



From touristic villages to coastal cities: The costs of the big step in Buenos Aires

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ABSTRACT

Coastal villages have grown due the increasing touristic demand of “sun and beach” resorts. This implies more services, more areas for bathing and shadows for tourists. The awkward assessment of touristic beaches and the shortages induced by natural erosion provoked the deterioration of bathing zones. The coastal defence policy and the management of the rain excesses can not reverse this deterioration trend. Storm-water discharges in many places are constructed towards the bathing zones by combined sewer overflows (CSO) systems that increase pollution problems. The decrease of the width of the beach demand interventions. Hard structures (seawalls, groynes) have proved to imply worse impacts; beach nourishment does not solve the problem but permits to rebuilt or modify some beaches under critic stages. The pavements of seaside avenues have been very controversial in some cities subject to storms. Sewage networks were originally oriented to sanitary ponds but odours and pollution of the water table led to reconsider some master plans. At the same time, groundwater is shortening towards the end of the season and new water reserves should be planned. However, federal governments do not envisage the magnitude of future problems, neither the impacts of climatic changes. In this sense, it is necessary to propose alternative coastal-defence policies, to avoid pluvial discharges to bathing areas, to promote aquifer recharges and to reverse the sewage network towards submarine outfalls.

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RESUMEN

Las villas turísticas han crecido debido al aumento de la demanda de “sol y playa”. Esto significa más servicios, mayor necesidad de superficie de playa, y mayor demanda de sombra para turistas. La torpe administración de las playas, sumado a la erosión natural inducida por tormentas provenientes del sur, han provocado el deterioro de algunas zonas de baño. La política de defensa costera y de manejo de los excesos hídricos no ha revertido esta tendencia. Los desagües pluviales no sólo aumentan la erosión de la playa, sino que en algunos sectores acarrear desechos domiciliarios a zonas de baño. La disminución de la superficie de playa está demandando playas artificiales, que se han logrado por obras duras (espigones, muros, pedraplenes) muy contraproducentes, y más recientemente por alimentación artificial. La pavimentación de avenidas costaneras ha sido muy controversial en sectores donde impactan tormentas episódicamente. El diseño de la red cloacal se orientó hacia lagunas de inundación, pero esta alternativa está originando sectores de sacrificio ambiental debido a olores y contaminación de niveles freáticos. Al mismo tiempo, los volúmenes de agua subterránea son cada vez más escasos y están obligando a planificar reservas hidrogeológicas. El gobierno federal no llega a encuadrar la magnitud de estos problemas, menos aún los impactos inducidos por cambios climáticos. En este sentido, se han propuesto alternativas de defensa costera, de evitar desagües pluviales en áreas de baño, de fomentar la recarga de acuíferos y de reorientar la red cloacal hacia emisarios submarinos.

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1. Introduction

The economy of touristic coastal areas is based on urban development, but they are heavily dependent on the preservation of the landscape and the bathing quality of the beaches (Klein and Osleeb,

2010). Beach users considered landscape and scenery as the most important factor of the coast of Wales (Morgan, 1999). After the 60s, coastal resorts and tourism practices switched to a more concentrated level of international growth (Shaw and Agarwal, 2007). Since 1970 World Tourism was growing at an increasing rate above 9% (Kay and Alder, 1999; Ergin et al., 2006). In the last years bank loans availability led to a boom focused to property investments of

