

The Tordera delta: Tensions, challenges and expectations of a complex rural landscape on the metropolitan periphery of Barcelona

Josep M. Panareda*

Institut d'Estudis Catalans

Original source:

***Documents d'Anàlisi Geogràfica*, 66/2: 371-392 (2020)**

(<http://www.uab.cat/dag>)

Translated from Catalan by Mary Black

Abstract

The Tordera River delta is small (it occupies just 8 km²), is located on the far northern end of the Barcelona metropolitan region and was predominated by market gardens in the first half of the twentieth century. Later on industries moved in, the urbanised space was expanded and intense tourist activity cropped up around the beaches. This article presents the key ideas on the current status of the urban uses of a mosaic landscape with ongoing conflicts over water use, spatial occupation and the effects of river surges and the constant erosion of the beaches caused by storms at sea. The main challenges include acceptance of the natural dynamic the way it is and knowing how to place limits on urban consumption, spatial occupation and the economic and social activities conducted there.

Key words: periurban landscape, changes in land use, coastal erosion, market garden, beach tourism.

1. Introduction

The Tordera River delta is small (it occupies 8 km²). It is located on the Mediterranean coast at the mouth of the 62-km-long Tordera River, which drains into the Mediterranean and has an area of 895 km², comprised of predominantly silicas (schist, granite and clay). The delta was not urbanised until modern times, but the towns of Blanes, Malgrat de Mar and Palafolls have been settled on its banks, outside the floodplain, for centuries. The area studied contains a vast variety of landscapes which vary over time and space because of both the dynamic of natural processes and the successive resource exploitation strategies used throughout history, especially in the past two centuries. Natural processes are heavily conditioned by the periodic river surges and recurring storms at sea. Human activity has long been favoured by water availability and the fertility of the land, and in recent decades the extension of the beaches has made tourist development possible. Additionally, its proximity to Barcelona has led to the installation of many industries and increasing residential activity associated with people who commute to and from Barcelona or different towns in the Maresme region. The outcome is a mosaic of landscapes in which rivers and beaches that periodically flood coexist alongside highly productive market gardens, population nuclei, urbanisations, campsites, industries and a dense roadway network. The relations among the different uses are complex and cause numerous conflicts (Panareda & Boccio, 2018; Parcerisas et al., 2012).

The purpose of this article is to present a summary of the most significant features of the diverse landscape in this delta region located on the northernmost point of the Barcelona Metropolitan Area, and to show its complexity and some of the discourses (on justification/exaltation/glorification/praise/vindication, protection, etc.) to which it has given rise, as well as its prospects at a time of major socioeconomic and natural transformations, in close relation with the variations in the river system and coastline and with climate change. Future articles should outline proposals on how to plan this periurban space with serious problems stemming from the diverse range of uses, the lack of space and the impact of natural phenomena.

2. Barcelona's three metropolitan deltas

There are three delta regions on the coastline of the Barcelona Metropolitan Region: the Tordera River, the Besòs River and the Llobregat River. All three are very distinct in terms of their current landscape and degree of urbanisation (Figure 1).

The Besòs River delta, located on the northernmost edge of the city of Barcelona, is similar in size to the Tordera River delta, but it is now totally urbanised and the riverbanks have been transformed into leisure and free-time spaces. Today the Besòs River corridor is a park, with the water flow controlled and the banks arranged so people can eat, play, run and ride their bicycles there.

Figure 1. Map showing the location of the Tordera River delta between the towns of Malgrat de Mar and Blanes.



Source: Made by Maravillas Boccio based on different sources.

The Llobregat River delta, located on the southern edge of the city of Barcelona, has an area measuring 90 km² and is highly urbanised. The entire town of El Prat de Llobregat is in the delta region, as are parts of other towns such as L'Hospitalet de Llobregat and Sant Boi de Llobregat. Major infrastructures have been built there, such as the airport and the port, a dense network of motorways and railways, many industries and retail and logistics hubs. Agricultural space occupies almost one-fourth of the delta and is specifically managed via the Pla Especial del Parc Agrari del Baix Llobregat (Special Plan of the Agrarian Park of the Baix Llobregat); this encompasses the farmlands in the delta and the floodplains in the lower Llobregat River valley as far upriver as El Papiol, with an area measuring 3,348.02 hectares, 70% of which is in the delta.¹ However, some groups view the Agrarian Park more as an urban green zone and

especially a reserve of space set aside for future urban development operations where services and installations can be installed when they become necessary. In fact, the current trend is a gradual decrease in both the farmland and all related activities (Sans & Panareda, 2016; Paül & Panareda, 2018).

The Tordera River delta has an area similar to that of the Besòs River delta, but it is around 60 km from the centre of Barcelona, so the influence exerted by the city is different than in the other two deltas, nor does it have the territorial potential of the Llobregat River delta, all of which should be borne in mind in a comparative study. However, metropolitan pressure has risen considerably in recent decades, and there are numerous conflicts stemming from both the battle over space and natural processes (Figures 2 and 3).

Figure 2. View of the Tordera River delta from Torre de Montagut



In the foreground is the industrial and residential sector on the northernmost end of Malgrat de Mar. In the background are glimpses of the tall apartment buildings in the Els Pins neighbourhood in Blanes. In the central part of the coast is an elongated strip which is where pine trees have been planted atop former dunes, currently transformed into a campsite. For more information, see the website of the Agrarian Park of the Baix Llobregat <https://parcs.diba.cat/web/BaixLlobregat>

Source: Author

Figure 3. Orthophotograph of the Tordera River delta showing the boundary of the delta area, where farmland, urban spaces and campsites predominate



Information taken from the Tordera River Delta and Downstream Region Commission (2017).

Source: Image from the Institut Cartogràfic i Geològic de Catalunya. The boundary of the delta is the author's original based on fieldwork.

