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MILANO 1863

DEPARTMENT OF ARCHITECTURE
AND URBAN STUDIES
LABORATORY OF INTERNATIONAL COOPERATION

POST GRADUATE PROGRAMME

COOPERA(C)TION

KNOWLEDGE AND SKILLS FOR
SUSTAINABLE CITIES IN THE GLOBAL SOUTH



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COLO-COLO PARK: ECOSYSTEMS AND CITIES IN THE DEVELOPING COUNTRIES SANTIAGO DE CHILE CASE STUDY

SANTIAGO, CHILE

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A.A 2015/2016**

Colo-Colo Park

Ecosystems and Cities in the Developing countries:
Santiago de Chile Case Study

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A sustainable future



The 17 Sustainable Development Goals (SDGs) are part of the 2030 Agenda edited by the United Nations for Sustainable Development which was adopted by world leaders on September 2015: These seventeen goals represent the target to be attended by the global community before 2030, by tackling issues such as poverty, climate change, inequality and exclusion. Namely the seventeen goals are:

1. End poverty in all its forms everywhere
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Ensure healthy lives and promote well-being for all at all ages
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5. Achieve gender equality and empower all women and girls
6. Ensure availability and sustainable management of water and sanitation for all
7. Ensure access to affordable, reliable, sustainable and modern energy for all
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

- 10.Reduce inequality within and among countries
- 11.Make cities and human settlements inclusive, safe, resilient and sustainable
- 12.Ensure sustainable consumption and production patterns
- 13.Take urgent action to combat climate change and its impacts
- 14.Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- 15.Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- 16.Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
- 17.Strengthen the means of implementation and revitalize the global partnership for sustainable development

It is interesting to note that the seventeen goals have a multi-sectorial approach which underlines that society and environment are correlated and deeply influence each other. Topic 11 is exceptionally relevant for Architects, being “Make cities and human settlements inclusive, safe, resilient and sustainable”: as Architects we found this topic of exceptional relevance being cities unique human artefacts that can foster social development under multiple aspects;

At the same time, we do acknowledge that it is still challenging to find a balance between development and resource management: this aspect becomes clear when we look at major cities in the developing countries, where issues such as congestion and lack of infrastructures are the leitmotiv to everyday life.

From the UN databases we obtained some relevant data regarding the current and future status of our cities, in particular we report that:

- Half of humanity – 3.5 billion people – lives in cities today
- By 2030, almost 60 per cent of the world’s population will live in urban areas
- 95 per cent of urban expansion in the next decades will take place in developing world
- 828 million people live in slums today and the number keeps rising
- The world’s cities occupy just 3 per cent of the Earth’s land, but account for 60-80 per cent of

energy consumption and 75 per cent of carbon emissions

- Rapid urbanization is exerting pressure on fresh water supplies, sewage, the living environment, and public health
- But the high density of cities can bring efficiency gains and technological innovation while reducing resource and energy consumption

From these premises we decided to take major cities in Developing Countries as a starting point for our reasoning.

Earth's future is in developing cities

"The fate of the Earth's climate" basically hinges on what we do with our cities from now on. But the fate of the world's cities largely hinge on what the developing world decides to do with their own growing metropolises in the next 20 years".

The Tyndall Centre for Climate Change Research_ University of West Anglia, Norwich, UK

According to the World Resources Institute (WRI), urban populations in the developing world are growing three times faster than the ones in developed countries.

UN-Habitat researches prove that says that a remarkable 95 percent of the expected global population growth within the next 20 years will be developing cities.

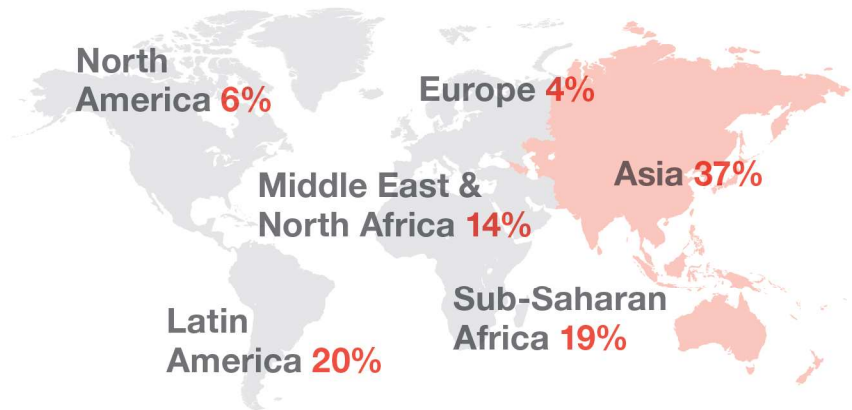
Moreover, most of the existing mega-cities (15 out of 21) can be found in the developing countries, and it is estimated that this is going to become the leading trend.

The World Bank says that 80 percent of the future economic growth of the developing world will come from its cities, at the same time the United Nations Environmental Programme (UNEP) has recently stated that population growth in the cities of the developing world "has outpaced the ability to provide vital infrastructure and services".