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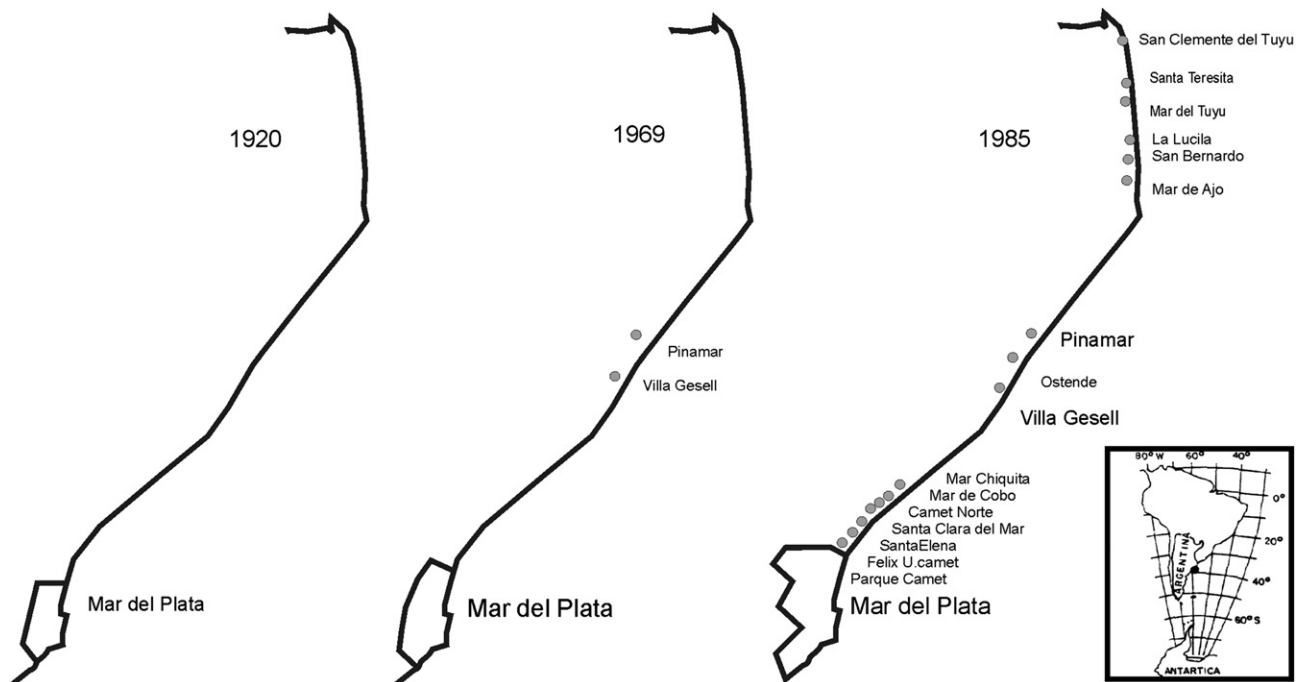


Fig. 1. Location map. Development of touristic villages of Buenos Aires Province in 1920, 1969 and 1985 (according to nautical charts of the Argentine Hydrographic Survey).

second-homes in touristic sites. This economic boom had serious consequences within the coastal environment. In some cities of the Mediterranean coast, buildings exceeded the demand (Cooper and McKenna, 2010). The inevitable consequence of urbanization at coastal barriers is the need of shoreline armoring or recurrent beach nourishments (Cooper and McKenna, 2010).

In northern Argentina, coastal villages flowered since the sixties, when the middle classes became owners of second-home properties (Fig. 1). To the beginning of the eighties, these localities became very popular and led to their administrative transformation into urban counties: Pinamar, Villa Gesell, Partido de la Costa (Juárez and Isla, 1999; Dadón, 2002; Juárez and Mantobani, 2006). As most of these villages were emplaced on sand barriers they are susceptible to physical constrains. The morphodynamics of these barriers depends on the substrate gradient, sediment supply and the effects of waves, tides, winds and sea-level trends (Hesp and Short, 1999; Dillenburg and Hesp, 2009). The development of these villages implies some improvements that could diminish the quality of some of the original natural resources.

In this paper, these barrier constrains to urban development are described in order to orientate decision makers to plan city growth and, at least, not to commit non-expected mistakes. Particularly, some structural guidelines were described for small touristic villages that are becoming coastal cities in a few years.

