coastal border of the new “Hobsonville Point” suburb, which was built on the site of the former NZ Air Force base. The masterplan’s primary objective is to establish a connection between the new neighborhood and the upper Waitematā Harbour, creating a green necklace made up of cycle path walkways and footbridges, that fosters a sustainable community. The design of the project focuses on restoring and reconnecting the ecological network, integrating historical remnants such as buildings and structures from the old Air Force base. It also serves as an educational tool, informing residents about the area’s history and offering opportunities to connect with nature through creative playgrounds. The intervention was conceived as a respite from the urban intensity, inviting people to relax and enjoy their surroundings. Cultural heritage is showcased in various ways, with some elements seamlessly blending into the natural environment while others serve as new functional infrastructure for the community.



STRATEGIES AND GUIDELINES FOR THE LANDLINK DESIGN

The project implemented a design strategy centered around providing an immersive and captivating experience for individuals of all ages, promoting exploration and the discovery of various elements throughout the journey. By incorporating playful elements, the project effectively highlights the beauty of nature and the significance of historical heritage, inspiring people to forge connections and gain knowledge from these features. Moreover, the project prioritizes convenient access to different points by establishing well-maintained walkways accessible to pedestrians and cyclists. Furthermore, utmost attention has been given to introducing individuals to the natural environment in a manner that safeguards its integrity, ensuring enjoyment while preserving its pristine condition. Finally, the strategies employed by the “Te Ara Manawa” project are highly relevant to the development of the ‘Landlink’ strategies for the masterplam on the edge of the Llanquihue Lake, as they aim to unite natural and cultural heritage. This is achieved through architectural and landscape interventions that foster enjoyment, learning, appreciation, and stewardship by the community.

3.2 Fortress Muiden - The Netherlands, Amsterdam
Designed by MTD landscape architects

The city of Muiden boasts a rich natural and cultural heritage, evident in its historic fortified structure, ramparts, and open polder landscape. Positioned within the Stelling van Amsterdam and the Nieuwe Hollandse Waterlinie, the city holds significant historical importance and is protected as a cityscape. MTD landscape architects were commissioned by the municipality of Muiden to develop a spatial vision for the city and its surrounding landscape. This included a vision for the public space, a landscape plan for areas outside the fortress, and a development vision for the North-western quadrant of the city. The historical map served as the basis for development, highlighting the unique character and origins of the area. Through a culture-historical analysis and urban planning survey, a combination of natural and urban planning elements were identified, forming the foundation for future developments. The analysis also identified distinct sub-areas with specific characteristics, informing limiting conditions for development in terms of public space and architecture, supported by reference images.

STRATEGIES AND GUIDELINES FOR THE LANDLINK DESIGN

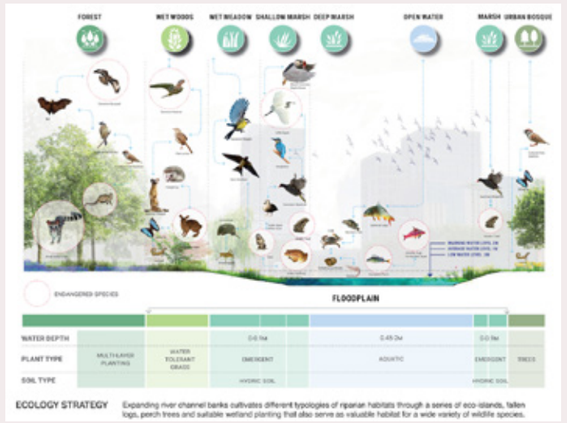
The “Fortress Muiden” project employed a range of design strategies to preserve and enhance the historical and cultural significance of the fortress. These strategies included historical preservation, interpretation and storytelling, well-designed public spaces, landscape integration, improved accessibility and connectivity, and sustainability measures. By focusing on these aspects, the project aimed to safeguard the fortress’s original features, engage visitors with its history, create welcoming public spaces, harmonize with the natural environment, promote accessibility, and incorporate sustainable practices. To sum up, the “Fortress Muiden” project serves as a valuable reference for the ongoing development project at the edge of Lake Llanquihue, as it successfully establishes a harmonious connection between the built environment and the surrounding natural landscape. By implementing a comprehensive masterplan, the project effectively safeguards both the natural and cultural heritage through various restoration efforts, informative exhibits highlighting its history, the creation of well-designed public spaces for recreational purposes, and prioritizing accessibility and connectivity to different areas.

3.3 Miaojing River - China
Designed by PLAT Studio

Kunshan City, located northwest of Shanghai, is characterized by its extensive waterways and canals, covering a significant portion of the city. Kunshan West, situated between Kuilei Lake and the old town center, has seen growth and development. The region features a core axis connecting major public spaces, including a retail center, Forest Park, and sports and commerce centers. The Yangcheng Lake East Ecological Corridor links the Kueilai Lake Reservoir to the central old town, while the Miaojing River Central Water Corridor, once an aqueduct, now serves as a green oasis with protective water channels and lush tree buffers in the heart of the urban landscape, preserving the city's historical and natural heritage. After the replacement of the aqueduct with a piping system, the Miaojing River has the potential to be transformed into a public open space. However, the current isolated corridor poses various challenges, such as dense forests with limited biodiversity and restricted access to the understory. Steep slopes along the riverbanks have also affected the health of the riparian habitat. The main objective of the design is to convert this hidden treasure into an ecological backbone of the Kunshan West District while preserving its natural and poetic essence (Plat Studio, 2022).

STRATEGIES AND GUIDELINES FOR THE LANDLINK DESIGN

To achieve this vision, key intersections along the river are enhanced with entry points that offer amenities like parking, bike rentals, cafes, and resting areas. These facilities aim to improve connectivity between the neighborhoods in the north and south. A continuous trail system is established, connecting the Kuilei Lake Area to Forest Park, while ensuring a respectful distance from the central waterway to minimize disturbances to the existing vegetation. Bridges are thoughtfully integrated into the trail network, and tunnels and underpasses are strategically positioned to overcome the disconnections caused by the city's street grid. Furthermore, permeable and elevated surfaces are extensively utilized, promoting environmental sustainability throughout the project. Consequently, this project could be used as a guideline for the project at the Llanquihue lake edge, thanks of its clear example of ecological connectivity. The project create a green corridor that protects the natural heritage stopping the urban friction with the wetlands and river. Also is used to connect and highlight the historical heritage of the city center.

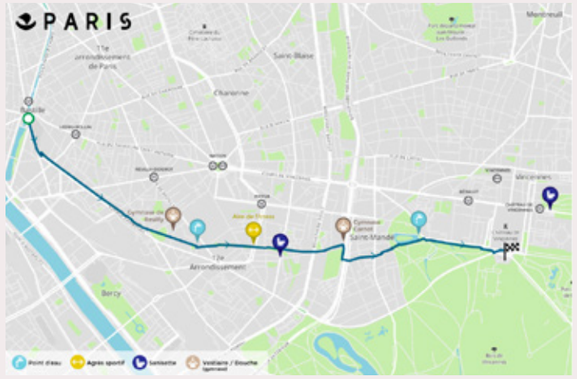


3.4 “Coulée Verte René-Dumont” - Paris, France.
Designed by Philippe Mathieux y Jacques Vergely,

The “Coulée Verte” is a transformed railway line that once spanned the eastern part of Paris and extended to the 77th district. Currently, it is fully accessible to pedestrians and provides a green lung in the heart of the city. The pathway is 5km long and leads citizens to the Château de Vincennes, with the possibility of continuing the journey into the forest. The project is characterized as a unique pathway that sometimes soars above ground and at other times ventures underground. Stretching from the Bastille to the Bois de Vincennes, it guides you across viaducts, footbridges, tunnels, and cuttings, showcasing the mesmerizing sights of the eastern part of Paris and its cultural heritage.

On the other hand, the project was originally designed by Philippe Mathieux and Jacques Vergely in 1988, but it wasn’t until 2021 that it was fully transformed into a pedestrian-friendly space. One of the biggest transformations of the project occurred in 1989 when the City of Paris embarked on an extensive rehabilitation project for the 71 arcades of the viaduct located beneath the promenade plantée. Known as the Viaduc des Arts, it serves as a space for Parisian artisans who are required to conduct most of their work on-site. Some artisans have transformed their workshops into storefronts, allowing visitors to witness the creative process and the birth of their creations in real time.

