



THE COMPLICITY OF URBAN PLANNING IN BUILDING TERRITORIES AT RISK: THE CASE OF THE URBAN FLOODING IN THE HARBOR-CITY OF TALCAHUANO.

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ABSTRACT: The earthquake and tsunami in Chile in 2010, served to highlight the situation around the country about how disasters and human settlements are managed. This research focuses on identifying the main social, economic and environmental effects of urban planning processes, implemented in Talcahuano between 1990 and 2010, were generated in the territory and how these are linked to the risk of flooding. For this, we used a mixed methodological approach, which involves observing the existing risk and hazard mapping, documentary analysis of planning instruments and prevailing legislation, and; the design of an index of social, economic and environmental effects that allows their hierarchical organization.

The main results establish that the urban planning processes carried out in the port city of Talcahuano, between 1990 and 2010, contributed to the exposure of different communities to the risk of flooding. This, by the repeated changes in land use plans and the dysfunctionality of the decisions concerning to the local administration and the central government of the country. Also displayed, even the communal economy has been boosted through various land use planning processes, loss of flora and fauna is evident in the territory.

Key Words: Urban Planning, Flood Risk, land use, social effects, economic effects, environmental effects, Talcahuano, Flood mapping, ICFM6.

1. INTRODUCTION

The territory is a linker between human beings, their personal relationships and the environment in which they live. Hence its importance in the study of any area of knowledge that involves the development of humanity in a defined geographical area.

So, the urban planning becomes the tool by which human activities take contact with the territory, tending to develop it. Spatial planning is understood as the oriented discipline to establish the conceptual body, parameters and criteria to reconcile and make sustainable the development of human activities, and its develop with the natural environment (Bustos, 1998), even when it has received many interpretations (Pujadas & Font, 1998).

Francisco Sabatini and Fernando Soler (1995) think that urban planning in Chile has been characterized by its severity. This has led a paradoxical result: "expansively growing cities without apparent formal order, deteriorating existing urban spaces, undermining its architectural heritage and compounding the problems of urban efficiency and quality of life". Also, they add, urban planning has largely lost control over the evolution of the city. The target-image of the city given by urban planners has traditionally assumed a thoroughly described physical form without clear connection with the real city.

The urban dynamism, continuous expansion of urban settlements and the uncertainty environment that surrounds all human activity, have created a need to study the risk in order to reduce the vulnerability of people, property and the cities against the various threats or hazards that coexist with humans in artificialized spaces. United Nations Human Settlements Programme (2007) believes that the rapid urban growth along with the geomorphology, hydrology, politics, demographics and economics, can create and exacerbate the landscapes of disaster risk in a variety of ways. Following this line, urban centers are growing in size and

number through a combination of natural population growth and immigration. A direct consequence of this is that "flooding, perhaps more than any other type of threat has been exacerbated by the physical processes of urbanization" (United Nations Human Settlements Programme, 2007).

The building of roads and houses makes it difficult for rainwater to drain through the soil, generating more frequent flooding in the cities" (United Nations Human Settlements Programme, 2007). We increase the risk of flooding in urban areas through sedimentation of natural watercourses and reducing groundwater, followed by salt intrusion or land subsidence due to not always real needs, with no impact research or planning.

2. STUDY AREA

For purposes of this research, we have chosen the city of Talcahuano, Chile, as a study area. This, for four main reasons: first, because of its geographical condition define it as a lowland isthmus that connects a mountainous plateau -Tumbes Peninsula- to the mainland and has an average altitude of 1 m.a.s.l. (United Nations Development Programme, 2012); second, its territory, open to the Pacific Ocean through two bays –San Vicente and Concepcion–; thirdly, its climatic characteristics define it as an area that has a warm temperate climate with a dry season of 5-4 months and an average rainfall of about 700 to 1200 mm per year, concentrated between the months of May and August, coinciding with the autumn and winter (Meteorological Office of Chile, 2008), and; fourthly, his record as flood-prone land.

Analyzing Talcahuano from the different land uses that the processes of land uses planning have assigned to its territory and crosslinking them with the data held by the municipality of Talcahuano about areas of recurrent flooding in the town, we made Figure 1, that shows the current communal situation about this kind of risk.

Typology	Total surface by category		Total flooded surface by category		Total flooded surface over territory's surface total
	Km ²	Percentage	Km ²	Percentage	Percentage
Land uses					
Agricultural surface	0	0	0	0	0
Artificialized surface	20,26	21,95	3,30	3,57	16,28
Spontaneous vegetation	61,27	66,38	0,1	0,56	0,1
Littoral	10,77	11,66	0	0	0
Total	92,3	100,0	1,74	100,0	16,97

Figure 1. Distribution of land uses and floodplain surfaces in Talcahuano. Source: Own calculations based on Lara (2012) and City hall of Talcahuano.