1.1. Coastal erosion

Coastal erosion is one of the most important factor that controls coastal development. Defence improvements tried to diminish the impacts of the South-Atlantic Ocean dynamics, but usually they provoked beach unbalanced. In the eighties Santa Clara and Camet Norte asked for groyne fields. The construction of Santa Clara groyne field assured the stability of the new artificial beaches. The federal authorities did not considered investments in Camet Norte with less population and it was condemned to a permanent scarcity of sand supply by littoral drift. Santa Clara is today a growing city; Camet Norte has significant variations in its sand availability that limited its development (Fig. 2a). Coastal erosion not only affected the coast

with cliffs, it can also cause scarps of dunes at coastal barriers. The Eastern Barrier of Buenos Aires contents beaches where the back-shore can be stable in relation to the sedimentary dynamics with the littoral dunes. There is a dynamic equilibrium between submerged bars, beaches and littoral dunes. There are other localities where beaches are unbalanced either by historical sand mining or by the exaggerated afforestation of the littoral dunes (Fig. 2b).

Several methods have been proposed to analyse the potential of coastal erosion. At beaches of sand and gravel of the United Kingdom, mean high water and the depth of closure seem to be very good indicators of erosion effects (Phillips and Williams, 2008). In coasts subject to storms, a SEPI (storm erosion potential index) parameter based on storm surge heights and duration was proposed (Zhang et al., 2001). Handling data from the Mar del Plata tidal station, the SEPI parameter was calculated to analyse the recurrence of strong storms that stroke the Southeastern coast of Buenos Aires in the last 20 years. The storms of April 1997, June 1994, December 1999 and March 1992 were estimated as the most severe (Fiore et al., 2009; Fig. 3).

In regard to coastal defence, groyne fields have been the most popular alternative during the end of the XX century (Lagrange, 1993). These hard structures caused adverse changes in the beach profile and sediment composition (Isla et al., 2001). In 1998, the first nourishment project provided 2,480,000 m³ in three beaches of Mar del Plata (Marcomini and López, 2004). New alternatives as detached breakwaters have been managed in the last years.

1.2. Blocking of the aeolian sand transport

In a similar way that groynes can block longshore transport, the fixation (afforestation) of dunes can diminish significantly the aeolian transport of sand. Miramar city is located south of Mar del Plata, and was planned as a touristic city attached to a wide bay with extense beaches. As the eolian accumulation of sand was a problem for the coastal area, the afforestation of the coastal dunes was planned as a forest reserve (Florentino Ameghino Reserve). But the transverse dunes were the transport agent to supply sand to the embayment. The reserve originated that forested dunes grew vertically while beaches and cliffs were receding (Fig. 4a). The sand supply