There is no overall territorial planning and management plan for the Tordera River delta, but several initiatives have emerged to deal with the current situation. At the request of the County Council of the Maresme and the town halls involved, in 1998-1999 there were plans to create a Tordera River delta agrarian park with the goal of preserving, consolidating and developing the agrarian space in the Tordera River delta following sustainable development and territorial rebalancing criteria. However, the initiative never got off the ground (Paül, 2006, 2010).

More recently, the Taula del Delta i la Baixa Tordera (Tordera River Delta and Downstream Region Commission) was created by the town halls of Blanes, Malgrat de Mar, Palafolls and Tordera. This commission is defined as a space of governance needed to restore the ecological and social balances in the territory through integrated planning of the Tordera River delta region and the territory around the Tordera River basin. It is a deliberative body which can create an ongoing space of dialogue with all stakeholders with the goal of informing the planning processes in a participative, transparent way.² At the same time, a participative process was undertaken for the ISACC TorDelta Project (ISACC is the acronym for Implicant la Societat en l'Adaptació al Canvi Climàtic al Delta de la Tordera [Getting Society Engaged in the Adaptation to Climate Change in the Tordera River Delta]), coordinated by CREAM (Center for Ecological Research and Forestry Applications).

Judging on different statements by the leaders of these initiatives, their overarching strategic goals are to restore the quality and quantity of water in the

Tordera River basin, to restore the geomorphological dynamic of the river and the coastal systems, to guarantee the protection of biodiversity, to promote territorial exploitation models that are compatible with the preservation of the natural space comprising the delta, to lower the risk of natural disasters, to include climate change when planning actions in the territory, to value farmers and the role of agriculture, to reinforce education and dissemination of the problems in the delta to citizens and to guarantee better governance that enables everyone to participate by establishing shared criteria and objectives.

The approaches of both actions reveal a keen concern for the natural conditions as factors limiting both people's everyday lives and economic activities. The main aspects to be examined are water, natural fluvial and marine phenomena, and space.

3. Barcelona's three metropolitan deltas

There are many studies of periurban agrarian landscapes which would be impossible to summarise in this brief article (see Vázquez & Verdaguer, 2010). Some of these studies are now several years old, such as the one by Bryant and Johnston (1992), which makes a distinction between periurban agrarian landscapes that are degenerated, adapted to the urban area and developed (where urban pressures are not intense). We shall only draw from the approaches outlined by Paül (2006, 2010) and Paül and Haslam McKenzie (2013), who have studied metropolitan agriculture in Barcelona. These authors believe that three major landscapes can be described which affect periurban agrarian spaces:

- The first encompasses agrarian realities with little to do with their periurban nature, such as those related to export agriculture or extensive grain agriculture, whose yields supply markets very far from the nearby city.
- The second reflects the Thünian model and is therefore based on agricultural intensification due to proximity to the urban market.
- The third is urban growth in the broad sense, which implies the transformation of the pre-existing agrarian landscape to the point that it disappears.

The last two give rise to strict periurban agrarian landscapes. The second has been deftly analysed by historical agrarian and rural geography studies, and at least in Europe it has generated a longstanding tradition of studying vegetable gardens as the quintessence of intensive Mediterranean irrigated agriculture near cities. The studies by Meeus (1995) and Meeus et al. (1990) contributed to spreading this concept, which was extensively studied in French and Spanish geography throughout the twentieth century to such an extent that it was included in the first European environmental report drafted in 1995, known as the Dobříš Assessment (Stanners & Bourdeau, 1995).

Bryant and Johnston (1992) call the landscapes with the third dynamic degenerate because of the urban encroachment. One classic case is agrarian deintensification, which occurs in contradiction with the previous dynamic due to urban proximity, when fields are no longer cultivated and land is left fallow due

to expected income (Paül, 2010; Paül & Haslam McKenzie, 2013). Lately there has been a great deal of emphasis on the fact that periurban agricultural landscapes are mixed, indecisive and dynamic (Gallent & Andersson, 2007; Gant et al., 2011). These studies examine the land uses of these landscapes which are seldom found elsewhere, such as tyre scrapping or dumps, which are often called *periurban uses* (Paül & Haslam McKenzie, 2013). Also noteworthy is the development of livestock uses which are not strictly geared towards urban consumption but instead towards local leisure, such as *horsification or hobby farming* (Gallent & Andersson, 2007; Paül & Haslam McKenzie, 2013).

4. Methodological considerations

The methodology consisted in three main phases: collecting the data; organising, processing and analysing the data obtained; and developing and disseminating their results. Different techniques were used because of the diversity of information needed, including indicators on the environment (relief, lithology, aquifers, river system and flow, sea tides and storms, flora and fauna) and the different systems for exploiting the resources, which change over time and place (surface water drainage and channelling, groundwater capture, cleaning coastal areas, transforming forests into pastures and crop fields, construction of houses and establishment of industries, service areas and roadway networks).

The data were obtained via fieldwork and examinations of the literature and documents. The fieldwork provided basic information for this study with the support of maps and photograms at a scale of 1:5,000. We primarily used data on land use with evidence of former exploitation. We also obtained references on the Tordera River dynamics and the evolution of the coastline. Comparative analyses of historical photograms enabled us to ascertain details about the recent evolution of land use and changes in the coastline; the oldest photogram dates from 1946. Direct observation and conversations with the local populace enabled us to learn about current land exploitation systems.

We consulted books and local magazines, which contain a range of information on the history of land occupation and historical types of land use (Llobet, 1955). The works of Serra and Pintó on the transformations of the landscape in the downstream Tordera River since the mid-nineteenth century have been essential. We checked statistics on the evolution of the population with global data on a municipal scale, especially the evolution of land occupation by activity. An important part of this information was obtained from the Municipal Archive of Blanes.

The data were stored, organised and analysed primarily using the programmes Access and Excel. The graphic representation was made with the support of the Affinity Designer application.

