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Geohistorical analysis of uses and activities on the waterfront of the “Parque Atlántico Mar Chiquito” Reserve, Argentina*

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ABSTRACT

Mar Chiquita is a small seaside town located in the province of Buenos Aires, Argentina. The everyday life of its residents has been considerably affected since the area was declared a biosphere reserve in 1996. The harmonization of its preservation along with the human activities has become the main challenge for the community. A geo-historical analysis of the different human activities carried through the waterfront of the natural reserve was conducted in order to identify conflict of interests, incompatibilities between the various activities and other issues of preservation. That being said, the main aim was to determine key elements in order to improve the area management. The results obtained allows us to identify the main problems of the waterfront and to establish a set of measures so as to ensure a proper management of the area. Moreover, strategic units were identified in order to ensure land-management policies and to redesign the protected area.

Keywords: incompatibilities, conflict of interests, management and sustainable development

RESUMO

Análise geohistórica de usos e actividades na beira-mar da Reserva de “Parque Atlântico Mar Chiquito, Argentina

Mar Chiquita é uma pequena cidade costeira na província de Buenos Aires, Argentina, que viu transformada suas vidas diárias, ao ser declarada reserva da biosfera, em 1996. Desde então, das actividades económicas com a conservação ambiental tornou-se o principal desafio para a comunidade. Através de uma análise geohistórica diferentes usos e actividades que se desenvolvem na orla costeira da reserva, foi feita a identificação de incompatibilidades dos usos, conflitos de interesse e de problemas decorrentes do conflito entre os objectivos de conservação e de uso. Como objectivo derivado, foram analisados os elementos críticos para melhorar a gestão. Os resultados permitem identificar os principais problemas da orla marítima e estabelecer recomendações para a adopção de uma gestão adequada. Por sua vez, são identificadas unidades estratégicas, para estabelecer políticas de uso da terra e redesenhar a área protegida.

Palavras-chave: incompatibilidades, conflitos de uso, gestão and desenvolvimento sustentável.

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1. Introduction

Coastal areas have the highest population density in the world. Historically, these regions have been the focus of major development in countries with access to the sea, and are often rich in natural resources. These two factors have led to a wide range of human activities in order to benefit from these territories. The variety and the intensity with which each of these activities are implemented has an impact, not only on the physical, environmental and ecological conditions of the area but they also generate major conflict of interests. The multiple land-use causes incompatibilities that bring about conflicts between the activities and the land users or even among certain sectors of society that intend to benefit from a specific activity. In this case, most common conflicts are related to the conservation of the area, recreational activities and economic growth. One of the main challenges in strategic and coastal management is to solve these conflicts and propose the most suitable organization of the territory in terms of sustainability, avoiding any land-use incompatibilities and meeting the needs and interests of the sectors involved.

Muñoz (2003) establishes a general classification of the various land-use types and economic activities that can be developed in the coastal areas. In regards to the land-use types he suggests the following:

- As a natural space
- As human settlement
- As facilities and infrastructure support
- As space transmitter/receiver discharges
- As a coastal defense

Economic activities include:

- Extractive or Primary
- Basic
- Industrial or Manufacturing
- Commercial linked to Maritime Transportation
- Leisure and Tourism

The practice of the previously mentioned land-use types depends not only on the physical environment characteristics but also on other factors such as the urban area size and population, level of economic development, political conditions, social perception and legal framework, among others.

In South America, along the Atlantic coast, the physical conditions allow the practice and development of all types of land-use and economic activities listed above, typically combined with large urban areas. One example would be the coastline of the Buenos Aires province, the most populated one in the country.

The truth is that both natural processes and human actions, generate territorial transformations, those of which can be either permanent and visible or dynamic and untraceable. Consequently, two types of analysis

emerge: the historical or geo-historical analysis that reflects the evolution of the territorial changes over time and the present analysis, which reflects the results, implications and consequences of this evolution.

Mar Chiquita is a small town in the province of Buenos Aires, Argentina, which has always lived off agriculture and livestock. Tourism contributes to the local economy during the summer season, but it has never been the focus of orderly development and planning.

All locations along the Atlantic coastline of Buenos Aires are considered to be "sun and sand" destinations sharing the same tourism model with a marked seasonality in supply and demand. The reserve lagoon, its fishing, open-air camping and distinctive tranquility have always been its main attractions, still Mar Chiquita has never been known as a popular destination.