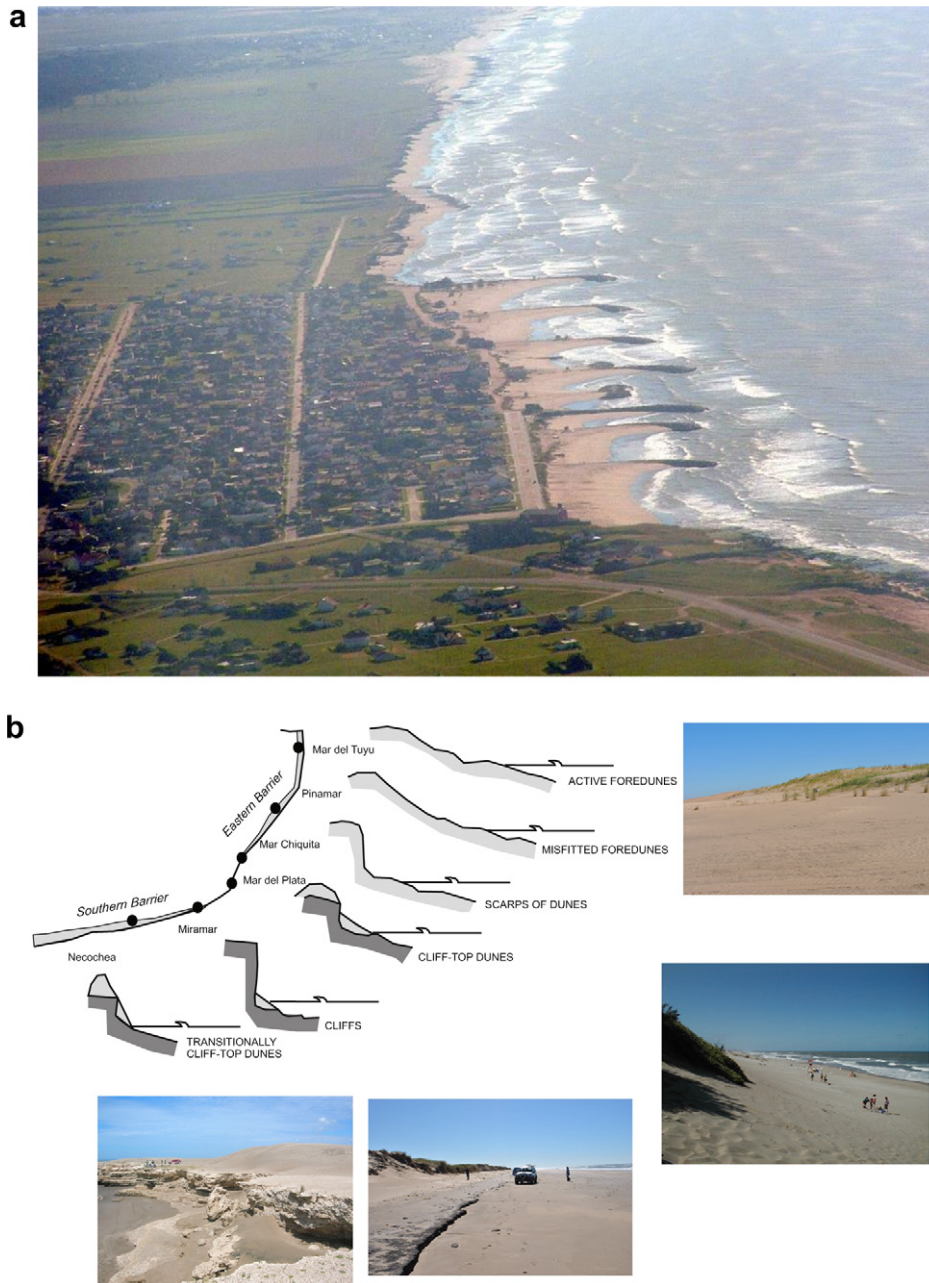


Fig. 2. a) Groyne fields assured sand for Santa Clara but they condemned to erosion at the locality immediately to the north (Camet Norte). b) scarps of dunes and unbalanced backshores dominate at the southern portion of the Eastern Barrier of Buenos Aires. (NEC: Necochea; MIR: Miramar; MDP: Mar del Plata; MCH: Mar Chiquita; PIN: Pinamar; MDT: Mar del Tuyú).

had been blocked and coastal defences should be constructed (rigid groyne in the 70s and ripraps during the 80s; Isla, 2010a,b).

At the same time, the urbanisation within dunes can cause heat-island effects: increase in temperature as the refreshing effects of onshore winds are blocked (Oke, 1978; Roth et al., 1989). When tall buildings are constructed at the interdune depressions within a dune field, these effects can increase. This type of heat-island effects are today increasing at the downtown of Villa Gesell, located 300 m from the shoreline and surrounded by dunes (Isla, 2010a,b; Fig. 4b).

1.3. Water pumping

Fresh water is another limiting factor for growing coastal villages. Urbanisations located on dune barriers depend on the volume of groundwater of good quality. At the Eastern Barrier of Buenos Aires,

these volumes are content in lens overlying salt water aquifers. In San Clemente del Tuyú, special cares have been improved to permit that summer freshwater demands do not lead to a drop of the water table and/or a rise of the fresh/saltwater phases. During the summer months of 2002 to 2007, water demands increase from 400 to 1200 m³/month (Fig. 5) and produced falls of more than 1 m in the groundwater levels (Kruse and Carretero, 2010). However, natural drops of more than 2 m of the watertable can occur in Buenos Aires coastal plain without implying large consumptions either by urban or rural pumping (Quiroz Londoño et al., 2010).

