



Report on the **LIFE ENEBRO**
internet conference

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INTRODUCTION

At the beginning of the Pleistocene (1.8 million years ago) a sandbar formed that partially closed the old Gulf of Valencia, giving rise amongst other things to Valencia's Albufera lake. This sandbar came about as a result of sediments brought by the Turia and Júcar rivers, as well as the effect of the sea current which moves in a N-S direction and thus redistributed these sediments. Although this sandbar stretches from Valencia to Cullera (about 30 km), over the centuries most of it has been greatly affected due to the establishment and growth of urban developments (Pinedo, El Saler, El Perellonet, El Perelló,) and the conversion into agricultural land, originally to supply the aforementioned towns. The best conserved part of this sandbar, which is similar in appearance to the original one and is of great scenic and environmental value, is known as "la Devesa de l'Albufera" and is located between the towns of El Saler and Perellonet.

Until the 1960's, the Devesa de la Albufera had not suffered serious alterations in either qualitative or quantitative terms. Until then, the main operation that could have significantly altered the natural environment was the attempt to drain the low wetlands between the dunes that flooded during the wet season, which are known locally as "*malladas* or *mallaes*" (salt marshes). From the sea to the inner land, the following environments could be distinguished:

- Beach.
- The first ridge of dunes, or mobile ridge of dunes.
- The second ridge of dunes, or semi-mobile ridge of dunes.
- The third ridge of dunes, or fixed ridge of dunes.
- Malladas or salt marshes.

Much more recently, during the urban development boom of the 1960's and 1970's, a large part of the Devesa's territory was abruptly reduced in order to build the Golf Course, the Parador Nacional (Hotel) Luis Vives, a Camp Site, a Hippodrome, and a plan for urban development was carried out. All of this involved building roads, car parks, a seafront promenade, sanitation and service infrastructures, and housing in practically 100 % of the territory which was still in a good state of conservation.

This urban development plan's execution meant the destruction of most of the environments, as described here:

-The first ridge of dunes was completely cleared away and a seafront promenade was built in their place. This involved clearing away the dune mounds and filling in the lowland between the dunes.

-The second ridge of dunes was cleared away in order to leave a flat geographical outline, ready for urban development and to build roads and car parks. This action also involved knocking down the dune mounds and filling in the lowlands between them.

-The third ridge of dunes was the least directly altered, although the part nearest the sea was



cleared away to build roads and car parks. Over the years it has suffered indirectly by greatly receding due to marine abrasion (as a consequence of the clearing of the first and second ridges that acted as a natural screen against marine abrasion).

-The Salt Marshes, which had already suffered alterations as of the previous century due to their being considered as insalubrious areas, were practically 100 % filled in and repopulated with eucalyptus trees to avoid flooding.

To sum up, it can be said that this urban development plan cleared away the dunes and filled in almost all of the low-lying areas (abrasion calderas and “malladas” or salt marshes) between them with sand from the dune mounds to achieve a flat geographical profile ideal for urban development of the area.

The First And Second Ridges Of Dunes have now been regenerated thanks to Valencia City Council's continuous effort since the early 80's (when the urban development plan was halted) and the important contribution from the European Commission through its concession of two Life Naturaleza projects (Life 2000/Nat/E/7339 and Life 2004/Nat/ES/44).

In addition, the restoration of the First and Second Ridges of Dunes has meant that most of the salt marshes' geographical shape has been restored. This is because they have been dug out to rebuild the dune mounds with the sand that they were filled in with in the 1970's. It has also meant the restoration of the part of the Fixed Ridge of Dunes nearest the sea, as the “natural agents” that were causing it to recede have disappeared.

All of these activities have been carried out with the aim of recuperating scenic and environmental conditions similar to those that existed before the 70's, and to promote the need to regenerate the area among the citizens and the scientific community.

Within the context of these promotional activities, Valencia City Council held Internet Conferences on 15th, 16th and 17th April 2008, in which the regeneration of coastal dunes and recuperation of dune habitats in Valencia's Devesa of the Albufera were dealt with.



PRESENTATIONS

THE LIFE ENEBRO PROJECT

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This paper deals with the main damage caused to La Devesa de l'Albufera in Valencia during the 1970s, and the actions that have been taken by two Life Naturaleza Projects to restore its dune environments.

Between 2001 and 2008 Valencia City Council has executed these two Life Naturaleza Projects, 50% co-financed by the European Commission, and which has involved a total investment of more than 5 million euros. The first project or stage is called "Life Duna" and the second "Life Enebro".

The area of action of these projects is inside the Albufera Nature Reserve. There are four large environments inside the Reserve: the lake, the marsh, the forest and the shoal or sandbar. Both Life projects have been executed on a 55-hectare section of the sandbar.

The aim of both Projects has been the regeneration of the dune habitats of a section of La Devesa de l'Albufera in Valencia, as well as their dissemination among citizens and the scientific community. It must be highlighted that a specific objective of the Life Enebro Project is to re-establish an autonomous and natural population of marine juniper in the area.

The La Devesa coastline (Albufera Nature Reserve) comprises significant areas of dune systems, with temporary lagoons known locally as "malladas", which house priority habitats contemplated in the Habitats Directive and species as important as marine juniper (*Juniperus oxycedrus* subsp. *macrocarpa*), Spanish toothcarp (*Lebias iberica*) and Valencia toothcarp (*Valencia hispanica*). However, a large part of this area was seriously harmed as a result of a comprehensive property development project started in the 1960s.

Until the sixties the appearance of the La Devesa dune ecosystem was very different to how it is today. From the sea going inland, after the dry beach, there was a long line of mobile dunes reaching 10 metres high in some parts. After this first line, there was a second line of semi-fixed dunes comprising abrasion craters and dunes of almost 10m high. Finally, there were the fixed dunes populated with abundant vegetation, where the predominant tree stratum comprises Aleppo Pine (*Pinus halepensis*) and Stone Pine (*Pinus pinea*). The semi-fixed and fixed lines of dunes were dotted with a large network of lagoons that flooded during the wet season and dried out as summer progressed. This flooding is possible due to a 15-40cm thick layer of grey silt that makes it waterproof. These areas are known locally as "malladas".

However, this geomorphology was completely devastated during the execution of the Development Plan approved in 1965. During the 1970s the first line of dunes was destroyed to construct a promenade along the length of La Devesa, the line of semi-fixed dunes was flattened and the malladas were filled in order to divide the land into plots and build a large number of roads, car parks and a sewage network in order to construct buildings (from single-family properties to large apartment blocks). The sand used to fill in the malladas came from the destruction of the first and second line of dunes, thus achieving a flat terrain ready for developing and which would not flood. In some sections of La Devesa such as the area of action of this Project, nothing was actually built thanks to the great public pressure that stopped the comprehensive execution of the development project. However, a large network of roads and car parks, a promenade and an extensive sewage network were constructed. As the area was to be used to develop a residential area, which would need water, electricity and telephony services, "passes" were also installed under some road sections. These are concrete slabs of various sizes pierced with five holes of varying dimensions. The purpose of these structures is to allow cables and pipes to be laid down under the roads without having to break up the paving.

These actions caused a serious alteration to the distribution of the vegetation, as well as the typical fauna of these eco-systems as the natural barrier created by the dunes disappeared and flooding of the malladas was prevented.



As a result of these actions, different habitats in the area were greatly altered. Among them it is worth highlighting some included in Schedule I of the Habitats Directive:

- Coastal dunes with *Juniperus spp*
- Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*
- *Crucianellion maritimae* fixed beach dunes
- Dunes with *Euphorbia terracina*
- Dunes with Malcomietalia grasses
- Dunes with sclerophyllous scrubs
- Mediterranean salt meadows (*Juncetalia maritimi*)
- Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosae*)
- Halo-nitrophilous scrubs (Pegano-Salsoletea)

Although the development project ceased in the 1970s due to great public pressure, human presence in this fragile eco-system is still evident. On the one hand, a large part of the alterations to the terrain still remain (Infrastructure, alterations to the terrain, etc.) and on the other, as it is a recreation area near the city of Valencia it is visited by thousands of people every year.

The infrastructure constructed during the 1970s was not currently functional and also occupied a large part of the terrain. As well as having great impact on the landscape due to its rigidity, it constituted an artificial barrier that prevented the natural dynamics of the dune eco-systems and its location reduced the potential area of the priority habitat "Coastal Dunes with *Juniperus spp.*" (Schedule I of the Habitats Directive) in La Devesa de l'Albufera. The negative effect caused by the infrastructure to the environment was not naturally reversible in the short- to mid-term, as shown by the fact that currently no line of dunes or mallada has been regenerated without human intervention, and it was also a barrier to the geomorphological restoration of the area. For these reasons, since the beginning of the 1980s Valencia City Council has carried out numerous actions aimed at the regeneration of the area. These actions culminated in 2001-2004 with the execution of the Life Naturaleza Project "Restoration model of dune habitats in l'Albufera in Valencia" (Life 2000/Nat/E/7339), with Valencia City Council as the beneficiary and through which 13.5 hectares of dune eco-system was regenerated through the elimination of infrastructure and the regeneration of malladas and the first line of dunes. In this way, through this prior action, the terrain is now prepared for the geomorphological remodelling and, thus, the reconstruction of the second line of dunes.

The objective of the project "Restoration of coastal dunes with *Juniperus spp* en Valencia" (hereinafter Life Enebro), executed between 2004 and 2008, is the recovery of the priority habitat "Coastal dunes with *Juniperus spp*" of Schedule I of the Habitats Directive and of a large network of malladas in La Devesa of Albufera Nature Reserve that existed before the destruction of the area in the 1970s. Thus the aim, among others, is to establish an autonomous and natural population of *Juniperus oxycedrus* subsp. *macrocarpa* in the regenerated area.

To meet these objectives the following actions have been carried out:

- 1 Removal of the obsolete infrastructure (promenade, roads and car parks, sewage network, etc.)
- 2 Restoration of the line of semi-fixed dunes by reconstructing the dune hills and abrasion craters.
- 3 Recovery of a network of malladas allowing the settlement of hydro-halophilous vegetation and aquatic fauna typical of this environment.



- 4 Fixing and repopulation of the new modelled line of dunes.
- 5 Reinforcing the current population of marine juniper (*Juniperus oxycedrus* subsp. *macrocarpa*) by planting at least 1000 specimens.
- 6 An I.T. application "Predictive model" has been created for the repopulation tasks to decide which is the ideal vegetation for each regenerated area. This will increase survival and accelerate the recovery of vegetation. A document can be found on the website giving a detailed explanation of how this task has been executed.
- 7 Creation of suitable environments for the existence of self-sufficient populations of Spanish toothcarp (*Lebias ibera*) and Valencia toothcarp (*Valencia hispanica*) in the recovered environments.
- 8 Disseminate the Project among the local and visiting populations.

QUESTIONS RAISED IN THE SPEECH

Question 1. Have all the project objectives been met?

Yes. The project had two fundamental objectives. On the one hand, rebuilding the habitat so that a self-sufficient and natural population of marine juniper could be re-established, and on the other, making citizens and the scientific community aware of the project. The first has been achieved by rebuilding the dune structures (dune hills and depressions), and the second through a significant environmental awareness campaign, as Azucena Muñoz will fully explain in her speech.

Question 2. Are juniper plants still being planted? Has all the planting been done, or do some areas still have to be planted?

Between November 2007 and February 2008, 952 juniper specimens were planted. Planting beyond this period would result in a decline in their survival. In any case, the Town Council produces juniper plants annually that will be incorporated in the regenerated area. In 2007, we also managed to increase the germination rate from 5% to 50%, which means that, from now on, over 1000 specimens will be produced annually for replanting in La Devesa.

Question 3. Have specimens been planted throughout the three years of the project?

No. The aim of the project has been to create the suitable conditions for a natural population of marine juniper to become established. If the juniper plants had been planted at the beginning, there would not have been a suitable habitat and they would have died. Planting has been done after regenerating the dune structures, which is when the suitable conditions for the survival of the juniper have been recreated. Hence all the juniper specimens have been planted in January and February 2008.



Question 4. Do the 1000 marine juniper specimens that will be planted during the project come from the 40 plants that existed in La Devesa?

Yes. The policy of Valencia City Council is to only regenerate the area with vegetation from La Devesa.

Question 5. Are there any plans for monitoring the actions?

Yes. Once the project has ended, Valencia City Council staff will monitor the area. The survival of the plantings will be controlled, as well as the dune structures, the state of the fences, etc. The environmental education and awareness tasks will also continue.

Question 6. Which maintenance tasks are necessary to reinforce the project?

This is a solid project, only monitoring will be needed. That is, periodically look over the area to see how the dune structures and plantings are responding, collect seeds, etc.

Question 7. What maintenance tasks will be done in 5 or 6 years time?

The idea is not to maintain the area, we have not wanted to create a garden. During the three years of the project the area has been given a boost, later nature should take over. In 5 to 6 years time we will not need to plant any juniper.

Question 8. What future actions are planned relating to the project?

The project is almost completed. In fact, these workshops are being held to evaluate the completed project actions. When the project ends, Valencia City Council will continue with its maintenance and awareness tasks.

Question 9. Can other zones of El Saler be recovered to restore the marine juniper habitat?

Yes, it can be done. The two large Life projects aimed at regenerating the dunes in La Devesa have been executed in the southern half. Among other things, this is because there are no properties in the sector, which has allowed infrastructure to be removed for the complete regeneration of the zone. In the north, where there are a fair number of properties and service zones, the regeneration works have also been done bearing in mind these criteria.

Question 10. Thanks to the juniper project will other threatened species be recovered? Are there any birds or animals that will benefit from the juniper project?

Yes. The Life Enebro Project is for the recovery of some ecological conditions, by increasing the diversification of the habitat. This will allow the development of species that are currently suffering in the area.



Question 11. Thanks to the juniper project will it be possible to recover other species that were under threat?

Juniper is an emblematic species, so if we recover the ideal conditions for the juniper to survive, this will imply the recovery of some ecological conditions allowing the survival of other species.