3. METHODOLOGY

Because the overall goal of the Research –related to determine the link between urban planning processes, realized in Talcahuano between 1990 and 2012, the risk of urban flooding and socio-territorial effects of these phenomena–, we have collated the various urban planning processes generated in the city of Talcahuano, embodied by the Communal Regulating Plans 1980, 2006 and 2011. Meanwhile, for concepts of analysis in this research, three episodes of flooding that occurred in the port city were used: The first corresponds to the floods caused by the frontal system from June 26 to July 2, 2005, with a total of 144.78 mm of rainfall; the second, the floods caused by the frontal system from 24 August to 1 September 2008, reaching a total of 154 mm of rainfall, thirdly, the extreme flood event of February 27, 2010, after the earthquake and tsunami that affected the city and flooded almost 20% of the urbanized area of the city.

4. PRESENTING THE RESULTS

Two research questions were detached from the specific objectives to give direction to the investigation and, ultimately, respond to the general objective.

What are the main events that have contributed to the socio-territorial exposure to flooding?

Master Plans of 1980, 2006 and 2011, through its various provisions; have tended to the progressive specificity of land uses around the communal territory. In 1990, there were eleven distinct zoning of the territory, and by 2006 there were thirty different zoning (see Figure 2).

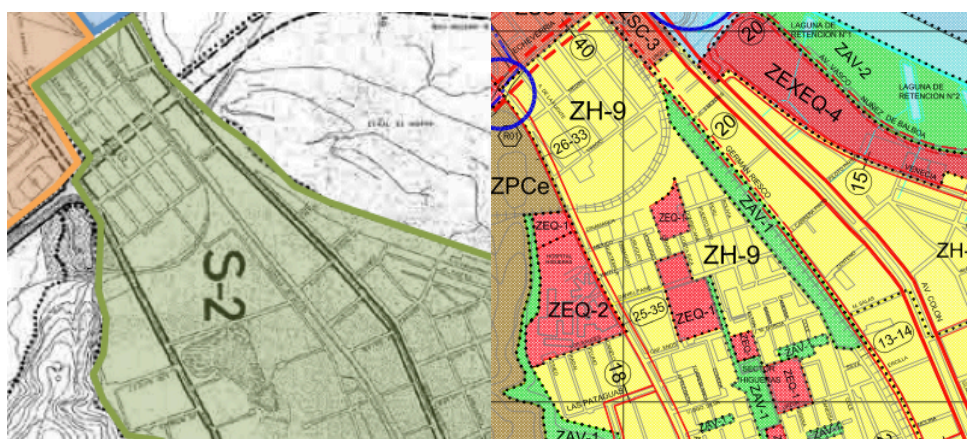


Figure 2. Increased specificity of zoning and land use in the city of Talcahuano, for the period 1990-2012. Source: Own elaboration based on city's Master Plans of 1982 and 2011.

Another important aspect to be reported refers to the variation of the main land uses for Talcahuano within the study period. Unlike what is expected, regarding a territory where artificialized spaces increases, they decreased the total assigned area to urban expansion (see Figure 3).

Typology	Total surface by category				Variation in land uses in the study period	
	1990		2012		Km ²	Percentage
Land uses	Km ²	Percentage	Km ²	Percentage		
Agricultural surface	0	0	0	0	0	0
Artificialized surface	33,21	35,90	30,58	33,13	-2,63	-2,84
Spontaneous vegetation	48,32	52,35	50,95	55,20	2,63	2,84
Littoral	10,77	11,66	10,77	11,66	0	0
Total	92,3	100,0	92,3	100,0	92,3	100,0

Figure 3. Variation of the main land uses for Talcahuano between 1990 and 2012. Source: own calculations.

How has varied exposure of the city of Talcahuano, between 1960 and 2010, to the risk of flooding?

According to the first result, between 1990 and 2012, the soils of Talcahuano suffered a progressive specificity, establishing definite and concrete applications. Alongside, a process of urban development was implemented in the territory, creating new territories exposed to natural and anthropogenic phenomena. According to this, areas within the Master Plan of 1980 listed as areas for landscaping and recreation (zone S-6) in Las Salinas sector were consigned to residential and industrial use (zone ZH) in the Master Plan of 2011, as Figure 4 shows.