1.4. Sewage and storm-water disposal

Resort villages grew constructing houses that pumped water from domiciliary wells and delivered the disposal waters to gravel-

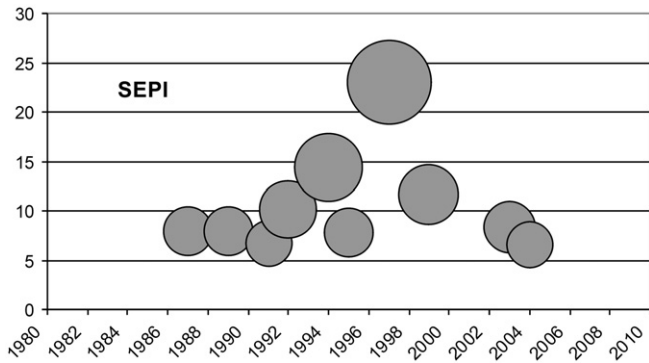


Fig. 3. Storm erosion potential indexes (SEPI) estimated from tidal records (modified from Fiore et al., 2009).

filled trenches or septic tanks. Villages designed within barriers used to have problems when these septic trenches were constructed at a high density. In Mar Chiquita, coastal erosion rates are exhuming these trenches at the scarps of littoral dunes 4 m altitude (Fig. 6).

The growing of these touristic villages led to the drainage of water excesses into municipal pluvial networks. Those areas close to the coast have significant problems with the storm-water delivered to the beach. Pollution is expected with the “first flush” that delivers much of the wastes accumulated during the dry weather period (Freedman and Dilks, 1996). In this sense, it is recommended that wastewater treatment requirements should be based on water or sediment quality criteria rather than by technology-based regulations (National Research Council, 1993). The planning of the 11-km Mar del Plata sewage outlet needed simulations models of the dispersive transport, primary dilution and in the far-field scale, mostly by tidal currents in order to satisfy bathing-quality levels for the next years (Isla and Casanelli, 2000). Its efficiency will depend on a monitoring program capable to propose operative improvements.

1.5. Water excesses

As barriers are usually composed of fine sand, their urbanization led to an increase in the risk of erosion induced by runoff. In Pinamar and Villa Gesell lots were planned preferentially on dunes (topographically elevated bedforms) while the streets were drawn at interdune depressions. The streets of these villages were originally composed of sand and shells, but later they developed into pavements drained towards the beach. This change caused a significant change: Precipitation does not infiltrate, instead water flows towards the beach. Beach erosion is therefore more caused by runoff than waves breaking during extratropical storms. The demand of more areas of beach to construct tents for shadow and services for summer tourists can cause significant erosion, as significant as the winter storms in some popular beaches (Fig. 7).

1.6. The big step

Tourism activity has multiplied in the last years and its demand led to construct artificial beaches (Cencini et al., 1988). In Argentina, the demand of hotels reservation at coastal areas surplus those oriented to mountains or even the Iguazú Falls ((www.indec.gov.ar; Fig. 8). Bathing tourism has been of concern to assure quality in regard to the Argentine law 25.997 (Dadón, 2005). However, in Santa Catarina, there were no attempts to implement carrying-capacity analyses in relation to the dimensions of the beach