STRATEGIES AND GUIDELINES FOR THE LANDLINK DESIGN



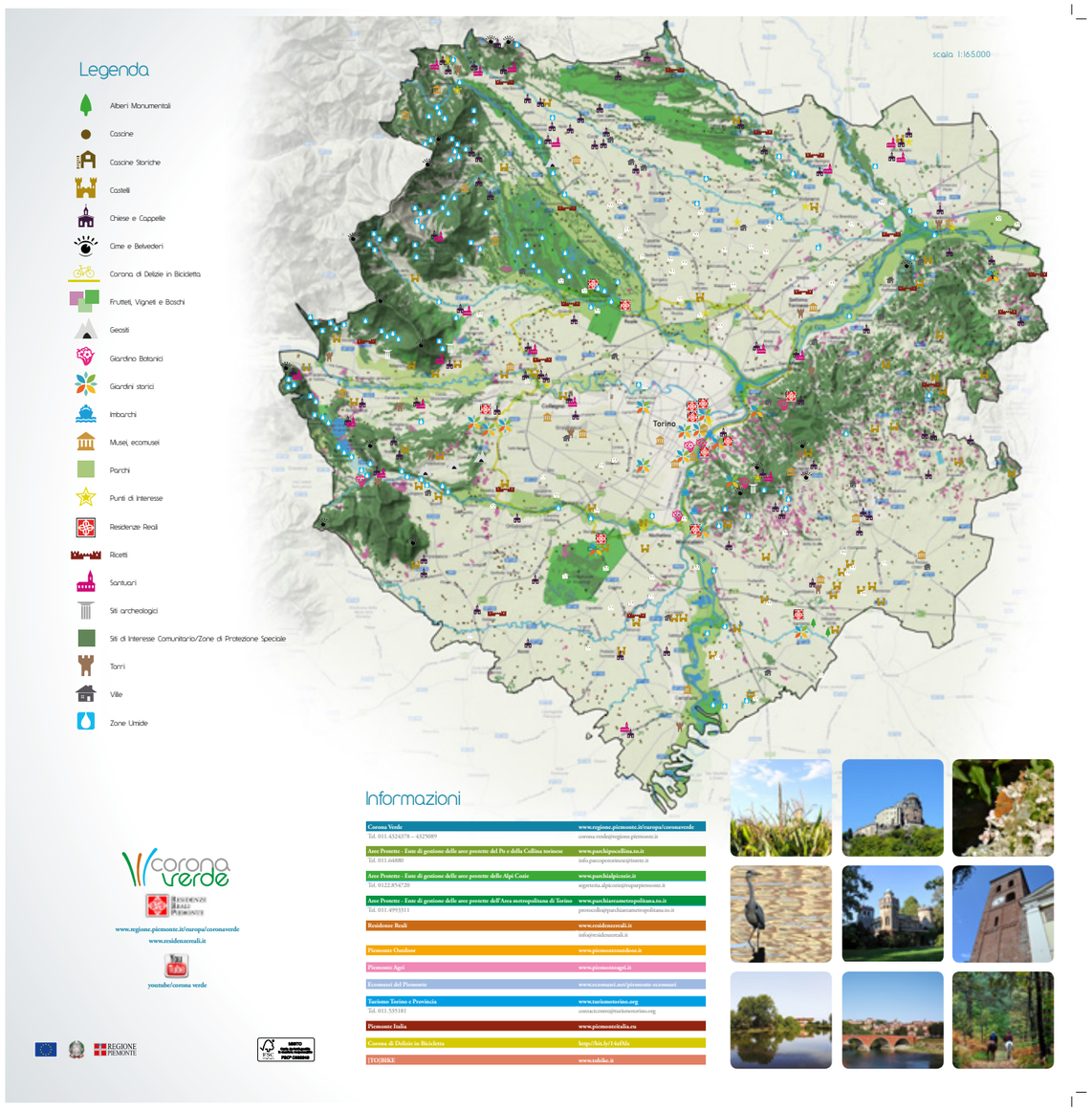
The “Coulée Verte” project employed a range of strategies to revitalize the former railway line and transform it into a pedestrian-friendly space. The main strategy was pedestrianization, which involved the elimination of vehicular traffic to create a safe and enjoyable environment for walkers, joggers, and cyclists. Another important strategy was the integration of green spaces, with a focus on landscape design to enhance the pathway’s visual appeal and functionality. This included the creation of gardens, parks, and relaxation areas along the route, promoting community engagement. Architectural preservation was also prioritized, recognizing the historical and architectural value of existing structures such as viaducts, footbridges, and tunnels, contributing to the area’s cultural heritage. Lastly, the project aimed for seamless integration with surrounding neighborhoods and nearby landmarks, providing convenient access points and pathways to ensure smooth transitions between the pathway and adjacent areas.

In conclusion, the “Coulée Verte” project serves as a valuable guideline for “The Network” project, particularly in terms of its strategies for connecting different sites, its well-developed landscape design and recreational areas, and its exceptional ability to preserve and transform cultural heritage, making it more appreciated and valued by the community. The success of the “Coulée Verte” project demonstrates how such initiatives can effectively enhance connectivity, create attractive public spaces, and contribute to the preservation and promotion of cultural heritage within a city.

3.5 CORONA VERDE MASTERPLAN - Torino, Italy

Design by Daniela Chiantore and Elena Porro

The “Corona Verde” masterplan is a project of 40 kilometers in the Piemonte region, centered around Torino. It acts as a ring, connecting the natural heritage, hydrological sources, rural lands, and the residences of the Savoy family, a significant cultural heritage. This project serves as an urban planning example that aims to strengthen the ecological network and preserve the cultural heritage by linking them together, providing recreational spaces for residents to enjoy, and enhancing their overall quality of life. To realize this, the project requires collaboration among 93 municipalities, offering ecological, social, and economic benefits. Ecologically, the project aims to combat environmental and noise pollution, land consumption, and the fragmentation of natural heritage caused by urbanization. It does so by establishing a network that restores ecological relationships and promotes resilience. Socially, the project aims to benefit the community by completing the cycling and hiking network, providing access to public green areas, and preserving architectural and historical landmarks of interest. Additionally, through this new infrastructure network, the project seeks economic benefits, such as tourism opportunities and the attraction of new economic and business development prospects. Overall, the “Corona Verde” masterplan in Piemonte represents a comprehensive approach to urban planning that takes into account ecological conservation, cultural heritage preservation, and the well-being of residents. By fostering connectivity and offering various benefits, the project aims to create a sustainable and vibrant region (Regione Piemonte, 2020).

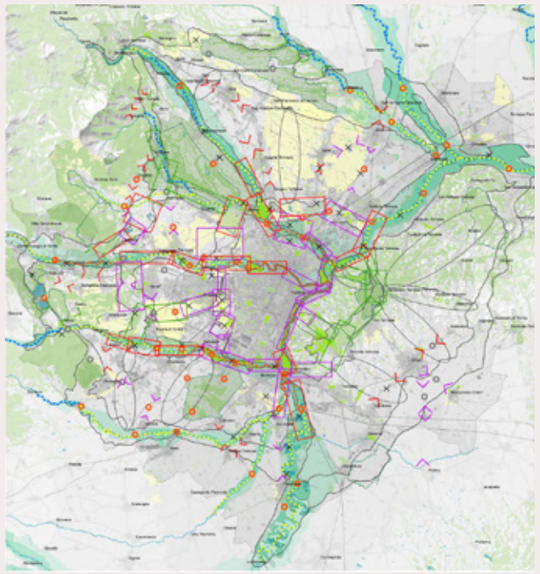


STRATEGIES FROM CORONA VERDE

The “Corona Verde” masterplan was developed through active citizen participation, aiming to foster a sense of ownership and generate a stronger community identity.

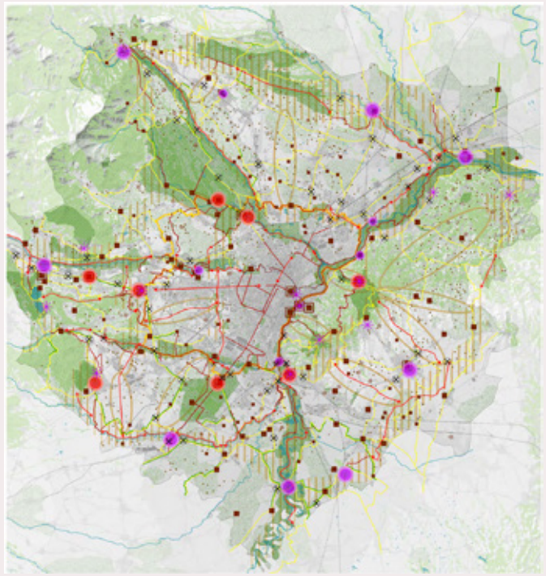
Four key strategies were employed in the design of the masterplan:

1. Strengthening the Ecological Network:



The primary focus of the project was the protection and preservation of water bodies. High-risk areas were identified, and efforts were made to establish connections throughout the entire hydrological network, ensuring the ecological integrity of the existing ecosystem (Regione Piemonte, 2020).

2. Connecting Natural and Cultural Resources:

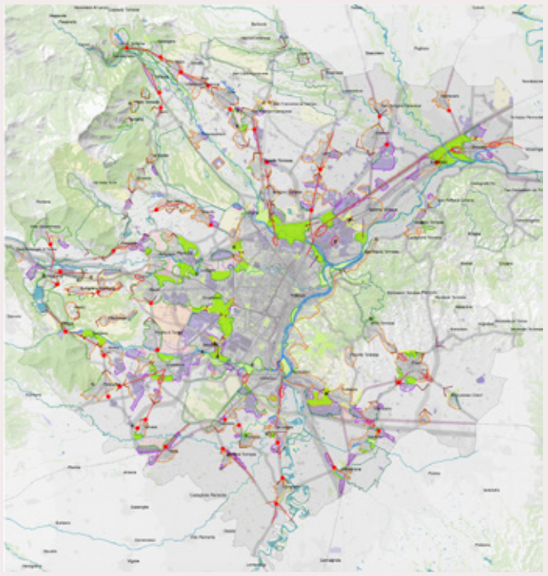


The masterplan prioritized easy access to the region’s most significant natural and historical-cultural sites. The aim was to ensure that these resources could be readily enjoyed and appreciated by residents and visitors alike (Regione Piemonte, 2020).

3. Valuing Peri-Urban Agriculture:

The masterplan recognized peri-urban agriculture as a fundamental characteristic of the Piemonte landscape. It was seen as an opportunity to maintain open spaces around the city, preserving the rural charm and supporting sustainable agricultural practices (Regione Piemonte, 2020).

