Coastal Management Activities in Valdevaqueros Dune Area (Tarifa, SW Spain)

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ABSTRACT

Valdevaqueros dune area is located in the SW of Spain (Tarifa, Cádiz) and represents an important recreational zone. However, after Spanish Shore Act approbation in 1988, sand extractions were prohibited and the system began to loose stability producing the dune invasion landwards.
The main objective of this paper is to present an integrated study of alternatives for Valdevaqueros dune area, considering all the problems involved: dune degradation, invasion of Punta Paloma road by the mobile dune, excessive recreational pressure on the dune area and adjacent lagoon, parking lots resettlements, and undesirable land uses in the surroundings, among the most important problems found in that area. In particular, a cost-benefit analysis for different alternatives was carried out regarding the road-dune interaction.

KEY WORDS: Dune management; beach and land uses, restoration works; alternative activities; Valdevaqueros; Spain.

INTRODUCTION and STUDY AREA

Sand dunes are important ecosystems linked to beach development as they help to reach equilibrium conditions. When present and if sufficiently large, foredunes can provide protection from coastal flooding, shoreline erosion, and wave damage. Stabilization is also necessary to control the landward movement of wind-blown sand into developed areas (CEM, 2002). However, when sand dunes are not stabilized, they usually provoke ecological problems that origin nuisances that must be controlled. In Spain, many causes of dune degradation have been analyzed by Gómez-Pina (1999) and Gómez-Pina et al (2000).

The littoral of SW Spain is characterized by being generally rectilinear, with a dominant swell in the SW-NE direction. Tidal conditions respond to a meso-microtidal environment. Predominant winds come from the W, which are often associated to cold fronts; despite East winds are usually stronger. In this environment, many dune systems have been developed along the coast, although the special wind conditions together with other pressures make difficult a suitable management. Dune ecosystem problems in Cadiz have been studied by Ramírez and Ley (1998), Muñoz-Perez et al (2001) and Román-Sierra et al (2004) with especial incidence in the mobile dunes of Valdevaqueros and Bolonia (Tarifa Co).

Valdevaqueros dune is located in Tarifa (36ºN 5ºW) and is a good example of a free mobile dune (Fig. 1).

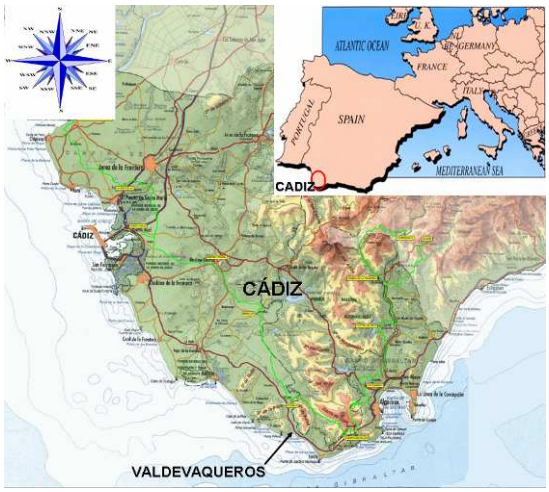

Fig 1. Location of Valdevaqueros dune, Cadiz, Spain.

Valdevaqueros dune represents a singular coastal geomorphologic formation, being extraordinary natural scenery and a sand reserve for beach equilibrium.
On the other hand it is noteworthy to denote the beach and laggon values, as they constitute unique and natural beach sceneries. Valdevaqueros beach has got good water and sand quality for beach users, as it represents a paradise for flying surfing activities all over the year. Moreover, this area is located very close to other similar spots, as Bolonia or Tarifa beaches.

Nevertheless, the actual unstabilized situation of Valdevaqueros dune represents a problem for the closer population and the military headquarters. Since the prohibition of sand extractions in 1988, the dune has

increased enormously its advance towards the only road to Punta Paloma. A view of Valdevaqueros area can be seen in Fig. 2.

Fig 2. Aerial view of Valdevaqueros cave.

The 1988 Spanish Shore Act ("Ley de Costas") arose with the aim of regulating the coastal activities and preventing littoral destruction, as before 1988, Spanish coastal dunes were totally unprotected. The Spanish Shore Act protects all coastal dunes, effectively banning sand-mining, development on the public domain, and also changes in land uses. However, this law alone does not prevent some other negative activities from occurring. Furthermore, the complexity of existing boundaries of the different authorities involved in coastal zone management policy makes integrated dune management a difficult task.

