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Coastal Views: A Key Component of Riviera Coastal Systems A Case Study from the French Riviera

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Abstract

Among famous seaside resort areas, riviervas are complex coastal systems where, more than in any other coastal region, coastal views have an economic value and can be considered as a heritage. Resulting from the combination of an indented coastline, an amphitheatre or balcony shaped topography and accessibility to viewpoints, coastal views are a major component of riviera systems. They are part of the riviera identity and they considerably influence territorial developments. Taking the French Riviera – part of the Côte d’Azur stretching from Nice to Menton - as a case study, we will illustrate panoramic views’ importance through road developments. Viewshed analysis achieved with GIS gives indeed clear evidence of how coastal views from roads have been valorized by sightseeing. The issue of view management in coastal areas should be discussed. Natural as well as man-made heritage, coastal views are affected by land use change. Using systems analysis, we will try to identify threats and preservation strategies related to them.

1. COASTAL VIEWS IN THE RIVIERA COASTAL SYSTEM

As anyone can admit, beautiful panoramas are an asset for tourism, particularly where topography creates sightseeing facilities. In this respect, unlike other seaside resort areas, riviervas have very much to do with coastal views. Wide sceneries are specific to these coastal systems : they participate in their fame, they considerably influence their land-use management and they are part of the heritage. Nevertheless, something must be said about these complex coastal regions, as many coasts known as “riviervas” do not comply with the riviera coastal system.

1.1 What is a Riviera?

“Riviera” is a rather confusing name. Borrowed from Italian, it has been adopted in English to refer to the Mediterranean areas where the very first seaside resorts of modern tourism appeared: the South Eastern coast of France and the North Western coast of Italy. Later on, it has been generalized to describe various coastal areas popular with tourists in the world (the Mexican riviera of Cancun, the Cornish Riviera in England, ...), including in Italy (*Riviera di Rimini*). To some extent, it is also related to urbanised coastal regions where tourism is key. But, a tourism-oriented economy is not a clear indicator of what a riviera is, as many seaside resort areas in the world are not named like this.

In Liguria, where the term “riviera” originally comes from, riviera refers to a specific coastal system based on a mountain / sea interface, more than a tourism-oriented coastal area. This is the base of our riviera coastal system definition. Therefore, Rimini on the Adriatic coast of Italy is not a “riviera” as in the Ligurian sense and neither

is the coast of Brighton in South England. But the Amalfitan coast (South East of Naples) as well as the Costa Brava (North East of Spain) might be named riviervas as they do resemble the riviera coastal system.

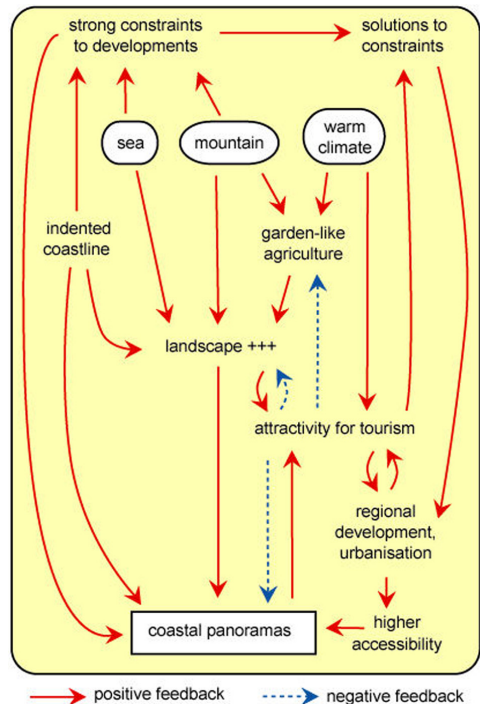


Figure 1: Basic Riviera Coastal System.

1.2 The Riviera Coastal System

Being a mountain / sea interface, the riviera coastal system is very much concerned with topographic issues (Figure 1). The physical environment (topography, climate, sea characteristics) can be considered as key :

- no plane areas but steep slopes, space scarcity, natural hazards and risks, low accessibility,
- warm climate, climatic shelter provided by mountains, slopes well exposed to sunlight.