4. Redesigning Borders and Urban Gates:



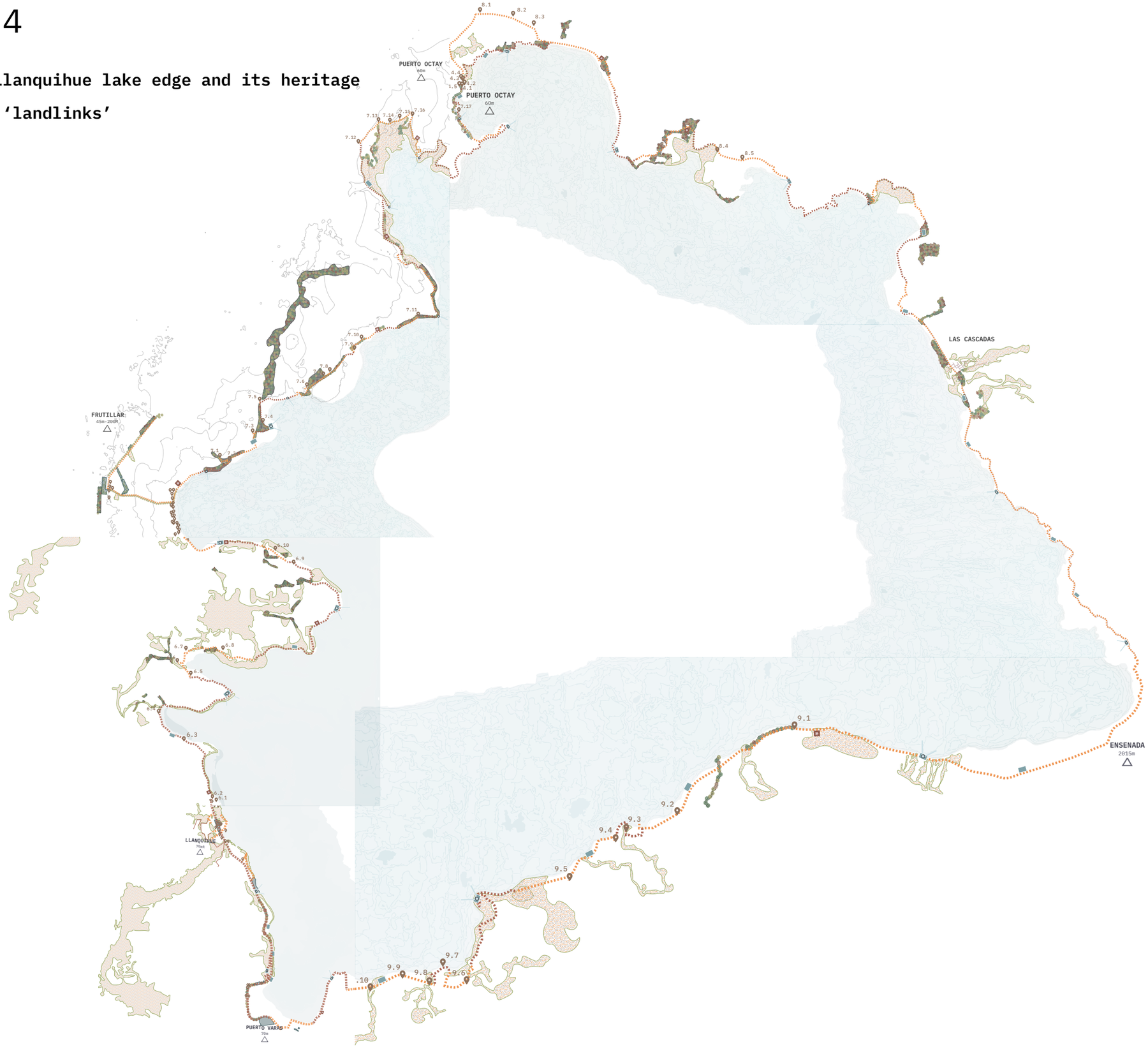
STRATEGIES AND GUIDELINES FOR THE LANDLINK DESIGN

The masterplan incorporated a redesign of borders and urban gateways to safeguard undeveloped areas with significant natural heritage. This approach aimed to counterbalance existing land consumption and protect and enhance the region’s natural landscapes.

To conclude, the “Corona Verde” project and the proposal for the Llanquihue lake edge that has been developed in this thesis share similar objectives. Both operate on a masterplan scale, integrating multiple layers and interventions to establish a network for the protection of natural and cultural heritage while improving accessibility for residents. These projects aim to address heritage fragmentation, urban expansion, land occupation, ecosystem degradation, and contamination through urban planning and landscape design initiatives that restore ecological and cultural connections. By prioritizing easy accessibility to heritage sites, these projects enhance the well-being of residents and foster educational experiences. The Corona Verde project exemplifies its objectives through detailed surveys of each layer, identifying areas requiring increased protection, restoration efforts, and the design of accessible infrastructure like hiking and cycling routes, as well as the implementation of hydrological and green corridors, rural landscapes, and public spaces to enhance connectivity and accessibility. Finally, this project also reuses residual spaces next to the river, inside the city, to protect the natural heritage and improve the quality of life for the inhabitants.

CHAPTER 4

Connecting the Llanquihue lake edge and its heritage systems through ‘landlinks’



4.1 Design strategies for re-establishing the heritage system continuity along the Llanquihue lake edge

From a fragmented lake edge and an unhealthy relationship with the natural and cultural heritage, this thesis aims to re-establish the connections and processes of the lake edge through a landscape architecture project which operates at two scales: the masterplan, which builds the network by articulating different landlinks to fortify the Llanquihue lake edge, and specific interventions that are key to solving critical cases of fragmented heritage, improving the relationship with its surroundings and the habitability of people. This decision was made after analyzing the issues and concluding that there are two main problems. On a vast scale, there is a lack of connectivity between cities in terms of infrastructure, and the unconnected and unprotected cultural and natural heritage, which detracts from the appreciation of its landscape. On a local scale, there is critical fragmentation due to isolation and/or friction of specific heritages with anthropic actions. These issues typically occur near or within cities and contribute to their degradation.

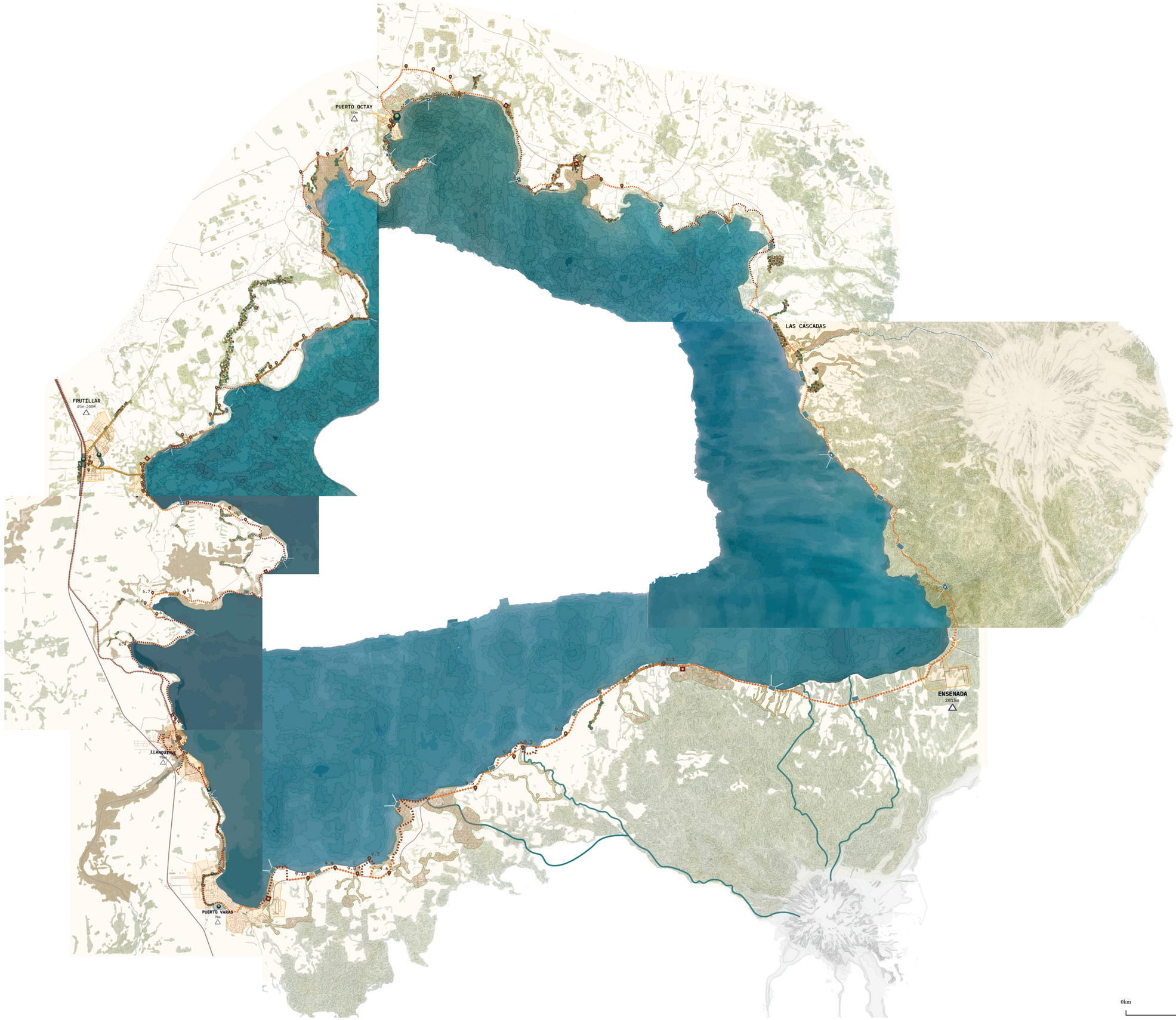
Therefore, the project consists of connecting the Llanquihue lake edge through the design of 'landlinks'. As we mentioned before, the 'landlinks' are green infrastructures with the characteristics of being multifunctional and versatile. They will act as connectors of the heritage and landscape, through different strategies that manage to improve four important dimensions that were decided as part of the design methodology: 1. Social dimension, 2. Cultural, 3. Ecological, and 4. Visual dimension. This decision was made so that the 'landlink' complies with the principle of multiplicity, achieving an infrastructure that showcases a complete landscape of the lake edge, in terms of expressing all its characteristics.

To connect the natural heritage, they will use strategies such as creating ecological corridors that reestablishe the vertical and horizontal connections through the reforestation of native forests. Also, they will enhance and protect some important patches of vegetation thanks to the recognition and protection of them by the regulatory plan, or also damage mitigation measures on their edges. Sometimes these interventions may not always have access for the people. They will be exclusive for protecting the heritage without directly involving the people. However, this intervention also improves other dimensions as the social and visual, creating a better relationship between the humans and healing unhealthy spaces and giving them a more complete landscape. In the case of cultural heritage, the 'landlinks' will connect the different pieces through the enhancement of existing roads. The above is through the paving of existing dirt roads, tree planting, creation of new roads and cycle paths. This strategy will also approach the social and visual dimension creating new accessibility to the lake and between settlements. This will make a big difference for the inhabitants, due to the relationship with the lake, giving them more alternatives to transportation and reducing the time. Finally, the landlinks will expand to incorporate green infrastructure for recreation as new public parks, resting areas, playgrounds, and existent and new viewpoints, fulfilling multiple functions.

To achieve the above, the project is considered to a long-term. In a real scenario, due to the scale and investments that would be needed by both state and private administrative entities, it is designed to be a project carried out in phases. It is also considered as a project that could change during its process or interventions that could not be done. Under this line, the methodology for the design part will consist of three steps. Firstly, the design of the masterplan, which will design the 'landlinks' on a vast scale will be addressed thanks to the division, analysis, and design of six stretches between cities: 1. Frutillar to Puerto Octay, 2. Puerto Octay to Las Cascadas, 3. Las Cascadas to Ensenada, 4. Ensenada to Puerto Varas, 5. Puerto Varas to Llanquihue, and 6. Llanquihue to Frutillar. The stretches were carefully studied and analyzed for their qualities and problems, particularly concerning the fragmentation of the natural and cultural heritage. The intervention will be designed to act in different ways to address the problems through interventions that connect the heritage between the settlements, fostering a healthy relationship with the surrounding systems. However, to demonstrate how the 'landlink' will work on a smaller scale inside the masterplan, it will be shown for each stretch how the 'landlink' solves the arrival into the cities and connects the heritage in general terms.

Finally, one of the most interesting stretches will be chosen to develop the project on a local scale. In this way, the project will take more details in terms of approaching the problematics through the design of the interventions. Each 'landlink' will show its characteristics, strategies, functions, and materiality.