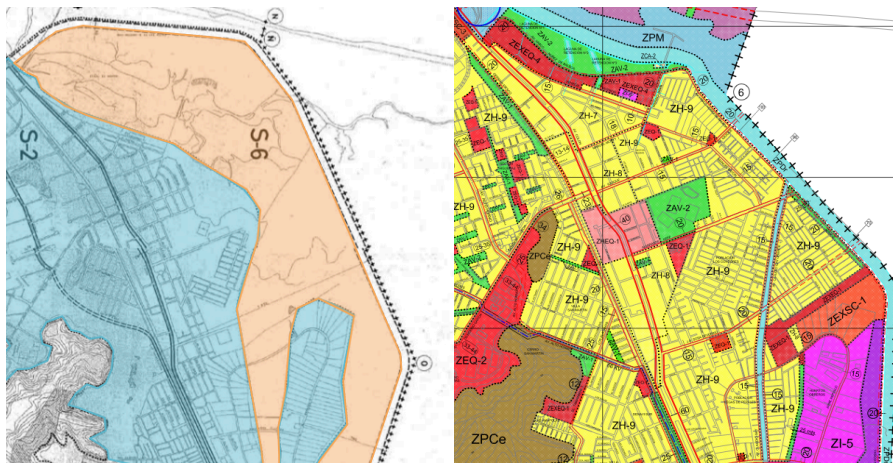


Figura 4. Changes in land uses for the period 1990-2012. Source: Own elaboration based on city's Master Plans of 1982 and 2011.

Given these variables, the analysis focused on comparing flooding episodes of June 2005 and August 2008 –as they respond to rainfall events with similar characteristics– and how these affected the territory. Was obtained that there is recurrence of affected areas, some of which are: Neighborhood Libertad, Bethlehem and Faro Gaete. Arenas et al. (2010) suggests "growth and unregulated urban overflow in many of our cities, to sectors exposed to various types of natural hazards, has meant a high cost to its population, the state and the productive sector."

With regard to exposure to flood the territory for the period of study, it is possible to recognize an increase in socio-territorial exposure between 1990 and 2012. This, mainly, because of the urbanization process in the territories (see Figure 4) that began in the late 1990s.

Surely, everything would not noted problem if there are none negative consequences involved. For this study case, the effects of flooding have a direct connection with the processes of urbanization made in recent decades in the city of Talcahuano. As already stated, Las Salinas sector has been heavily hit by interior and coastal floods that have left marks that, until today, are suffered by many people. Meaning, among other things, stopping water supplies due to the sedimentary saturation of sewage systems, flooded neighborhoods, suspension of various educational institutions of the sector and the outbreak of respiratory disease due to the high moisture percentage in the atmosphere.

According to the above, it should be noted that the main causes of urban flooding in the commune has climatological, morphological, tidal and land uses causes. These latter, related to urbanization, have caused the runoff coefficient variation in vast communal territories linked to new locations, such as: the extension of Las Salinas, which translates into an increase of about three times the flow rate, for the same intensity of precipitation and land surface. Also, the lack or inadequacy of drainage systems in many sectors, especially in the most recent urbanized neighborhoods.

In short, the results of this research enables to establish the relationship between urban planning processes that occurred in the port city of Talcahuano, between 1990 and 2012, and the creation of flood hazard areas, specifically in those recently developed areas.

5. CONCLUSIONS

Spatial planning a young branch of study, but deep if we talk about the different economic, cultural and Environmental implications that can come to encompass. Human activities since prehistoric times, when humans began to self-conceived as such, have always been linked to the territory. However, its importance as a place of confluence, both interpersonal and human relations with the environment, has begun to be analyzed from recently. Seen this way, we

believe it is necessary to further advance the understanding of spatial and urban planning, as tools that enable the harmonious and sustainable development of life on the planet. Because, every time we thought humans are beings independent of nature, and not as an indissoluble part of it, we are overvaluing human society and underestimating nature and its processes. Exposing the human and natural environment to hazard.

From a practical point of view of research, although Talcahuano has climatic and morphological characteristics that generate that much of the communal area is considered as floodable, decisions resulting from urban planning processes of the city have a high degree of responsibility in the socio-territorial exposure of the city to flooding. Second, is easy to recognize the economist-productivist approach of Talcahuano's Master Plan, designed to make flexible the rules for land use in order to attract industrial and housing investment to the city, allowing the construction of new neighborhoods in flood areas.

We understand that urban planning processes have the chance to make true all decisions that contribute to making human settlements a space where different social dynamics find a place to grow and transmute in order to achieve all objectives that emanates from their internal processes.

In conclusion, we think that quality of life, urban development and the achievement of economic goals are not excluding areas. That is why we believe in the need to rethink the way we plan and build cities in our country, in addition to move towards new processes that achieve different types of objectives at the same time, evolving from economist approach only to sustainability, quality of life and a better relationship with the environment, not overlapping some over others. It is also necessary to change the development paradigm. Understood as the change that harmonizes economic growth for the benefit of human beings and the environment and their unbreakable relationship.

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