5. Results

Below is a summary of the ideas regarded as key in interpreting the landscape today. They have been grouped into five sections. The first is water, the main element shaping the landscape on both a geological and human scale, and currently the most important resource. Next, the most significant features of the

Tordera River as a force shaping the landscape, a resource and a risk area are listed. The third section outlines aspects related to surges and floods, phenomena that condition both the structure of the riverbed and the defences to prevent or mitigate the impacts on agriculture and constructions. The fourth section mentions the history of agricultural activity in recent years. And finally we discuss the coastline dynamic due to its retreat caused by the heavy impact of tourist activity, which has become one of the main points in today's economy (Table 1).

Table 1. Main uses and occupations of the Tordera River delta and defence and protection measures taken

<p style="text-align: center;">Uses and occupation of the territory</p>	<ul style="list-style-type: none"> — Drying of wetlands and lagoons. — Transformation of the delta floodplain into farmland, first dry farming and later irrigation farming. — Construction of wells for household, industrial and agricultural water supply. — Construction of irrigation channels to water crops, which are currently severely damaged and abandoned. — Installation of greenhouses. — Expansion of the urban nuclei of Blanes and Malgrat de Mar. — Construction of the railway (nineteenth century) and motorways. — Enlargement and subsequent expansion of the port of Blanes. — Installation of industries with heavy water needs. — Installation of seaside campsites, especially on the beach and the dune line. — Extraction of sand from the Tordera River bed for construction. — Extraction of gravel and sand from the sediments on the delta floodplain for construction. — Extraction of sand from the seafloor to regenerate the beaches. — Extraction of sand from the lower stretch of the Tordera River to regenerate Blanes beach. — Construction of desalination plants for the seawater from the lower stretch of the Tordera River.
<p style="text-align: center;">Defence and protection actions</p>	<ul style="list-style-type: none"> — Securing the dune line by planting pine trees. — Channelling the Tordera River by installing mounds secured with cane. — Channelling the stream from Burg valley (Blanes). — Regenerating the Blanes and S'Abanell beaches by dredging the nearby seafloor. — Building the seafront promenade in Blanes. — Building jetties on Blanes beach. — Building, rebuilding and expanding the S'Abanell seafront promenade over the beach. — Building a breakwater in the middle of S'Abanell to protect the campsites. — Building breakwaters at the mouth of the Tordera River. — Monitoring the phreatic level to prevent salination. — Studying the process of beach destruction and the retreat of the delta coastline. — Creating the Tordera River Delta and Downstream Region Commission by the four town halls affected.

Source: Author

5.1. *Water*

The current Tordera River delta was formed during the Holocene. For several millennia, the bottom of the bay where the delta currently lies has been sedimented with different levels of gravel, sand and silt in relation to the river materials and sea level. The outcome is a coastal plain with a subsoil with different levels of aquifers harbouring a prized and intensely exploited hydric resource. This groundwater is used to water highly fertile gardens and supplies several towns and countless industries.

The water used to water crops traditionally comes from the Tordera River or one of its tributaries through irrigation ditches, many of which are now abandoned, while others have been totally engulfed by the landscape. Water has been extracted from aquifers by waterwheels, which are currently unused, or by motors.

The demand for water has risen dramatically in the past few decades, such that during drought phases, even less intense ones, the Tordera River cannot supply enough to offset the water removed, and this has led to very strict control of aquifer levels to stave off an irreversible salinisation process. In order to meet the high water demand, desalination plants have recently been built, which has also raised the price of drinking water, has a high energy cost and generates saline waste that is difficult to manage (Baca, 2013).

5.2. *The river and wetlands*

The Tordera is a typically Mediterranean river with a system characterised by irregularity in relation to precipitation. The summer baseflow is quite noticeable, even though the natural surface circulation seldom disappears. Currently, the riverbed is totally dry in the last five kilometres, except in periods after intense precipitation (Farguell, 2019).

This extreme, lasting baseflow in the lower stretch of the river is caused by the presence of the delta aquifer, which is quite extensive and runs from the edge of the town of Tordera to the mouth of the river. Water extraction from the aquifer is so intense that the surface current of the river filters down totally within a few metres, and all too often the river flow is not enough to offset it. Despite the permanent monitoring of the phreatic level, in drought episodes extractions have to be drastically curtailed in order to prevent salinisation (Figures 4 and 5). At the same time, the surface circulation has been bolstered by the permanent drainage from the purification stations, especially in the middle stretch of the Tordera River. This influx of water into the river system is extremely important in the landscape, as it means that surface water is permanently present, even during the summer months in dry years, at least in a more or less longer stretch after the point where the purified water is drained into it. The most noteworthy consequences are that the aquifer is replenished and vegetation develops that requires moist soil, such as communities of helophytes (cattails, watercress and reeds) (Panareda, 2008).

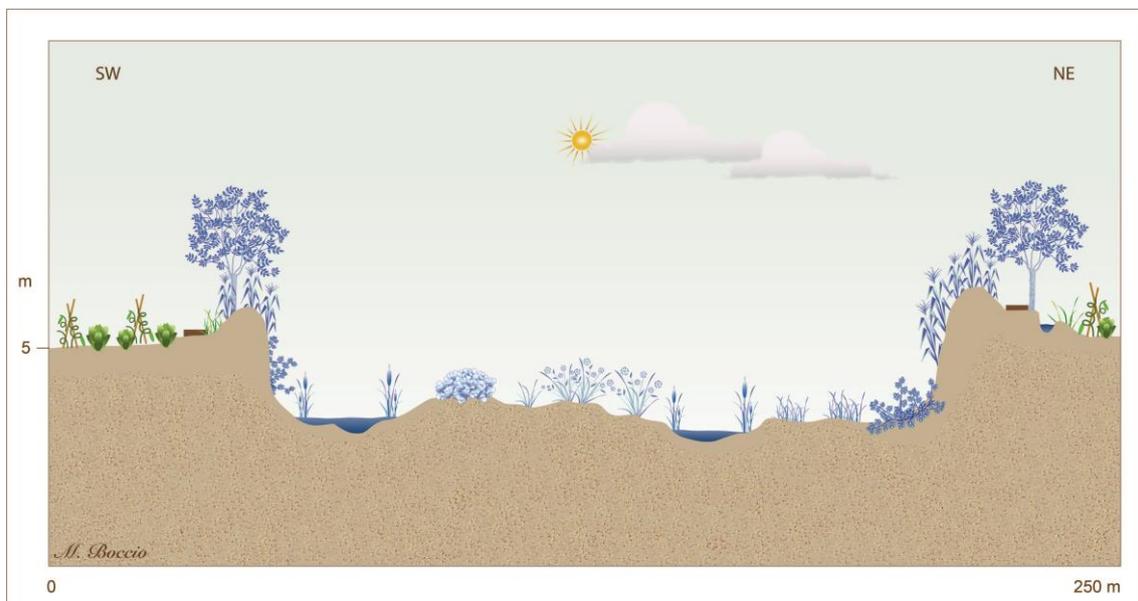
Figure 4. Anastomosed current on the Tordera River bed in the delta region