Question 12. How many visitors can the recovered dunes bear?

This depends on several factors. Among them, I would emphasise the aggressiveness with which each person visits the zone and the stage of development of the vegetation protecting the dune.

Question 13. Do you know whether any similar project is underway in any other dune system in Spain?

I know that similar work is being done in other areas. However, the work carried out in La Devesa in Valencia is quite unique, as many different tasks are being done in a very small area (demolition, reconstruction of dune structures, elimination of foreign species, construction of the necessary infrastructure with materials and morphologies that are compatible with the environment, I.T. applications to repopulate La Devesa, environmental awareness tasks, etc.). As far as I am aware, it is the only place in Spain where so many things have been done in such a small place.

Question 14. You mention that invasive plants were detected and eliminated. What methods were used? Is there any monitoring of spreading in the new habitats?

Work has mainly been done with the Hottentot fig (*Carpobrotus acinaciformis*) and the Century Plant (*Agave americana*), which are two of the most widespread and problematic species. Valencia City Council has worked for many years to try to eliminate these species. It has finally been concluded that, in La Devesa, manual removal is better than chemical elimination.

Question 15. It seems that a dune recovery project is being drawn up covering the area from the old Plexi factory to the sports centre. Are these suitable areas for introducing marine juniper?

I cannot answer this question as I have not read the project. So I cannot tell you whether, once the dunes are regenerated, it would be a suitable place for juniper to inhabit.

Question 16. Which part of the project can best be exported to other Spanish coastal areas?

I think that the whole project can be exported; and not only to Spanish coastlines, but to anywhere worldwide. Although as you say, La Devesa was altered in the past and covers a small area, it is a complex dune system with great ecological value. All of this together with its proximity to a large number of towns (the city of Valencia, El Saler, El Palmar, El Perrellonet, etc.) makes it an unusual place where one of the challenges is to find a balance between conservation and the use and enjoyment of the area. These actions have been carried out through Life Projects (Life Duna and Life Enebro), and one of the objectives of the Life Projects is that they are demonstrative and, therefore, the experiences and results obtained can be used to solve similar problems in other parts of the world. In fact, a dune regeneration manual has been published that is available from this Website, free of charge. Specifically, the



methodology for the following actions can be exported: - Earth movements and reconstruction of dune structures. - Reconstruction of dune hills, abrasion craters and "malladas". - Fixing of regenerated dune structures. - Elimination of the obsolete hard infrastructure and treatment of the residues. - Construction of hard infrastructure with materials and shapes that do not have a great impact. - Collection, conservation, production and planting of the regenerated area with native vegetation. - Elimination of allochtonous species. - Dissemination and awareness of the resources among citizens. - Management of the area.

Question 17. What final conclusions do you draw from the project now that it is coming to an end?

As a final conclusion, mention that the project has met the objectives set out at the start. Recovery of the habitat in such a way that a native and natural population of marine juniper could become established. Although it is still early days, the first data indicate that at the moment this has been well done. The first juniper plants were planted in November 2007, and they are healthy, have shoots and an optimum appearance.

Regarding the dissemination, we have tried to do this in different places and aimed at different audiences (schools, universities, general public, technicians, scientists, etc). However, Azucena Muñoz will comment on this aspect in her speech.



DESIGN OF THE NEW MORFOLOGY OF THE AREA OF ACTIONS OF THE LIFE ENEBRO PROJECT

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TRANSCRIPTION OF TALK

The Life-Enebro Project has been implemented in the southern part of La Devesa de l'Albufera in Valencia. One of the main actions considered in this project has been the execution of the works proposal aimed at the recovery of the dune morphology of the entire area of action in order to create the ideal habitat for the reintroduction of the marine juniper.

The proposal has been drafted using maps and orthophotography from 1965 and 2001, both at a scale of 1:2000, from the Devesa-Albufera Service of the City Council, and some geo-referenced orthophotos from February 2003 provided by the El Jucar Hydrographic Confederation.

The exhibition is based on 8 graphic documents included in SCHEDULE I.

Plan n° 1 digital model of elevations 1965-2001 Devesa southern area

Plan n° 2 digital model of elevation 1965 area of action

Plan n° 3 digital model of elevation 2001 area of action

Plan n° 4 map of changes 1965-2001 area of action

Plan n° 5 digital model of the proposed situation

Plan n° 6 General floor plan of the final proposed northern situation (contour lines)

Plan n° 7 General floor plan of the final proposed southern situation (contour lines)

Plan n° 8 provisional digital model of the executed situation

To realise the design of the new morphology of the area of action a comparative analysis has been done between the two maps, that of 1965 and of 2001, to quantify and detect the changes that have taken place between both dates.

Plan n° 1 digital model of elevations 1965-2001 Devesa southern area

Analysing the morphology of the southern part of La Devesa, prior to the destruction caused by the development process started at the end of the 1960s, two sets of dunes of different characteristics can be clearly seen, separated by a wide longitudinal depression (1965 map).

The outer or first line of dunes, the location of the area of action, was characterised for having two differentiated alignments, separated by a narrow longitudinal depression produced by wind deflation. These were genetically transversal dunes; with a longitudinal orientation parallel to the coast, asymmetric with steep leeward slopes, not very wide and with average heights around 4-5 metres reaching maximums of up to 10 metres in the southern part of the first line. Within this set, the first alignment is discontinuous, broken up by transversal corridors and with variable heights. The second alignment, of an average height of 5 metres, had similar characteristics to the first although with more evident asymmetry. The entire area of action of the project is on the old first line of dunes.

In the 2001 map the whole exterior or first line of dunes is destroyed except for some dunes in front of the Parador and in the southern part of the second alignment, to the south of the Casal d'Esplai. Neither of these sections is included in the area of action. The new relief is practically flat, homogenous and with very few differences in altitude.



Plan nº 2 digital model of elevation 1965 area of action

Plan nº 3 digital model of elevation 2001 area of action

Plan nº 4 map of changes 1965-2001 area of action

As a result of the comparison between the 1965 and 2001 maps, a map of changes has been established showing the decreases in height in blue tones and increases in orangey-yellow tones. The first mainly correspond to old dunes that no longer exist and the second to old abrasion craters that have been filled in most probably as a result of the flattening of the terrain.

Analysis of the map of changes together with the calculation of the amount of sand available showed that there was not enough sand to recover the dune morphology as it was before the flattening. Analysis of the map of changes showed a need for approximately 500,000 m³ of sand to create the units of relief as they were before the flattening and the current availability of sand was some 180,000 m³. (The amount of sand available was determined by studying the filling of each mallada for which recovery was planned and calculating the sand that could be obtained from the possible new craters).

As a result it was decided to try to maintain, in principle, the morphology prior to the flattening but reducing the height of the dunes by an average of 1 or 1.5 metres.

Having established the design of the new morphology, fieldwork was carried out to find out, on-site and at this time, the convenience or not of the location and design of the new defined elements. Different modifications were made to the first design. It was absurd to place a dune where there now exists a crater, or vice versa, make a crater where there is now a dune (it must be borne in mind that the map of reference is from April 2001 and the proposal was drafted in 2005).

Plan nº 5 digital model of the proposed situation

Plans nº 6 and 7 General floor plan of the final proposed situation (north and south contour lines)

With the results of the map of changes and the fieldwork, and being aware that current environmental conditions are different to those that modelled the relief shown in the 1965 map, the new morphology was designed as shown on the map "proposal and location of the new elements, dunes and craters". Here the dunes are shown in orange, the craters in light blue, the new lake in dark blue and the malladas that are to be emptied and recovered are in green.

In the area to the south of the Casal d'Espilai, the intervention has been focused on the part nearest to the second alignment of the exterior set of dunes. As there was a lack of sand and as the landscape in this section of the action is "not so homogenous" (action had already been taken in 1988, 1997 and 1998), it was decided to act only on the aforementioned part in order to "eliminate" the remains of an old access road.

Once the location of the new elements to be recovered was decided (dunes, craters and malladas) the morphology of each of these new units was designed defining their maximum and minimum heights, slopes and fracture lines and the volumes of the earthworks needed to realise each element was established as well as the origin of the sand.

Plan nº 8 provisional digital model of the executed situation

This plan shows the final situation once the project was executed. Small modifications have been made to it. (The plan is provisional; some elements have still to be included).

The sand used to realise the morphological restoration has all come from La Devesa: from the malladas, which due to the property development had been filled with sand originating from



the destruction of the dunes and from the new abrasion craters created in the area of action. The dunes have been fixed following the methodology used by this technical office for over 20 years.

QUESTIONS RAISED IN THE SPEECH

Question 1. What is the difference between abrasion calderas and “malladas” (salt marshes)?

The difference is in how they originate. An abrasion caldera is a hollow formed by wind in the dunes whereas malladas is the local name for a depression between dunes that develops between two ridges of dunes (the outer or first ridge of dunes, and the inner ridge or fixed dunes).

Question 2. Is there up-to-date data on how the coast is developing on the Devesa stretch, and specifically in the area where action is being taken?

Yes, there is a study based on aerial photographs from 1947 to 2000, and another based on a series of profiles of the submerged beach along the Devesa coast which are 500 metres long and reach a limit of -8, from 1992 until 2007. Both studies conclude that the whole Devesa coast has suffered a heavy progress of regression caused by lack of supply, the rising sea level and above all the barrier effect that the Port of Valencia has on this stretch of the coast. The further from this area we go, the lesser the regression. Between 1947 and 2000, around 70 metres of the most northern stretch of the Devesa's beach was lost, and about 30 metres in the southern stretch where the Juniper Project has been carried out. Based on the profiles created, the annual rate of loss is currently 0.8 metres in the north and almost 0.4 metres in the south.

Question 3. What future is in store for the dunes if the sand north of the Port of Valencia accumulates and meteorological damage eliminates sand from the beaches that are left south of the Port?

The dunes are a reserve of sand for the beach and logically if this material does not reach the beach then the beach will get smaller and with it so will the dunes. The dunes hold up this process.

Question 4. Is there any environmental factor that limits the height of the dunes? With time, will the naturally-formed dunes get higher? And what about the artificially-formed ones?

Three elements are necessary for a dune to form: the sand that makes the dune, the wind that pushes the sand so that it makes the dune, and an obstacle that helps to form the dune “embryo”. The height of the dune depends on the width of the beach and the availability of sand. On a beach with accretion, where a constant supply of sediment is provided, over time the dunes become more stable and perhaps higher. Whether they are natural or artificial is not relevant in this case. The problem is when there is no supply of sand and the beach regresses.



Question 5. You have explained that the supply of sand to the beach is very low. Does this imply that human intervention is constantly necessary to maintain the dunes, or will they remain fixed in place simply with vegetation?

When the vegetation planted reaches a notable size and stage of development, this is sufficient to fix the dune, but as we have said before the dune is a reserve of sand for the beach, so if there is no supply of sand they will get smaller. For the Devesa's beach and dunes to become stabilised, a constant supply of sediment is necessary. In a study carried out by the Valencia Polytechnic University (Universidad Politécnic de Valencia), this need has been quantified and is currently at 50,000 cubic metres of sand per year for the north end of the Devesa (until La Gola (Canal to sea) de El Pujol) and 40,000 cubic metres of sand per year for the southern stretch (Gola de El Pujol – Gola de El Perellonet).

Question 6. If the supply is lower than the degradation, will the dunes end up disappearing along with the beach? Or are the present conditions expected to improve? What is the thinking with respect to this problem?

Yes, if the supply is lower than the process of regression, the beach will get narrower and the dunes will disappear. What is happening to the Devesa is the same as with 70 % of the world's coasts that are regressive. The situation could improve if, as has been said before, there were a constant annual supply of sediments. A transfer could be made from the north of the port to avoid the barrier effect of the port on the southern beaches, but one must be aware that in recent years studies show that the beaches located to the north were growing but they no longer are.

Question 7. Is it true that from a geo-morphological point of view the area of El Saler that is best conserved is the El Saler golf course area?

Not exactly. In the Devesa there were 2 areas left of the first dune ridge that were not cleared away with the Urban Development process. These were the Rambla dune and the Pujol dune. The Rambla one is located further north and so has suffered a greater erosion process, with the front part of the dune having disappeared. The Pujol one is in quite a well conserved state. It is 9 metres high and has conserved all the distribution of its vegetation communities that are characteristic of a coastal dune.

The golf course dunes have conserved their original morphology but are totally fixed in place by the golf course. This excessive fixation represents a problem of destabilisation for the beach, since it impedes an exchange of sand between the beach and the dune, producing escarpments on the windward side of the dunes.

Question 8. Do the urbanised areas in the Devesa have any effect on erosion of the beach?

Any "impermeable obstacle" near the sea and on a narrow beach encourages erosion, because when waves strike against it in times of storms or high winds there is an increase in energy and thus more sand is transported. In the Devesa there are currently two constructions that encourage destabilisation of the beach: the El Saler sports centre wall and the wall that protects the Kasbah urban estate. They are both very near a narrow beach and in times of storms the process of erosion is greater. The rest of the Devesa's urbanised area does not currently affect the beach's stability.



Question 9. In your presentation you commented that a lot of sand had been lost and that the dunes constructed are now smaller. What consequences might this have?

The Devesa beach is now very narrow and the height of first-line dunes is related to the width of the beach. When the first dune ridge was cleared away, all of the vegetation that was growing behind it suffered and receded on being directly exposed to the sea wind. With the construction of the new dune ridge, the vegetation developing behind it has experienced more growth in recent years.

Question 10. Did the sand used in the geo-morphological restoration undergo any kind of treatment to avoid the spread of intruding weeds?

No. Before work began, the autochthonous vegetation (carpobrotus) was removed by hand to prevent it from expanding and intruding. Care was also taken when building the palisades so that the vertical canes that were buried in the sand to hold the marram grass in place were dry and not green to ensure they did not sprout and invade the dune.

Question 11. When a dune is being regenerated, is the distance from the sea taken into account?

Yes, because if it is constructed very near the sea it loses stability.