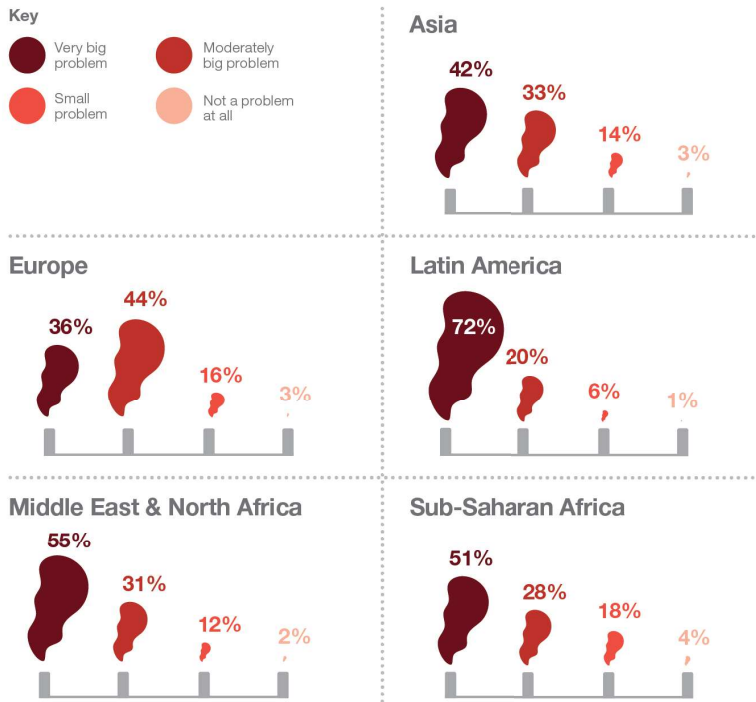
Among many features, rapid economic growth in developing countries is connected to pollution which is not only transport related, but also linked to densely industrialised areas.

According to World Bank, 20 percent of all the health problems in the developing world can be attributed to environmental factors, particularly pollution.

Which region will be most affected by rising pollution in the developing world in the next 12-18 months?



How great a problem does rising pollution in the developing world pose for regions around the world?



Santiago Emergent Ecologies



We decided to engage with a topic that would take into account Urban development in a Developing Country in relation to Environment because of the relevance of such topic according to our previous research.

The Santiago Emergent Ecologies competition was the occasion to investigate the topics of possible environmental developments in fast growth scenarios, such as the reality of Santiago de Chile.

The competition started from the need of envisioning equitable development and a sustainable future of the Metropolitan Region of Santiago;

Moreover, the competition aimed to display a set of proposals for the area comprised between the city of Santiago and the El Roble ecological conservation site, which is one of the major reservoirs of biodiversity in Chile: in fact, any action taken towards this major ecosystem

pool would directly impact the environment and the quality of life in the Region of Santiago, hence influencing the potential economic development of the area.

The objective was to take this site as an opportunity to generate new periurban scenarios for the Metropolitan Region of Santiago, creating a productive landscape that at the same time could protect biodiversity and promote a better relationship with the environment.

Among the main challenges, we considered the following ones:

Conservation and protection of biodiversity

The ecosystem of the site should have been an attracting element and the occupation of the area should preserve biodiversity while envisioning growth.

Productive Landscapes

Another important theme was the one of creating a net of local producers that would be based on the fringe territory surrounding Santiago de Chile thus creating an infrastructure for sustainable production systems.

Community Infrastructure

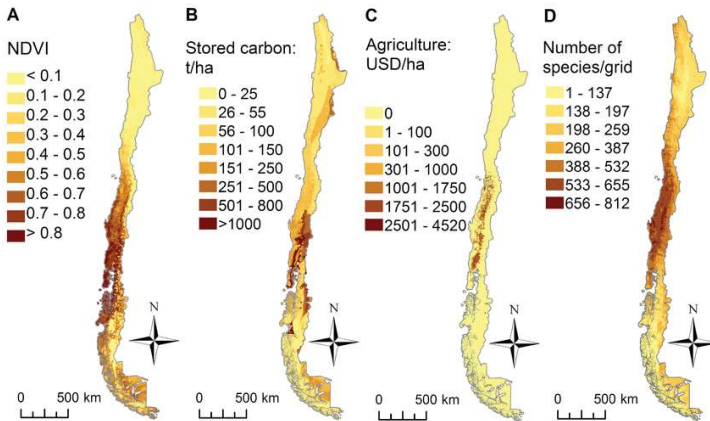
The site should have been a resource for the nearby preceint of Maipù, a problematic district nearby.

The project proposal should have envisioned a set of public spaces that would have been a new reference point for that community.

Ecological Urbanization

In conclusion the site should have been the testing ground for alternative development models, which could have then become paradigmatic.

Chile's environment management



Ecosystem service and biodiversity distribution in Chile

Currently, Chile is consuming less than what its productive areas can regenerate, which is quite rare if we consider the global situation.

Chile has still a national ecological remainder of 0.8 ha per capita, even though it consumes 20% more than what is available per capita worldwide, this due to its considerable coastal area.