Masterplan design process



LEGEND

- Public parks
- Resting areas
- Playgrounds
- Enhancement of roads and their pedestrianization
- Pathways
- Ecological corridors
- Enhancement and protection of the natural heritage
- View points
- Natural Heritage
- Rural
- Urban
- Cultural Heritage

1. THE LANDLINK FROM FRUTILLAR TO PUERTO OCTAY AND ITS STRATEGIES

LEGEND

1. Lack of accessibility to the lake
2. Volcanoes risk zone (low, medium and high risk)
3. Fragmentation of the cultural heritage by isolation, due the lack of accessibility:
   - a) Extremely isolated cases
   - b) Pathways in bad statewith
4. Fragmentation of the natural heritage by isolation and friction

Natural Heritage
Rural
Urban
Cultural Heritage
Wetlands
Protected Areas
Principal routes
Secondary routes
Tain rail
Rivers

Natural Heritage
Rural
Urban
Cultural Heritage

SOCIAL DIMENSION

Transformig residual spaces into places for recreation and education about the Llanquihue lake heritage and its landscape

- Public parks
- Resting areas
- Playgrounds

CULTURAL DIMENSION

Re-connecting the wooden german cultural heritage from Frutillar to Puerto Octay making it accessible

- Enhancement of roads and their pedestrianization
- Pathways

ECOLOGICAL DIMENSION

Re-connecting, protecting and making value the existent natural heritage in the Llanquihue lake edge

- Ecological corridors
- Enhancement and protection of the natural heritage

VISUAL DIMENSION

Improving visual accessibility through the exploration of different types of landscapes that characterize the Llanquihue lake edge, to connect people and encourage them to appreciate them

- View points

THE LANDLINK ON A LOCAL SCALE: THE ARRIVAL TO FRUTILLAR

SOCIAL DIMENSION

- Public parks
- Playgrounds

Transformation of landfills and dumping sites in the city with high healthy risk into public parks that improves the habitability of the inhabitants

ECOLOGICAL DIMENSION

- Ecological corridors
- Enhancement and protection of the natural heritage

Connecting the left patches neerby Frutillar through green corridors crossing the city. Also protecting important buffers or creating new ones to balance and stop the urbanization

CULTURAL DIMENSION

- Enhancement of existent roads
- Pathways

Pedestrianization for walkers and cyclist between Frutillar Alto and Frutillar Bajo, and the street Arturo Alessandri. The above alows a better accessibility to the existent cultural and natural heritage.

VISUAL DIMENSION

- View points

Improving access to a unified landscape of cultural identities and natural heritage in the city

2. THE LANDLINK FROM PUERTO OCTAY TO LAS CASCADAS AND ITS STRATEGIES

LEGEND

1. Lack of accessibility to the lake
2. Volcanoes risk zone (low, medium and high risk)
3. Fragmentation of the cultural heritage by isolation, due the lack of accessibility:
   - a) Extremely isolated cases
   - b) Pathways in bad statewith

- Natural Heritage
- Rural
- Urban
- Cultural Heritage
- Wetlands
- Protected Areas
- Principal routes
- Secondary routes
- Tain rail
- Rivers

SOCIAL DIMENSION

Transformig residual spaces into places for recreation and education about the Llanquihue lake heritage and its landscape

- Public parcks
- Resting areas
- Playgrounds

CULTURAL DIMENSION

Re-connecting the wooden german cultural heritage from Puerto Octay to Las cascadas making it accessible

- Enhance of existent roads and its pedestrianization
- Pathways

ECOLOGICAL DIMENSION

Re-connecting, protecting and making value the existent natural heritage in the Llanquihue lake edge

- Ecological corridors
- Enhancement and protection of the natural heritage

VISUAL DIMENSION

Improving visual accessibility through the exploration of different types of landscapes that characterize the Llanquihue lake edge, to connect people and encourage them to appreciate them

- View points

The park as a key landlink for Puerto Octay

THE LANDLINK ON A LOCAL SCALE: THE ARRIVAL TO PUERTO OCTAY

SOCIAL DIMENSION

- Public parks
- Playgrounds

Transformation of a landfill in Puerto Octay with a dump atach to it, into a public park that improves the health of the population and gives them a space for recreation

ECOLOGICAL DIMENSION

- Ecological corridors
- Enhancement and protection of the natural heritage

Connecting the natural heritage through the new park in the city built with native species. Also the park acts as a barrier for a big patch of existent natural heritage next to the park

CULTURAL DIMENSION

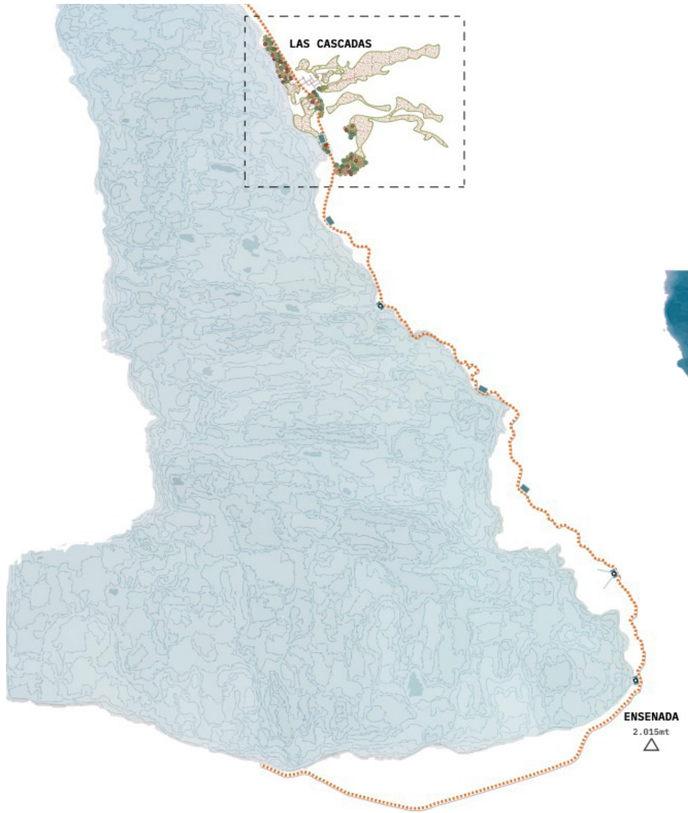
- Enhancement of existent roads
- Pathways

Enhancement of the existent roads in the city center that conects the cultural heritage and the landlinks through its improvement and tree planting

VISUAL DIMENSION

- View points

Improving access to a unified landscape of cultural identities and natural heritage in the city



LEGEND

1. Lack of accessibility to the lake
2. Volcanoes risk zone (low, medium and high risk)
3. Fragmentation of the cultural heritage by isolation, due the lack of accessibility:
   - a) Extremely isolated cases
   - b) Pathways in bad statewith
4. Fragmentation of the natural heritage by isolation and friction

- Natural Heritage
- Rural
- Urban
- Cultural Heritage
- Wetlands
- Protected Areas
- Principal routes
- Secondary routes
- Tain rail
- Rivers

SOCIAL DIMENSION

Prioritizing lightweight passageway infrastructure due to the volcanism risk

- Resting areas

CULTURAL DIMENSION

Implementing good, safe, and direct pedestrianization for walkers and cyclists from Las Cascadas to Ensenada, considering that it is a risk area due to volcanism, for connecting landlinks

- Enhance of existent roads and its pedestrianization
- Pathways

ECOLOGICAL DIMENSION

Safeguarding areas of ecological high value next to the settlements and restoring degraded natural connections. However, thanks to being an area of high-risk zone due to volcanic activity, and with the presence of the Vicente Perez Rosales National Park, this area boasts a unique natural heritage that is already protected

- Ecological corridors
- Enhancement and protection of the natural heritage

VISUAL DIMENSION

Improving visual accessibility through the exploration of different types of landscapes that characterize Llanquihue lake edge, connecting the people with it and encouraging them to appreciate it. This piece highlights the relationship between the people and nature and volcanos, due to being next to a National Park

- View points

THE LANDLINK ON A LOCAL SCALE: THE ARRIVAL TO LAS CASCADAS

SOCIAL DIMENSION

Pathways

Connecting the people with the nature inside the city through pathways and plataforms, improving its quality of life

ECOLOGICAL DIMENSION

Ecological corridors
Enhancement and protection of the natural heritage

Connecting and protecting the natural heritage through the protection of rich areas with natural heritage through a new regualtory plan and ecological corridors

CULTURAL DIMENSION

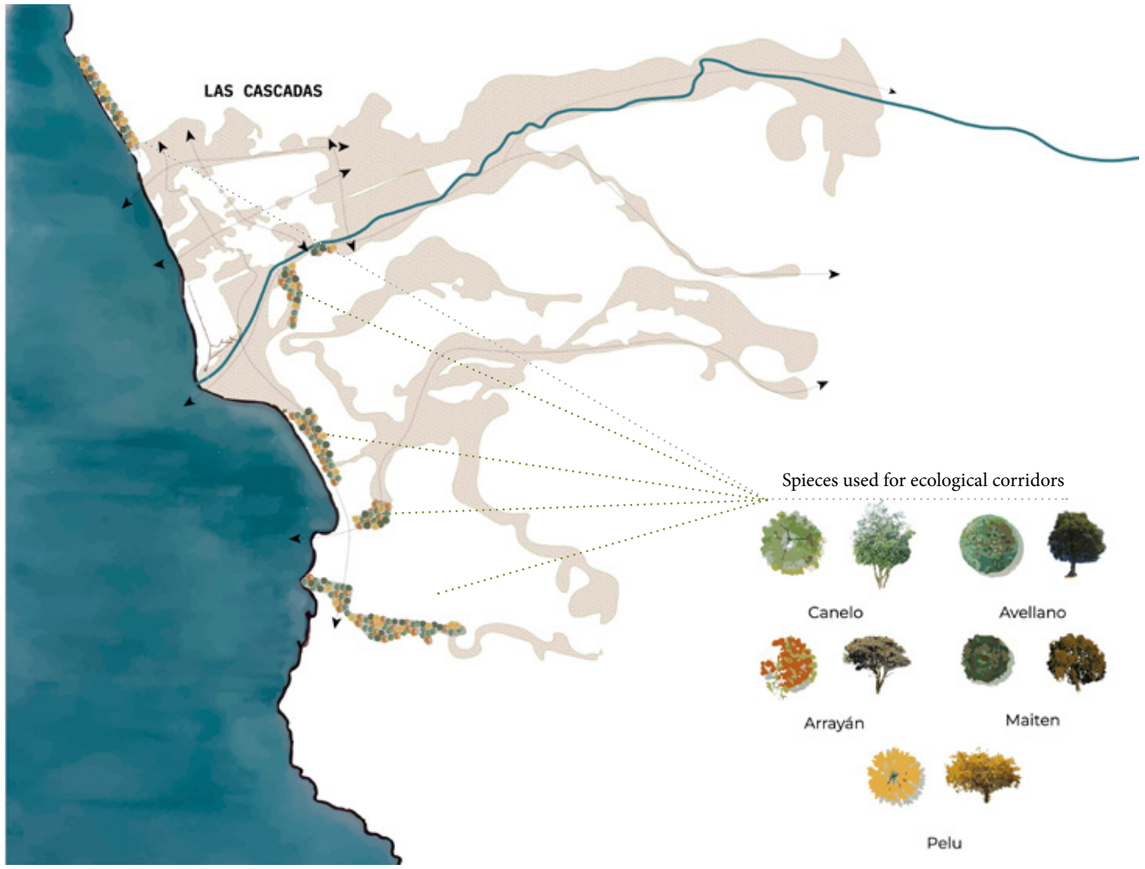
Enhancement of existent roads

Enhancement of the existent roads that conects the landlinks and lake edge

VISUAL DIMENSION

View points

Improving the relationship between the people and the natural heritage through a new experience with the landscape inside the city