The city plan was approved in 1949 (Venancio, 1951) but it was with the biosphere reserve declaration in 1996, within the *Man and Biosphere* program (MAB), that the still existing dichotomy between a mass development activity and a low impact activity arises.

The first one is carried through with the "sun and sand" model around the lagoon area, considering the immoderate number of visitors which is not advisable and even detrimental to the ecosystem size and fragility. The low impact alternative takes place entirely in the core area of the biosphere reserve which has a limit of 50 visitors per day.

Even though the appropriation and certain uses of coastal resources may be common to different time periods in history, it is also true that many of those have changed. In this regard, the declaration of the biosphere reserve represented a turning point which involved the design of new development strategies.

From that moment onwards, the implicated sectors' interests were to be oriented towards the development and use of resources in agreement with the objectives of the reserve. These specifications might imply certain adjustments and modifications in some of the uses and activities that are regularly developed in the area.

Based on the above, the following objectives are being raised:

- Analyze the different uses and activities that have been developed in the Mar Chiquita waterfront since 1949 until today.
- Describe any conflicts and incompatibilities between all current uses and other resulting issues.

2. Study Area

The study area corresponds to the Mar Chiquita MAB reserve. Mar Chiquita is the only long canal semi-enclosed coastal lagoon within Argentina and the southernmost one of its category in South America. It is

located between 37° 33' - 37° 43' S and 57° 15' - 57° 30' W in the Atlantic coast of the Buenos Aires Province. It has an elongated shape, with a general NNW-SSE direction, a length of 25 km. and a variable width between 100 and 4500 m.

According to Cousseau (2003), the Mar Chiquita reserve has a total area of 46 km² with a drainage basin of 10,000 km². It is separated from the ocean by a large chain of dunes developed during the Pleistocene Epoch and its connection with the open ocean is performed by a canal which is approximately 6 km long, 200 m wide and a depth ranging between 3 and 0.5 m. In addition to the surface area of the lagoon, the nearly 260 km² of adjoining territories should be also considered as part of the Biosphere Reserve "Parque Atlántico Mar Chiquito".

The Argentine coastline extends over 4725 km long (IGM, 2001) and can be divided into two main areas: the Pampeano and Patagónico Fueguino (Dadón & Matteucci, 2006). Mar Chiquita belongs to the Pampa coastline, which is low with few landforms and full of dunes located parallel to the coast creating a ridge. In general, the sea and wind create wide sand dune beaches which partially or totally obstruct the drainage of the rivers that descend into the sea, resulting in ponds, marshes and estuaries of saline soils with acidity

acidity problems. The waterfront of the Mar Chiquita department extends for a total of 67 km.

For the purpose of this work, it is considered the coastal region included within the reserve area "Parque Atlántico Mar Chiquito", the one which expands from the Mar de Cobo's border to the Villa Gesell department for approximately 30 km. At the same time, the Mar Chiquita waterfront is divided into two large areas. The first one extends from the border of the Mar de Cobos beaches to the mouth of the lagoon, which coincides with the urban area and is part of the buffer and transition zone in the reserve zoning. The second section extends from the mouth of the lagoon towards north until the border of the Villa Gesell beaches, located in the core area of the reserve. In Figure 1 the delimited study area.

3. Materials and Methods

3.1. The operational framework

To attain the proposed objectives, a combination of approaches and approximations were selected. The main approach was achieved by using a geo-historical analysis. The reason for choosing this analysis responds to the need for a retrospective study of the changes that have occurred in the Mar Chiquita waterfront over the past 60 years.