However, the consumption of the nation is constantly growing: it is estimated that if the use of resources keeps expanding, Chile will get to the point where all of the ecological productivity within its territory would be occupied for its own consumption within the next seven years. At the same time it is expected that the world population may have grown to 7.7 billion people, with a much reduced available ratio of ecologically productive land available per person than the current situation, the world population may most likely have grown to 7.7 billion people with 1.5 ha of ecologically productive land available per person.

Therefore it is fundamental for nations to adopt a strategy to reduce their environmental deficit.

At the Current time existing protected areas in Chile do not contain an unusually high proportion of carbon storage (14.9%), agricultural production (0.2%) or biodiversity (11.8%), and also represent a low level of plant productivity (Normalized Difference Vegetation Index of 0.38)

In conclusion, even if Chile is still in a favourable position with regards to its environmental deficit, it is highly recommended that it immediately started endorsing a policy of environmental preservation and consumption management in order to put in place a virtuous growth policy.



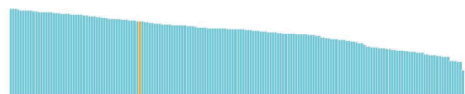
The Environmental Performance Index (EPI) created by Yale University ranks countries' performance on high-priority environmental issues in two areas: protection of human health and protection of ecosystems.

In Chile's specific case we notice that, while the Environmental Health sector remarkably improved in the last decade, the Ecosystem vitality is on average quite scarce.

52

OVERALL RANK
OUT OF 180

ISSUE SCORE
FOR 8 CORE ISSUES



77.67

OVERALL SCORE
OUT OF 100

+5.75%

10 YEAR TREND
OUT OF ±100%

\$15,093.00

GDP PER CAPITA

17.62

MILLION PEOPLE

743,532

SQUARE KM



NAME OF INDICATOR	SCORE	RANK	10 YEAR CHANGE
Health Impacts	96.81	12	1.13%
Air Quality	88.4	53	19.62%
Water and Sanitation	94.47	37	4.06%
Water Resources	94.26	16	12.23%
Agriculture	41.21	150	-13.88%
Forests	36.58	85	-0.44%
Fisheries	38.2	95	-10.73%
Biodiversity and Habitat	75.15	108	1.93%
Climate and Energy	40.29	106	0%

Santiago in a nutshell



Bird's eye view

POPULATION: 6.158.080 inhabitants

AREA: 641 kmq

DENSITY: 8470 inh/kmq

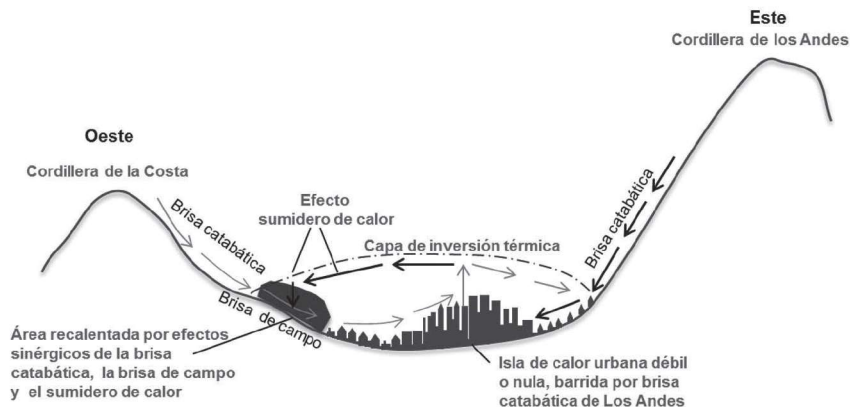
ELEVATION: 521 mt

Santiago clearly embodies all the inequalities that are still present in Chile nowadays with one of the highest Gini index when compared to developing countries.

Santiago lies in a large bowl-shaped basin which measures approximately 80 km in a north-south direction and 35 km from west to east. It is flanked by the towering Andean cordillera to the east and north and the Chilean coastal range to the west. In the south lies the Angostura de Paine, an elongated spur of the Andes. The city lies at an elevation of about 400 mt and reaches over 500 mt further east. This basin has been filled with fluvial sediments coming from the two main rivers of this area: the Mapocho River with its source in the Andes flows through Santiago and into the second one, the Maipo River. Being located outside the tropics, Santiago enjoys a Mediterranean-type climate. Hosting today about 45% of Chile's population,

"The Gini Index is a measurement of the income distribution of a country's residents. This number, which ranges between 0 and 1 and is based on residents' net income, helps define the gap between the rich and the poor, with 0 representing perfect equality and 1 representing perfect inequality."

Topography and pollution



Isla de calor phenomenon

In order to understand the environmental challenges that Santiago de Chile is currently facing it is fundamental to take into account the topography that determined the morphology of the city.

Santiago is surrounded by the Andean mountain range, with an altitude of urban mountains that goes from 1,500 to 3,200 meters above the sea level.