The buildings of two dome-shaped desalination plants can be seen over the long row of reeds.

Source: Author

Figure 5. Cross-section of the lower stretch of the Tordera River in the delta



The riverbed is surrounded by protective mounds that are currently colonised by continuous reed beds, at the base of which ash, elm, white poplar and poplar trees are scattered. Further out, market gardens predominate on both banks, and there is a roadway for vehicles between the gardens and the mounds. On the northeast side, next to Blanes, there is an irrigation channel which is currently unused.

Source: original data from Josep M. Panareda and illustration by Maravillas Boccio.

Figure 6. Lagoon at the mouth of the Tordera River



The lagoon is separated from the sea by a sandbar which is broken up every time the river floods and naturally reappears when the flow diminishes. In the background you can see the riparian forest with ash and white poplar and strips of reeds and cane.

Source: Author

Near the mouth, a permanent lagoon often appears, which is closed to the sea by a tall walkable sandbar, which only disappears during episodes of heavy flooding and remains open as long as the water flowing from the river is sufficient to counter the thrust of the seawater. When the river flow diminishes, the sandbar once again appears until a new flood pushes it out to sea again. This lagoon is the only notable wetland in the delta, and it is valuable both for tourists and the environment, especially because of the ornithological diversity. Its size varies according to the amount of time that has elapsed since it was formed and the flow of water reaching it from the mouth of the river. Upstream the river continues in a landscape with an anastomosing current, although surface water still flows there; otherwise, it is a dry sand bed with a microtopographic legacy from the last water that circulated (Panareda, 2018) (Figures 4, 5 and 6).

We can assume that there were more extensive wetlands in the delta centuries ago. However, the current fragments are more related to past uses, such as irrigation or mill reservoirs, or human interventions, such as old sand and rock extractions and drainage recesses or networks, than to the direct remains of natural coastal wetlands or lagoons (Almera, 1913; Serra, 2001).

On the river floodplain and upstream in the delta there are several small, unconnected lagoons and wetlands. They are currently protected areas colonised by riparian forests, especially willow and ash tree stands, and communities of tall grasses including cattails (*Typha* sp.), reeds (*Phragmites australis*), watercress (*Rorippa nasturtium-aquaticum*, *Apium nodiflorum*) and sedge grass (*Carex* sp.). The dispersion of these environments, the historical agricultural pressure and the current pressure from industrialisation and urbanisation are not helping their conservation. Furthermore, the drop in the phreatic level and the

channelling of the Tordera River will make them disappear almost imperceptibly. Just as in the delta, we can assume that there were more extensive and better developed wetlands not too many centuries ago, and that the current fragments are clearly related to past uses.

5.3. *Surges and floods*

The document research is still incomplete, but we are aware of texts which report on the existence of surges and floods with catastrophic consequences. For centuries, the delta wetlands have been cleared and dried out to expand the croplands, and river embankments have been built to prevent the floods from spreading. Each major flood has prompted significant changes in the landscape: they severely disrupt the colonise spaces, transform the structure of the existing wetlands and lagoons and create new ones (Baca, 2013; Riba, 1995; Sagristà et al., 2017). Channelling the rectilinear riverbed like the current one and building embankments or mounds to keep the water from leaving the channel has substantially improved the land uses and allowed the area used as irrigated farmland to increase. However, while all of this has been highly effective in controlling the lesser surges, it is insufficient when they are major, and they can still cause considerable destruction.

The mounds have been planted with cane (*Arundo donax*), which forms a dense network of robust rhizomes that protect the artificial dike from surges of river water. Cane is an exotic species with a strong ability to colonise wet open spaces, and for this reason it is currently considered an invasive plant that has to be eradicated and replaced with autochthonous plants from riparian communities. However, this cannot be done efficiently, given that the riverbed would first have to be widened, which can only be done on farm, industrial and residential lands, much to the dislike of the people affected by it. Nonetheless, if the cane were removed without expanding the floodplain, the mounds would vanish with the first surge, even if it were not very intense, so urgent intervention is needed to build cement dikes or large breakwaters on both banks of the river.

5.4. *The predominance of agriculture*

Until the mid-twentieth century, the dominant land use was agriculture, especially grains and vineyards, until the late nineteenth century. Market gardens increased throughout the nineteenth century, but they dramatically expanded throughout the twentieth century until becoming the predominant type of cropland in the delta (Paül, 2006; Serra, 2001; Serra & Pintó, 2005; Valdunciel, 2005). During its peak, some people, like the architect and urban planner Nicolau Rubió i Tudurí, actually claimed that this 'agricultural river' could become a zone of tourist interest because of its keenly aesthetic landscape value. Rubió (1932, p. 54) said:

The agricultural landscape of our region is as fine as the wild landscape. For example, if we consider the stretch of the Tordera River valley near the mouth, [...] we will grasp how right we are to suggest the agricultural rivers there as possible tourist reserves.