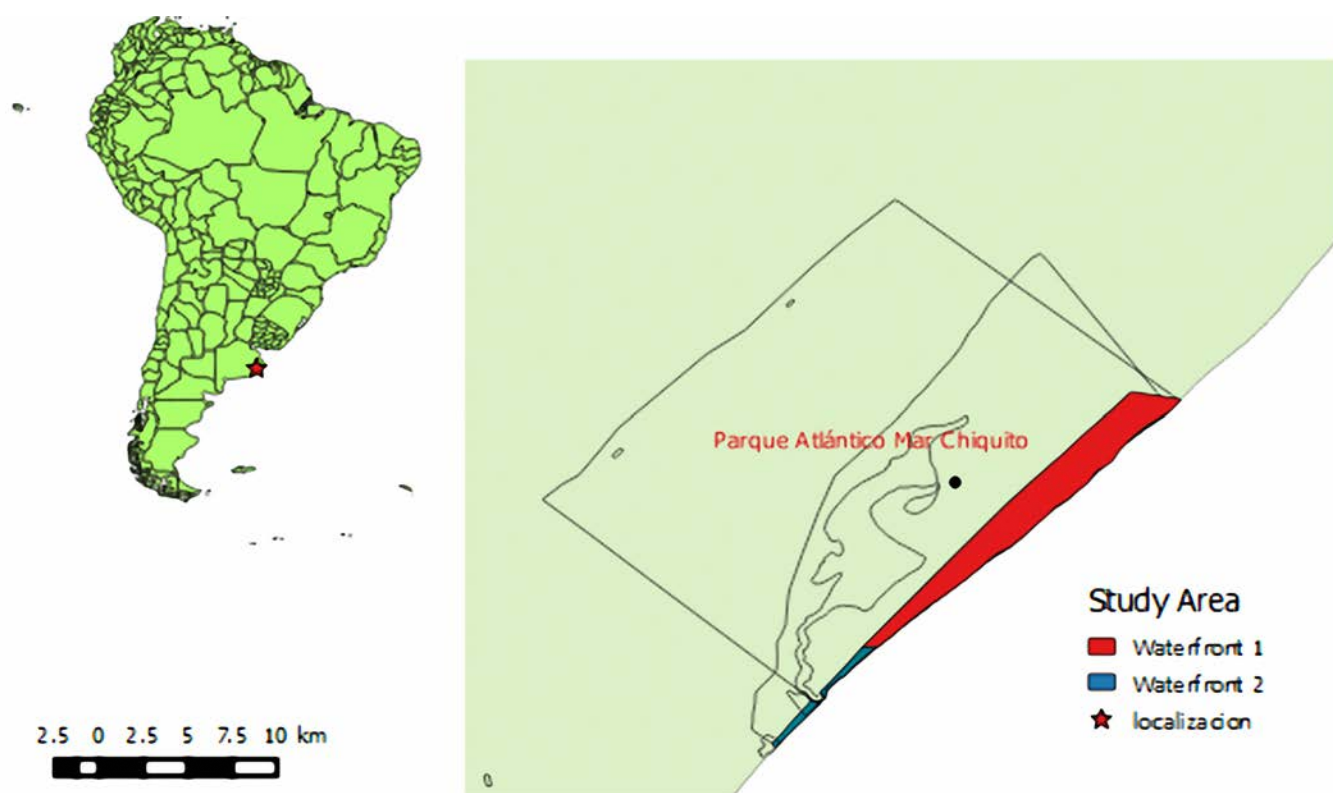


Figure 1 - Study area on the waterfront of the "Parque Atlántico Mar Chiquito" Reserve.

Figura 1 – Área de estudo na beira-mar da reserva do "Parque Atlántico Mar Chiquito"

This approach takes into account the concept of coastal system proposed by Muñoz (2003) and the Integrated Coastal Zone Management (ICZM). Even though the changes will always be understood from an integrated view, the following division into three subsystems shall be considered: physical-natural, socio-productive and legal-administrative.

3.2. Materials and data collection

A number of photographic records and aerial images were used as material: aerial photographs from 1931 (Admiralty Hydrographic Division), two Google Earth images from 2003 and 2013 and other aerial photographs from 1996 to 2013 ("Interpretation Centre of the Biosphere Reserve Parque Atlántico Mar Chiquito").

The Mar Chiquita blueprint from 1949 (Venancio, 1951) as well as different surveys, records and statistical data were also consulted in order to complement the previously mentioned information. A third source of data were the bibliographic documents that have studied the changes and transformations on the Mar Chiquita coastline.

3.3 Data analysis

The evaluation process includes several important steps. The information collected in the first stage, along with the field observation, was used to identify the main land-uses and activities that are currently developed in the area. The second step consisted in processing the bibliographic documents by applying the geohistorical analysis in order to recognize the changes occurred on the waterfront and to describe the present situation.