This shelter has been developed by agriculture (flowers, citrus fruits, *etc.*), rarely by industry (Genova and Savona, two industrial harbours in Liguria, are exceptions) and of course by tourism (Vallega, 1991). Nevertheless, until quite recently (19th century), most of these coasts remained poor regions because they were hard to develop and isolated (due to a bad transportation network).

From the end of the 18th century onward, with the beginning of the “winter season”, nice climate, beautiful landscapes and sceneries have made many of these primarily repellent coasts very attractive to tourists. Some rivieras became very popular and started to change. Strong territorial transformations occurred, mainly produced by tourism. Nowadays, for many rivieras, this success also means urbanisation, traffic congestion, agriculture’s decline, landuse competition, the rise of real estate prices, and landscape degradation.

In terms of coastal area management, considering rivieras as specific coastal zones is a prerequisite as they are very different from other seaside resort areas. Land planning, landscape management and conservation can’t be conducted like in any other tourism-oriented coastal region. This is essentially due to the specific environmental conditions.

1.3 Riviera and Coastal Views

Where tourism has emerged and later on prospered, landscapes and panoramas are a key issue. Along with the climate, early settlers and tourists looked for exotic and beautiful sceneries. They enjoyed evergreen and colourful vegetation, blue skies and coastal views. Many of the first “villas” and “Grand Hotels” were installed far from the sea but had privileged panoramas onto the coast, as one can still see today from the *Chateau de l’Anglais* in Nice, the *Villa Maria Serena* in Menton, *Hanbury Villa and Gardens* in Ventimiglia or the “*Swallow’s Nest*” near Yalta in Crimea, Ukraine (Figure 2).



Figure 2: A 1925 Poster of the of the South Eastern Coast of France by PLM (Paris Lyon Méditerranée Railways).



Figure 3: A 1935 Poster of Roquebrune Cap Martin by PLM.

During the 20th century, with the rise of the automobile, road developments have been made in order to make sightseeing easier on the coast. In South Eastern France, the three “corniches” linking Nice with the Italian border via Monaco are the best example (Figure 3). They have “opened” the scenery to everybody and have confirmed coastal views as one of the symbols of the riviera, a key element of this coastal system. Other roads of this kind can be found around Yalta in Crimea or Amalfi in Italy. Nowadays, panoramas have gained an economic value which is still an asset for these coastal areas but also a threat. Real estate prices have reached incredible levels, depriving local people of buying property. New building programs, using more innovative techniques, tend to spread urbanisation on slopes and along roads, modifying land use and landscapes and making travellers deprived of coastal views, originally available from these roads.

Though some specific policies have been defined to protect some of these coasts from urbanisation and speculation (land acquisitions by the *Conservatoire du Littoral* in France, convention for the protection of the *Costiera amalfitana* as a World Heritage by UNESCO, etc.), most of the rivieras are endangered. In spite of the increased awareness of this environmental issue, there is a real need to consider coastal views as a major concern in the realm of coastal area management.

2. VIEWSHED ANALYSIS ON THE FRENCH RIVIERA

In order to highlight the importance of panoramic views in riviera coastal regions, an analysis has been conducted to assess viewsheds available from roads on the French Riviera. Based on Geographical Information Systems (GIS) capabilities and a multi-temporal geographical database, covering the coast from Nice to the Italian border, the analysis aims to show how panoramic views can be used into an appropriate integrated coastal area management.

2.1 Area of Study

As many studies from historians have shown, Nice remained very poorly connected to other provinces of France and Italy until the 19th century. The development of the “winter season” urged the connection of the region to surrounding provinces by road as well as by rail (trains first reached Nice in 1864). In the second half of the century, various roads were constructed to improve the accessibility to new resorts (Beaulieu, Monte-Carlo, etc.) but also to offer new ways to discover the coast (Boyer, 2002). Built on steep slopes, with tunnels and viaducts, made of rare straight sections but many curves, these roads brought the panoramic dimension of the French Riviera to visitors. They were indeed designed to offer the best views on the coast, rather than to shorten the journey from Nice to the border (Figure 4).

To a large extent, these roads have contributed to the French Riviera identity. They offer delightful views on the slopes dominating the coast and the sea. This should be considered in integrated coastal zone management policies. Viewshed analysis can help on this matter.