The area used for farmland has decreased considerably, especially from the mid-twentieth century until today. In the eastern part of the delta, which belongs to the municipality of Blanes, the amount of land used as market gardens has dropped considerably due to urban expansion, the installation of industries and services and more recently the establishment of an extensive area used for campsites between the towns of Blanes and the course of the Tordera River. In contrast, on the western side, which belongs to the town of Malgrat de Mar, market gardens still occupy considerable space, even though the strip near the beach has also been transformed into campsites and the population nucleus has expanded considerably.

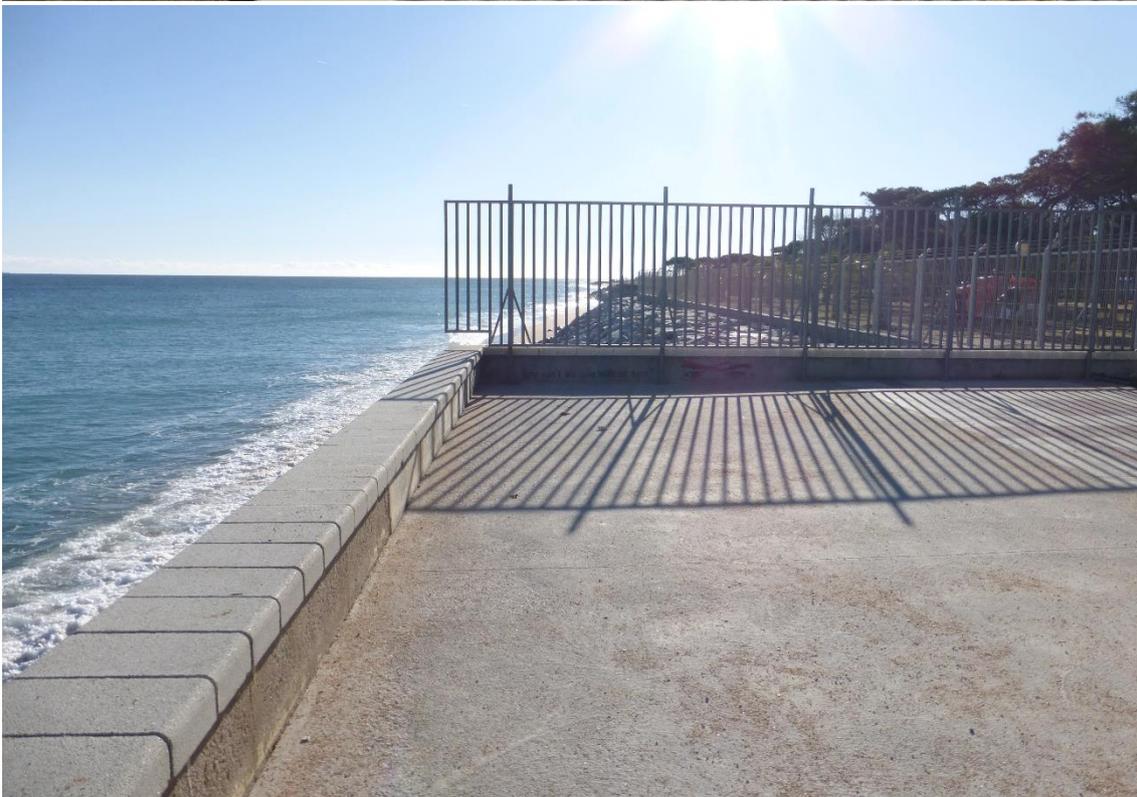
However, market gardens still imprint a specific personality on the delta landscape, even if they employ few workers, most of them immigrants. The produce is distributed in the markets in neighbouring towns and is quite popular as Km-zero produce.

5.5. *The coast: Beaches and dunes*

The coastline is the sector that has undergone the most transformations in recent years. It has gone from being 100 metres wide in many places, continued with dunes, to dunes repopulated with pine trees, which were later occupied by campsites. More recently, it has suddenly shrunk during storms at sea because of the heavy waves, which have removed sand and swept away much of the beaches and the area now occupied by the campsites (Sagristà et al., 2017; Serra, 1998).

It is essential to have a global view of river and coastal phenomena related to human activity. Throughout the eighteenth and nineteenth centuries, with the improved climate, much land in the Tordera River basin was broken. The soils without plant protection eroded and were carried downriver in the streams and creeks to the mouth. Once these sediments reached the sea, they were stirred up by the sea tides and currents, creating ever wider beaches. Later, the wind carried away the sand grains to create the dune line. This phenomenon of the formation of new medium-sized dunes has also been observed in other nearby river mouths, such as the Ter and Llobregat Rivers (Ferrer, 1995; Sans & Panareda, 2016; Paül & Panareda, 2018).