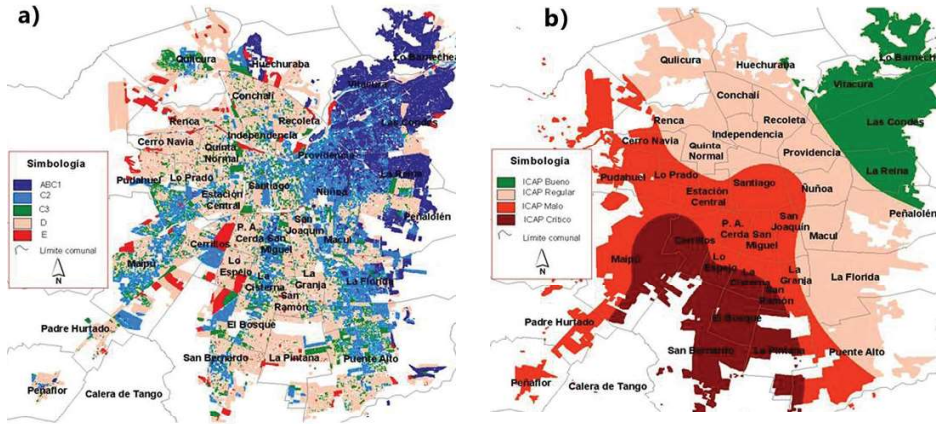
We then find a system of 26 urban hills, the Cerros, that have been absorbed by the city expansion during the past centuries: these play an important role in the equilibrium of the ecosystem of the whole city, being empty spaces that act as green lungs in the dense urban fabric of the consolidated city, thus decreasing the levels of CO₂ and pollutants in the air.

Because of its peculiar location, Santiago de Chile is one of the most air-polluted cities of South America: as previously mentioned, it is completely surrounded by high-peek

mountains that keep air from freely flowing through the city.

The complex orographic situation of this city blocks most of the winds, making air renewal difficult, therefore we can find high levels of air pollution and other phenomena, such as the “Isla de Calor” and the “thermal inversion” during the winter season: both of these consist in an overheating of the urban area due to scarce ventilation.

Environmental injustice



Air quality and air pollution are severely affecting the population of Santiago: in fact, it is estimated that at least 2,500 people die annually due to cardiovascular and respiratory diseases directly associated with air pollution, while hundreds of thousands are experiencing acute or chronic diseases also caused by it. (Ostro et al., 1995).

The spatial distribution patterns of the causes and consequences of air pollution in Santiago are clearly determined by the economic condition of the inhabitants.

In fact, privatization of urban territories and loss of influence of the public policies as instruments of spatial planning, are deeply influencing the growth of Santiago: most profitable and green areas are acquired by the richer strata of the population, while the poorer strata are confined in areas that appear less profitable and unhealthier.

Moreover, while the richest areas are responsible for mainly polluting the atmosphere, the low-income sectors, proportionally less polluting, are places characterized by high concentrations of suspended particles and gases.

The consequences of this are high rates of mortality in poorer neighbourhoods, forming a typical situation of environmental injustice.

In conclusion, according to the WHO (World Health Organization) Santiago could tackle the current environmental challenge it is facing by investing on green spaces which should assure the right area of trees to the whole population with a smart planning of the consolidated fabric and, moreover, blocking any further urbanization of the suburbs.