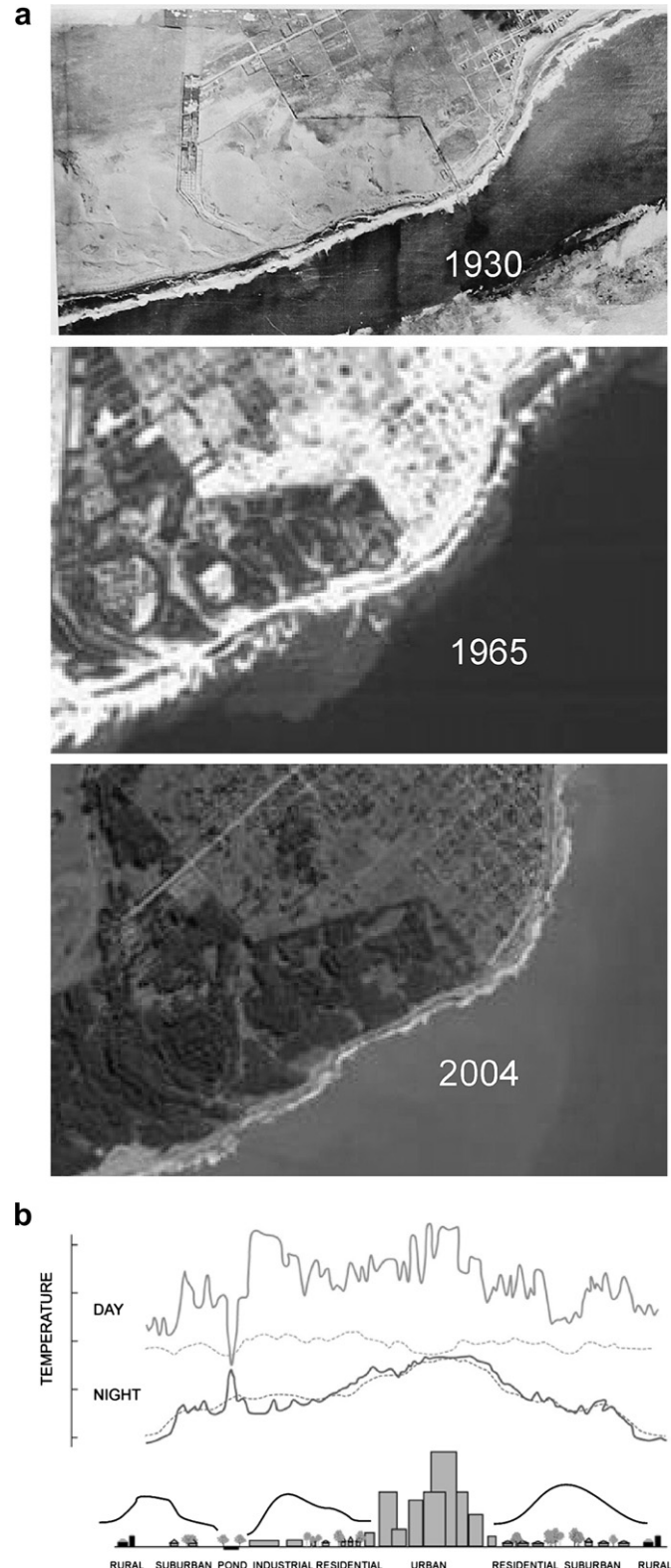


Fig. 4. a) The fixation of the dunes to the SW of Miramar blocked the sand supply to the embayment of the city. b) The urbanisation within a sand-dune field increases the heat-island effect (modified after EPA, 2003).

(Polette and Raucci, 2003). The administration of Villa Gesell city in Argentine decided in 2006 that at some places there was not enough space for resort buildings, a seaside avenue and parking. The street was converted into a pedestrian ramble. The plan was to