Question 12. I have walked around the Project area and I have seen that there is still some gravel left from the roads that were there before. Is this a problem?

In principle it isn't a problem. The only thing is, it is an eyesore for the dunes, taking away their natural look. Before the dunes were constructed, the areas where aggregates remained from the old car parks were cleaned with a stone raker, but it is very difficult to completely eliminate the gravel from the sand.

Question 13. When regenerating a dune, is an attempt made for it to be like the one there was before it?

To regenerate the dunes, the cartography prior to the clearing away is taken into account, but also the fact that the present environmental conditions are different from those that formed the original dune ridge. When designing the distribution of the dunes and the abrasion calderas in the dune zone, the present relief profile is also taken into account. It is "absurd" to place a dune where there is a caldera today, or vice versa.

Question 14. Was the possibility of bringing sand from nearby sites never considered?

If we distinguish between the northern Devesa (up to La Gola de El Pujol) and the southern Devesa (Gola de El Pujol – Gola de El Perellonet), we can say the following: in the southern Devesa all of the dune regenerations have been carried out by the Valencia City Council itself, using sand exclusively from the Devesa (from the malladas and the abrasion calderas). In the



northern Devesa, the two regenerations were carried out by the national Directorate General for Coasts using sand from outside the Devesa. In the former case, sand was dredged from the bottom of the sea north of the port and transported by boat to the Devesa. In the latter case, the sand was brought in lorries from the dry beach situated north of the port. In this case, the grain size was bigger which gave rise to a more stable dune.

As for the regeneration carried out at the l'Arbre del Gos beach, the sand came from a quarry (and was placed inside the dunes) and different excavations that had been carried out to construct buildings in the Albufera sandbar (which was placed on the outside of the dunes). (The sandbar is the bar of sand that separated the Albufera lake from the sea and stretches from the mouth of the new Turia river course to the cape of Cullera).

Question 15. Do you know if there are plans to recuperate the dunes in any other part of the Natural Park?

I think, but I don't know exactly, that the Directorate General for Coasts is thinking of carrying out a regeneration Project for the Dorssel dunes of Cullera, but anyway I don't know for sure. I also think that the Department (Conselleria) wants to recuperate the beach of the old tennis courts of the El Saler sports centre, and the Directorate General for Coasts is carrying out the formalities to be able to recuperate the beach located on the old Plexi factory section.



CONSERVATION AND RECOVERY OF MARINE JUNIPER IN LA DEVESA DE L'ALBUFERA

Juniperus oxycedrus ssp macrocarpa

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This report informs on the experiments carried out by Valencia City Council to recover marine juniper in La Devesa between 1980 and 2008.

Inicial estate

In 1980 work was begun to recover the natural vegetation that should grow on the dune area known as Devesa de l'Albufera in Valencia.

Between 1981 and 1982 the Environmental Reports were drawn up for the drafting of the Special Plan for the Protection of Monte de la Devesa in El Saler (PEPMDS) and, based on these, Valencia City Council approved the plan in 1982.

These Environmental Reports have the first diagnosis on the situation of the marine juniper population, as they contain a census of the location of the existing specimens and information on the biotic and abiotic circumstances at that time in the areas comprising its potential habitat.

During the creation of the PEPMDs Vegetation Report (Vizcaino, A. et al. 1982), 39 specimens were located, of which four died during the study period; one from being trodden on and three in a fire.

At the end of 1982 there were 35 specimens left, broken down into eighteen males (51%), fifteen females (39.5%) and two unknown. The report also contained data on the height, diameter of the crowns, situation (isolated or forming part of a group) and the species accompanying every juniper plant.

Of the 35 juniper plants, the sea spray affected eight, one had a deplorable appearance and no phytopathological problem was specified for the rest. The situation was really critical, as almost all the dune areas with the most suitable characteristics for the survival of the marine juniper had been destroyed.

In 1982, Valencia City Council created the Devesa-Albufera Technical Office (DATO), which included the objectives of the conservation and recovery of the natural values of La Devesa.

The first efforts to protect the marine juniper plants.

In 1982, the DATO began work to produce marine juniper and the first measures were taken aimed at protecting the existing specimens.

In 1984, four Reserve areas were established: the enclosures of La Creu, La Rambla, El Pujol and La Punta. The first two housed juniper plants, the third was one of the few areas with the required conditions for its reintroduction and the last area comprised a severely altered potential area, where no construction of any kind had taken place, and which could be used for monitoring of the spontaneous recovery process upon having minimal human interference.

In the 1980s approximately 300 specimens were planted. Although it could be considered that these repopulations were not important, on the basis of the quantity of specimens planted, over time they have become a key factor, as many juniper plants are currently produced thanks to the seeds provided by the specimens planted then.

Among the plantations of that time, that done at the Racó de l'Olla Interpretation Centre is outstanding, where some 200 specimens were planted in half a hectare.

But, at the same time that work was done to recover the juniper, the number of "natural" specimens in La Devesa, that is, those not planted, continued to decline. Some were lost in forest fires, such as the fire of 1986, others died as they were covered by the growth of pines and bushes, and others suffered the effects of contamination caused by the surfactant transported by the sea spray.



The 1998 census.

The marine juniper population census was not updated until 1998 (PASTOR, I., 1998). In this census 30 natural specimens and 164 repopulated ones were counted, in total 194. The "natural" juniper plants and the eighteen repopulated ones were in La Devesa and the other 146 in the Racó de l'Olla. Fructification was observed in twelve specimens (25%) in La Devesa and in 69 specimens (47.26%) in Racó de l'Olla.

In the 1998 census the location coordinates for each individual plant were recorded, the vegetation near each specimen was mapped out, a sketch of the plant and the profile of the trunk and main branches was done and a photograph taken.

It was recorded that of the 48 specimens in La Devesa, three (6.25%) were affected by a borer beetle, fifteen (31.25%) had numerous galls caused by insects, fifteen (31.25%) were affected by the sea spray and twelve (25%) had significant drying as their branches were in the shade of other trees or shrubs. In summary, twenty-eight individuals (58%) were affected by one or several of the aforementioned phytopathologies.

It verified that the state of the natural population had worsened since 1982, as 14% of the specimens had died and approximately half of the survivors were affected by a phytopathological problem. Another alarming fact was the scarce presence of individual plants with fruit and, therefore, the difficulty of natural regeneration.

Start-up of the marine juniper recovery plan.

In 1999 a new census was done, the phytopathological status of the population was studied and a Recovery Plan for the marine Juniper Population of La Devesa (García, J.J., 1999) was drawn up, a plan that commenced that the same year.

In November 1999, 258 juniper seedlings were introduced. The repopulation was organised dividing the juniper plants into forty-nine groups of approximately five plants each. The groups were distributed from north to south along the whole of La Devesa in order to find out the response to the different conditions that, in principle, were considered most suitable. The age of the seedling was recorded, planting 121 one-year olds, 90 two-year olds and 47 three-year olds or more.

In November 2000, the initial success of the repopulation was evaluated, verifying that 172 individual specimens had survived, that is 66.66%. It was recorded that the three-year old specimens, or older, had less problems, followed by the two-year old and finally, the one-year olds, with a survival rate of 81%, 62% and 29% respectively. The relevance of the negative effect of rabbit was stated, a factor that until that time had not been borne in mind, proving that it had caused numerous plants to die, particularly among the one-year old specimens.

In the 2004 census it was verified that the average survival rate of junipers planted in 1999 had dropped to 29.45%.

Realisation of a geographic information system (G.I.S.) for the marine juniper.

2003 saw a new census and monitoring of the marine juniper population (Hueso, M. C., 2004). The objective was to update the census, check the evolution experienced by each individual plant, redo the data sheets for each specimen (coordinates, mapping of the surrounding vegetation, sketch of the trunk and branches, photograph) and incorporate all these data in a G.I.S.



The number of existing juniper plants in 2004 was 335, which could be grouped into: Devesa, Racó de l'Olla, maritime promenade of Pinedo and the Municipal Nurseries of El Saler (MN).

In La Devesa 132 juniper plants were counted, of which 70 were survivors from the 1999 repopulation. In Racó de l'Olla there were 79 individual plants. In the green areas of the maritime promenade in Pinedo there were 21 junipers, planted in 2001. And 13 specimens in the MN.

Data were also obtained on the circumstances favouring the fructification of the females. In general, these had little fructification. The females with abundant fruit were in one of these two situations: or they had few males less than 80m away in the direction of the dominant winds (west-southeast) or they had a large number of males within a 15m radius, their situation in relation with the dominant winds not being relevant.

The state of health of the junipers is satisfactory. In 293 specimens it was good or very good, in 42 it was okay and in 2 it was bad.

Upon redoing the data sheets and comparing the changes experienced by each individual specimen there arose the chance to study in greater depth the threats to the survival of the junipers.

- The largest individual plants could be attacked by *Semanotas laurasii*. This affected the branches and trunks over 5cm in diameter. The larvae make elongated galleries some 5mm in diameter in the cambium and can manage to circle the bark in its entirety.
- The young individual plants, less than 1m high, could suffer significant damage caused by a small snail of the *Cochlycella conoidea* species. In summer, numerous specimens often group together along the stem, making small circular holes 1mm in diameter, causing the young juniper to die, as they devour the entire thickness of the bark.
- In specimens under 40cm high, the significant damage caused by rabbits devouring the trunk and branches was recorded once again.
- A very important cause in the weakening and death of junipers is the competition for light with other plants. The junipers that live sheltered from the sea spray run the risk of being displaced by the growth of pines and surrounding brush. It stated that *Pistacia lentiscus*, *Phillyrea angustifolia*, *Smilax aspera* and *Pinus halepensis* were the species that most commonly displaced junipers.
- Among the abiotic threats, the effects of the summer drought, contaminated sea spray and forest fires were significant.

Damage caused by contaminated sea spray.

Between 2004 and 2005 a study was done to confirm the incidence of sea spray contaminated with surfactants on the vegetation of La Devesa (Diamantopoulos, P., et al., 2007).

In accordance with the results obtained, La Devesa was, generally, moderately affected by the contaminated sea spray although, at some times of the year, the effect on the landscape was noticeable, recording important effects on the most exposed junipers.

The first visible sign is yellowing of the part of the plant that is most exposed to the sea spray, followed by necrosis. The main contaminant present in the sea spray is the tensoactive synthesis arising from the detergents that, in the case of La Devesa coastline, reach the sea through the submarine EDAR sewage pipe in Pinedo.



Difficulties facing the establishment of a viable population of marine juniper in La Devesa:

La Devesa dunes have generally been organised into three large sectors: first line of dunes, transition area and fixed dunes. In principle, the junipers could prosper on the dunes with some degree of geomorphologic dynamism caused by the wind, but the intense action of the wind affecting the dunes closest to the sea, jeopardizes their recolonisation by the junipers. On the other hand, the lesser influence of the wind on the dunes further away from the sea favours the growth of species that end up displacing the junipers.

The problem arises, therefore, in that the most suitable sector for juniper, that is, the transition area, is completely altered by the development works done in the 1970s and there was no large area for the reintroduction of junipers until 2007, thanks to the Life Enebro project.

Another factor to bear in mind is the effect of the protection policies applied in the last 25 years, which has caused a considerable increase of coastal vegetation. This caused problems for many "natural" junipers, as they could be displaced by the growth of brush. For this reason, since 2004 the vegetation that successfully competes with the junipers on the fixed dunes has been cleared. Thus, many specimens stay vigorous which comply with a fundamental strategic function for the recovery tasks, that of maintaining as great a genetic diversity as possible. In some cases, corridors have been opened to favour the pollinisation of the female plants that have become isolated from the nearby males due to the abundance of bushes.

Also, one of the biggest problems for increasing the reintroduction of junipers has been the extremely low rates of germination obtained for many years. It was thought that the circumstances of the majority of the female plants made their suitable fructification difficult. The juniper field established in Racó de l'Olla has changed location and now it is possible to obtain a lot of good quality seeds. On the other hand, thanks to the germination experiments done in 2007 and 2008, the percentage of germinations obtained has risen considerably, now exceeding 50% (Bellido, A. 2008).

These days, the influence of the contaminated sea spray is appearing to be the problem with the most difficult solution as it is beyond the scope of Valencia City Council. Until the volume of contaminated water poured into the sea is reduced, the reintroduction of junipers in the areas most exposed to the sea spray is severely compromised, although some specimens manage to survive in these circumstances.

The boost of the European Life funds.

Between 2001 and 2008 two projects were done that, at last, allowed an important population of marine juniper to be established in La Devesa.

In the Life Duna (2001-2004) project, the constructions remaining from the attempt to develop the area were removed from sixteen hectares within the potential distribution area of marine juniper, and the first line of dunes was recovered along 2,160m, as this reconstruction on the first line of dunes is a first step towards the restoration of semi-fixed or transition dunes that, in La Devesa, are the most suitable for the reintroduction of marine juniper.

With the Life Enebro (2004-2008) project, a surface area of fifty hectares has been returned to conditions that should allow for a viable population of marine juniper.

Before proceeding with the repopulation of the junipers, the area was geomorphologically restored, windbreaker plants were planted in the highest areas and a predictive model I.T. tool



was created (Sánchez, A. et al. 2007) to determine with high probabilities how the vegetation should be distributed that is reintroduced together with the junipers.

912 junipers have been planted, of which 92 were female, 384 male and 436 unknown.

The repopulation was designed as follows:

- 865 junipers have been divided into 66 groups. Each group has three juniper plants, including one 3-year old female and four males and eight plants of various ages and sexes.
- The 47 remaining junipers have been planted in areas for which the predictive model does not give the highest probability for the vegetation that accompanies the juniper but that, on a large scale, have many of the environmental factors allowing for the presence of juniper.
- The areas chosen for repopulation have been those that the predictive model considered suitable for *Crucianelletum maritimae* Br.-Bl. (1931) 1933, *Teucrio belionis-Halimietum halimifolii* Costa & Mansanet 1980 and *Phyllireo angustifoliae-Rhamnetum angustifoliae* Costa & Mansanet 1980.
- In order to monitor the plantation an identity label was buried next to each specimen and photos taken in the nursery and where planted.
- Upon transplanting the base of the stem was buried in soil and, if relevant, the lower branches too.