*image:
citizens' income (a)
is compared to levels of pollution (b)*

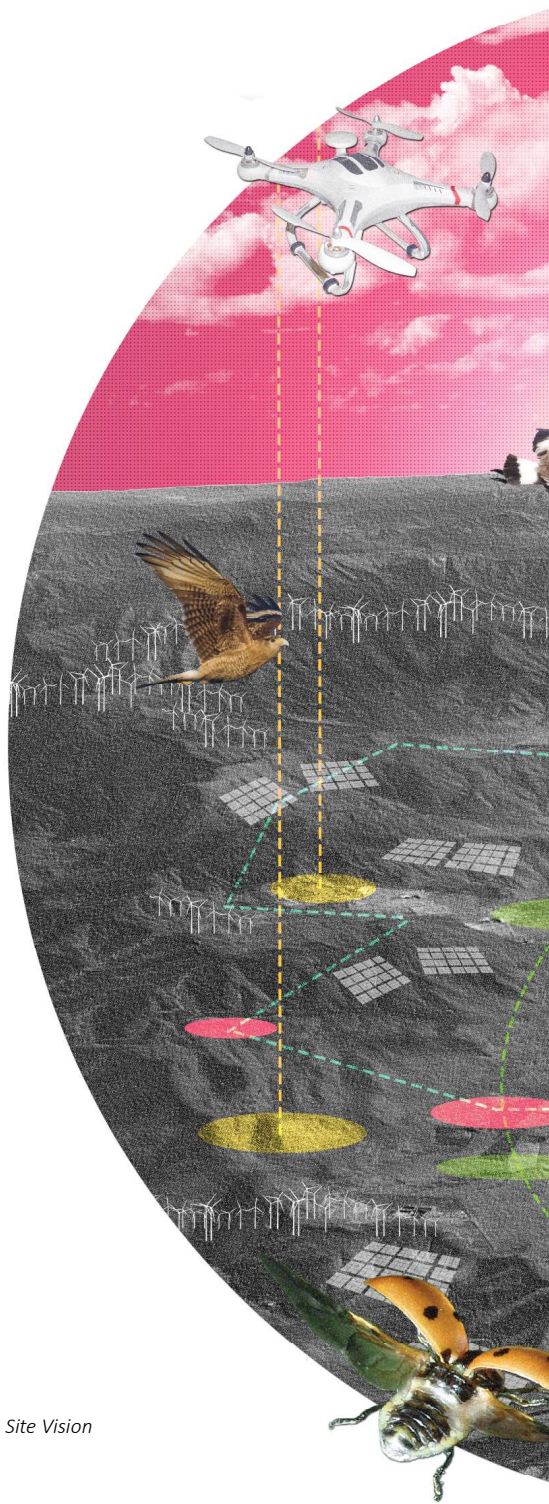
The proposal

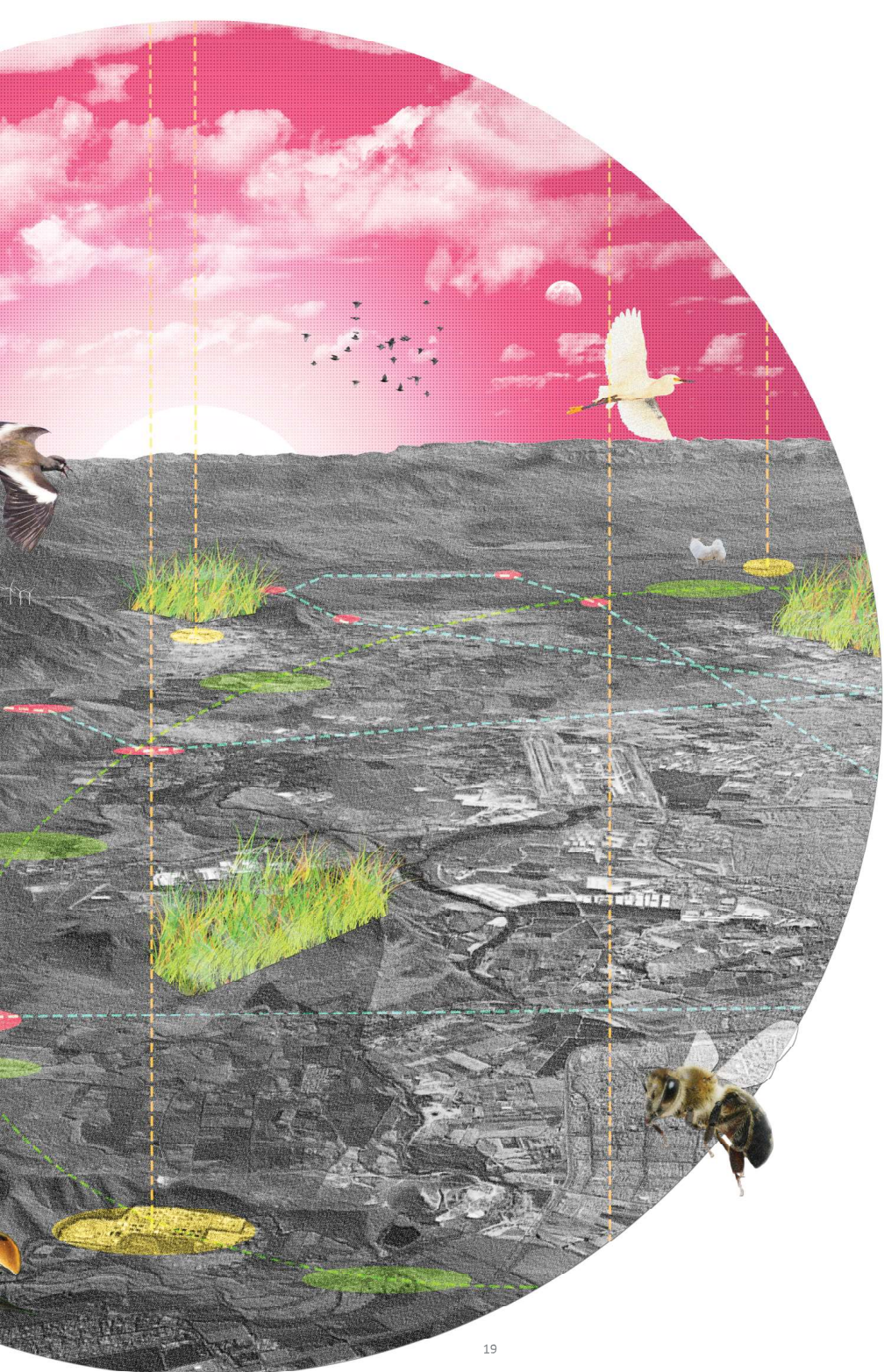
"One of the most important challenges of our world is to face the environmental issue. The increase of this kind of problem breaks the belief that science and technology can overcome the nature and this topic leads us to reflect on the full significance of the site problem."