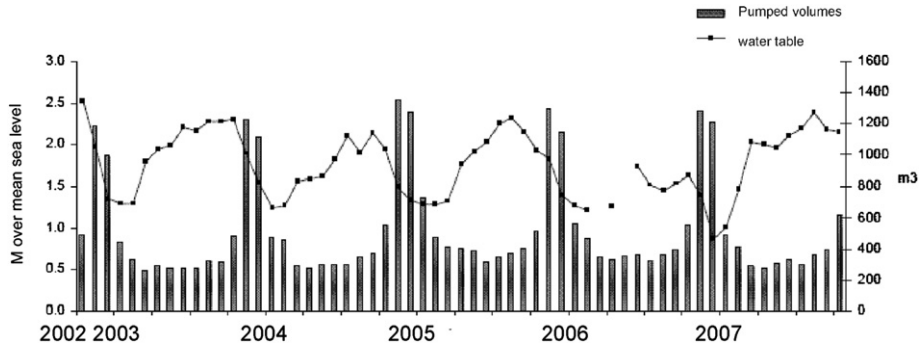


Fig. 5. Groundwater volumes pumped in San Clemente del Tuyú between 2002 and 2007, and variations of the water table (modified after Kruse and Carretero, 2010).

convert resorts constructed by cement and subject to episodic erosive crises into new constructions composed mostly of wood. The plan was subject to a trial performed by some of the former owners of the concessions for bathing resorts. The plan conceived by the beach management commission was thrown out by the new government administration.

Although city planners are increasingly more aware about these coastal problems that condition their development, the magnitude of the episodic effects are usually forget or denied (Fischer and Arredondo, 1999). This lack of focus led to minimize coastal problems when planning the expansion of the urbanized areas. Each year new urban areas are drained via master pipelines that progressively became old, small and subject to failure. Same processes affect the sewage networks, as most of the domestic sewages of coastal cities of Argentina are discharged to the inner shelf without any treatment (Elías et al., 2004). Touristic coastal villages like Pinamar and Villa



Fig. 7. a) The urbanisation of the dune barrier in Villa Gesell originally favoured water infiltration during the 60s. b) During this century, urbanisation led to promote runoff towards the beach. c) Runoff induces channels at the beach.



Fig. 6. Scarp of a littoral dune cutting a gravel-filled trench for domestic sewages (Mar Chiquita village).

Gesell have planned and developed their sewages towards ponds where the sludge was naturally processed. These systems used to operate normally during most of the year. Towards the end of the summer season (February) odors increase significantly. The growth of these cities will induce to overview the sewage systems that worthy should be oriented to marine outfalls (Fig. 9). During the beginning of the summer season 2009–2010 a big controversy crashed regarding the coastal pollution of Mar del Plata beaches. The Major of the city hurried to deny any kind of littoral contamination while a sewage outfall of 11 km was being constructed with the financial support of the National administration.

2. Discussion

The demand of sun-and-beach resorts has unpredictable consequences at certain touristic coasts. In Southern Brazil, unplanned accesses to the coast will increase erosion in the near future; much of this erosion increases during storms coming from the south (Esteves et al., 2003). Same effects increase the risk of erosion at the coast of São Paulo (Souza and Suguio, 2003). Coastal occupation in Brazil is causing severe impacts that should be assessed in order to guarantee sustainability (Santana, 2003). In Olinda, Pernambuco (Brazil), the increase in pluvial discharges has diminished beach recreational areas and bathing quality (De Gois and Oliveira, 2010). Along certain coasts of the State of Bahia (Brazil), the conversion of abandoned spaces into basic infrastructure for tourism and recreational purposes has been considered a very good choice (Silva et al., 2010).

The decision to register the village of Didim, Turkey, as a region of “cultural and tourism protection and development” (2005) produced significant land-use changes difficult to predict for the fate of these areas. In the last years, Didim offers 15,000 beds in 200 facilities certified by the government but a strategy should be proposed (Esbah et al., 2010). In this sense, touristic coastal villages should consider the costs of beach maintenance as an investment in their local economies (Klein et al., 2004). Another issue is related to the clientelist relationships (Yüskel and Yüskel, 2007). In a high-intensity administrative culture, development projects oriented to tourism may be approved for investment purposes without careful attention to sustainable development criteria. There are examples demonstrating the negative impacts of clientelism on tourism planning and development (Yüskel and Yüskel, 2007). Fortunately, new methods have been tested to help in decisions concerning coastal scenery (Ergin et al., 2006) some of them proposed to evaluate natural and socioeconomic variables (Barbosa de Araujo and Ferreira da Costa, 2008).