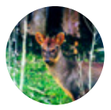


The proposed landlinks in the town of “Las Cascadas” would be primarily achieved through a change in the land use management, creating a regulatory plan that legally protects natural heritage in designated areas and promotes mixed land use for the future. In this way, landlinks involve the protection of designated areas, reforestation of critical sectors, and landscape interventions that enable vertical and horizontal ecological corridors, safeguarding ecosystem cycles. Furthermore, these interventions are designed to bring people closer to nature and encourage its preservation.

Species of animals than could be protected with the implementation of this landlinks into and around the city:


Skunk (Conepatus chinga)


South America Gray Fox (Pseudalopex griseus)


PUDU (Pudu pudu)


Huillin (Lontra provocax)

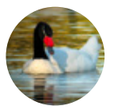

Yellow-billed Pintail (Anas georgica chilensis)


Cinnamon teal (Anas cyanoptera)


Yellow-billed teal (Anas flavirostris)


Great grebe (Podiceps major)

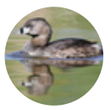

Red-gartered coot (Fulica armillata)

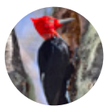

Black-necked swan (Cygnus melancoryphus)

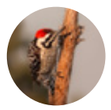

Silvery Grebe (Podiceps occipitalis)


Chiloé wigeon (Anas sibilatrix)

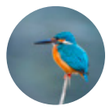

White-tufted grebe (Rollandia rolland)


Pied-billed grebe (Podilymbus podiceps)


Black woodpecker(-Campephilus magellanicus)


Striped woodpecker (Picoides lignarius)


Neotropic cormorant (Phalacrocorax brasilianus)


Common kingfisher (Ceryle torquata)

4. THE LANDLINK FROM ENSENADA TO PUERTO VARAS AND ITS STRATEGIES

LEGEND

1. Lack of accessibility to the lake
2. Volcanoes risk zone (low, medium and high risk)
3. Fragmentation of the cultural heritage by isolation, due the lack of accessibility:
   - a) Extremely isolated cases
   - b) Pathways in bad stateswith
4. Fragmentation of the natural heritage by isolation and friction

- Natural Heritage
- Rural
- Urban
- Cultural Heritage
- Wetlands
- Protected Areas
- Principal routes
- Secondary routes
- Tain rail
- Rivers

SOCIAL DIMENSION

Transformig residual spaces into places for recreation and education about the Llanquihue lake heritage and its landscape

- Public parks
- Resting areas
- Playgrounds

CULTURAL DIMENSION

Re-connecting the wooden german cultural heritage from Ensenada to Puerto Varas making it accessible

- Enhance of existent roads and its pedestrianization
- Pathways

ECOLOGICAL DIMENSION

Protecting and reconnecting the existing natural heritage, avoiding its fragmentation and isolation

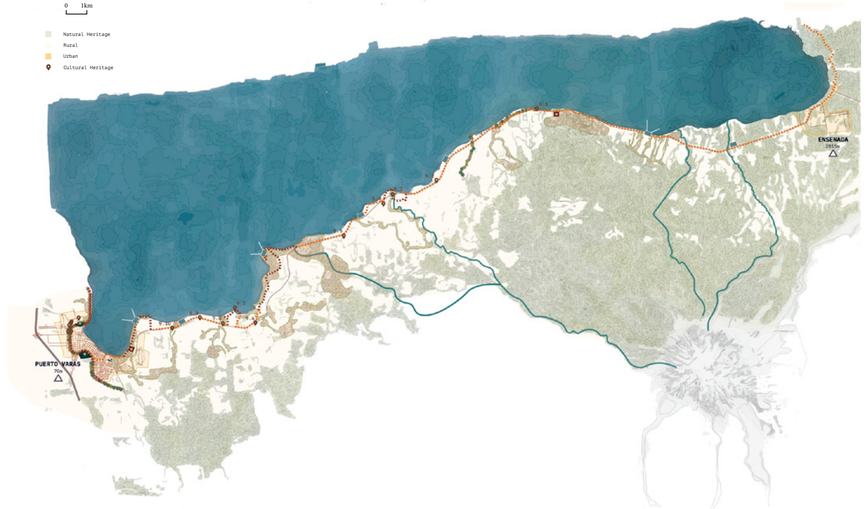
- Ecological corridors
- Enhancement and protection of the natural heritage

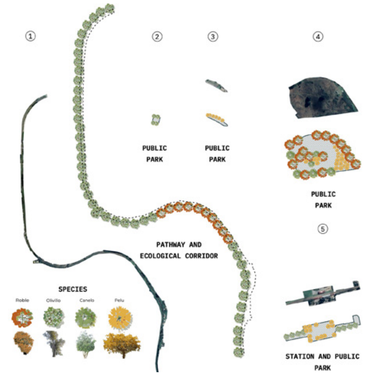
VISUAL DIMENSION

Improving visual accessibility through the exploration of different types of landscapes that characterize the Llanquihue lake edge, to connect people and encourage them to appreciate them

- View points

0 1km





THE LANDLINK ON A LOCAL SCALE: THE ARRIVAL TO PUERTO OCTAY

- Natural Heritage
- Rural
- Urban
- Cultural Heritage
- Wetlands
- Protected Areas
- Principal routes
- Secondary routes
- Tain rail
- Rivers

SOCIAL DIMENSION

- New public parks
- Playgrounds

Transformation of empty and degraded lands inside and next to the city, such as the abandoned trail rail, into spaces for recreation and education about the heritage

ECOLOGICAL DIMENSION

- Ecological corridors
- Enhancement and protection of the natural heritage

Connecting the natural heritage through a green corridor in the old train rail and big buffers of natural heritage attached to it or inside the city

CULTURAL DIMENSION

- Enhancement of existent roads
- New pathways

Enhancement of the existing roads in the city center that connect the cultural heritage and the 'landlinks' through their improvement and tree planting

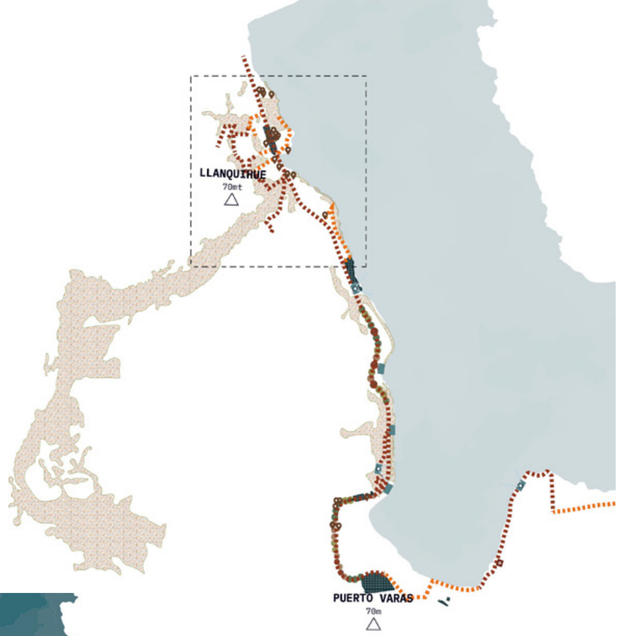
Transformation of the abandoned train rail into a path for pedestrians and cyclists

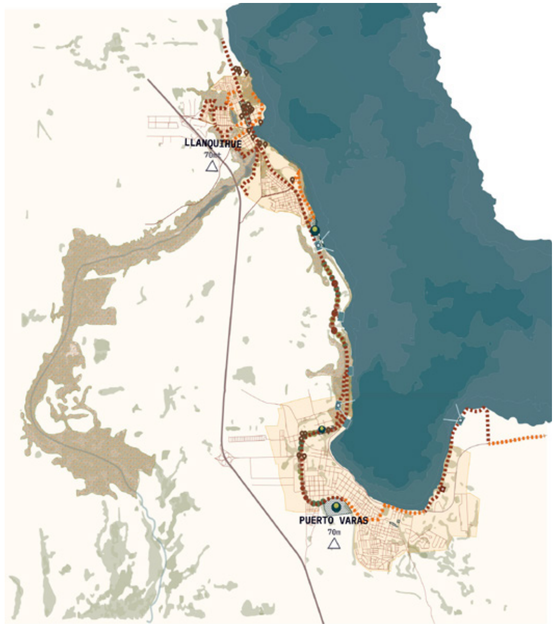
VISUAL DIMENSION

- View points

Possibility of exploring a unified landscape of cultural identities and natural heritage in the city thanks to the renovated train rail

5. THE LANDLINK FROM PUERTO VARAS TO LLANQUIHUE AND ITS STRATEGIES





SOCIAL DIMENSION

Transformig residual spaces into places for recreation and education about the Llanquihue lake heritage and landscape

- Public parks
- Resting areas
- Playgrounds

CULTURAL DIMENSION

Re-connecting the wooden german cultural heritage from Frutillar to Puerto Octay and make it accessible

- Enhance of existent roads and its pedestrianization
- pathways

ECOLOGICAL DIMENSION

Connecting and protecting the natural heritage through the train rail transformed into a green corridor. Also through the protection of certain areas