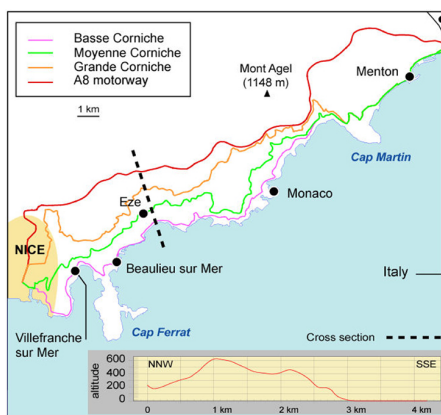


Figure 4: Area of Study.

2.2 Methodology

The principles are quite simple. Using GIS capabilities and appropriate data files, we can calculate areas which are seen from our roads of interest. In a unique geodetic system, it is required to get three elements: 1) a digital elevation model (DEM) to represent topography, 2) a road network file to represent the selected roads and 3) a landuse file to get the information on the landuse of the area viewed. Our GIS relies on the MapInfo[®] and Vertical Mapper[®] softwares. For each road, the analysis is made as follows (Figure 5) :

- the road (polyline) is converted into a series of n viewpoints (dots), separated by less than 250 m
- for each dot i , we know the geographical location and the altitude from the DEM
- a viewshed analysis is calculated dot by dot with selected parameters : viewshed radius = 5 km, i height = 1 m
- the output is a raster file where, according to their altitude, pixels are declared : “out of reach” (value = null), “viewed” (value = 1) or “hidden” (value = 0) from i
- to get the viewshed of the road, the n viewsheds are merged. The output is a raster file where the higher the pixel value, the more often it is viewed from the road.

The data used in this work comes from a dataset described in a previous paper (Robert, 2003) and called “GIS French Riviera”. This is a multi-temporal database designed to analyse territorial and coastal changes in this famous region, where tourism is a powerful vector of change and topography an asset as well as a constraint. Here, the database has been used to perform viewshed analysis from the three roads connecting Nice to the Italian border and from the motorway.

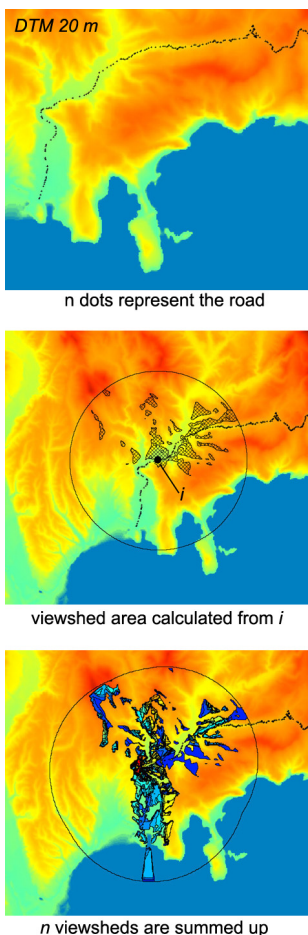


Figure 5: Viewshed Calculation Process.

Once viewshed files are obtained, they can be compared to each other to answer the following questions : What is the road providing the widest view over the sea ? What are the places seen most often ? What is the landcover in the viewshed area?

2.3 Data Accuracy and Sources

Such an analysis depends a lot on the data used to run calculations. Here, DEM resolution and road file accuracy are critical.

Regarding the DEM, it has been made from the French *Institut Géographique National* Bd-*Alti* ® database (planimetric accuracy : 50 m, altimetric accuracy : 20 m). Its resolution is 20 m. It is suitable for middle scale analysis, that is around 1 : 50 000. The road network file comes from the *Bd-Carto* ®, produced by the same institute. It complies with analyses ranging from scale 1 : 50 000 to scale 1 : 250 000. Since terrain data is supposed to be more accurate, the road features

file has been checked using a 50 cm orthoimage from *IGN Bd-Ortho* ®.

Concerning the landuse data, it partly comes from the *Corine Landcover* database and from our own digitization based on orthoimages. Whatever the file, scale compliance is satisfied.

3. RESULTS AND DISCUSSION

The results are maps of the areas viewed from the roads. They can be converted into statistics for quantification and comparisons. Some of these maps are quite interesting for they give clear figures. Nevertheless, data quality is to be discussed.