The plantation of junipers ended in the middle of January 2008 and there are still no data allowing the success of the action to be evaluated. Within the Life Enebro project there just remains the creation of a G.I.S. before July 2008.

Some peculiarities of the reintroduction of junipers.

Based on the reintroduction experiments done by the DATO, some recommendations can be made which may be of interest when executing a marine juniper reintroduction project.

- The most suitable time for planting is autumn, as the rain that is typical for this season and the mild winter temperatures of the coastal areas allow the radicular systems to be developed to a maximum before summer arrives, thus reducing deaths due to summer droughts.
- When planting it is a good idea to bury part of the stem and the lower branches, as junipers are adapted to be partially covered by the sand and this allows deeper roots to develop and reduce evaporation-transpiration, which increases the availability of water for the plant. This also favours rooting, which could increase survival and reduce the incidence of problems caused by the spiralling of the roots in the container.
- When marine juniper is introduced in areas with different geomorphologic dynamism due to the influence of the wind, it is worth organising the repopulation on the basis of the growth behaviour of individual plants. It has been recorded that approximately 80% of La Devesa junipers grow upright and the other 20% creep. The upright specimens prioritise growth vertically and creeping ones do so horizontally. Upright individual plants have less problems in areas of low geomorphologic dynamism whilst creeping ones have less in areas of high dynamism. This is because the upright plants compete better with the bushes in the areas protected from the wind, whilst the creeping ones adopt shapes that allow them to better support the gusts of wind.
- It has also been verified that competition with the pine trees in areas of low wind influence ends up killing the junipers, even if upright specimens, so junipers should be planted some distance away from the pine trees.
- We recommend replanting junipers in groups of five or more seedlings and within a fifteen-



metre radius. The aim of this measure to plant specimens of both sexes close to each other. If this does not happen in the first plantation, replanting should occur until done.

- In the long-term it is a good idea to favour the presence of animals that help in the dispersal of juniper seeds, such as, for example, foxes or badgers. Although given the small size and isolation of La Devesa, this problem is not easily solved.

QUESTIONS RAISED IN THE SPEECH

Question 1. Have marine junipers been found in El Saler over recent years that are due to spontaneous regeneration?

There have been very few junipers found in El Saler that are due to natural regeneration. I know that 4 have been found, four that must have come from natural regeneration, judging by their few years of age and the fact they are not the product of the repopulation work that has been done. They have all been found in the northern half of the Devesa near where the most significant natural population of junipers is located.

Question 2. What is involved in the activities to help the junipers that already exist in the zone?

Work has been done in El Saler for some years aimed at encouraging the increase and conservation of marine junipers. The work can be divided into two groups:

1. Maintenance of the existing population. Most of the existing junipers at the moment in the Devesa are in a zone called a fixed dune zone. Here, the biggest problem for the juniper is the competition from shrubs and pines. Although the juniper is a plant that grows quite vigorously, it cannot compete with others like mastic, phillyrea angustifolia, or above all the combination of pine and sarsaparilla which could stifle the juniper within a couple of years. The maintenance work is aimed at stopping this suffocation of the juniper by the bushes surrounding it.

The junipers that are in the transition dunes and the dunes nearest the sea do not receive any special maintenance. The only thing that must be done is to monitor their progress and avoid trampling if they are in transited areas.

One problem that affects them all is polluted sea spray being deposited on them, but there is practically no way to intervene in this problem. The only thing to do is to plant new junipers in places that are sheltered from this pollutant. The windbreak screens are not effective as the junipers adopt an aerodynamic shape that exposes them to the slightest sea wind carrying the pollutant.

2. To help the juniper it is necessary to strengthen it and this is done by repopulating. Since the Life Enebro project ended, we have an area of 50 Ha in which 912 junipers have been planted, but there is room for many more. Not all survive; we foresee that around 70 % will certainly die over the years. We plan to intensify the work of repopulating the juniper in this zone in a period of 4 – 6 years.

Question 3. What are the most important factors that influence junipers becoming established?

We have asked ourselves this question quite a lot throughout the Project. The Predictive Model (which is available on the Internet) was made in attempt to solve this and to be able to design



the repopulation of vegetation living in the whole Project zone. The Project is being carried out on a strip that goes from the shoreline to the fixed dunes. Within this we have a zone to the rear of the front line dunes, transition dunes, and fixed dunes, all with areas very exposed to the wind, some with high ones near the freatic level, etc. We had to distribute not only the junipers but also all the accompanying species over the entire area, and with sufficient guarantees for success.

With the juniper, we have intuited, studied and researched what the requisites are that condition repopulation. We know that the marine juniper thrives in sandy ground, but on a practical level the conditioning factor has been the mobility of the sand. The juniper goes best in places where the wind is very active and the sand is very dynamic. In areas where the sand does not move, the juniper ends up being displaced by bushes and pines.

This criterion of mobility coincides with the typical leeward vegetation on the first ridge of dunes, with Chamaephytes – small bushes of less than 50 cm high – on the transition ridge, and Phanerophytes in the most sheltered zones, especially white rockrose plants from the Cistaceae family. We have planted the marine juniper in the company of these species.

Question 4. With respect to the implantation of junipers in the field, what age are they? Are they going well? Have many failed to take root?

On designing the Life Enebro plantation in the field, all the conclusions from work that had been previously carried out were used. The work that gave us the answers to these questions was carried out in 1999 and 2000. A plantation was created made up of individuals organised into groups according to age, with individuals of one, two and three or more years of age. The data is in the communiqué but what was seen is that after one year the junipers that survived most were those of three years of age, surviving at an approximate rate of 80%, while for those of two years it was 60% and those of one year it was 30%. In the conditions we work in at the Devesa it is advisable for us to repopulate with junipers of three years of age, though we are aware that using plants of a certain age poses problems such as those we had with fungal infections in the Nursery.

The specimens of one year of age suffer most as prey to rabbits, while the bigger specimens survive this gnawing better.

The monitoring carried out in 2004 showed that the survival rate of this plantation of junipers from 1999, which in that year was at 62%, had dropped over five years to 30%. What are the factors that cause this death of 50% of the individuals that survived the first year? We don't know, but environmental factors like the drought caused deaths during the first summer. Then there are the winter storms loaded with sea surfactants. One could say that until two years have passed, the junipers planted have not yet suffered the environmental agents that cause most of the deaths.

Question 5. Is the sea air having negative effects on the junipers most exposed to the sea?

The sea air is one of the effects that favours the marine juniper as opposed to other typical dune species. However, the sea air that appears in the Devesa is not totally natural, but is loaded with pollutant elements. The effects of the sea air have been studied in Italy and in the Barcelona area, and they are the same as those of the Devesa. These coastal areas are near



urban population centres which generate a large volume of sewage and waste water that is discharged to the sea after deficient treatment.

To the north of the Devesa there is the Pinedo Water Treatment Plant, the biggest in the Valencia Community Region, where a considerable volume of Hm^3 comes out per year that has not been given a sufficient degree of treatment. The tensioactive materials from detergents come into this waste water causing serious effects in the marine junipers and other species in the Devesa.

In cooperation with CEAM it has been seen that the sea breeze can also cause problems with ozone since the juniper is also very susceptible to this pollutant.

Question 6. Is it known whether there is more resistance or not according to the sex? Is there a higher death rate among males or females?

We do not have those kinds of conclusions, although we can make deductions about the matter. It seems that it is more difficult to be female than male, because the females undergo the process of fruit production. We know that the fruit drains off nutrients and also that junipers live in ground that is poor in nutrients. So, a female that produces fruit continuously every year (though two years are needed to ripen) can easily be weakened after each cycle of bearing fruit. This weakness, together with other environmental factors, could end up causing its death.



EXPERIMENTS CARRIED OUT IN THE MUNICIPAL NURSERIES OF EL SALER TO IMPROVE THE GERMINATION OF MARINE JUNIPER

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Introduction

The production system for marine juniper (*Juniperus oxycedrus* spp. *macrocarpa*) that has been used until recently in the Municipal Nurseries of El Saler, belonging to the Devesa-Albufera Technical Office, was based on direct autumn sowings in seed trays, stratified at ambient temperature and maintained for, at least, three years. Germination obtained in this way has always been scarce and, generally, less than 5%.

Marine juniper seeds have, mainly, two germination restraints. One is internal and physiological and is due to the presence of inhibiting substances. The other is external and caused by the low permeability of the seed case. To encourage the germination of the seeds they must be gathered at a certain time of year, before the internal inhibitors are released, and preliminary treatments carried out (selection, cleaning and disinfecting, scarification and stratification).

Material and methods

In 2006 and 2007 different kinds of treatments were done on a batch of seeds gathered in the autumn of 2006, in order to find a process to increase the germination rate. Ten groups of seeds were prepared with different treatments, as shown in Table 1.

ensayos realizados										
tratamientos	camara de germinación o ambiente controlado									
	germinación (10-20°C)		germinación (10-20°C) zorro		germinación (10-30°C)		estratificación caliente 20°C /estratificación fría/5°C germinación (10-20°C)			
	gse	gsr	gze	g zr	gse'	gsr'	eme	emr	eve	evr
limpieza y selección (flotabilidad por densidad)	X	X	X	X	X	X	X	X	X	X
sin escarificar. semillas enteras	X	-	X	-	X	-	X	-	X	-
escarificadas. semillas con la testa rota	-	X	-	X	-	X	-	X	-	X
pasadas por el tracto digestivo de un zorro	-	-	X	X	-	-	-	-	-	-
semillas de frutos maduros	X	X	X	X	X	X	X	X	-	-
semillas de frutos no maduros	-	-	-	-	-	-	-	-	X	X
estratificación caliente a 20 °c sin fotoperiodo	-	-	-	-	-	-	X	X	X	X
estratificación fría a 5°C sin fotoperiodo	-	-	-	-	-	-	X	X	X	X
cámara de germinación 10/20°C con fotoperiodo 12 horas	X	X	X	X	-	-	X	X	X	X
cámara de germinación 10/30°C con fotoperiodo 12 horas	-	-	-	-	X	X	-	-	-	-

Tabla nº 1. Relationship between batches and treatments.



From the results obtained in this experiment, and awaiting confirmation of the data set out above, we reconsider the work according to the following cultivation guidelines:

- 1 Gathering of fruit selected for ripeness.
- 2 Cleaning and immediate removal of the flesh.
- 3 Disinfecting.
- 4 Selection of seeds to eliminate empty ones.
- 5 Sowing of seeds in trays with sand in a controlled environment or germination chamber, at a constant temperature of 20°C, with a 12-hour photoperiod and without scarification.

Gathering

Firstly, using the colour of the fruit as a guide, the exact moment of suitable ripeness for **gathering** the fruit had to be determined.

The pollinisation of *Juniperus oxycedrus* spp. *macrocarpa* occurs in autumn, the berries achieve their maximum size at the end of the first summer after flowering and ripen at the end of the second summer.

Taking particular care not to make mistakes and gather the wrong berries, we must bear in mind that normally the three degrees of ripeness may be found on the same tree and even on the same branch.

First, we will gather the 2-year old green fruit and then, lastly, the ripe berries.

Cleaning

The next important step is the **immediate removal of the flesh**, as the green fruit may ripen during the selection and cleaning process, and regarding the ripe fruit we do not know the degree to which the chemical inhibitors have an effect, so the sooner the flesh is removed, the better the chance of less latency.

They are left to soak in water and sodium hypochlorite (1%) for 24 hours, then ground with an industrial grinder. Cleaning is finished using sieves and running water.

Seeds selection

Another important stage is the selection of seeds with different systems. The first and most selective (regarding quantity) is floating in a saline solution. Each batch of seeds gathered may vary in the quantity of salt and/or density in selection, due to the various sizes and weights, as well as being perforated by insects or empty.

The most common cause of the proliferation of empty seed cases is abortion followed by predation.

In our selection, we use (as a guide only) a litre and a half of water with 350g of salt producing a density of 1.135 g/ml at 20°C, managing to discard 65 % of the empty seeds with this method.

Afterwards we used manual selection to remove broken or empty seeds that had passed through the previous filter, eliminating 5% more. Finally we selected 30% of supposedly good seeds from the total gathered.

We have standardised the size of the seed with a 3mm sieve obtaining two batches, <3mm (11% of the total gathered) and >3mm. This way we will see whether the size of the seed has an influence on the germination rate.



Cultivation in a germination chamber.

On this occasion, and given the results obtained in last year's test, we have decided to sow the seeds in trays of sandy substrate at a constant temperature of 20° and controlled humidity with a 12-hour photoperiod.

At the moment the experiment is in its initial stages and after 90 days in the germination chamber we have exceeded a germination rate of **50%**, which confirms the data obtained in the previous experiment (2006-2007).

We can see in table 2 that the two batches **< 3 mm** germinate successfully in similar percentages to those of the 16 batches **> 3 mm**. There are no significant differences despite what is traditionally thought.

Batches	21-02-08	03-03-08	14-03-08	27-03-08	08-04-08	17-04-08	09-05-08	Ut.Ger.	% Ger.
A>3 – 1	54	4	2	1	1	4	3	69	46,00
A>3 – 2	51	30	5	4	0	1	1	92	61,33
A>3 – 3	60	14	1	4	2	1	1	83	55,33
A>3 – 4	80	11	0	4	0	1	0	96	64,00
A>3 – 5	70	11	8	2	2	0	0	93	62,00
A>3 – 6	46	12	1	5	0	1	2	67	44,67
A>3 – 7	44	37	7	4	3	0	3	98	65,33
A>3 – 8	65	8	0	2	1	2	1	79	52,67
A>3 – 9	3	0	6	32	6	4	0	51	34,00
A>3 – 10	30	11	18	2	0	0	1	62	41,33
A>3 – 11	0	24	21	13	6	4	10	78	52,00
A>3 – 12	36	18	8	7	3	3	2	77	51,33
A>3 – 13	4	31	13	5	3	1	5	62	41,33
A>3 – 14	16	36	21	8	2	3	2	88	58,67
A>3 – 15	0	7	27	40	7	5	6	92	61,33
A>3 – 16	8	22	7	1	8	5	7	58	38,67
A<3 – 1	7	38	16	15	1	1	0	78	52,00
4<3 – 2	65	15	4	5	2	1	1	93	62,00
	748	394	196	170	55	37	45	1416	52,44

Tabla 2. Monitoring of germination 18 groups of 150 seeds.