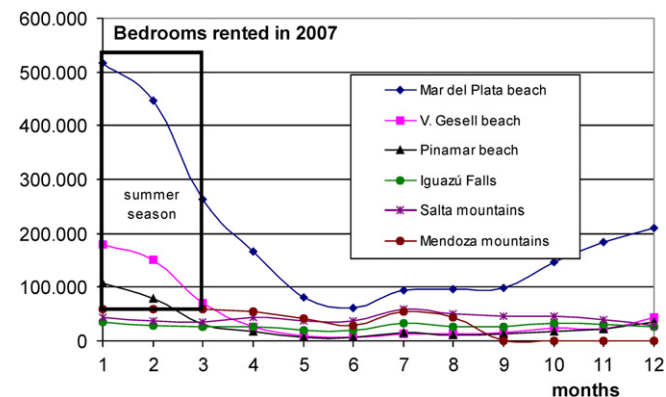


Fig. 8. Bedrooms occupied at touristic localities of Argentina during 2007 (data from Instituto Nacional de Estadística y Censos, (www.indec.gov.ar)). Significant increases occur during the summer months (January, February).

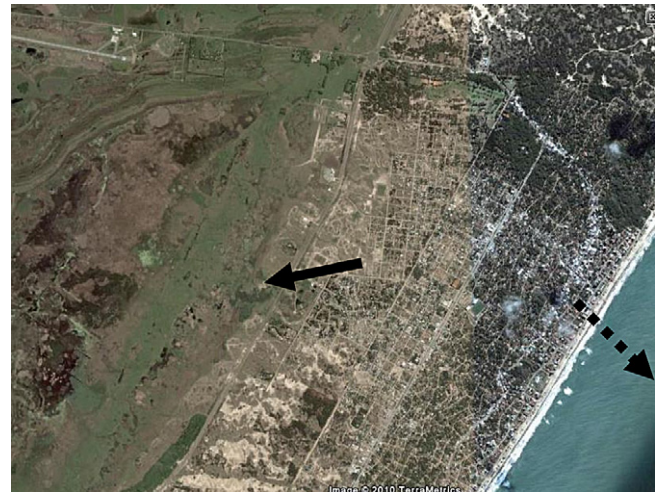


Fig. 9. Villa Gesell growth led to the urbanization of almost the entire width of the sandy barrier. Present sewage networks are delivered to ponds (solid arrow). In the future these networks should be reversed towards an ocean outfall (dotted arrow).

Beach nourishment seems the best choice to repair beach unbalances in certain sectors. However, experiences from other countries should be considered in order to handle erosion problems into touristic benefits (Hansom et al., 2002). Significant changes should be assessed relative to human behaviour in order to improve practices that favour sand stability.

Strategic plans should be based on agreements between the authorities and the local population specifying guidelines to be followed by the administrations (during 4 years). However, this is not the common rule and the agreements are replaced by new initiatives of the decision makers. Growth management strategies are suggested to plan the stormwater fluxes in urban areas (National Research Council, 1993). In Camboriú (Santa Catarina State, Brazil), citizen participation was considered fundamental for the implementation and control of public policies; the capacity building of the population is a significant step for the implementation of a master plan (Moraes et al., 2010).

3. Conclusions

1. In a coast dominated by longshore drift as Buenos Aires Province, coastal defences should take care not to block this drift or the sand transport induced by wind. Beach nourishment was definitively recommended over hard-structure interventions.
2. As coastal erosion is a limiting factor of sand barriers subject to episodic storms, it is highly recommended to establish setbacks. When new urbanizations are being planned, these setbacks should be based on the knowledge of the receding rates or the modern trends of these rates.
3. Water excesses should be drained avoiding channels across the beach.
4. Urban planning of coastal villages should consider master plans to manage waste waters without delivering them to bathing areas. Sewage disposals should be planned from the knowledge of the coastal dynamics and considering dispersive models and a monitoring program.

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