Analysis of the current problems

Muñoz (2003) performs an analysis of the different views over time in terms of defining and addressing problems in the coastal areas. According to him, the problems have basically three stages or levels:

1. Deficiencies on the social system and organizational structure that allows and sometimes even supports the step to the next stage;
2. The development of a specific human activity that involves the malfunction of the area or other coastal resources;
3. An impact on: the same activity or another activity, one or more coastal resources, the established order, or simultaneously on more than one of the previously mentioned groups (Muñoz, 2003).

According to the author, the deficiencies on the social system and organizational structure would be the source of the problem while the human activity is the cause and the negative impact is the consequence. Thus, based on the idea that there are deficiencies on the Mar Chiquita's social system and organizational structure

and by knowing the current uses and activities, is that we represent the existing problem with a graph of cause and effect.

Incompatibility and Conflitiveness

The functionality of uses and activities should be intended specially in terms of relations between them: synergy, complementarity, neutrality, malfunction or incompatibility.

For these concepts are understood:

- Synergy: when the confluence of two or more uses are mutually reinforcing.
- Complementarity: when a positive development in the direction of an application involves next to another.
- Neutrality: when developing a use or activity is independent of another.
- Competition and/or malfunction: when developing a use or activity means the decrease for the development of another.
- Incompatibility: two uses are incompatible with each other when achieving one implies the failure of another.

To describe relationships of conflict and incompatibility of uses (and other problems arising), matrices of compatibility and problem trees were used. These techniques allowed us to systematized the critical analysis of the current situation, which were then compared and discussed with the results of other studies related to this issue.

The development of this process of data analysis allowed us to suggest strategies of management for the Mar Chiquita coastal area.

4. Results

4.1. Geohistorical analysis of land- uses and activities

The territorial transformations on the Mar Chiquita waterfront can be divided into two phases: the first one, mainly characterized by the action of natural phenomena and the second one, with a strong intervention and action of humans. The use and development of the waterfront increases chronologically, accompanying the development and growth of the town.

For each of the sectors analyzed, the following uses have been identified:

Waterfront 1

This portion of the waterfront recorded fewer uses and activities and less territorial transformations. Their analysis must inevitably be divided into two periods: until 1996, and after the declaration of the natural reserve.

In the first period we can identify three types of applications. The first one is linked to the recreational use of the area near the mouth of the lagoon, although with very few visitors and low impact. The second one is referred to the urbanization of area, which has between 100 and 230 inhabitants (INDEC, 2001). While the urban sector or infrastructure was not planned, this area was affected by the fixation of sand dunes that altered the natural dynamics of the sector.

The third use is related to the coastal protection methods. As it will be further explained in details, Mar Chiquita suffers, since the 40s, one of the most important natural phenomena of coastal erosion in the province of Buenos Aires. Consequently, a series of interventions were performed in order to try to attenuate this problem. In this sector of the waterfront it can be mentioned a project that had a major impact; the construction of a breakwater at the mouth of the lagoon in 1973. This managed to secure the mouth of the lagoon, which had suffered from fluctuations up to 2500 meters.

After 1996, this area is included in the core zone of the reserve. Therefore, as of this date, its only use is as a natural area. No major changes in this sector have been recorded in the last ten years, but the continued erosion in Mar Chiquita has produced variations in relation to the quantity of sand available on the beaches.

Waterfront 2

Historically, this sector has suffered the largest number of transformations since it has focused almost on all uses and activities.

Coastal Defense

Although most of the coastal defense activities have been developed since the 80's, these activities are linked to historical natural processes, covering even periods prior to those described in this work. In any case, the coastal defense has been associated with the first stage of this analysis, which runs from 1949 to 1983. During these years, one of the most extraordinary natural phenomena of coastal erosion took place in the province. Various studies show that there was an inland shoreline displacement of 320 meters during a period of 32 years with an average of 10 meters per year (Lagrange, 1993; Merlotto & Bértola, 2008; Supporting Information I).

Another natural phenomenon that occurred over these years was the displacement of the lagoon mouth. The fluctuations were around 5000 m and have changed its original conformation from north to south (Lagrange, 1993; Supporting Information II).

Following these natural phenomena one of the most important uses begins to develop; coastal protection. Because of the severe erosion problems from previous years, a series of protective coastal methods were performed by the public sector.

The first intervention was in 1973 when a breakwater was built in the southern sector of the mouth of the lagoon that allowed its current configuration (remodeled again in 1983). The second stage starts in 1982 and coincides with the further development of the town and better positioning as a tourist destination. This allows, on one hand, an increase in the uses of the waterfront by the local community and a more active intervention of the public sector.