DISCUSSION OF RESULTS OF THE 2008 EXPERIMENT

As we have seen so far, the seeds gathered prior to ripening obtain a greater rate of germination compared with those gathered with an already ripe berry. And although they also germinate, exceeding a rate of 40%, they do so after a year, whilst the green ones germinate in barely two months. This is very relevant data for professionals of the forest plant production sector, where they require a large number of plants as quickly as possible.

The use of a sandy substratum for cultivation in the chamber compared with the use of sterile paper and card, has certain qualities that reduce the fungi the seeds may have. Although if the cultivation period in the chamber is prolonged (ripe seeds), then the use and study of the



application of fungicides is necessary.

Scarification not only favours germination, but also harms the chaotic growth of the seedling and facilitates the entry of fungi.

Cultivation with a controlled environment chamber at a constant temperature of 20°C and a 12-hour photoperiod, has given us a germination rate over 50%, and seems to be the most effective approach to date.

Thus it must be stated that suitable **gathering, cleaning and disinfecting** and, finally, a minute **selection** of the seeds have been key factors in the successful rate of germination obtained.

QUESTIONS RAISED IN THE SPEECH

Question 1. When growing junipers, what plant health problems can arise?

Generally, in the Nurseries for the production of plants in containers we have a problem with fungi. This is usually the so-called damping-off type. They are a group of ground fungi which is usually ubiquitous and polyphagous. Pythium, Fusarium, and Rhizoctonia are fungi that are found above all in the ground, the substratum, and in the seeds that carry them. With good agricultural practices and adequate measures they can be kept at bay, above all by prevention. As for cultivation, during growth in the adult stage we have had a heavy attack of fungi, especially Phytophthora and Seridium cardinale. These two fungi attacked at the same time very heavily. Fortunately, not sufficiently to prevent carrying out the juniper Project positively, but we had to take the decision to carry out heavy chemical treatment (plaguicides) with Fosetil and copper (Benlate, Maneb), which are products that are aggressive but which were required due to the attack. In the end we have maintained a high-tech ecological treatment based on chelated micro-elements that boost cell multiplication, with a phosphorous-potassium group that encourages plants to take root and bear fruit, and copper pectinates that protect and regenerate the cell walls. With this cocktail of three products, we managed to stop the attack and so the junipers have continued to grow.

Apart from that, there have been other general nursery plagues, but applying good agricultural practices these can always be kept in check.

Question 2. From what you say in your presentations, you have performed the germination experiments in a germination chamber with controlled lighting and humidity. Now that you know what the suitable conditions are, can this germination be carried out in conventional nurseries?

Yes. Soon we are going to have a germination chamber for production in nurseries. This does not mean that the traditional system of direct sowing is no longer a very good system still in use.

The "quid" of the question is the collection of the juniper's fruit. Very good results are obtained by doing this when it is green (not fully ripe). In a chamber with a controlled atmosphere we are going to accelerate and improve this process and, of course, it can be used in a nursery.



Question 3. It seems that the test's success is mainly due to the "green" collection of its fruit. How did the idea come about?

There is a list of books with respect to this and it is commented in various books that germinations can be carried out with fruit collected green (pre-ripe) and that this could give immediate results when sowing in early autumn. However, these notes are not very concise and quite vague. We also have the experiment of a Research Centre with these germination tests using Spanish juniper (*Juniperus thurifera*) which had given them negative results. So, at first we hadn't considered using the green fruit. What happened was that during a manual collection, a batch of green fruit appeared and, well, we said "why not?" Let's try, and see if differences occur in germination. The surprise came that it was just this kind of seed that gives a germination percentage that can reach 50% in just 60 days.

Question 4. Dose Scarification or breakage of the seed case help the germination rate?

One of the trial phases was the scarification or breakage of seed cases in all of the different treatments that were going to be placed in the germination chamber, in 50% of the batch. This was done manually, in an atmosphere of controlled humidity at a temperature of 20° C. This helped all the bacteria, fungi, etc in the seeds come out quickly to the point where in three months all the tests had to be stopped because the infection was very big.

This type of affliction by fungi is controllable, but the thing is we did not consider using fungicides though there are books and experiments with respect to this that use fungicides like Captan or Tiram, which are wide-ranging. Himexazol too at 1%. We did not use them, and then the results for the seeds with broken cases were very bad. In addition, on breaking the seed case we detected that radicle and cotyledon growth was really irregular, growing badly.

Due to all of this, it was decided that it is not an advisable practice, and furthermore the group that was not scarified obtained very good germination rate results.

Although the seeds with their case broken germinated more quickly, following the graphs for development over time we observed that those that were not broken reached the same amount as the former ones and in healthier conditions with regard to fungi.

Question 5. Is it thought that homogenizing the sample according to seed size could eliminate the smaller ones that may be empty seed cases?

In principle it usually happens that way. In table 2 one can see that there are seed batches that passed through a sieve of over 3mm and others under 3mm. Their germination results are similar for bigger or smaller sized seeds.

We select the seeds by flotation in a saline solution. This system allows us to eliminate up to 65% of the total, after which a manual selection can be carried out to eliminate possible bad seeds directly. In this way, separation or selection by size is not necessary.



ANALYSIS OF THE EDAPHIC REQUIREMENTS

of *J. oxycedrus* L. subsp. *macrocarpa* (Sm) Ball

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Introduction

The importance of coastal ecosystems not only stems from the biodiversity they contain but also because they act as regulators of the water system preventing and controlling floods in autumnal rains and restraining the saltwater intrusion processes. Generally, the soil of natural coastal ecosystems can be classified as saline soils with primary salinity in those with a strong specialisation of the plants that are distributed by edaphic factors, being a predominantly *edafofila* vegetation. In these environments the salinity and humidity are differentiating characteristics and refuge for plant species of great interest, among which *J. oxycedrus* L. subsp. *macrocarpa* (Sm) Ball stands out (Costa, M. 1995, 1999; Pérez, R. et al. 1992). The most representative populations of marine juniper are in El Saler and Prat de Cabanes-Torreblanca (Laguna, 1998; Tirado, J. 1998; Boira, H, 1995; García, J.J. 1999).

Between 1999-2000 marine junipers were planted in El Saler, observing during the monitoring a great influence of the edaphic conditions on the chances for success of the final establishment of the seedlings (García, J. J. 1999, 2000). In order to optimise the selection of the plantation areas and to guarantee their success an exhaustive analysis of the soil where juniper grows was proposed, to identify the preferential edaphic characteristics of marine juniper.

Material and Methods

1.1 Localisation of populations

The existing specimens were located in the Nature Reserves of El Saler and Prat de Cabanes-Torreblanca and their edaphic distribution recorded. In El Saler, the few remaining specimens of *J. oxycedrus* subsp. *Macrocarpa* occupy the post-dune area of the first large alignment as well as the most inland area of thicket, although greater growth with tree-like appearance is observed in the protected specimens of the inland area. The soil characteristics of the area are described as Psamments (Soil Taxonomy, 1998) belonging to the Entisoles order with sandy texture and less than 35% of rocky fragments. In some more depressed areas with the water table close to the surface, the Ustipsamments are developed, which have an ustic regime, the rest can be defined as Quartzipsamments as they have more than 90% of materials of a size >0.02mm comprising resistant minerals.

In the Prat de Cabanes-Torreblanca Nature Reserve, on the line of sand dunes with pebbles, the few specimens of *J. oxycedrus* subsp. *macrocarpa* that exist in the area are established here. In this area there are two kinds of soil: Psamments (Entisoles order) and Typic sulfihemists (Histosoles order), the latter are typical of the depressed area with abundant marsh vegetation where the gradual accumulation of organic material occurs in a humid environment, causing the formation of a water-saturated organic horizon and the presence of sulphidic materials with a pH around 6.5 and permanent shallow reduction conditions. *J. oxycedrus* subsp. *macrocarpa* is found in the highest areas on the shoreline with sandy soil (Quartzipsamments) that have a large quantity of smooth pebbles, particularly on the surface. The location of the only population existing in Torreblanca is in the southern zone of the Nature Reserve next to La Sal Tower.

1.2 Profiles analysis

During the opening of the profiles, they were described according to the Soil Taxonomy, 1998 methodology. The sampling of the profiles was done by taking disturbed samples from two depths: 0-15cm and 0,30cm and unaltered samples using the cylinder method to analyse the



hydraulic properties, the humidity of the field and the apparent density. In the El Saler area a total of 8 profiles distributed over two areas were characterised, the first in the most exposed area close to the beach behind the first lines of dunes with a total of 3 profiles and the second in the most protected area inside the pine forest, where 5 profiles were taken. Regarding Prat de Cabanes-Torreblanca, a total of 7 profiles were taken, all in the same area as the population is extremely scarce and only 7-8 specimens remain distributed over an area of approximately 1200m².

In the laboratory the following physical properties were analysed: apparent density (unaltered cylinder method), real density (pycnometer method), porosity (from the real and apparent density), humidity of the field (gravimetric analysis), mechanical analysis (Boyucos hydrometer), humidity curves (pressure cooker method), hydraulic conductivity (permeameter method). The chemical and physico-chemical properties analysed were: Obtaining the extract of the saturated paste (centrifugation) and extract according to Spurway, analysis of anions and cations (methods described in Cobertera, 1993), pH (pH meter), electrical conductivity (conductimeter), organic material (Walkley-Black) and carbonates (Bernard calcimeter). The capacity of cationic exchange was not measured as the presence of clays is very low and on occasion imperceptible. To complement the laboratory tests field annotations were taken describing the horizons and their characteristics; degree of hydromorphism, structure, consistency, presence and nature of clayskins, fastening, pores, roots, rocky fragments, nodules, biological activity and limits between horizons. Finally, some superficial samples were taken in a grid form recording the predominant species in each quadrant.

Results and Conclusions

Analysis of the results establishes a series of characteristics of the profiles and grids studied.

Profiles

They have a sandy texture with a very low percentage of clay, so they have a very low capacity for cationic exchange and water retention.

In the La Sal Tower profiles, the presence of very large elements is observed in percentages above 70%, which increases in the macroporosity and, therefore, the infiltration and facilitates radicular development.

The average conductivity values range between 1-4 dS/m, however in some profiles from La Sal Tower much higher values were observed around 70dS/m. In this area some individual marine juniper plants are semi-dry, proving the saline stress. This fact may be related to the saltwater intrusion phenomenon that is being observed in the area due to the indiscriminate use of irrigation water.

The hydraulic conditions indicate that the soil has a very high saturated hydraulic conductivity and, therefore, good drainage where the water table is deep. On the other hand, it has low retention capacity and a very low percentage of water that can be used by the plants.

The contents of mineralised organic material are very low, however, in La Devesa del Saler area a



great accumulation of plant remains in semi-decomposition has been observed (organic horizon SJ006h) which retain water and prevent the losses of humidity caused by solar radiation as well as being a source of gradually released nutrients.

An abundance of carbonates is observed in all the profiles.

Regarding fertility, it is low. The majority of nutrients are below the suitable limits.

Grids

In the transect formed by grids MJ2 and MJ3 we observed that conductivity increased in the highest areas, this is due to the increase of salts as an effect of evaporation-transpiration. The water table is over 50cm below the surface in the dry season.

The upper part of the dune (MJ1) is the area with less salinity as the water table has not affect here as it is too far away (>400cm).

In grid MJ4, the depressed area has the greatest conductivity. This is due to the presence of the water table just a few centimetres below the surface even during the dry season, observing permanent hydromorphic characteristics.

The conductivity values range between 1 and 10 dS/m in the areas where marine juniper is established, in the areas where the capillary rises or where the water table is permanently just below the surface, it can reach values greater than 300 dS/m.

The humidity of the field increased in the depressed areas.

The pH values range between 7.5-9.0, observing a link with the electrical conductivity so as the conductivity increased the pH decreases. The greatest pH values are in the higher areas (MJ1).

Regarding the vegetation, the transect formed by grids MJ1, MJ2 and MJ3 clearly describe the typical distribution of the Valencian coastal vegetation. On the upper part of the dune (MJ1) exposed to sea breezes there is *Elymus farctus*, *Ammophila arenaria*, *Lotus creticus*, *Othanthus maritimus*, *Malcomia littorea* and *Ononis natrix subsp. Ramosissima*. Behind the dune, less exposed, there is *Eryngium maritimum* and *Pancratium maritimum*. In the post-dune area (MJ2. MJ3) protected from the sea breeze, species are appearing on the semi-fixed dunes (MJ2): *Ephedra distachya*, *Launaea fragilis* and *Ipomea imperati* which are replaced by brush species in the fixed dune area (MJ3): *Quercus coccifera*, *Chamaerops humilis*, *Pistacia lentiscus*, *Pinus halepensis* and *Juniperus oxycedrus subsp. macrocarpa*. The latter is in the area with conductivity of less than 6 dS/m.

In conclusion it must be indicated that the ideal edaphic conditions for the establishment of new marine juniper plants are: sandy texture, with organic horizon, deep water table and electrical conductivity between 1-4 dS/m. Marine juniper is not demanding regarding specific nutrients. The presence of brush and/or tree vegetation facilitates the installation of the new juniper specimens, which reach greater development and height in semi-cleared areas. In these areas,



the presence of an organic material accumulation area also facilitates the storage of water and the reduction of evaporation-transpiration, providing the juniper with a great quantity of nutrients and water. However, in these areas other factors must be borne in mind for the establishment of new plants in future repopulation programmes, such as: competition between species and the presence of some herbivores.