- Ecological corridors
- Enhancement and protection of the natural heritage

VISUAL DIMENSION

Improving visual accessibility through the exploration of different types of landscapes that characterize the Llanquihue lake edge, to connect people and encourage them to appreciate them

- View points

THE LANDLINK ON A LOCAL SCALE: THE ARRIVAL TO LLANQUIHUE

SOCIAL DIMENSION

- Public parks
- Playgrounds

Transformation of empty lands inside and next to the city into spaces for recreation and education about the Llanquihue Lake heritage

ECOLOGICAL DIMENSION

- Ecological corridors
- Enhancement and protection of the natural heritage

Connecting and protecting the natural heritage through the train rail as the main green corridor, and also other new protected areas

CULTURAL DIMENSION

- Enhancement of existent roads
- Pathways

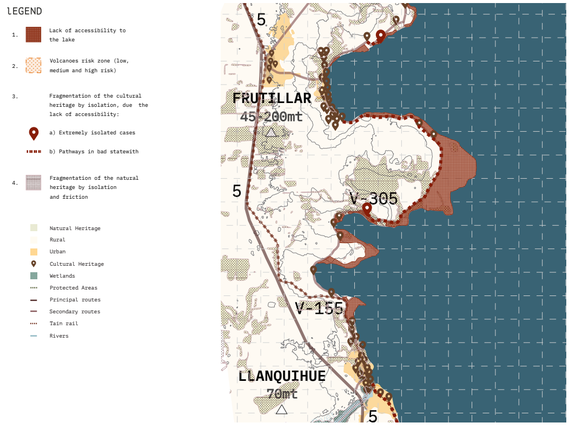
Enhancement of the existing roads in the city center that connect the cultural heritage and the 'landlinks' through their improvement and tree planting

VISUAL DIMENSION

- Viewpoints

Possibility of explore an unify landscape of cultural identities and natural heritage into the city

6. THE LANDLINK FROM LLANQUIHUE TO FRUTILLAR AND ITS STRATEGIES



SOCIAL DIMENSION

Transformnig residual spaces into places for recreation and education about the Llanquihue lake heritage and landscape

- Public parks
- Resting areas
- Playgrounds

CULTURAL DIMENSION

Re-connecting the wooden german cultural heritage from Frutillar to Puerto Octay and make it accessible

- Enhance of existent roads and its pedestrianization
- New pathways

ECOLOGICAL DIMENSION

Re-connecting, protecting and making value the existent natural heritage in the Llanquihue lake edge

- Ecological corridors
- Enhancement and protection of the natural heritage

VISUAL DIMENSION

Improving visual accessibility through the exploration of different types of landscapes that characterize the Llanquihue lake edge, to connect people and encourage them to appreciate them

- Viewpoints

4.2 A landscape architecture project to reconnect natural and cultural heritage from Puerto Varas to Llanquihue

After planning and designing the landlink network, which aims to unify the heritage of the Llanquihue Lake edge and make it accessible, the Llanquihue to Puerto Varas section was chosen as a key element to exemplify the strategies used in the master plan. The project designed for this section seeks to demonstrate on a smaller scale how the 'landlink' works to activate the connection between these two cities, with a focus on their heritage and accessibility to the lake. The section was chosen due to its significant history surrounding the railway connection, as well as its current status as an abandoned train rail and other cultural heritage sites from that time. These factors have resulted in a significant disconnection between these two important cities, leading to the fragmentation of their heritage and a lack of accessibility to the lake edge.

History of the South Railway in Chile

At the end of the 19th century, Chile experienced a boom due to the substantial income generated by the large export of saltpeter from the north. During that time, the government's primary goals were to settle and connect the territory while improving port infrastructure for international trade. Following German colonization in 1845 along the Llanquihue Lake edge, agriculture flourished. In 1911, the Balmaceda government decided to build a railway connecting Llanquihue and Puerto Montt, passing through Puerto Varas. This initiative brought significant factories, industries, and infrastructure to the region, exemplified by the IANSA factory located next to the train rail in Llanquihue. IANSA was one of the country's most important sugar beet harvest industries and was established in 1958. However, southern railways faced a crisis in the early 20th century, marked by service reductions and a growing operational deficit by the government, ultimately leading to the closure of this section (Empresa De Ferrocarriles Del Estado (1858-1979), n.d.)

Currently situation and use

Currently, the train rail and other infrastructure, like the IANSA factory, the Eiffel Bridge, and train stations are abandoned and deteriorating. Despite this, the memory of the train rail persists. After visiting the site, it was observed that neighbors of the train rail and residents of Llanquihue and Puerto Varas still express an interest in using the train rail as a space for connection, walking, cycling, or recreation. With no constructions in this national territory, vegetation has started to grow around it, transforming the line into a natural ecological corridor between the cities. This has also inspired inhabitants to use the space recreationally. For example, near the train rail upon arrival in Llanquihue from Puerto Varas, people have set up banquets and urban orchards. On the other side, it was also observed that due to the informal use of this transitional space between ruralization and the growing vegetation or urbanization and the growing vegetation, some parts are used as micro-dumps, posing a risk to the heritage and the health of the inhabitants. This also indicates that, despite its current use, the conception of the cultural heritage of the train rail and its value is missing for some people.

Landlink strategy between Puerto Varas and Llanquihue

Therefore, given the existing lack of accessibility to connect Puerto Varas and Llanquihue, the absence of accessibility to the lake edge, the loss of memory of the existing cultural heritage, and the current intentions of the people and nature to use this train rail as a green corridor, the 'landlink' proposes to formalize these intentions into a designed path for walkers and cyclists. The landlink design follows the train rail, emphasizing the importance of this cultural heritage for the place's memory and adapting its structure to include valuable spaces that connect people to the heritage and the lake edge. The project incorporates landscape design with native species that enhance the existing connection between natural heritage and recreational infrastructure, such as parks. Finally, following the masterplan design for the entire lake edge, the project aims to plan this section in a way that the landlink protects the heritage from future urban or rural expansions that may lead to fragmentation.

Railway from the south 1855-1913 (Picture), by Memoria Chilena, (n.d), Portal (https://www.memoriachilena.gob.cl/602/w3-article-553566.html).

Micro-dumps on the trainrail, 2023

Current use of the trainrail, 2023

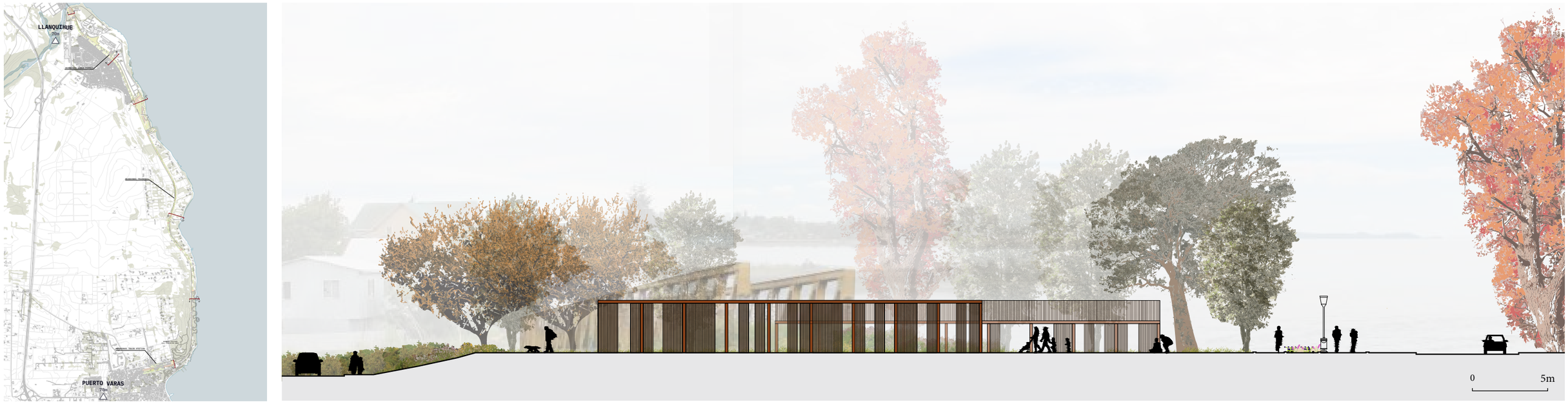
Current use of the trainrail, 2023

Current use of the trainrail, 2023


EIFFEL BRIDGE
Woodland with restings areas and playgrounds
Square with skatepark
Green plain
Resting areas & orchards
IANSA FABRIC
LLANQUIHUE
Fitness area, multi-court and resting areas
Park with accessibility to the lake, green plains, woodlands, playgrounds and multi-court
Stairs of stone for access to the lake
Pedestrian path and cycle path that accompany the restored train rail
Accessibility to the lake through a stone path
Accessibility to the lake through wooden plataforms
PHILIPP HILL PARK
Accessibility to the Philipp Park through gravel paths
TRAIN STATION
Landscape proposal for the train station: green plains, woodlands and squares
EDIFICATIONS
NATURAL HERITAGE
CULTURAL HERITAGE
PUERTO VARAS
0
200m

4.2 A LANDSCAPE ARCHITECTURE PROJECT TO RECONNECT NATURAL AND CULTURAL HERITAGE FROM PUERTO VARAS TO LLANQUIHUE

SECTION A-A´

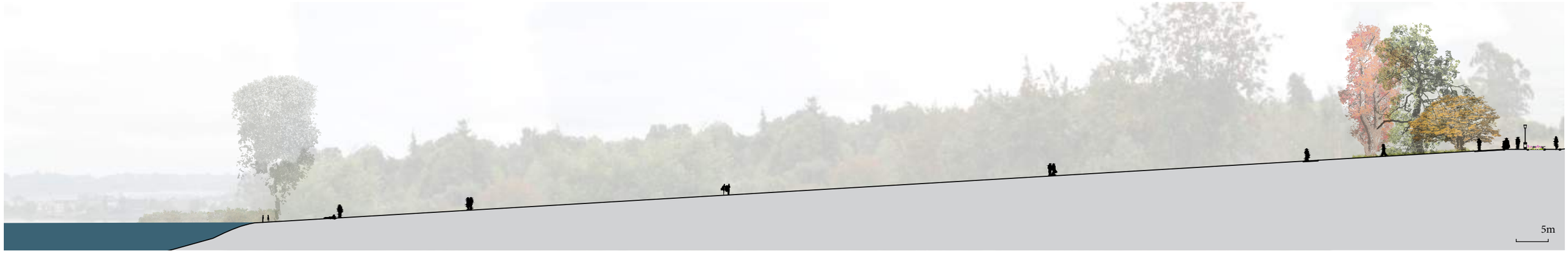


SECTION B-B´

SECTION C-C´

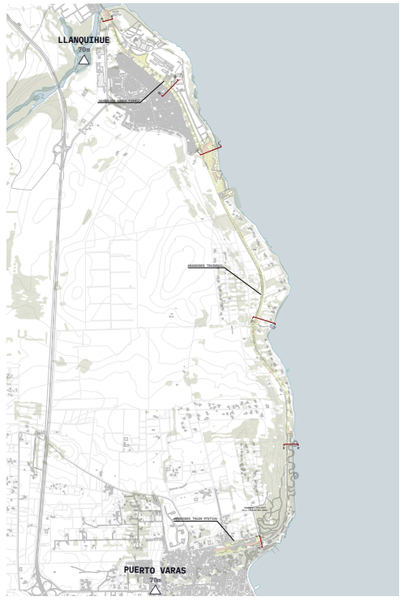
4.2 A landscape architecture project to reconnect natural and cultural heritage from Puerto Varas to Llanquihue