Sebastiano Vassalli

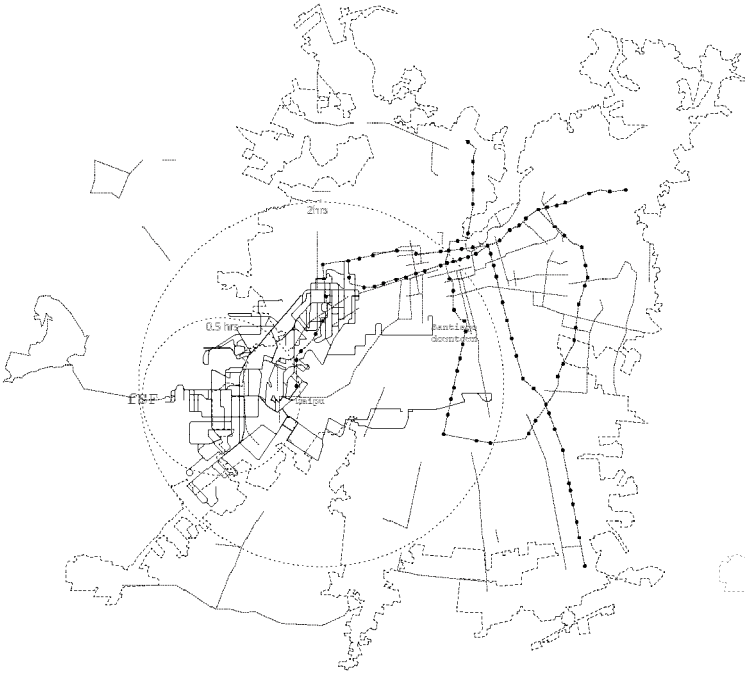
Fundo San Francisco represented a big opportunity because of its strategic position: in fact, as a residual space between the Pre Cordillera mountain chain and the constantly sprawling city, at the present time, this area is being threatened by the construction of new residential settlements that will completely invade what once was a resource in terms of production and ecosystem preservation.

Site Vision



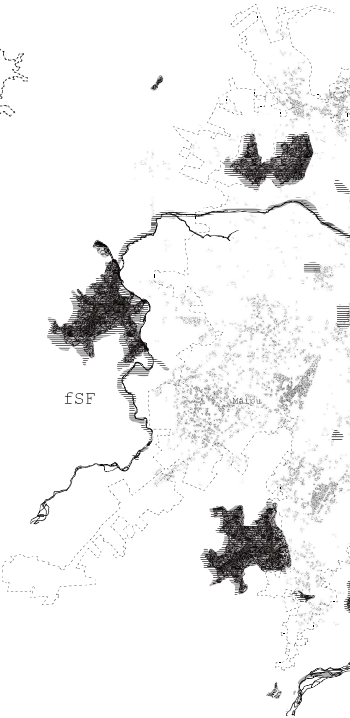


Data analysis



Infrastructure analysis

In spite of the presence of a local metro station, Maipù is considered a cul de sac, hence it is prone to remain a dormitory district.



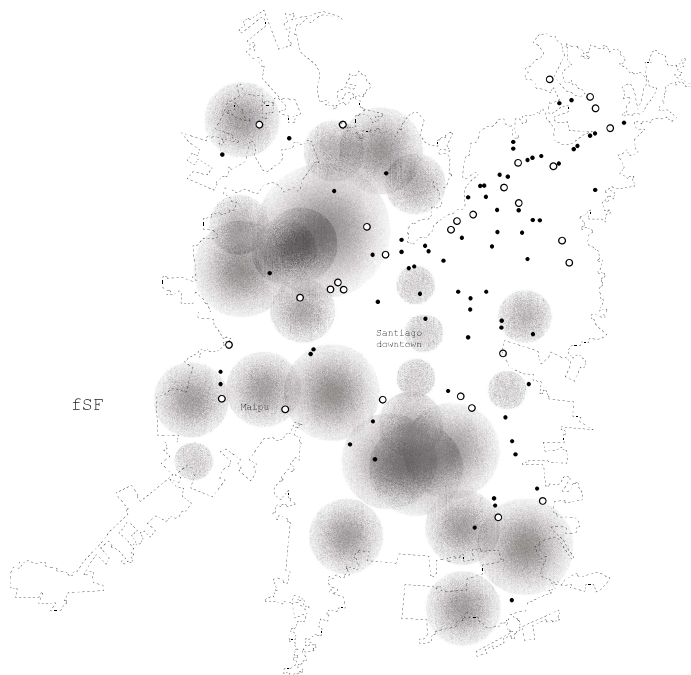
Territory

Green open areas in the North-Western suburbs of the city.



Editorial analysis

s are mainly located in the
burbs, thus leaving the rest
y heavily polluted.