Over the years different techniques were applied. Firstly, pneumatics were located in line to protect the coastline, and then other concrete elements were used as shown in Supporting Information III).

In 1991 four jetties were built at the south of lagoon mouth; three of which currently still protect the area along the streets Funes, Gallardo and San Martin. The last one is the longest one, reaching 80 m length. Along with this project, the previously mentioned methods, such as the pneumatics and concrete elements, were considerably improved while other rocks were also used to protect these sectors in risk. However, these sectors also create a great visual pollution due to the presence of iron debris scattered along the beaches.

From an administrative point of view, the legal issue of coastal erosion in the province falls under the Laws 11,723 from 1995, 13,516 from 1998, and especially 12.122 from 2006 declaring the Mar Chiquita coast as an emergency zone.

From a legal framework, several plans and projects were presented to defend the waterfront. In 2006 the project called "protection and stabilization of the waterfront on the Mar Chiquita district" was implemented (Merlotto & Bértola, 2007; Bértola *et al.*, 2013). scheme of works made from 1991 to the present is shown in Supporting Information IV.

Urbanization

Among other human factors, the presence of buildings and roads along the coastline damages the environment, mainly because they were built on the first line of sand dunes that provides sediment to the beach, maintains its dynamic balance and constitutes the rainwater reserve of the area.

During the early twentieth century the uses and activities in this area were limited. Mar Chiquita had not yet been established as a touristic destination and had a low percentage of residents. Constructions were just beginning and it was in 1949 that the first plan of subdivision of the town (File 69-25-49) was approved.

The date of this subdivision coincided with the foundation of the town. The initial criteria for the subdivision followed the ruling principle at the time, to urbanize as close as possible to the beach. For this reason, blocks and streets were laid out in an area implying dune re-

moval, leveling and/or fixed with man made forestation. Due to these actions, natural dynamics were quickly and sharply altered, constituting one of the causes for the severe erosion between 1949 and 1957. Until 1979, in the south sector of the town alive dunes could be found, while in the remaining area they were fixed. This coincides with the lowest rates of erosion in the first sector. From that date on, with the urbanization and the expansion of the vegetation on the south sector, erosion rates began to increase, ranking among the highest in the town (Merlotto & Bértola, 2008). More information about the delimitation of the coastal zone it is provided in Supporting Information V.

However, the urbanization and settlement process was developed slowly and even today Mar Chiquita remains a very small town. The various censuses reflect a permanent population of 133 inhabitants in 1980; 162 inhabitants in 1991; 394 inhabitants in 2001 and 487 inhabitants in 2010 (INDEC, 1991, 2001, 2010).

It is noteworthy that there are a lot of second residences and according to the Ministry of Tourism and Environment of the town during the weekends the town often congregates up to 5,000 people. In the last decade the development of the waterfront has slowed its pace due, on the one hand, to the changes in legislation and secondly, to the erosion problems and cultural awareness of the risks.

Discharges

The treatment of both, municipal solid waste and sewage, has historically been very poor and there are currently large gaps. Storm drains into beaches have not been built; consequently, streets perpendicular to the shore and sloping toward her act as such. In various sectors of the urbanized waterfront it can be seen "canals" as rainwater drains on the beach and dragging sand into the sea. These phenomena are observed only in some streets, mainly in Avenue San Martín which is the only paved road (Supporting Information VI).

Sand Mining

The growth of coastal cities during the 1970s and 1980s greatly increased the demand for sand, and this area served as supplying for other Departments of the interior of the province. Sand mining has been considered one of the most important causes of coastal degradation in the Department of Mar Chiquita (Fundación & Municipalidad, 1991).

Sand mining was banned in 1977 (Decree Law No. 8,758) in Mar Chiquita and other Departments. However, in the 1980s and 1990s the extraction performed by public state entities was allowed and conducted by the city of Mar Chiquita on beaches located at the south of the district (Merlotto & Bértola, 2007).

Sand extraction was carried out without control and organization during a long time, mainly between the 60's and 70's. Despite the ban in 1977 there have been numerous incidents of illegal extraction in the later years. Today this use has virtually disappeared and sand mining rarely occurs.