SECTION D-D´



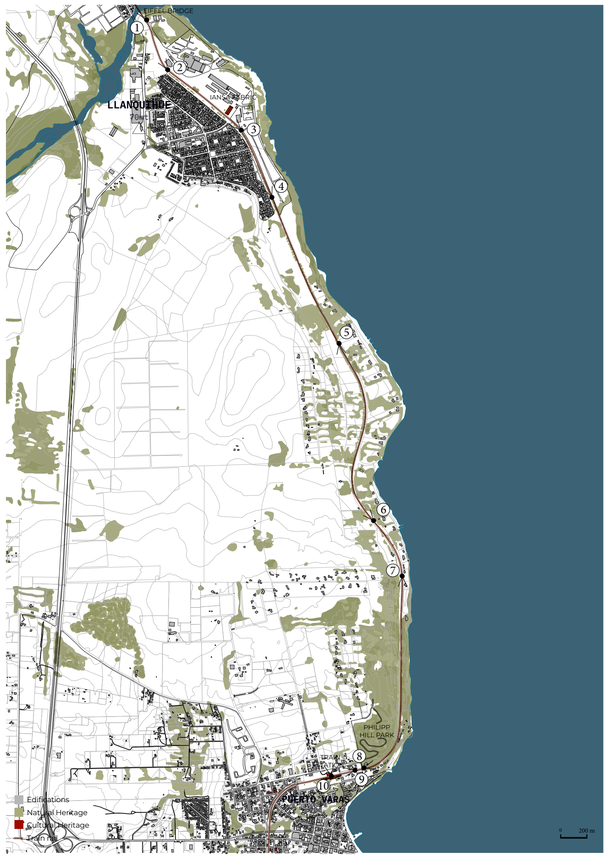
SECTION E-E´

SECTION F-F´

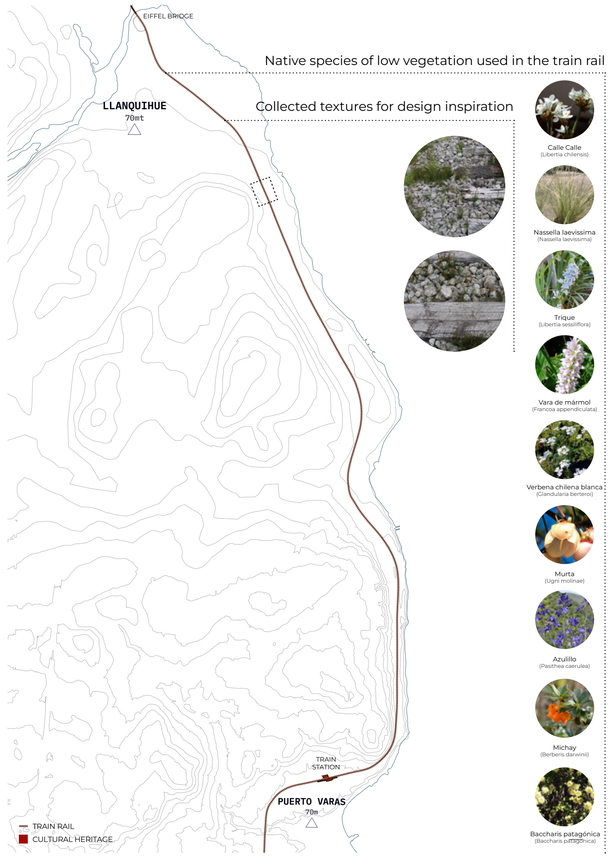


4.2 A landscape architecture project to reconnect natural and cultural heritage from Puerto Varas to Llanquihue

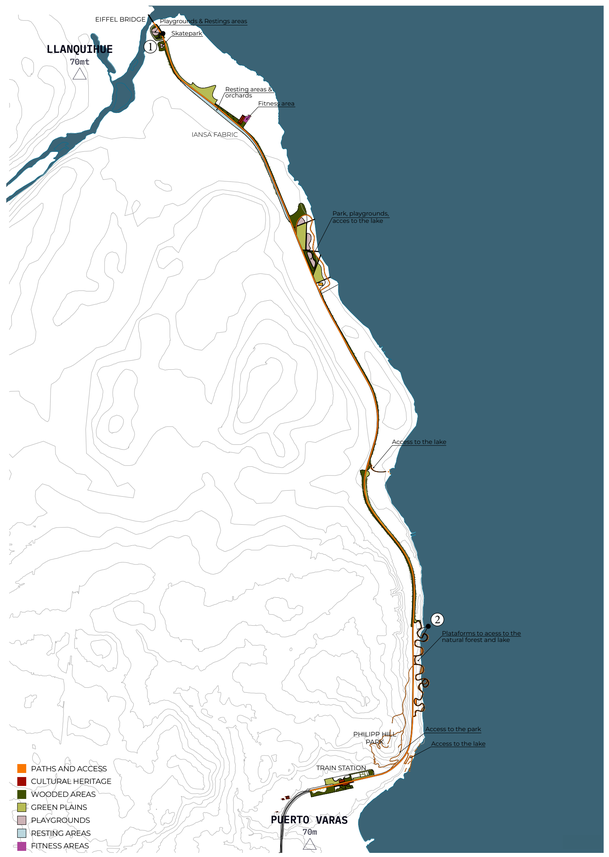
1. EXISTING CONTEXT



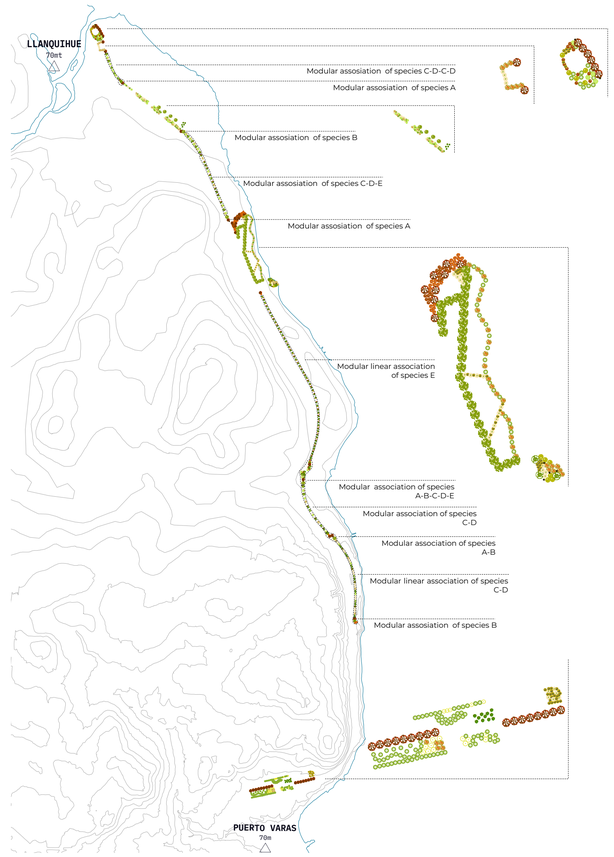
2. TRANSFORMATION OF THE ABANDONED TRAIN RAIL TO A NEW PATH FOR WALKERS AND CYCLIST WITH MEMORY OF ITS HERITAGE



3. EXPANSION OF THE LINE: The adaptability of space delivered to the train line to generate accessibility to the landscape