QUESTIONS RAISED IN THE SPEECH

Question 1. Is there a variety of soils in the different areas where the marine juniper is distributed?

In the studies I've carried out in the Torreblanca zone where there is a population that is decimated but still existing, and in the El Saler zone, I have noticed that the marine juniper selects places where there is a large amount of sand, that is to say sandy ground, and it is not found in other kinds of ground. The variety appears more in terms of humidity and salinity but not in the composition of the type of texture.

Question 2. Do you think it would be advisable to analyse the ground in other juniper populations to better specify the soil requirements of marine junipers?

Of course. The remaining populations along the Valencia Community region's entire coast are quite limited. I haven't noticed big differences in terms of their soil compositions or properties. What I can give is a basic idea of what the general conditions of the ground is where the junipers become established. It would be advisable to compare this with other areas where, for example, there is a larger population or they have progressed more.

The general characteristics are totally sandy grounds, with a great capacity for permeability. In other words, ground that drains easily, with conductivity lower than 6-16 dS/m. From here on the juniper begins to suffer from water deficit and of course saline stress. I have also seen that as the composition is 95% sand, they are not very capable of retaining nutrients and water. In zones where there may be more stabilised fixed dunes with other shrub species, they are going to introduce organic material into the ground to allow the juniper to collect more nutrients than in more exposed zones. Observing the habitat of other juniper zones I have noticed that the ground is more developed than that of the work zone.

Question 3. I have read in some publications that the marine juniper has preferences for ground with a high iron content. Have you done experiments here?

There are quite a lot of analyses of micro and macro-nutrients in my report. The fact is that practically no iron content can be appreciated. I would like to be able to analyse in other zones to see if what you are telling me about the preference for iron is true and improve the introduction of the seedlings we are producing.

Question 4. If we had to reintroduce junipers in a dune zone, as well as climate characteristics and exposure to the sea what would we basically have to take into account from the point of view of the soil?

To make a general summary of the characteristics of the habitats where marine junipers are



found, we have mentioned that they are sandy grounds, with a lot of drainage and low electrical conductivity and salinity. They also have a low nutrient content.

In a transect that goes from the beach shoreline to the wooded area, looking at the soil conditions and topography we find the following distribution: firstly, there is the first dune line which are of very loose sand where the juniper cannot take root. Then we have the post-dune area with semi-fixed sand that is more stabilised, where the freatic level is sufficiently far from the surface so that there is not a high conductivity (always below values between 1-4 dS/m which is optimum for where the juniper establishes itself), with bushy vegetation of low stature that helps to increase establishment of the juniper. Further inland, we find depressed zones where the topography allows the influence of the saline freatic level to reach up to the surface in direct contact with the sand. We cannot establish the marine juniper in this area because the conductivity is very high and we know that salinity is negative for the juniper. Finally, in the hinterland there is an area with bushy and wooded vegetation, and the soil conditions are good in the sense of stable sand and a supply of organic mass with more developed ground. Nevertheless, we can find dense vegetation that does not allow the juniper to get established. The juniper can only become established in clear spaces.

To sum up, I would choose two areas from the point of view of soil for juniper establishment: the post-dune zone of the first line of dunes, and clearings in the wooded area.



GENETIC DIVERSITY

of *Juniperus oxycedrus* ssp *macrocarpa*

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INTRODUCTION

Juniperus oxycedrus L. subsp. *macrocarpa* (Sm.) Ball (Cupressaceae) is a long-life shrub, growing on coastal sand dunes, along the Mediterranean basin and SW Asia (Greuter *et al.*, 1984). It is a wind-pollinated procumbent plant (up to 3 m), characterised by brownish-reddish female cones. In Spain, it shows a disjunctive distribution in the SW and E of the Iberian Peninsula, and in the Baleario Islands (Güemes & Rosello, 2003). These current populations are severely fragmented and isolated, showing three main áreas: SW of Andalusia, E of Spain and the Balearios (figure 1). The former population has the highest number of individuals (table 1), although currently it has suffered severe regression due to human pressure resulting in a discontinuous distribution (Pastor & Juan, 1999).

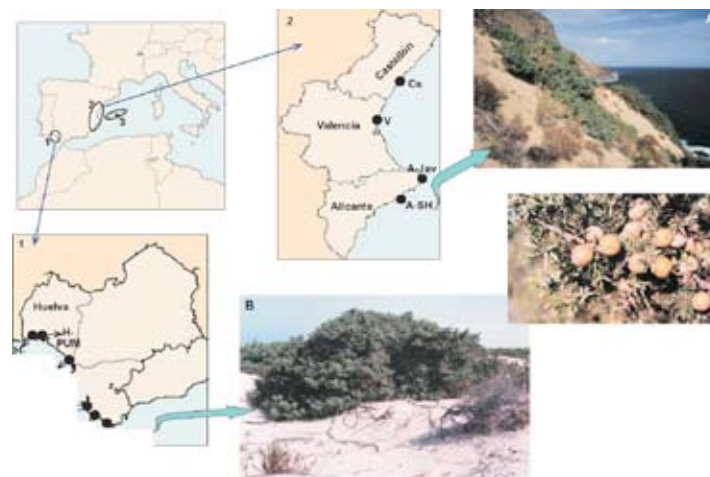
Their habitats are threatened by the dramatic changes in the coast, mainly due to urbanization. This fact origins a permanent and continuous destruction of their fragile natural áreas. By this reason, this plant has been catalogued endangered (EN) in SW of Spain (Blanca *et al.*, 1999) and recently as "Vulnerable" (VU) in Spain (Güemes & Rosello, 2003) according to the IUCN (2001) categories.

The aim of the present study is to analyse the genetic variability of Spanish populations and to check: (1) if they are structured as genetically isolated populations due to their current fragmentation; and (2) if the biometric differences shown among some of this populations (Juan *et al.*, 2003) are in relation to any genetic structure of the populations.

MATERIAL AND METHODS

The studied populations and the estimated number of individuals for each one are shown in table 1. A total of 56 samples were analysed using AFLP (PE Applied Biosystems Inc.) using EcoRI (a rare 6-base cutter) and MseI (a frequent 4-base cutter). Twelve combinations of three selective bases of EcoRI and MseI primers did not yield enough results, due to the large size of genome of this taxon. So, the selective primer trial was repeated with combinations of four selective bases for MseI primers. Twelve combinations were tested of which three combinations of selective bases yielded excellent results (ACT+CTAG; ACG+CTAA; ACC+CTAC).

The fragments were separated using an ABI 377 sequencer. Gel analysis was carried out with Genescan 3.1 and Genotyper 2.0 (PE Applied Biosystems Inc). Amplified fragments from 500 base pairs (bp) were scored: present (1) or absent (0) for all individuals, resulting a binary





However, the accessions from the Balearics formed a compact and separate group, clustering together in the NJ dendrogram. This genetic aggregate would respond to the long isolation of this archipelago from the Iberian Peninsula within the last 6 million years, probably existing no current genetic relations between the Balearic and the Iberian populations.

QUESTIONS RAISED IN THE SPEECH

Question 1. According to your studies, the populations on the Iberian Peninsula are not very far from each other. There are some areas where there are now very few specimens. Do you think that the specimens in places where the population is bigger could serve as “mother” plants to strengthen populations?

According to the results I have obtained from genetic analyses, the material from one population could easily be taken from one population to another. The marine juniper's genetic diversity is quite homogenous apart from in the Balearic islands. In any case, what I would do would be to repopulate the Valencian populations exclusively with Valencian material and not with material from Andalusia, for example. I have been able to progress in studies with other molecular markers and the Valencian populations are clearly later than the Andalusian ones and are beginning to separate themselves from the latter genetically. I would move material from some populations to others but separating three large areas: the Balearics, the Valencia Community region, and Andalusia.

Question 2. Given the little genetic difference genetic that I believe there is between peninsular marine junipers, would it be advisable to use Andalusian junipers to repopulate any area of the Valencia Community region?

I wouldn't do it. The data I have presented in my communiqué indicates that there is more or less some genetic homogeneity and that it is all one population. However, studies carried out with new molecular markers show that there may be some genetic separation, albeit very slight, between Andalusia and some areas of the Valencia Community region. I would recommend repopulations in Andalusia with exclusively Andalusian material, and in the Valencia Community region with Valencian material. Even so, I must emphasise that this genetic difference is currently very fine.

Question 3. Do you think it is necessary for the seeds that are to be used in the natural restoration of the Devesa to be collected exclusively in situ? Or could they be brought from another region when dealing with meagre, withering populations like that of the marine juniper?

Ideally, the individuals that are going to be used to repopulate the Devesa come from old populations that are nearby or at least from nearby populations like Castellón or Alicante. If there were no material from these groups it would be perfectly feasible to bring material from Andalusia, but not from the whole of Andalusia as some of their populations are beginning to become separate genetically. Some are more related to those of Valencia, so a certain amount of care must be taken in selecting the material.

It is recommendable to use populations that are more or less nearby, collecting material in situ.



Question 4. Is there a genetic variation according to the ecosystem in which they are found? I mean in populations near the sea or further away.

There is no kind of genetic variation with respect to the ecosystem where it is found. It is all the same if the population is nearer or further from the sea. Neither have there been results of genetic separation with regard to the sex of the plants. Independently of where the plant lives or its sex (male or female plants), they appear mixed both in the Iberian Peninsula and Balearics region and in some areas of Andalusia. There is no ecological difference, not even according to the individuals' sex.



THE PRODUCTION OF MARINE JUNIPER IN THE

Juniperus oxycedrus subsp. *macrocarpa* NETWORK OF GREENHOUSES OF ANDALUSIA

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Introduction

Coastal juniper fields are a typical plant community of the Andalusian Atlantic coastline, considered a "Priority Habitat" by Council Directive 92/43 EEC regarding the Conservation of Natural Habitats and of Wild Flora and Fauna. In Andalusia its critical conservation status has led the Department of Environment to include marine juniper (*Juniperus oxycedrus* L. subsp. *macrocarpa* (Sibth & SM.) Ball.) in the *Andalusian Catalogue of Threatened Species (Law 8/2003 of the Wild Flora and Fauna of Andalusia)*, as a species **in danger of extinction**.

Recognition of this category of threat led the Department of Environment to carry out a detailed assessment of the risks and disruptive agents for the species and its community, as well as a diagnosis of the state of its populations. It also established the fundamental objectives of guaranteeing the protection and conservation of the existing populations minimising the factors of threat, and favouring their growth and occupation of their potential area. The main threat is development of the coastline, which provokes irreversible destruction of the populations and fragmentation into very small groups.

Attainment of these objectives has materialised in the **Coastal Juniper Fields Conservation Programme (2002-2006)** which has included various restoration actions of the habitat of this species and a complementary line of monitoring, research, dissemination and environmental education tasks.

An important part of these recovery actions has been the restitution using marine juniper produced in the **Network of Greenhouses of the Department of Environment**. In this case the objective was to reduce the isolation and progressive reduction in size of the current populations.

In order to deal with this demand propagation of this species has been fundamental, a task that has been done since 2001 at the Network of Greenhouses of the Department of Environment.

Distribution of Marine Juniper in Andalusia

In Andalusia the current populations of marine juniper are distributed discontinuously along a narrow coastal strip some 225 km long, between El Rompido (Huelva) and Tarifa (Cádiz). They are distributed through the **Cádiz-Huelva-Algarve sector**. It is estimated that the Andalusian population of this species currently comprises some 24,245 individuals of all ages, although in small populations the majority are of a medium to large size, young plants being scarce as a result of their low natural regeneration. The older Andalusian juniper field populations are in protected natural areas.

The **habitat** for marine juniper is typically in areas close to the sea, normally on sandy soil, although it can also live on rocks or cliffs as in the La Breña Nature Reserve and Barbate Marshes. With the exception of the latter, the small marine juniper forests often appear in sandy areas near beaches, on mobile or fixed dune systems, both fossil and more recent, indistinctly occupying the dune peaks and slacks between successive lines of dunes (known locally as "corrales").

Production of Marine Juniper

collection and cleaning

The **fruit** of the marine juniper is a 12-15 (-25) mm round or somewhat ovoid fleshy cone known as "galbula", which is light green when unripe and purple-brown when ripe. The **seeds** are triangular, hard and do not have wings. Each fruit has between 2 and 3 seeds, although as few as 1 and as many as 7 (-9) may be found.

Fruiting is from March to May, and the galbulas ripen in the second year.



They are **harvested** between August and October. The fruit is harvested manually before they are completely ripe, which is shown by their yellowy-green colour. The harvest is done from the ground. Care must be taken as the fruit does not ripen until the second year, so first-year fruit must not be harvested (distinguishable by their smaller size and green colour).

Marine juniper is **dioecious**, which must be borne in mind during the harvest as only the female plants will have fruit.

The following table shows the quantities of fruit and number of towns where Marine Juniper has been harvested by the Network of Greenhouses of Andalusia between 2002-2007:

Year	Kg fruit gathered	Number of towns
2002	4.808	10
2003	130,8	2
2004	42	2
2005	4.980,8	4
2006	804,9	7
2007	16	1
TOTAL	10.782,5	

The fruit is soaked **clean**, the seeds are separated by mechanically removing the pulp and rinsing until the seeds are completely clean; they are air-dried until they reach the optimum humidity content for their conservation and later they are subjected to fanning which will remove any remaining traces of dry pulp and skin.

Once clean they are stored at 3-4°C in a refrigerated chamber until they are due to be sown. In batches stored for two years in these conditions no decrease in the percentage of germination has been detected.

Juniper seeds have **orthodox behaviour**, that is, they are able to remain viable after being dried to less than 5-10 % of their humidity content.

The data shown in the following table has been taken from populations of *Juniperus oxycedrus* subsp. *macrocarpa* in the territory of Andalusia and are based on the experience of the Network of Greenhouses:

Average weight 100 seeds (gr)	Seeds/kg	g seeds/ Kg fruit	Purity
6,119	16.342	168,3	98%

For every kg of fruit harvested an average of 168.3g of seeds are obtained, in other words, an approximate yield of 16.8%. With the cleaning methods used a 98% batch purity is obtained. One kg of marine juniper seeds contains an average of 16,000.