Activities Related to Leisure and Tourism

For many years Mar Chiquita was considered as a spot near the city of Mar del Plata. This was observed even after its foundation as a town; the process of urbanization was slowly developed and has never grown into a large urban center. Despite this, it has always attracted interest on leisure and recreation. See Supporting Information VII.

A similar phenomenon occurs with tourism. Mar Chiquita responds to a mass tourism scheme, "sand and sun", although the extent of this activity is relatively smaller compared to other destinations in the Buenos Aires Atlantic coast. Tourist activity is developed in the waterfront and around the area of the lagoon, although only the first sector is of interest in this work.

According to the municipal delegation of Mar Chiquita, beside its 487 inhabitants, between 600 and 1000 temporary residents arrive on winter weekends and between 1000 and 3000 on summertime. Based on the load capacity scheme proposed by Yepes (1998), Bertoni (2013) estimated that the number of users on the beaches of Mar Chiquita is comfortable.

The Coastline as Natural Area

Other forms of coastal use identified by Munoz (2003) is as a natural space. This purpose in Mar Chiquita is materialized through the various statements as a protected area. In Mar Chiquita there are three jurisdictions administering the territories under protection. During the first years of town development there was no protection, until in 1996 an international recognition created the Atlantic Biosphere Reserve Parque Mar Chiquito. After that it obtained recognition at provincial and municipal level. It is noteworthy that the protection extends to even the entire urban area of the town. The use as a natural area for the purposes of this paper has two distinct sectors. While the coastal sector number 1 has a strict protection, the second is considered as a buffer and transition zone.

The use as a natural area doesn't implied major changes or territorial transformations on the waterfront. This is because most of the interventions described in previous sections were performed before the reserve declaration. However, being the sector under strict protection has established a certain balance and from 1996 to the present has barely been transformed.

Use as natural space takes place in the coastal area 2 and has very low environmental impact. It is only ac-

cessible through visits organized by the Visitor Interpretation Centre, limited to a maximum number of 50 visitors per day.

4.2. Problems associated with uses and activities

For this type of analysis it is important to understand that the population is the main element and acts as a physical environment transformer. Activities to be considered are many, and can be categorized by type or scales.

Of the uses currently being developed in the city and those that have generated a transformation that still persists, the relationship of conflict can be analyzed through the problems they generate.

According to the approach developed by Munoz (2003) and based on the idea that there are deficiencies on the social and organizational structure in Mar Chiquita, can be expressed by a graph of cause and effect as shown in Supporting Information VIII. Different uses and activities generate impacts individually, but it is also important to consider the effects that cause altogether. Direct evidence problems are coastal erosion and pollution. However, each of them not only has been influenced by other coastal uses but also as a whole, generating major impacts: environmental degradation and loss of homes.

Coastal Erosion and destroyed of houses

Coastal erosion is one of the oldest problems in this area and even today remains a serious concern. It is strongly influenced by natural processes but is also enhanced by human action. Erosion is partly generated by sand extraction that affects the sedimentary material involved in the littoral drift. The extractive activity not only affects areas where it is carried out, but also increases the erosion of northern beaches (Marcomini & López, 1999).

Urbanization is another use that increases the phenomenon. In the early years, forestation and fixation of sand dunes avoided beach recovery and sedimentary natural balance. Subsequently, the processes of real estate expansion implied sand dune removal and the progress of construction near the sea limited the beaches dynamic sector.

The infrastructure also influences the erosion. In this case, works of coastal protection generate sand accumulation in one sector, but expand the erosion processes northward reaching similar levels of coastal regression (10 m/year) (Isla, 1992; Merlotto & Bértola, 2007).

Another use that creates an erosive impact is urban waste. Although it has been observed that there is no sewage or storm water drains with direct access to the sea, it is noteworthy that in some cases drainage of certain streets towards the beach generates erosion.

Activities related to leisure and tourism should also be considered in this problem. Externalities generated re-

garding erosion are related to construction and fittings of space to provide services to tourists and the excessive human pressure that may be generated during the summer season.

The loss of housing is a problem associated with coastal erosion that virtually took place since the beginning of the development, in 1949, until the present. It was mentioned previously that the average landwards displacement of the coastline was 10 meters per year. It was recorded between 299 and 320 meters of regression in the considered period (Lagrange, 1993; Merlotto & Bértola, 2008).