4. TREES VEGETATION PROPOSAL




People crossing the Eiffel Bridge walking on the train rail


Cemetery of Llanquihue next to the train rail



Iansa Fabric next to the train rail and on a focus view


The train rail and the natural forest in the background

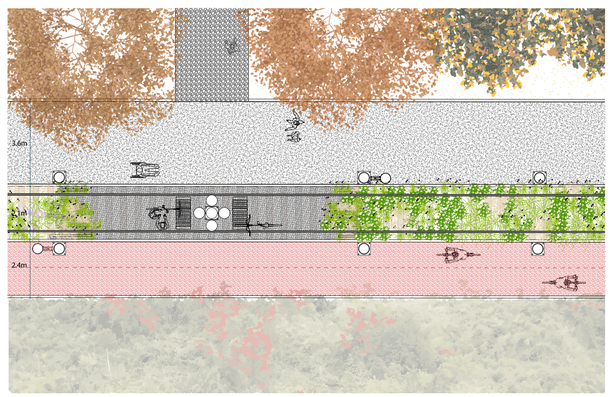

Train rail and the panoramic views

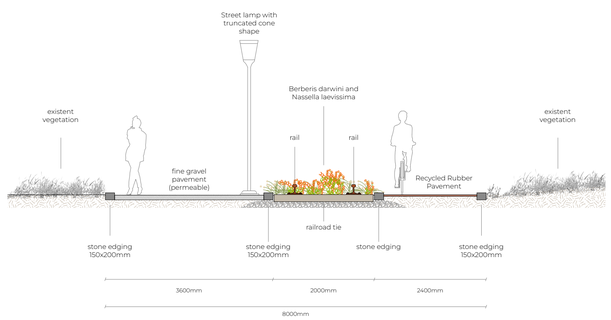

Train rail and low vegetation around


Division of the train rail arriving at Puerto Varas

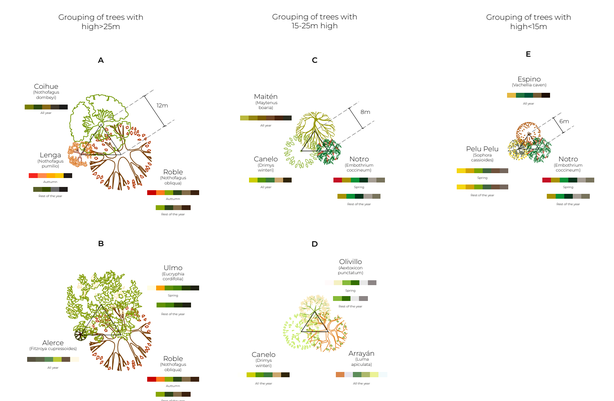

Train Station of Puerto Varas from the train rail

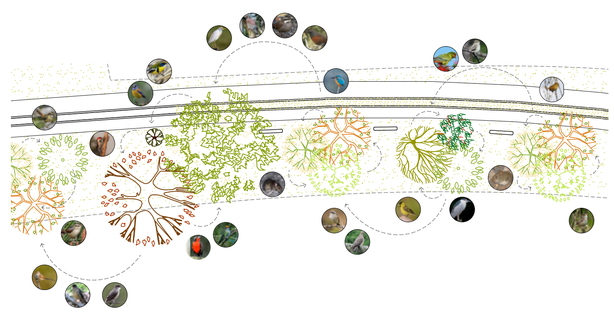

Street art at Puerto Varas Train Station





Modular association of species to create the ecological corridor





CONCLUSION

This thesis project took the Llanquihue Lake as a case study, part of the hydrological network of the 23 North Patagonian lakes, aiming to uncover and study the mosaic of unique systems shaped by its history. This history accentuates its topography and nature, as well as the narrative of German colonization that kickstarted its population and development, leaving a lasting imprint. An analysis of the various systems characterizing the edge of the Llanquihue lake (1. Natural, 2. Rural, 3. Urban, 4. Cultural Heritage) revealed an insufficient spatial transition between them, resulting in the fragmentation of both natural and cultural heritage. This fragmentation has caused the lakeside to lose fundamental qualities of its landscape, encompassing nature and history. The lack of connectivity is also represented in terms of accessibility between settlements or to the lake, hindering people who live in or visit the area from connecting with the water landscape. As was shown, the fragmentation not just affects the landscape of the edge, but also affects the quality of life for the people in the area in terms of in terms of identity, and physical and mental health.

Addressing this problem the 'landlink' concept from 'Landscape + 100 Words to Inhabit It' was adapted into a spatial design strategy to unify and protect heritage, facilitating the transition between different systems. This approach allowed for interconnected territories, enabling a more comprehensive appreciation of the landscape. Therefore, the masterplan consistently prioritizes heritage protection and connection, enhancing accessibility for people. To achieve this, the 'landlink' incorporates four dimensions into its strategy: 1. Social Dimension, 2. Cultural Dimension, 3. Ecological Dimension, 4. Visual Dimension. By considering these dimensions, the proposed project successfully safeguards heritage and improves habitability, fostering connections of the people with the environment and enhancing its accessibility.

Considering the scale of the project and its feasibility, the proposal was thought for made in phases. The masterplan was divided into 6 sections, with the finality of a long-term project. In terms of legal and administrative tools, each stretch involves 2 municipalities that would modify their regulatory plans. The masterplan is a carefully studied proposal, reflecting the development of the 'landlinks' strategy. However, when it comes to translating it into reality, it could be modified due to the amount of property and collaborations it would require. As mentioned before, many of these properties are private, so incentives would have to be offered or private and state buyers sought.

After developing the masterplan, the Llanquihue-Puerto Varas section was chosen to demonstrate how unifying heritage through the landlink can activate the area, providing people with a complete appreciation of the Llanquihue lakeside landscape. The project transforms the abandoned train rail between these two cities into a new path for walkers and cyclists, enhancing the quality of life for people by improving accessibility between the cities and to the lakeside. The project illustrates that the 'landlink' can act to protect and value heritage, either safeguarding unused lands or transforming residual spaces into green corridors through native species to enable natural ecological processes. Connecting cultural heritage through the line offers people the opportunity to learn more about the history of the place, fostering identification and a sense of value and care for it.

Finally, this thesis aims to foment the investigations of the other 22 Noth Patagonia lakes edges in Chile, due to its importance in terms of heritage and undeveloped urbanization. The landlink strategy can be adapted to similar contexts with the finality of planning the protection and access to the heritage before the development of urbanization and ruralization without planning. The landscapes of these lakes are unique and rare, and there is still time to protect them from the fragmentation of their heritage.

BIBLIOGRAPHY

1. Ahmed, S. F., Kumar, P. S., Kabir, M., Zuhara, F. T., Mehjabin, A., Tasannum, N., Hoang, A. T., Kabir, Z., & Mofijur, M. (2022). Threats, challenges and sustainable conservation strategies for freshwater biodiversity. Environmental Research, 214, 113808–113808. https://doi.org/10.1016/j.envres.2022.113808

2. Alvarado Ojeda, A., Baldini Urrutia, A., & Guajardo Becchi, F. (2012, November 1). Árboles Urbanos de Chile : Guía de reconocimiento. SIMEF. https://simef.minagri.gob.cl/bibliotecadigital/handle/20.500.12978/25009

3. Alvarado, A., Guajardo, F., & Devia, S. (2014, January). Manual de Plantación de árboles en áreas Urbanas. https://www.conaf.cl/cms/editorweb/institucional/Manual_de_Plantacion_de_Arboles_en_Areas_Urbanas.pdf

4. Biblioteca Nacional de Chile. (s. f.). Puerto Montt 1853-2002. Memoria Chilena: Portal. Recuperado 30 de noviembre de 2023, de https://www.memoriachilena.gob.cl/602/w3-article-783.html

5. Cabeza, A. & Weber, Carlos. (2019). Los Paisajes Culturales en Chile: conceptos, legislación y situación actual. https://angelcabeza.cl/wp-content/uploads/2019/01/Paisajes-Culturales-en-Chile.-%C3%81ngel-Cabeza-2009.pdf

6. Colafranceschi. (2007). Landscape + 100 palabras para habitarlo. Gustavo Gili.

7. Cosgrove, & Petts, G. E. (1990). Water, engineering, and landscape: water control and landscape transformation in the modern period (Cosgrove & G. E. Petts, Eds.). Belhaven Press.

8. Consejo de Monumentos Nacionales de Chile, Tipos de Protección del Patrimonio (2019). https://patrimonio.bienes.cl/tipos-de-proteccion-del-patrimonio/.

9. De la Vega, F. (2020, October 5). Día Internacional de los Animales y del Hábitat: Amenazas latentes que podemos revertir. Portada Universidad de Chile. https://uchile.cl/noticias/169254/amenazas-latentes-a-los-animales-y-su-habitat-que-podemos-revertir

10. Di Scienze Progetto E Politiche Del Territorio, D. I. (2014). Linee guida per l'analisi, la tutela e la valorizzazione degli aspetti scenico-percettivi del paesaggio. Retrieved November 27, 2023, from https://hdl.handle.net/11583/2543335

11. Empresa de Ferrocarriles del Estado (1858-1979). (n.d.). Memoria Chilena: Portal. https://www.memoriachilena.gob.cl/602/w3-article-553566.html

12. Fernández, T. (2020). Umbrales de borde: Rearticulación del borde lacustre en Panguipulli como estrategia de consolidación y conservación de un paisaje frágil (Tesis). Pontificia Universidad Católica de Chile, Santiago, Chile.

13. Forman, R. T. T. (1995). Land mosaics: the ecology of landscapes and regions. Cambridge University Press.

14. Fontaine, C. (2021, March 29). De Bastille à Vincennes par la Coulée Verte [From Bastille to Vincennes via the Coulée Verte]. The Paris.fr. Retrieved from https://www.paris.fr/pages/de-bastille-a-vincennes-par-la-coulee-verte-4932

15. Gausa, M. (2007). Landlinks. En Editorial Gustavo Gili, S.L. (Eds.), Landscape + 100 palabras para habitarlo (pp. 116-120). Gustavo Gili.

16. Gomes, M., Úrsula de Azevedo Ruchkys, Rodrigo Lopes Ferreira, & Fernando Figueiredo Goulart. (2019). Fragmentación del paisaje alrededor de las cuevas ferruginosas del cuadrilátero ferrífero de Minas Gerais, Brasil/Landscape Fragmentation around Ferruginous Caves of the Iron Quadrangle, Minas Gerais, Brazil. Cuadernos de Geografía (Bogotá), 28(1), 89–. https://doi.org/10.15446/rcdg.v28n1.67506

17. Höpfner, H. et al. (2021). Guía de arquitectura tradicional en madera del Lago Llanquihue. Editorial: Ediciones Universidad San Sebastían. URL: https://arquitectura.uss.cl/guias_post/guia-de-arquitectura-tradicional-en-madera-del-lago-llanquihue.

18. Lindenmayer, D. B., & Fischer, J. (2006). Habitat fragmentation and landscape change: An ecological and conservation synthesis. Island Press.

19. Lobos Peña, P. (2020). Fragmentación del Patrimonio Colonial en el Centro Fundacional de Santiago de Chile: Casa Colonial Urbana Como Ventana de Aprendizaje Y Observación. ProQuest Dissertations Publishing.

20. Ministerio del Medio Ambiente, Humedales de Chile. (2022). https://humedales.mma.gob.cl/

21. Ministerio de obras Públicas & Dirección General de Aguas. (2016). Atlas del Agua Chile 2016. https://snia.mop.gob.cl/sad/Atlas2016parte1.pdf.

22. Muñoz, A. (2019). Estética del encuentro, una aproximación al paisaje. En A. Correa (Ed.), Psicoanálisis y estética: por una misma vía hacia lo inconsciente. Sodepsi Ediciones.

23. Plat Studio. (2022). “Miaojing River”. Landezine. https://landezine.com/miaojing-river-by-plat-studio.

24. Regione Piemonte. (2020). “Corona Verde”. Corona Verde. Da: www.coronaverde.it

25. Sánchez, L. (2002). Impacto sobre los Ecosistemas. 2007, de Unesco Sitio web: https://www.researchgate.net/publication/242207906_Impactos_sobre_los_Ecosistemas.

26. Turra Díaz, O. (1994). La estructura agraria en Llanquihue 1852-1913. Revista De Historia, 1(4), 169-182. https://doi.org/10.29393/RH4-9EAOT10009

27. United Nations Educational, Scientific and Cultural Organization (UNESCO), 2002.

28. Vergara, P., & Armesto, J. J. (2009). Responses of Chilean forest birds to anthropogenic habitat fragmentation across spatial scales.

29. Plat Studio. (2022). “Miaojing River”. Landezine. https://landezine.com/miaojing-river-by-plat-studio.

* All the images that are without citation were created by the author of the thesis