Seedbed sources

The **seedbed sources** comprise "trees located within a fruit and seed harvest area, with a surface area containing one or more groups of well-distributed trees and in a sufficient number and density to ensure adequate interpollination". They are one of the two kinds of basic materials accepted for producing reproduction material for the **identified category**.

The seedbed sources are basic materials that are approved for the purpose of providing seed to reforestation programmes with species of medium or low economic value, and where they look to ensure local seed supply from those where the origin is known and, therefore, there is an



assumption that it is perfectly adapted to the ecological conditions of the area.

In the *Order of 10 July 2003, which approves the list of basic materials for the production of identified forestry reproduction materials* (BOJA nº 145) three **seedbed sources** are included for *J. oxycedrus* subsp. *macrocarpa* in Andalusia:

Region of origin	Province	Code	Municipality	Forest name
43. Southern Andalusian coast	Huelva	E-43	Almonte	Arenas Gordas
43. Southern Andalusian coast	Huelva	E-43	Punta Umbría	La Bota y El Portil
43. Southern Andalusian coast	Cádiz	E-43	Conil de la Frontera	Playa del puerco

The seedbed sources are included in the **National Catalogue of Basic Materials for the production of Identified FRM** (BOE nº 234, of 28 September 2004).

Since **seed certification** has started, five batches of Marine Juniper have been certified, all for the production by the Network of Greenhouses itself, four batches from 2006 and one from the 2007 harvest:

FS-237/43/21/002	Punta Umbría	8,9 Kg	22 y 23/08/2006	Network of Greenhouses. CMA	E-AN/0006/06
FS-237/43/21/001	Almonte	36 Kg	17/08/2006	Network of Greenhouses. CMA	E-AN/0007/07
FS-237/43/21/001	Almonte	37 Kg	16/08/2006	Network of Greenhouses. CMA	E-AN/0012/07
FS-237/43/11/001	Conil de la Frontera	63 Kg	14/08/2006- 17/08/2006	Network of Greenhouses. CMA	E-AN/0013/07
FS-237/43/11/001	Conil de la Frontera	16 Kg	08/08/2007	Network of Greenhouses. CMA	E-AN/0025/07

Propagation

Sowing must be done in autumn (October), the seeds are first soaked in water for 348 hours, removing any that float (empty seeds) and rinsing several times.

This species accepts transplanting well, sowing is done in seedbed boxes using peat moss and vermiculite in a proportion of 9:1, covering the seed with vermiculite 1.5 times the largest size. Perlite and fertilised coir have also begun to be used in a proportion of 1:1 for the seedbed boxes, giving quite satisfactory results.

Germination occurs between 3-5 weeks (40 days), when the seedlings begin to germinate they are protected from extreme temperatures, in greenhouses or under plastic, so that the ambient temperature of the seedlings is 20-21°C. For this reason the ventilation is monitored to obtain temperatures as close as possible to these values, as the plants are very delicate during the first stages. 40% germinate.

This species accepts transplanting well, when the seedlings have 2 or 3 needles they are transplanted to a plug tray or flowerpot (400cc cavities are recommended), the soil used should drain more so the mix used is 90% peat moss and 10% river sand, but always maintaining a certain humidity. Experiments are also being done for the production with another soil formed by fertilised coir and perlite in a proportion of 9:1.

One-year-old plants can grow to 50cm tall, and can remain in the same recipient for 2 years, later needing to be transplanted to larger flowerpots or tray cavities. The survival rate during



the first year is approximately 90%.

Periodic preventative treatments must be done during production with broad-spectrum **fungicides**. It is also advisable to apply **soil insecticide** to seedbeds on a monthly basis to control the appearance of nematodes.

This species is mainly produced in the Greenhouses of La Alcaidesa (Cádiz) and San Jerónimo (Seville), which are the greenhouses that belong to the network that have the most similar conditions to the natural distribution of marine juniper. Although a part has also been produced in the Greenhouse of Las Tobas y Alberquillas (Huelva).

In total 71,684 feet of coastal juniper have been planted in the field within the framework of the juniper fields Project using **1-year-old plants**, planting has been done in two successive stages (2003/04 and 2004/05), in the provinces of Huelva and Cádiz. The following tables show the areas of action:

Municipality	Forest	Year of planting		Total planted
		2003	2004	
Palos de la Frontera	Dunas del Odiel		1.720	1.720
Punta Umbría Huelva	Campo Común de Abajo	740		740
	Ganchos de la Laguna Marítima	1.000	4.120	5.120
	Llanos de Bacuta	640		640
Lepe	Flecha del Rompido	1.620	15.240	16.860
Isla Cristina	Dunas de Isla Cristina	845	7.440	8.285
			Total:	33.365

Municipality	Forest	Year of planting	Total planted	
Tarifa	Dunas de Tarifa-Punta Paloma	2003	1.300	
	Dunas de Tarifa-Punta Camarinal	2003	1.485	
	Betis	2004	6.600	
Barbate	Breñas Alta y Baja	2003	15.567	
	Dunas de Barbate	2004	1.660	
Conil de la Frontera	Rosan	2004	2.600	
	Dehesa de Roche	2004	4.014	
Puerto de Sta. M ^a	Dunas de San Antón	2004	2.063	
Rota	Pinar de Rota	2004	2.750	
Sanlúcar de Barrameda	Pinar de la Algaida	2004	280	
			Total:	38.319



Finally, a series of dissemination campaigns, biodiversity and social participation training have been developed, particularly aimed at the populations of the area occupied by marine juniper fields. These tasks have comprised the creation of abundant dissemination material and the start of several sub-programmes, including various plantings using volunteers.

The **total number of juniper plants** that have left the Network of Greenhouses during this time is 80,470, as well as supplying its own Juniper Fields Conservation project for the different actions such as reinforcement of populations and environmental education campaigns, the rest of the plants have mainly been sent to different Councils in the province of Cádiz, as well as to environmental education campaigns, Botanical Gardens or habitat restoration projects. The following table shows the final destination of the plants:

DESTINATION	PROJECT
Acuartelamiento de Bolonia (Tarifa)	EDUCACIÓN AMBIENTAL CÁDIZ
Agente de Medio Ambiente	EDUCACIÓN AMBIENTAL CÁDIZ
Asociación de vecinos de Facinas	EDUCACIÓN AMBIENTAL CÁDIZ
Ayuntamiento de Algeciras	AYUNTAMIENTOS CÁDIZ
Ayuntamiento de Chiclana	AYUNTAMIENTOS CÁDIZ
Ayuntamiento de Rota	AYUNTAMIENTOS CÁDIZ
Ayuntamiento de Puerto Real	AYUNTAMIENTOS CÁDIZ
Ayuntamiento de Rota	AYUNTAMIENTOS CÁDIZ
Ayuntamientos Cádiz	AYUNTAMIENTOS CÁDIZ
C.C.T.A DE MÁLAGA - ALGARROBO-COSTA	EDUCACIÓN AMBIENTAL MÁLAGA
C.E.I.P. SAN FELIPE DE LA LINEA	EDUCACIÓN AMBIENTAL CÁDIZ
C.E.I.P. TARTESOS DE ALGECIRAS	EDUCACIÓN AMBIENTAL CÁDIZ
ceip Nª Sra del Rosario Guazamara	EDUCACIÓN AMBIENTAL ALMERÍA
Centro formación empleo Campo de Gibraltar	EDUCACIÓN AMBIENTAL CÁDIZ
COLEGIO MONTECALPE DE ALGECIRAS	EDUCACIÓN AMBIENTAL CÁDIZ
Conser. De hábitats litoral de Cadiz EGMASA	PROYECTO CÁDIZ
Conserv. Hábitats litorales de Cádiz EGMASA	PROYECTO CÁDIZ
Educación Ambiental Cádiz	EDUCACIÓN AMBIENTAL CÁDIZ
El Boticario	OBRAS PROPIAS ALMERÍA
Goyca - Marismas del Odiel	OBRAS PROPIAS HUELVA
HOSPITAL PUNTA EUROPA DE ALGECIRAS	EDUCACIÓN AMBIENTAL CÁDIZ
Huelva Goyca	AYUNTAMIENTOS HUELVA
I.E.S. Almadraba de Tarifa	EDUCACIÓN AMBIENTAL CÁDIZ
I.E.S. BAELO CLAUDIA-TARIFA	EDUCACIÓN AMBIENTAL CÁDIZ
JARDIN BOTANICO AYTO. PUERTO REAL	EDUCACIÓN AMBIENTAL CÁDIZ
JARDIN BOTANICO DE GIBRALTAR	EDUCACIÓN AMBIENTAL CÁDIZ
Jardín Botánico Dunas del Odiel	OBRAS PROPIAS HUELVA
JARDIN BOTANICO LAS TRES CULTURAS	EDUCACIÓN AMBIENTAL CÁDIZ
Monte publico laguna del Odiel-Palos de la Frontera	OBRAS PROPIAS HUELVA
Obras propias Huelva	OBRAS PROPIAS HUELVA
Parador de Mazagon	OBRAS PROPIAS HUELVA
Proy. Control especies exóticas TRAGASA	PROYECTO CÁDIZ
Rep. Forestal montes propios de Cádiz SEMISUR	PROYECTO CÁDIZ



DESTINATION	PROJECT
Rep. Huerta Grande	OBRAS PROPIAS CÁDIZ
Rep. Montes Públicos de Cádiz	PROYECTO CÁDIZ
Rest .humedales de la Comarca de La Janda	PROYECTO CÁDIZ
Restauración Paisajística - Carril Bicil	OBRAS PROPIAS HUELVA
Restauración Paisajística de Punta Umbría - Huelva	OBRAS PROPIAS HUELVA
Salinas de astur	OBRAS PROPIAS HUELVA
Sanidad vegetal	OBRAS PROPIAS SEVILLA
Taller de Empleo Pinar del Rey-Ayto. de San Roque	EDUCACIÓN AMBIENTAL CÁDIZ
Yacimientos arqueológicos, Bolonia	PROYECTO CÁDIZ

QUESTIONS RAISED IN THE SPEECH

Question 1. How is germination induced in marine juniper seeds?

Germination is not induced in Andalusia. The seed is gathered when it is still a greeny-yellow colour. In this way, and without treating the seed, germination rates of 40-50% are obtained.

Question 2. As well as the juniper plants, do you produce other species that are present in the coastal juniper fields?

Mainly plants from arid areas and that can bear limewater.

Question 3. In the 2002-2006 coastal juniper fields conservation programme, were only one-year old juniper plants used?

One and two-year old plants were used, following the criteria of the technical staff in charge in each area. In very windy areas, one-year old plants could be covered by sand.

Question 4. Do you have any plans for a new marine juniper project?

We do not produce juniper plants for any specific project, but to replace any that have died in previous projects.

Question 5. What happens with plantings done in peat-rich soils for sandy soils, as is the case with juniper?

Producing a plant in the nursery is relatively easy. The problem is producing a plant that later takes root. Problems can arise in places with very dry, shallow soil, etc. When peat dehydrates it is extremely difficult to rehydrate it, which is what happens in places like Andalusia. For this reason, we are using peat mixed with coconut fibre.

Question 6. Do any special precautions have to be taken to produce juniper?

In general, no. The key to producing juniper is the moment the seeds are gathered. They must be gathered before the germination-inhibiting enzymes are activated.



Care must be taken with fungal attacks during the first stage.

Question 7. Has the decline of marine juniper in Andalusia slowed down? What are the risk factors for juniper fields in Andalusia?

The main problem for juniper is the destruction of its habitat.

Question 8. I would like to know if you use mycorrhizae in the plants grown in the nursery, or whether you inoculate the plants in the field. I would also like to know if mycorrhizae are considered in this project.

The Department for the Environment has a mycorrhizal association plan for edible fungus. Black and white truffles are being used in mycorrhizal associations in Almeria. Tests are being carried out with the Saffron milk cap and grumel.

Question 9. Do the different parts of Andalusia have different juniper production success rates?

Of the three areas in Andalusia, the best for reproduction is Punta Umbría. The reason is no known, but the success rate is double in this area compared with the other two areas.

Question 10. Have you transplanted marine juniper, when it has had to be removed due to a property development plan? If so, what is the success rate?

This is not usually done. There was a case in the Roche area, where a residential area was going to be built, where the property developer was forced to remove some specimens for their later reintroduction. Although the results were a disaster, it must be emphasised that we do not know how this work was done.

Question 11. What measures are taken upon gathering the seeds to conserve the genetic diversity?

Human resources are used. There are several brigades, each led by a technician who is in charge of gathering the seeds from the field. When they are gathering, they never take all the seeds from a specimen and they take seeds from the largest number of specimens possible. They do not use the same area as the year before.

Question 12. The proliferation of Stone Pine is harmful to Andalusian juniper fields?

I believe not.

Question 13. I understand from the answer to mycorrhizae and juniperus that they are not used in other nursery-grown species either, are they?

At the moment no mycorrhizae of any kind are being used, except those of edible fungi.



Question 14. What are the optimum conservation conditions for marine juniper seeds?

What we do in Andalusian nurseries is, once the seeds are gathered and cleaned, they are stored in sealed glass jars in a conservation chamber at 3-4°C. This way the power of germination is maintained for 4 to 5 years.

Question 15. Is the idea to achieve some continuity of juniper fields along the Andalusian coastline?

That is a matter for the Conservation Service.

Question 16. Do you produce a specific number of juniper plants every year, or does it depend on the need?

Andalusian legislation restricts the production of threatened species by only allowing it when contemplated with a Recovery Plan. Therefore, production is done within the juniper recovery programmes.

Question 17. What is the greatest problem for producing juniper plants?

Juniper does not currently have any problem with production. A species is deemed to have this problem when: 1) there are difficulties in gathering the seeds and/or 2) the germination rate is low.