The loss reached 409 lots, according to Lagrange (1993), while Merlotto & Bértola (2008) estimated a total of 444 lots located in the coastline and 7 houses, totaling 451 properties disappeared by the coastline retreat. Total surface loss for 2007 taking into account the original plan was 64.36 hectares (Merlotto & Bertola, 2008).

Pollution and environmental degradation

Pollution in the study area is usually presented in two ways: in liquid form and as solid waste. Solid waste is mostly dumped by tourists and recreationists, but also dragged from the streets of the city to the beach on rainy days.

Liquid waste is coming through rainwater that drags urban area pollution and is poured onto the beach through the streets that has sloping onto it. Also can be submitted through the mouth of the lagoon, where the pollution comes from the lagoon itself.

Environmental degradation as a problem arises as the result of the combination of all the above negative impacts. Excessive, inappropriate or poorly regulated and managed use produces a gradual degradation and primarily affects the quality of the resource. The importance of this issue is even greater when taking into account the rebound effect of this problem. Like the uses and activities contribute to environmental degradation, this effect will decrease the possibilities of use of space and will reduce the quality of recreational experiences. For this reason, is needed seek to develop activities in a sustainable framework to prevent it become self-destructive

4.3. Incompatibility and conflictuality

Faced the identification of problems and dysfunctionalities in the uses and activities, is necessary to establish a land use planning. To do this, one of the main issues is to define compatibility.

This task is closely linked with the assessment of the aptitude of a territory. In this assessment process existing activities must be considered, as well as also potentials ones. For the first case (which is addressed in this study) needs and expectations of the population should

be analyzed, in combination with locations relative to the physical environment natural vocation and (economic, social and environmental) sustainability, but especially its functionality in terms of relations between them: synergy, complementarity, neutrality, dysfunction or incompatibility (understanding these concepts as expressed in the methodology).

Supporting Information IX shows the relationships between uses and activities identified in the study area.

5. Discussion

Several studies have addressed some problems of the Mar Chiquita waterfront, some of which have been taken as a source of information for this study. Mostly, these studies are focused on space transformations that have taken place in this area, either by natural factors or changes related to the growth and development of the town.

Perhaps the issue that has attracted most attention is coastal erosion. Many authors have studied this problem (Schnack *et al.*, 1983; Lagrange, 1993; Isla, 1997; Merlotto & Bértola, 2007) and it can be said that there are coincidences regarding the gravity of the situation and even as to the quantification of the coastline retreat. Most notable in this regard are recent studies that have shown the ineffectiveness that have so far the coastal defense works that have been implemented (Isla, 2006; Bértola *et al.*, 2013).

Other studies have addressed the processes of urbanization in the province of Buenos Aires and many have included analysis of the development of tourism and environmental impacts generated on the beaches. The studies of Dadón (2000), Dadón *et al.* (2002) and Bertoni (2013) are the most significant in this area.

However, few studies have focused on addressing the incompatibility of uses, land use planning and environmental conflicts. Conflicts are common in any society and in any kind of space, but the case of Mar Chiquita has an important feature. The late development of this area coupled with certain intrinsic characteristics resulted in a declaration as a protected area in 1996. This situation involved a tendency towards a development paradigm based on sustainability, which could in some way alter the use of space and its resources.

These changes are clearly evident in the study area of this work, where it can be seen as a sector of the waterfront it joined a strict protection zone, while in the other sector uses of varied nature are allowed. In accordance with the identified waterfront uses the following actors can be identified: the local community, tourism entrepreneurs, real estate developers, staff affected to the conservation and protection of the reserve, tourists and the public sector.

Some of these actors advocate a specific interest in a use or activity, while others may have more than one

inference. Thus, real estate developers and tourism operators have an economic motivation linked to the further development and expansion of its activities. The same can happen with tourists and visitors, who demand free access to the beach and the existence of infrastructures close to the beach or on the same beach. Also, the local community, the public sector and even the conservation agents require the existence of economic activities and a certain degree of development, but must worry about the care of resources and sustainability understood in all its dimensions.

Taking it as a starting point, the analysis of existing problems in the waterfront and the table of incompatibilities between uses and activities can establish relations of conflict between the different actors. The relationships of conflict in Mar Chiquita waterfront can be summarized in a binomial of development *versus* conservation, and the search of a third option within the paradigm of sustainable development. On one hand, this contrast is reflected in the need of the local people and their representatives to generate economic activities and develop infrastructural projects that can provide an improvement on services and quality of life. However, on the other hand, is manifested the need to make rational use of coastal space and ensure their long-term sustainability.