Socio-economic analysis

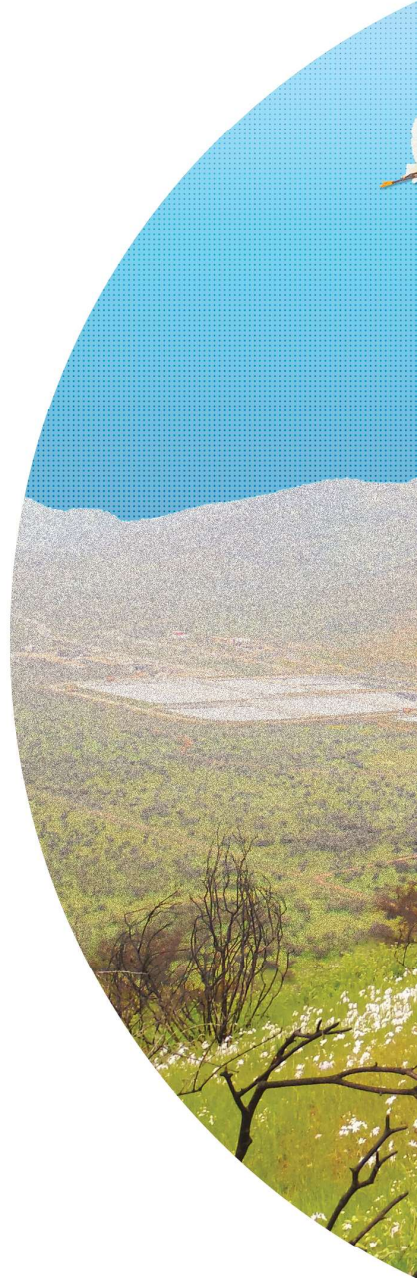
The District of Maipù is mainly served by
weekly ferias which encompass informal trade
and temporary structures.

Intervention focus

#1 connectivity

The introduction in Fundo San Francisco of an extremely recognisable and iconic element such as a funicular represented an opportunity for this space to become a gate to the pre-Cordillera mountain chain, rather than remaining what could be considered as a backyard.

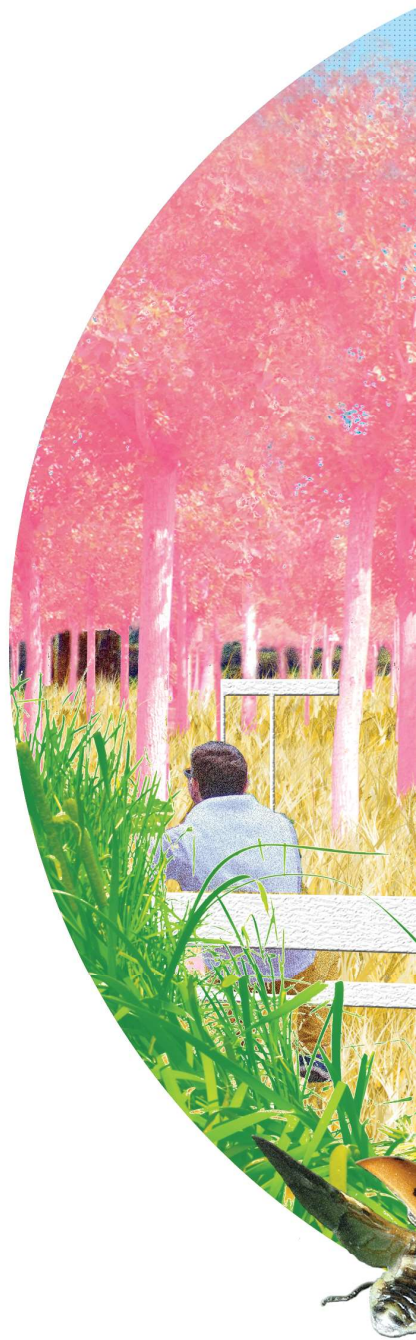
The funicular would constitute an attraction point for both Maipù and Santiago, moreover, it would establish a peculiar relationship with its surroundings thus becoming a landmark for the locals.





#2 ecology

The site layout is organised to equally include agricultural areas, tree nurseries and wildlife areas: according to a disposition that takes into account the presence of natural underground canals as the starting point for the reintroduction of permanently green areas, we then structured buffer zones constituted by tree nurseries that serve the function of green reservoir of available plants to be exported in the rest of the city. The most controlled areas are the agricultural ones that are located in the earth of the Fundo.