3.1 Uneven Coastal Views

The very first interesting results are viewshed areas. Given the selected parameters (5 km radius, viewpoint height : 1 m, road considered as a series of viewpoints every 250 m), the three corniches and the motorway do not offer the same area to look at. Because of topography and road location, looking far away is sometimes possible and sometimes it is not.

Table 1: Viewshed Characteristics.

<i>from</i>	Total area (sq. Km)	Sea area (sq. Km)	Exposure Index
Grande Corniche	194	103	144
Moyenne Corniche	199	128	174
Basse Corniche	213	148	102
A8 motorway	159	57	107

As shown in Table 1, the widest view is given by the *Basse Corniche*, the one which is at the lowest altitude. From *Nice* to the *Italian border*, the area which can be seen within a 5 km radius is 213 sq km. The two other panoramic roads offer a little less to look at, but much more than the motorway.

Considering the marine area which is seen from these roads, differences are higher. Statistics indicate that the *Basse Corniche* is the best road to observe the sea, as the water surface accounts for almost 70 % of the total viewshed. From the *Grande Corniche* (53 %) and *A8* (36 %), the sea remains less visible. Using maps, we can observe another difference: viewsheds are not composed with the same coastal areas (Figure 6).

Maps from Figure 6 give two levels of information : 1) the geographical location of the areas contributing the most to panoramas from the roads and 2) how often a place is seen from the roads, i.e. the exposure index. It appears clearly that

unlike the three corniches, the motorway is not an appropriate route to observe the coast, except for its Eastern part. As for the corniches, they all have their geographical particularity. The area most viewed from the Grande Corniche is the Eastern part of the coastal zone, particularly the sea facing Cap Martin and Menton. Regarding the Moyenne Corniche, the area most seen is the coastal zone of Monaco. Finally, from the Basse Corniche, the best viewed area is the sea facing Beaulieu sur Mer and Eze, in the Western part of the area of study.

These results can be helpful to identify sensitive areas. They show the sites and places that contribute to the sceneries appreciated by visitors. As a matter of fact, they should be integrated in land planning policies since they locate terrains and landscape having a true cultural and economic value.

3.2 Data Accuracy and Viewshed Relevance

As suggested earlier, results rely on data quality, particularly on DEM data. As for panoramas, visual obstacles can be diverse and of various sizes. Mountains, but also trees, buildings or houses can prevent travellers from having a nice view to look at, even from the famous corniches. This obviously means that our results cannot be used at every scale.

In order to further explore viewshed usefulness, a trial has been made with a more detailed and accurate elevation data file. Because of a very long calculation time, the original dataset (1 m resolution, 1 m XY accuracy, 1 m Z accuracy, provided by Istar®) has been downsampled at 5 m resolution and the test has been conducted on a smaller area. The Western part of our area of study (from Nice to Beaulieu sur Mer) has been selected and viewsheds have been calculated from the Basse Corniche only. The comparison between the 5 m DEM based viewshed and the 20 m DEM based viewshed is spectacular (Figure 7). The area that can be looked at is much smaller. Buildings and vegetation are true obstacles, particularly in the western part of the image where the road enters the city of Nice. Surrounded by multistorey buildings, the Basse Corniche can't offer more than glances on the sea. This output reveals how far buildings which align the road can affect coastal views. In terms of urban planning, viewshed analysis can therefore be of great help, particularly on the French Riviera where a site beauty has an economic value. It can be used by local authorities - stressed by real estate companies, in search for terrains - to find ways to both preserve sites and satisfy the demand for new constructions.