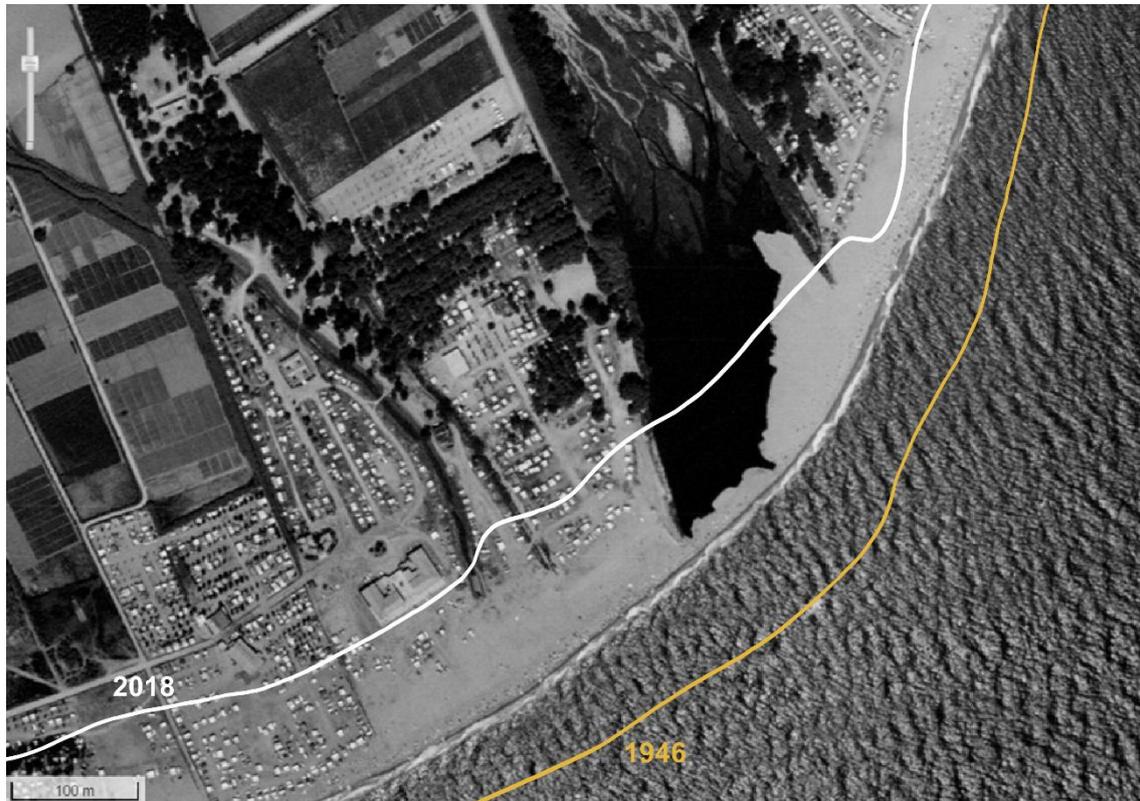
Figure 7. Photographs of the same place, S'Abanell beach, in August 2006 and January 2016



It shows one of the current processes which is causing the most conflicts: the retreat of the coastline with the overall narrowing of the beach and the disappearance of some stretches where a breakwater has had to be built.

Source: Author

Figure 8. Aerial photograph of the mouth of the Tordera River in 1986, when tourist occupancy (campsites) was high



The yellow line shows the coastline in 1946, and the white one shows it in 2018. Note the strip of campsites in 1986 which had been engulfed by the sea by 2018.

Source: Image from the Institut Cartogràfic i Geològic de Catalunya. The coastlines were marked by the author based on a numerous aerial photographs.

The presence of recently formed and more dynamic dunes worried the farmers, who watched as their fields, irrigation channels and paths were being invaded by the movable mass of sand. Starting in the nineteenth century, projects were undertaken to secure the dunes by repopulating them with pine trees. The toponymy printed on maps reveals these historical changes: sand bed or dune, pine grove or campsite, depending on the date when the maps were published.

Throughout the twentieth century, many crop fields in the Tordera River basin were abandoned, so that by the end of the century there were very few cultivated plots on the banks. One of the consequences of regenerating the plant cover is soil protection and a drastic reduction in the amount of sediment heading out to sea, which has prompted a change in the coastal dynamic. During episodes of storms at sea, the waves break the regularity of the beaches and carry part of the sand out to sea, as always. Before, that erosion was later offset during the long periods of calm weather; the regular tides and calm sea currents recomposed the beaches and the coastline with the recovered sediments and new ones transported by the river.

However, today little sediment is available to naturally remake the beach landscape (Sagristà et al., 2017). In each storm at sea, the sandy part of the

beaches becomes narrower and the coastline further encroaches on the buildings, roads, crop fields and campsites. There are no satisfactory solutions, not even artificially adding sand, building a seafront promenade, installing a breakwater with large stone blocks or building a cement wall. Conflict arises when the erosion of the coastline approaches the fence of the campsites and the wall of an apartment building, or when it breaks off part of the seafront promenade and carries it away (Figures 7 and 8).

The sediments brought by the Tordera River led to an advance of the beach in the nineteenth and early twentieth centuries. Now the river doesn't carry enough sediment to offset the sea erosion, and the outcome is a progressive retreat. The process has been inverted.

6. Discussion and conclusions

The Tordera River delta is the home to landscapes in constant flux because of both natural dynamics and human intervention. The main conflicts stem from control over the water and the new occupations of the space.

Of the three landscape dynamics that affect periurban spaces according to Paül (2006, 2010) and Paül and Haslam McKenzie (2013) discussed at the beginning of this article, the last two coexist in the Tordera River delta. On the one hand, market garden farming has intensified alongside a drastic reduction in the cultivation of grains and vineyards. On the other, the installation of highly technical greenhouses makes this highly profitable. All of these factors have been enhanced by a local market that values Km-zero produce. Farm activity is guaranteed in the short and middle term because of this profitability, and because it is an identity factor. Agriculture creates a landscape that is highly prized by both the local population and visitors as a green environment. However, tourist activities are a fierce competitor with the farm landscape, which are also on the rise because of the climate, the beaches, the infrastructures and the proximity to the conurbation of Barcelona. The competition today particularly comes from the constant expansion of campsites, driven not only by their low installation and maintenance costs—especially compared to the initial and ongoing outlays needed with a hotel—but also by the current economic crisis. Campsites occupy a considerable amount of space and are clearly in competition with the market gardens. Scaling down the gardens, especially those that do not use greenhouses, would devalue the landscape, because they are also one of its attractions along with the beaches, leading to the installation of the campsites.

All of this is coupled with the more pressing need for space to meet the expansive demands of the towns and urbanisations, industries and retail and logistics services, as well as the demand for new roadway infrastructures and new services in general. It is important to recall that the delta area is limited and that the consolidation of urban growth is leaving less and less space available to develop for other uses and activities.

The long, wide beaches have been sites of keen social and economic interest. The coastal sector across from Blanes is a bay that has been used to anchor vessels to protect them from sea surges or to repair them or build new ones, as well as to load and unload goods. During the first half of the twentieth and the early twenty-first centuries, the beaches have been shared by fishers and tourists.