The special characteristics of Valdevaqueros dunes together with their natural and scenic values confer to Valdevaqueros cove a great attraction. The frequent local Levante wind regimes give rise to high wind speeds of up to 100 km/h (Gómez Pina et al, 2002) and represent a paradise for flying-surfers. The high longitudinal aeolian transport is responsible for building up a huge mobile dune at the northern beach side. Wind conditions together with the direct burden caused by dune visitors make it difficult to establish permanent vegetation on the dune. As a result, the dune becomes unstable, showing a continuous massive movement towards an adjacent pine grove and the local Punta Paloma road (Figs. 3 and 4). Before 1988, when dune sand mining was a profitable business, the mobility of Valdevaqueros dunes was relatively well controlled and the adjacent local road rarely was blocked by the mobile dunes. However, the frequency and high velocities of Levante winds make it very difficult and costly to maintain the adjacent local road cleared.

Fig 3. Occupation of Punta Paloma road by Valdevaqueros mobile dune.

Fig 4. Perspective of the dune covering the pine grove.

Some of the beach and land uses are an added problem to the dune situation, due to anthropic behaviour. Kite and windsurfing represent a high recreational pressure for the area due to the lack of adequate regulation for these activities. Other uses, as the existence of inadequate parking lots and off-road vans that spend all their holidays at the zone, as well as campings, “chiringuitos” (refreshment stands), a pig farm, etc., make more difficult a satisfactory management of the area.

Although several restoration works have been carried out by the Coastal Department in the last years, the special wind conditions that affect the dune do not facilitate the control of its mobility.

Dune restoration works started with the reshaping of the dune profile in order to obtain a better aerodynamic stability complimented with the experimental use of wooden fences to decrease erosive surface patterns. Also experimental transplanted vegetation techniques

(*Ammophila arenaria* sowing) were used along certain potentially stable areas.

These experimental dune activities have been carried several times in order to lessen the frequency of the occupation of the local Punta Paloma road by the mobile dunes, still an unsolved "problem". Controlled sand bypassing operations with the remaining sand have been used beneficially to nourish some beaches in Tarifa County.

In fact, in 1990 sand by-passings were performed and willow fences were settled on the dune. Later on, sand extractions and by-passings continued to be necessary to decrease the dune advance towards the pine grove. Nowadays, some wooden fences have been settled on several points of the dune to help dune fixation, although it seems not to be the final solution to the dune invasion problem.

METHODOLOGY

The Coastal Department, after having analyzed the problem that the dune unstopping advance represents for Mas Palomas inhabitants, has proposed three alternatives.

Alternative I consists of changing the level at the affected zone of the existent road (Fig. 5). The works would be performed along approximately 500 m and the road would be elevated about 8 m. This fact would decrease the dune advance capacity and sand extractions would be easier to carry out in the future.

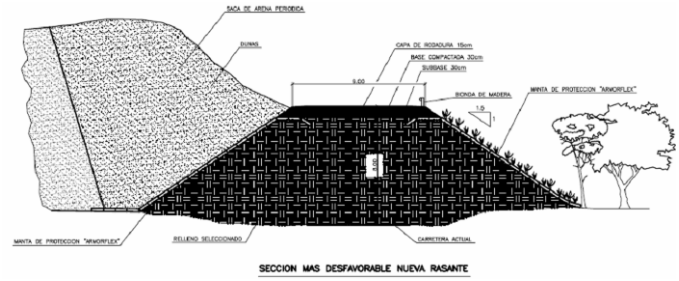

Fig 5. Aternative I. Elevation of the existing road.

Alternative II is based in the protection of the road by the creation of a false tunnel. The aim is to profit the high dune advance rate without the necessity of sand extractions. As a result, dune natural development would not be interrupted.

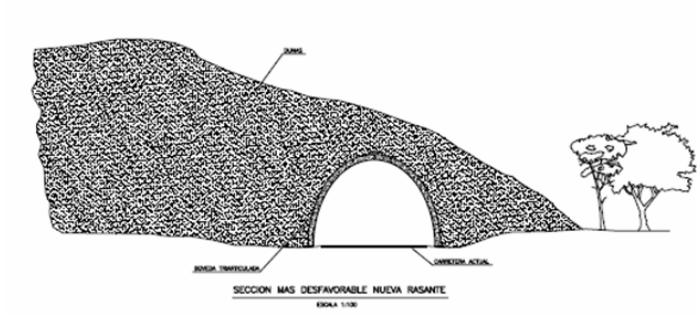

Fig 6. Alternative II. Creation of a false tunnel.