From this broad view of the conflict other conflictual relationships are derived that may exist between each group of actors or between the occasional exercise of a use over another. The difficulty of handling these situations is to set limits and create respect for them.

The table of relationships indicates which uses are currently living in this area and indicates potential sources of conflict. Setting limits on certain uses and activities depend on the development vision that is intended and on the future scenarios to which it points.

Regarding the planning of protected areas in recent years they have shown certain tendencies. In the first instance there is a concern relating to the competition for space and the lack of land use planning that threatens conservation units (Burkart, 2005; McDonald *et al.*, 2009; Morea, 2014). This concern in the case of biosphere reserves is greater due to the coexistence of urban development and productive use within the reserves themselves (Riddiford *et al.*, 2014). Regarding the latter, other authors have highlighted the importance and value that can have the stakeholders participation in the operation and management of these areas (Borrini-Feyerabend *et al.*, 2012; Calado *et al.*, 2014; Borrini-Feyerabend *et al.*, 2012)

Therefore, in addition, another big trend in investigations of protected areas is related to the planning of land use and the search for new methods of zoning and design that allows to achieve the compatibilization of biodiversity conservation with the use of resources (Gar-

cía-Frapolli *et al.*, 2007; Geneletti & van Duren, 2008; Ruiz-Frau *et al.*, 2015).

In this case, management and planning of the territory, and particularly at the coastal front, remains an open account. However, some initiatives in recent years reveal an emerging willingness to guide actions in this direction. As example of this, it can be highlighted the launch in 2011 of the 2010-2020 Strategic Plan of Mar Chiquita Department, which includes among its objectives the management and planning of the territory. Although to the date there is little progress, in the year 2012 began the Urban Management Plan.

On the other hand, from the province of Buenos Aires through the Unit for the Coordination of Integrated Coastal Management was launched in 2008 the Comprehensive Plan of Bonaerenses Coast, which among its most ambitious goals, intends to enact the Law of Coast of the province of Buenos Aires. However, progress has been considerably slow and none of the goals has not yet been achieved.

6. Conclusions

This work aimed to analyze the different uses and activities that have been developed in the Mar Chiquita waterfront since 1949 and to describe the conflicts and incompatibility relationships between them. Results show that Mar Chiquita has suffered considerable territorial transformations, but also important environmental, cultural, social, economic and administrative changes.

The cause of these changes is that among the uses and activities that were recorded, many are totally incompatible or have some degree of incompatibility. Behind these incompatibilities, there are economic, social and environmental conflicts, involving all sectors of society.

Furthermore, the bibliographic review shows that there are a considerable amount of studies addressing topics such as the development of tourism on the beaches of the province of Buenos Aires, the coastal urbanization, the environmental impact and the phenomena of coastal erosion; however, very few of them apply a holistic perspective. In that context, land use planning and integrated management of the coastal front is an outstanding account from their effective planning and implementation, but also from the scientific and academic approach.

Based on the results and the problems and conflicts identified in this study, the following lines of action are proposed:

- **Establish a land management strategy:** guided by instruments such as ICZM, establish a rearrangement of uses and activities that incorporate the normative to allow incompatibilities and articulate the current legislative dispersion, and the complex jurisdictional framework.

- **Rethinking the management system:** given the large number of players involved and the complex jurisdictional framework, it is evident the need to design a management model by the public sector, but that actively involves all parts, as an alternative to excel inter-sectoral conflicts.

- **Redesign of the protected area:** as a corollary of the previous recommended actions, will be necessary to evaluate the functionality of the Biosphere Reserve boundaries and zoning regarding the new proposed system. The effectiveness of the protected areas design has become a centerpiece in the quest for joint the binomial use and preservation.

Finally, results here obtained should be useful to contribute with the ICZM processes because it shows which are the main uses and activities and puts in evidence the relationships of incompatibility and conflicts between them. This information should be an important source for developing strategies of use and coastal zone management.

Appendix

Supporting Information associated with this article is available on-line at http://www.aprh.pt/rgci/pdf/rgci-646_Morea_Supporting-Information.pdf

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