Once naval activity disappeared and fishing was concentrated in the port, the beaches in both Blanes and Malgrat de Mar became the main tourist attraction. However, in the late twentieth century, as noted above, the consequences of the decrease in sediments carried by the Tordera River suddenly became noticeable. Sea surges sweep away many sectors of the beach, and some stretches of the beachside promenades have crumbled and collapsed. This more visible image of the change is endangering the future of the campsites. The institutions' response is to once again consolidate the seafront promenade and restore a minimum strip of beach by bringing in sand from the outside. However, this is difficult on some stretches of the coastline, and breakwaters made of large stone blocks have to be built to halt the coastline's retreat. Yet these actions are only temporary solutions because the next storms once again carry away the sand on the beaches and continue to undermine the seafront promenade and other protections. Eventually, even the breakwaters will be rendered useless by the sea surges.

The overall result is a mosaic landscape in constant flux—in terms of both human interests and natural conditions—which is not easy for part of the population and those who economically and politically control the territory to accept. Striking the balance of sustainable use that is acceptable to the majority of the social actors is no easy task, yet it is essential in order to continue making use of the natural resources—water, soil and landscape—that underlie the economic activities.

The Tordera River delta is a peculiar periurban landscape. The farmland is extensive enough to be the predominant feature of the visual landscape, even though farming employs few workers and that number is constantly diminishing. The industrial and logistics activity, in contrast, employs a high percentage of the active population. Tertiary activities, especially tourism-related services, have risen in recent years. Furthermore, much of the population works outside their towns, especially in the city of Barcelona and the area immediately around it.

While the recent changes and current uses of the Tordera River delta are comparable with those of the Besòs and Llobregat River deltas, the differences are considerable, especially in terms of size, distance from Barcelona and degree of urbanisation.

The current landscape of the Tordera River delta resembles that of the Llobregat River, despite all the differences in their areas and distances from the city of Barcelona. In both deltas, the landscape is a mosaic, but they show different trends in terms of types of use. The urbanised residential area is growing in both deltas. Industries have suffered and continue to suffer from dire crises; some have disappeared while others have been renovated, but new ones have not come to either delta. Infrastructures and metropolitan services play a very prominent role in the Llobregat River delta; however, only motorways and one railway line cross the Tordera River delta. The same holds true of commercial services, which are metropolitan, national and international in the Llobregat River delta but only local and regional in the Tordera River delta. Tourist activity has recently declined in the Llobregat River delta, stifled by urban expansion and the growth in commercial services and mobility, whereas it has risen in the Tordera River delta due to the beaches, the range of hotels and campsites available and the survival of the agrarian landscape. It should be borne in mind that Blanes is considered the start of the Costa Brava. Its agricultural space is

proportionally smaller than that of the Llobregat River delta, plus the threats reducing it are constant. Vegetable production is higher, more specialised and higher-tech in the Tordera River delta thanks to the installation of greenhouses; however, the future of agriculture is also uncertain there because of both the urban and industrial expansion and the new tourist demands, as well as the ageing of the rural population.

There is a constant defence of protecting the agricultural space. Examples can be found from Rubió i Tudurí to the current Tordera River Delta and Downstream Region Commission. However, the agrarian space can only be maintained as a strictly agricultural activity if its commercial prospects are guaranteed. The local demand for vegetables is sufficient to absorb all the yields, but suitable commercial channels have to be assured in light of constant competition with the large networks. Likewise, the core problem lies in the fragility of the agrarian structure, and in the agricultural activity itself, which is threatened not only by the decrease in available space because of the expansion of the campsites and the built area but also, as mentioned above, by the ageing of the farmers and the difficulties in replacing them.

The prime challenge facing the Tordera River delta is how to make natural resource use compatible with the maintenance and development of all the expanding activities in a small area with constraints placed by natural phenomena and clearly limited natural resources. Several studies, and the recent approval of the Tordera River Delta and Downstream Region Commission, reveal both the gravity of the situation and the awareness that this is a problem that requires a global response with the engagement of the institutions and the different stakeholder groups in order to find solutions. All of this shows that there are many good intentions, although the actions that seek to harmonise the different activities and diverse uses have not been satisfactory, nor have the interventions to prevent or at least mitigate the impacts of natural phenomena. Instead, they seem like the expression of a collective impotence before a natural and social reality that is beyond their grasp and a failure to accept that not everything is possible.

There is not enough water to meet the increasing demand, especially during episodes with little rain, a phenomenon that happens quite often. Stringent control over the aquifer and water quality is needed, and it is essential to be mindful that this is a renewable but limited resource. The risk that the Tordera River surges over the mounds and floods fields, campsites and urban spaces is high in the short term. The storms at sea will continue to sweep away beaches, campsites, constructions and crop fields, in addition to undermining the seafront promenades virtually every year, and often more than once a year. Dealing with the river and sea surges during a storm at sea is very difficult, so studies are needed to conduct preventive actions and determine how to act when they arise, if that is even possible. Some of the preventive actions include understanding that one of the most efficient ways to attenuate the effects of these extreme phenomena is by offering the space we have historically taken back to the Tordera and the sea, but this alternative will never achieve majority support, and it will be a poor remedy if it is solved with cement and stone walls or with breakwaters.

There is not enough space to maintain an agricultural space that creates a landscape if the towns and the industrial areas, warehouses, campsites and

hotels, not to mention the increasingly dense roadway network, are simultaneously expanding. There aren't enough water resources for everything, nor is there enough space to meet the added needs from the economic activities.

The major challenge is to accept the natural dynamic the way it is and to know how to place limits on consumption, space occupation and the economic and social activities there. Who should place these limits? Will any party agree to give something up?

Therefore, we have to admit that the conflicts will be ongoing. The key is whether society and the people in charge are capable of managing these inevitable conflicts. For the time being, it seems that they are not, especially because it is difficult to accept the stubborn reality, namely that the space is what it is, that it is tending to decrease and that a range of natural phenomena will continue to cause disturbances that will hinder the use and occupation of the territory.

Bibliography

ALMERA, J. (1913). *Mapa geológico y topográfico de la provincia de Barcelona: Región cuarta ó del río Tordera detallada*. Scale 1:40,000. [There are also editions from 1914 and 1915].