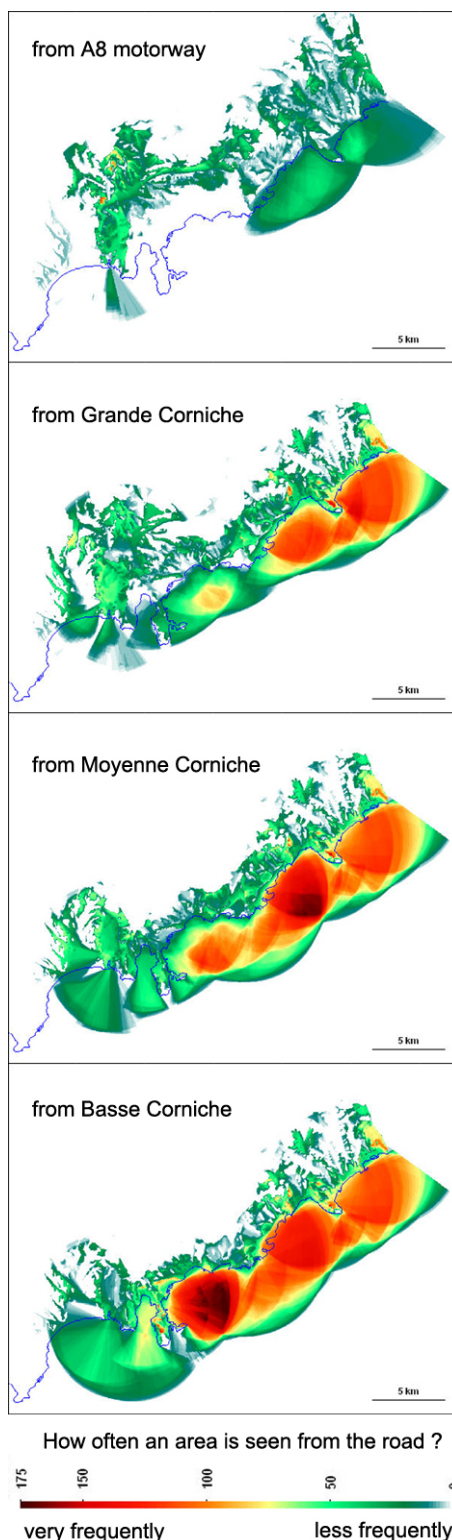
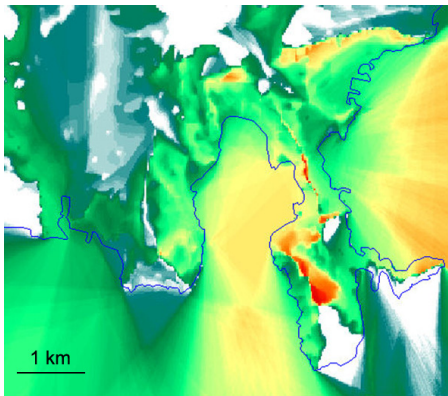
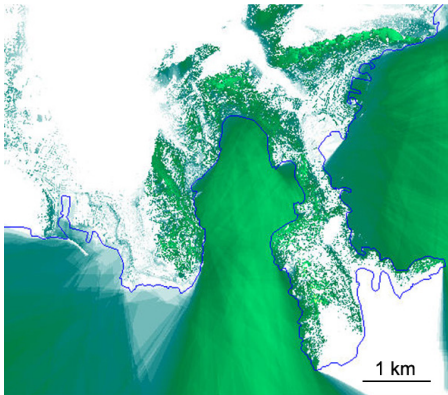


Figure 6: Viewshed Areas.



Viewshed calculated from a 20 m DEM



Viewshed calculated from a 5 m DEM

Figure 7: Area Seen from the Basse Corniche, (color scale same as in Figure 6).

Managing urban and regional development along with coastal views conservation is hard to set up. But this is a true challenge for riviéras. Popular with tourists, especially with high class tourists, these coastal areas rely a lot on their beautiful landscape. But as Figure 1 shows, too much urbanisation can affect coastal panoramas by land-use change and finally threaten global development. This is particularly true in the Mediterranean zone where coastal areas still remain attractive and tend to propel their dynamism into their hinterland (Voiron-Canicio, 1999). As for riviéras, this is not without causing serious damages to landscape quality along with an increase in natural hazards.

4. CONCLUSIONS

Riviéras are fragile coastal zones. Though the name is quite confusing, this paper intends to say

more about these coastal systems based on a mountain / sea interface.

Very famous throughout the world, riviéras coastal systems are endangered because of too much success with tourism, in particular through the strong residential economy. Coastal views, which are a key component of these coasts, should be studied and protected. Using viewshed analysis, we show how urban and regional planning could integrate this heritage into a true integrated coastal zone management policy. Conservation does not mean necessarily building prohibition. Various recent projects concerning coastal planning try to take this into consideration (Gaggero; Ghersi, 2002) ; that may be a good sign for riviéras.

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