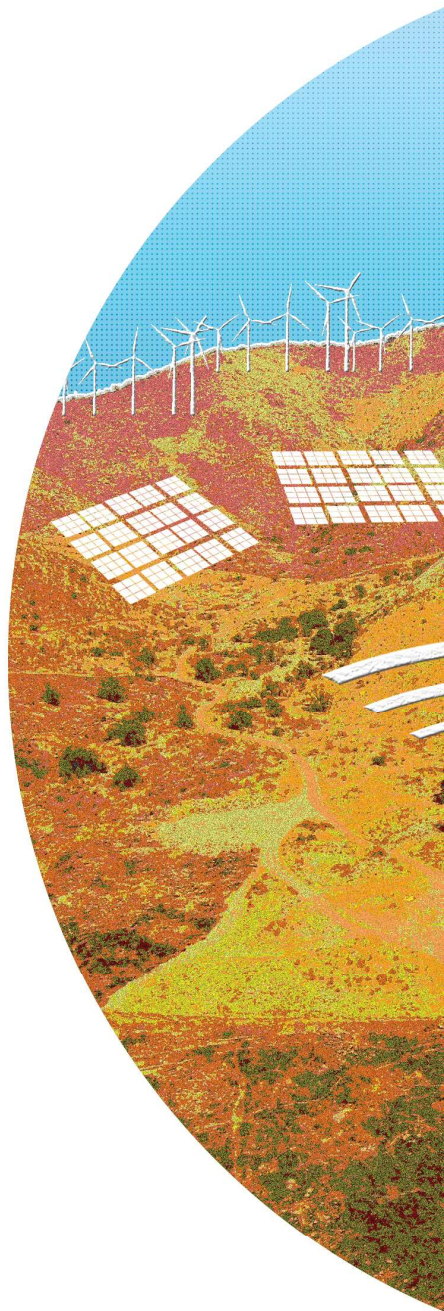




#3 energy

The adjacent cave to Fundo San Francisco represented a strategic point for renewable energy.

At the same time, we propose a set of mixed functions, both recreational and social, in order to present technology as a positive element that can be enjoyable.







#4 community

We decided to locate the feria at the core of the park in order to create a place for social gatherings that can constitute an occasion for people of different social extractions to get together and bond as a unique community.





Technovalley

Ferio Colo C



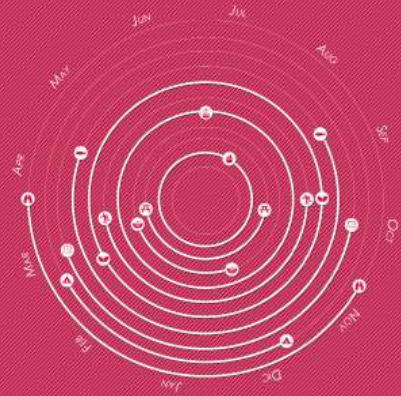


Colo

Wildlife observatory & tree nursery



3E: 4E: 4J: 5K: 6J





INSTRUCTIONS

1. PICK THE THREAD OF YOUR STRICT
2. RATE YOUR NEIGHBOUR BY LINKING THE DOTS WITH THREAD
3. CUT AND CLOSE THE TH
4. SEND US YOUR OPINION PINK ENVELOPES!



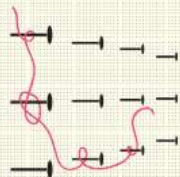
Technical Sheet

Burnished Screw

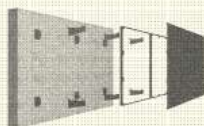


These nails pinpoint the crossing between a feature of a District and a appreciation rate (from 1 to 9)

The visitors of the museum are invited to interact with the installation by knitting the corresponding wire of their District within the grid of nails, thus giving a visual evaluation of their everyday environment. Thanks to the participation of people from different neighbourhoods, the discrepancy among the various living conditions will be clear to everybody.



Panel



The panel can be both hanged or displayed horizontally:
Its essential characteristic has to be its reachability, especially by kids, who must be able to express their opinion.



Cotton Wire



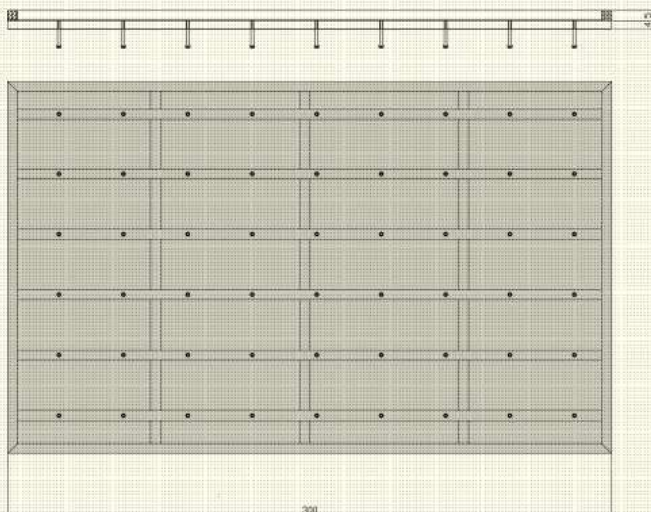
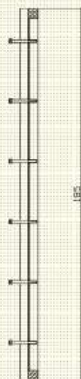
Each person will begin to knit the wires around the nails, and only at the end of their operation they will cut the wire path. It will be up to the museum staff to check and refurnish the finished thread.

Pink envelope



The city belongs to you and as such you've got to take care:
this is a simple but powerful tool to have your say and express a thought to improve the state of things.

Assembled structure



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Landscapes of Chile

Photo reportage

August 2016

Atacama desert

Chile

This collection of pictures comes from a 21-day trip to Chile we undertook in occasion of the International Workshop of Landscape Architecture

WATER CANALS

COMMON SPACES ARCHITECTURE

SANTIAGO DE CHILE

School of Architecture Universidad Mayor

August 3th – 12th, 2016, Santiago, Chile.

Thanks to this experience we were able to collect on-field data about Chile, its Nature, Places and People.