Alternative III consists in the reconstruction of the road affected by the dune. This actuation means to abandon the road and leave the dune develop without intervention. The new way would profit an existing military road to Punta Paloma (Fig. 7). The new distance covered would have a total length of 5,74 km, beside the 2,67 km of the actual road. In relation to the military road, it would be necessary to asphalt or repave.

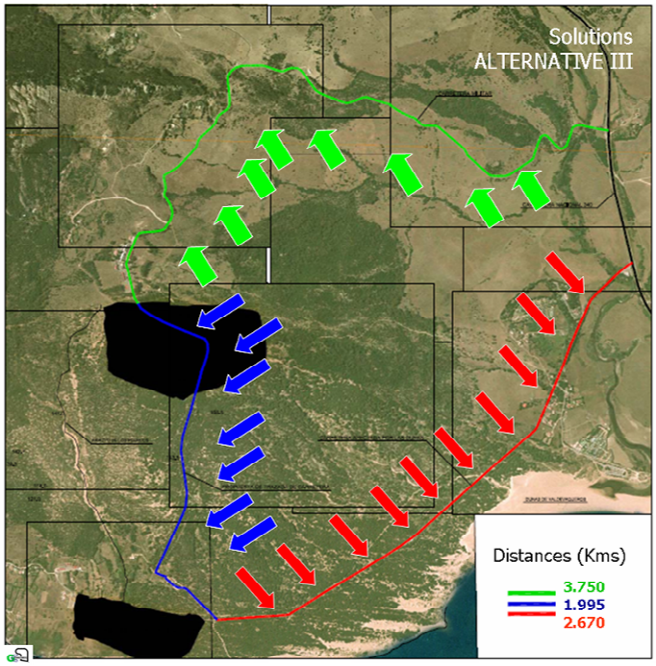

Fig 7. Alternative III. New road profiting an existing military path.

In order to absorb anthropic pressure at Valdevaqueros zone, other complementary solutions are proposed. Nowadays, the parking and its accesses seem to be insufficient for the high affluence of visitors to the area. When this occurs, cars are parked at the dunes zone, which contributes to the degradation of the area. Moreover, others activities derived from the existent pig farm produce toxic substances that pollute the river and create eutrofization problems in the laggon waters.

An improvement and rearrangement of these infrastructures by the construction of new parking pockets as well as new accesses to the beach are good options to take into account. These works would need the demolition of the actual parking and the expropriation of part of the camping and the adjacent pig farm.

Restoration of the degraded dune zone and creation of a new dune field of approximately 500 m^2 have also been foreseen.

RESULTS AND DISCUSSION

Once these alternatives have been described, a viability analysis of each one has been carried out, taking into account all the advantages and disadvantages for their application. It is important to consider that all these alternatives regarding road-dune interaction have been studied starting from the idea that road invasion by the dune represents a serious problem for the development of the area.

Alternative I (elevation of the road) would assure the road communication and would facilitate sand extractions and by-passings from the new road. On the other hand, the dune advance would not be completely stopped. As a result, this option would not allow the environment to reach an equilibrium situation. Execution budget by written contract is estimated for 4,6 million of Euros.

Alternative II (creation of a false tunnel) would permit the natural dune development without any technical actuation within a long- term period. However, the cost for this work is considered too high for such a low traffic density road (5,2 millions of Euros).

Alternative III (reconstruction of the road) seem to be the least costly alternative, with a technical budget of 3,3 millions of Euros. The new road would be longer, although it would be possible to take advantage of the existing militaty road. This option would preserve the natural dune environment and the problem would disappear. Despite that, Punta Paloma military headquarters seem to be opposed to the road use by civil population.

CONCLUSIONS

Once dune natural behaviour affects anthropic infrastructures, these interactions start being a problem. Besides several new actuations to improve the accessibility to Valdevaqueros beach, three alternatives have been analyzed to avoid Punta Paloma road to be covered by Valdevaqueros dune. In this case, the least costly alternative consists of designing a new road connecting Punta Paloma local road with the main road. In that way the mobiles dunes could have a more sustainable stabilization. Nevertheless, this alternative is still under consideration by Tarifa Town Hall and Punta Paloma military headquarters.

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