BACA, J. (2013). "L'aigua a Blanes, apunts sobre mines, fonts, pous, rieres, recs i l'abastament municipal", in *Blanda*, 16, pp. 10-19.

BRYANT, C.R., JOHNSTON, T.R. (1992). *Agriculture in the City's Countryside*. London: Pinter Press; Toronto: University of Toronto Press.

FARGUELL, J. (2019). "La conca de la Tordera, el 2008: Un any excepcional", in *Aulet*, 18, pp. 40-47.

FERRER, J. (1895). *Proyecto de fijación y repoblación de las dunas procedentes del golfo de Rosas*. Madrid: Imprenta de Ricardo Rojas.

GALLEN, N., ANDERSSON, J. (2007). "Representing England's Rural-Urban Fringe", in *Landscape Research*, 32(1), pp. 1-21.

GANT, R.L., ROBINSON, G., FAZAL, S. (2011). "Land-Use Change in the 'Edgelands': Policies and Pressures in London's Rural-Urban Fringe", in *Land Use Policy*, 28, pp. 266-279.

LLOBET, S. (1955). "De geografia agraria de la comarca del Maresme (Barcelona)", in *Estudios Geográficos*, 58, pp. 23-71, 59 and 215-297.

MEEUS, J.H.A. (1995). "Pan-European Landscapes", in *Landscape and Urban Planning*, 31, pp. 57-79.

MEEUS, J.H.A., WIJERMANS, M.P., VROOM, M.J. (1990). "Agricultural Landscapes in Europe and Their Transformation", in *Landscape and Urban Planning*, 18, pp. 289-352.

PANAREDA, J.M. (2008). *L'evolució del paisatge mediterrani de ribera*. Barcelona: Institut d'Estudis Catalans.

– (2018). "El paisatge de la Baixa Tordera", in *Aulet*, 17, pp. 20-35.

PANAREDA, J.M., BOCCIO, M. (2018). "Land Use Change and Conflicts in the Tordera Delta, a Peri-Urban Area on the Edge of Metropolitan Barcelona", in PAÜL, V., LOIS, R.C., TRILLO, J.M., HASLAM MCKENZIE, F. (eds.). *Infinite Rural Systems in a Finite Planet: Bridging Gaps towards Sustainability* (pp. 511-620). Santiago de Compostela: Universidade de Santiago de Compostela.

PARCERISAS, L.; MARULL, J., PINO, J., TELLO, E., COLL, F., BASNOU, C. (2012). "Land use changes, landscape ecology and their socioeconomic driving forces in the Spanish Mediterranean coast (El Maresme County, 1850-2005)", in *Environmental Science & Policy*, 23, pp. 120-132.

PAÜL, V. (2006). *L'ordenació dels espais agraris metropolitans: Plans, gestió i conflictes territorials a la regió de Barcelona*. Barcelona: Universitat de Barcelona. Unpublished doctoral thesis.

– (2010). "El cambio de los usos agrarios del suelo en el actual ámbito metropolitano de Barcelona (del siglo XVIII a la actualidad)", in *Investigaciones Geográficas*, 53, pp. 145-188.

PAÜL, V., HASLAM MCKENZIE, F. (2013). "Peri-urban farmland conservation and development of alternative food networks: Insights from a case-study area in metropolitan Barcelona (Catalonia, Spain)", in *Land Use Policy*, 30(1), pp. 94-105.

PAÜL, V., PANAREDA, J.M. (2018). "Humedales, dunas y huertas a las puertas de Barcelona: Claves paisajísticas y patrimoniales de los espacios abiertos del Delta del Llobregat", in MOLINERO, F., TORT, J. (eds.). *Paisajes patrimoniales de España: Valor y significado del patrimonio territorial español* (pp. 1114-1135). Madrid: Ministerio de Agricultura, Pesca y Alimentación; Ministerio para la Transición Ecológica; Universidad Autónoma de Madrid, III.

RIBA, O. (1995). "Qüestions obertes sobre la geomorfologia, la hidrologia i la sedimentologia de les rieres del Maresme i del Barcelonès amb exemples de la Riera d'Arenys", in AMAT, J., CASASSAS, E. (eds.). *Trenta-dos aspectes de ciència i tecnologia* (pp. 281-316). Barcelona: Institut d'Estudis Catalans.

RUBIÓ, N. (1932). *El pla de distribució en zones del territori català (Regional Planning)*. Barcelona: Generalitat de Catalunya.

SAGRISTÀ, E., AGELL, G., SARDÀ, R., REYES, T., ROGER, A., ROURA, J. (2017). *La platja de Blanes i el Delta de la Tordera: Passat, present i futur*. Blanes: Centre d'Estudis Avançats de Blanes-CSIC; Arxiu Municipal de Blanes.

SANS, J., PANAREDA, J.M. (2016). *Els espais de l'aigua al delta del Llobregat*. Barcelona: Institut d'Estudis Catalans.

SERRA, I. (1998). "La problemàtica derivada dels temporals marítims a la vila de Blanes", in *Blanda*, 1, pp. 59-74.

– (2001). "L'evolució del paisatge blanenc en el període 1861-1998", in *Blanda*, 4, pp. 75-91.

SERRA, I., PINTÓ-FUSALBA, J. (2005). “La transformació del paisatge del delta de la Tordera en els darrers cinquanta anys: Una anàlisi per mitjà dels canvis en els usos i les cobertes del sòl”, in *Documents d'Anàlisi Geogràfica*, 46, pp. 81-104.

STANNERS, D., BOURDEAU, P. (eds.) (1995). *Europe's Environment: The Dobříš Assessment*. Copenhagen: European Environment Agency.

VALDUNCIEL, J. (2005). “Blanes i la Baixa Tordera: El procés històric de construcció del territory”, in *Blanda*, 8, pp. 98-111.

VÁZQUEZ, M., VERDAGUER, C. (2010). *El espacio agrícola entre la ciudad y el campo*. Madrid: Universidad Politécnica de Madrid.