MANAGEMENT OF THE ALBUFERA LAKE AND ITS DEVESA

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The Devesa is a thin coastal strip of sand that forms part of the sandbar that closed off the gulf of Valencia, turning it into the Albufera. It originated in the Quaternary period through rains, and is located 9km south of Valencia capital city with a surface area of 850 ha.

HISTORY OF THE ALBUFERA AND ITS DEVESA

ANTIQUITY

Romans

Arabs

MIDDLE AGES

This spans from Don Jaime I's re-conquest of Valencia in 1238 to Don Alfonso III

MODERN ERA

Spanning from 1479 to 1808, with two very clear periods standing out:

From the reign of Fernando the Catholic up to Felipe V.

From Felipe V to Carlos IV. In 1761, Carlos III ordered the "General surveying and demarcation of the Albufera and its neighbouring Devesa", giving a surface area of 13,962 Ha.

CONTEMPORARY ERA (1808-1905)

As of 1905

The Valencia City Council begins the procedures to obtain the transfer of the lake and its Devesa from the State. On 23rd June 1911 the Transfer Law was decreed, and on 3rd June 1927 Alfonso XII transferred the 3,144 Ha that the Albufera and its Devesa then occupied, the City Council paying 921,819.65 pesetas and 151,160.76 pesetas respectively for the two areas.

In 1962 Valencia City Council transferred 97,315 m² to the Ministry of Tourism to situate the Parador Nacional Luís Vives (Hotel) here. That same year, a plot of 50,000 m² was ceded for 50 years to the Ministry of Agriculture where the "Centre de Protecció i Estudi del Medi Natural" (Environmental Study and Protection Centre) is currently located.

Practically until 1964, the Albufera of Valencia and its Devesa remained intact for all Valencians to use and enjoy.

Urban Development Plan (1964 – 1978)

- Large alteration in practically the entirety of the Devesa's ecosystems:
 - 90 % of the outer dune ridge is cleared away and substituted by a sea promenade parallel to the coast.
 - The "malladas" or depressions between the dunes are filled in with sand and repopulated with eucalyptus trees
 - The inner lines of dunes are broken up with the construction of roads, buildings and hydraulic and electrical infrastructures.
- The Devesa is used as a traditional green area by a great number of visitors:
 - Free parking
 - Indiscriminate tourism (fires, tables, chairs, rubbish)
 - Little knowledge of natural values.



- Valencia City Council managed the Albufera and its Devesa without suitable technical criteria. They were lacking in qualified staff to handle the complex and heavily unbalanced ecosystems.
- 467,216 m² of the Albufera's Devesa was privatised.

Social Movement

- University:
 - Escuela de Arquitectos de Valencia (Valencia School of Architects)
 - Colegio Oficial de Doctores y Licenciados en Filosofía y Letras y Ciencias (Official Association of Doctors and Masters Graduates in Philosophy, Letters and Sciences)
- Prominent individuals:
 - Docavo Alberti
 - Felix Rodríguez de la Fuente
 - Josep Vicent Marqués
- Ecological pre-movements:
 - AEORMA
- Social movement:
 - 15,750 signatures

Management

The first democratic City Council in 1979 halted the Devesa's "Urban Development Plan" and ordered a team of various disciplines to draw up a report (urban planning, legal, economic, ecological) that should allow it to have an adequate base for the decisions to be taken on the Devesa's future, called "Prior Studies for the Organisation and Regulation of the El Saler Devesa Countryside Area (Valencia City Council, 1980)".

On 3rd June 1980, the Valencia City Hall Meeting takes on the study's conclusions, suspends licences in the area and decides to begin drawing up a Special Protection Plan for the El Saler Devesa Countryside Area (PEPMDS in Spanish), approved in 1982. This Plan, carried out using the 1975 Land Law, is a legal tool that ensures the maintenance and regeneration of the Devesa's ecosystems, eliminating uses and exploitations that are incompatible with the area's natural characteristics or with the regeneration of its ecosystems.

Main Aims of the PEPMDS

- To conserve the least affected areas
 - Motor traffic closed off in all the southern area and part of the north, comprising an area of 473 ha. With this closure, a colony of Grey Herons (*Ardea cinerea*) has been encouraged to establish itself in the Devesa and the black-crowned Night Heron (*Nycticorax nycticorax*) too. Furthermore, the population of fauna in general has increased.
 - Pedestrian access closed off in Plà de la Sanxa and in La Creu, areas of high scientific and/or naturalistic value (a grey heron colony, and populations of marine juniper).
 - Pedestrian access closed off in the most invaluable front-line dune areas, such as la Punta, the Muntanyar de la Rambla and the Muntanyar del Pujol, with a total of 311.000 m².
- To recuperate degraded areas.
 - Mobile dunes
 - Elimination of 6,530 linear metres of seafront promenade parallel to the coastline.



- Pilot areas: From the spring of 1981 until the autumn of 1988, different dune regeneration experiments were carried out that served as a base to establish the criteria for most suitable action to be taken in regenerating the Devesa's dune landscape. The following conclusions were obtained:

Distance to the sea	Wet beach 2-3 m Dry beach 23-39 m
Morphology	Windward 30% Leeward 40%
Particle size	Wind speed: ≥ 16 km/h Grain size 0,2 mm mínimo
Permeability	40-50 % permeability Height: 50-80 cm

Malladas (temporary lakes situated in depressions between dunes)

- Felling of approximately 12,800 specimens of *Eucalyptus sp.*, in order to avoid this species' negative effects.
- Recuperation of 145,047 m² of malladas by removal of the sand with which they had been buried. With this activity we have simultaneously recuperated two ecosystems of high ecological value in the Devesa.

A special case in the regeneration of malladas in "Racó de l'Olla"

In 1986 the regeneration of the Racó de l'Olla mallada was begun, with the following basic project lines:

- An Information Centre and rehabilitation of the old stables as an Educational Centre.
- Regeneration of degraded ecosystems and encouragement of the most threatened species in the Natural Park area.
- Educational, reserve and filter lakes.
- Educational itinerary with its corresponding signposting and bird observatories.

Municipal Nurseries

- As there was no market for nurseries trading in autochthonous plants and little experience in growing these species of vegetation, the El Saler Municipal Nurseries were created in 1981. The average annual production over the first few years was 50,000 plants divided among 40 species of vegetation. From 1986 to 1990 this amount increased to 100,000 annual plants of 60 species of vegetation. In recent years, production has been far greater, reaching 500,000 plants a year.
- In addition, a seed bank was created which now has a total of 84,890,706 seeds of 144 different species.

- To put the uses in order according to the state of conservation and their susceptibility with them:
 - Park Zone
 - Buffer Zone
 - Filter Zone



REGENERACIÓN DEL PRIMER FRENTE DUNAR

FIRST STUDIES

Bibliography

- Vegetation

- Fauna

Verbal history

- Vegetation

- Fauna

- Uses

Old maps

Metodology for regeneration the first dune front:

• Geomorphological Restoration

- Study of old maps and photographs to determine the geomorphology of the area to be restored.

- Elimination of obsolete infrastructures like roads, wells, hydroelectric huts and so on.

- Use of heavy machinery to carry out the necessary movement of earth to create the dune ridge.

- Construction of a system of palisades capable of retaining the sand accumulated on one side, and on the other capturing new sand that may be brought by the wind. Material used: giant reed (*Arundo donax*) and espartina grass (*Spartina Versicolor*). Wind permeability between 40 and 50 % and height between 50 and 80 cm.

• Restoration of the vegetation cover

-Planting is done by hand as the conditions of the terrain mean it is inadvisable to use any other technique, placing the plants at random to create as natural an appearance as possible.

-The seedlings must be buried, as well as the root ball and nearly all of the aerial part, such that only the top 10 cm show above the sand.

-The seeds are planted at a depth that is double their diameter.

-Cuttings must be 20-30 cm long, and are planted as vertically as possible leaving only the first 5cm uncovered by sand.

-Bulbs are used with their leaves stripped off and buried as deeply as possible, which means at least 25-30 cm.

The complete development of the vegetation cover is a process that takes from 4 to 6 years, although after 2 or three years it already reaches a state approaching that which is being sought, as can be seen in the photograph.

• Adaptation of the restored area for visitors and environmental education campaign.

-Provisionally closing the regenerated area: Zone fenced off and signposts placed informing of the temporary prohibition.

-Adaptation of access from car parks to the beach in order to channel the visitors and avoid trampling of the regenerated area.

-Environmental education campaign through informative leaflets and signs aimed at the users, explaining the reasons for the temporary closure and the aims of the restoration.



MANAGEMENT

Suitable Regulations

- Plan Especial Municipal de la Devesa (Devesa Special Municipal Plan)
- Bandos de Alcaldía de usos (City Council Local Rulings on uses)
- Plan Especial autonómico (Autonomous region Special Plan)
- PRUG (Plan Rector de Uso y Gestión autonómico- *Autonomous Region Guiding Plan for Use and Management*)
- Ordenanza municipal de embarcaciones en la Albufera (Municipal bylaws for watercraft on the Albufera)

Increasing visitor's awareness

This aims to inform the population about the natural worth of the Albufera's Devesa of Valencia, and make them aware of the need to conserve these natural spaces such that the citizens adopt positive attitudes with respect to the natural environment.

- Educational Campaigns
- Courses for Students
- Course for Wardens
- Youth Training Centres
- Educational Nursery
- Educational material

Signposting

- In 1988 informative signposts were installed (ecological, historical and geographical characteristics) at the most visited points of the Devesa.
- In 2000 the CV-500 main road and the access roads to the Devesa were signposted.

Surveillance

- Surveillance in keeping with Guidelines for Use and Local Bylaws.
- Checking on activities carried out in the areas by other bodies.
- Checking and monitoring of areas closed off to pedestrian traffic.
- Checking and monitoring of areas closed off for naturalistic reasons.
- Surveillance and checking on the Racó de l'Olla Nature Centre.

Management of staggered acces to the coast

- Avoid the spreading out of adverse effects
- Concentrate uses and aid evacuation

Fire Prevention

Since 1989, the Plan of Action for Forest Fires has been drawn up in cooperation with the Civil Protection authority. Annually, there are 7.5 fires and a surface area of 6,607 m² is burned.



Scientific Monitoring

- Promotion of studies into geomorphology, fauna, botany, soil, sedimentology, limnology, etc., in direct connection with the different university departments and individual researchers.
- Creation of the Albufera Ornithological Station.
- Participation of the OTDA in different conferences, presentations, talks and scientific congresses, at both national and international level.
- Cooperation with the Mediterranean Environment Study Centre (CEAM in Spanish) atmospheric studies of the Devesa and its relation with the ecosystem.
- Direction of Theses and degree course Final Projects, by the OTDA.
- Agreements by the OTDA with the ADEIT and the UPV to carry out practical experiences in companies.

Life projects

- Life medio ambiente (environment)
 - In 2002 "European network for the assessment of air quality by the use of Bio-indicator plants". LIFE EUROBIONET
 - In 2001, approval was given for the Environment Life Project "Demonstration plant for composting sludge from the treatment plant and rice straw, and agronomic evaluation of the compost created". LIFE BIOCOMPOST
 - In 2003 approval was given for the Environment Life Project "Integrated management of lighting in the Albufera Nature Reserve (Valencia)". LIFE ECOLIGHT
 - In 2004, approval was given for the Environment Life Project "Sustainable management of rice straw." LIFE ECORICE
- Life medio naturaleza
 - In 2001 approval was given for the Life Naturaleza Project "Restoration of dune habitats in the Albufera Devesa of Valencia". LIFE DUNA
 - In 2004 approval was given for the Life Naturaleza Project "Recuperation of marine juniper habitats in the Albufera park". LIFE ENEBRO
- Life starter
 - In 2004 there was cooperation with the Life Starter project "Conservation of endangered flora in the western Mediterranean"

QUESTIONS RAISED ON THE SPEECH

Question 1. What subsequent monitoring and maintenance is carried out with interventions during the Life Enebro Project?

Most of the activities we carry out are related to monitoring. In the case of the junipers, this will be done with every plant and an inventory will also be drawn up of the vegetation that has been sown by seed and directly with a seedling, to see which ones have germinated over time and which have failed to take root. With respect to the mobile dunes, the truth is that if they are seen to be going well and functioning normally after monitoring several times, we don't usually substitute or reintroduce any more species. In this case it is the first time that we are carrying out this type of regeneration with junipers, and it is possible that while monitoring it is necessary to replace some specimens.



Question 2. What is the possible impact on the fauna?

Rather than impact I think there are benefits. In other words, when you regenerate an area both in terms of the landscape and the vegetation what you are doing is encouraging certain animals or fauna related to these plants to enter. We do not have experience in this kind of regeneration with marine juniper, but we do with front-line dunes and it has been seen that after approximately two years the vegetation starts to look totally natural and one begins to see above all insects, red-tailed lizards, lacertid lizards, and these are species that appear shortly after natural regeneration. We do not monitor this exhaustively, but rather than impact what it does is to encourage fauna to enter an area which until that time did not have vegetation.

Question 3. In the immediate area of the Sidi hotel there is a notable proliferation of hottentot fig plants. Is work continually carried out to remove aloctonous plants from La Devesa?

There are quite a lot of aloctonous species or intruding species that normally enter from the nearby gardens. In the case of the red hottentot fig, this is a South African species, from Madagascar, which was introduced into Spain precisely to cover and fix banks lining main roads etc. It is a very intrusive species that grows heavily and prevents germination of the area's vegetation. Moreover, this plant has been encouraged here in Valencia; it is known as curatall ("cut-cure" in Valencian) because when we have a wound you put this on it and it cures the cut. It is also very colourful, such that people collect it. At first we thought that this only happened with cuttings, but we have seen that it also goes very well from a seed, which makes it more problematic.

In the Life Duna Web page, there is a study on the use of Glyphosate to control the hottentot fig, but as remains are left on the ground we don't use it. It is eliminated by hand, ripping it out.

There are two other species that are causing problems: one is the *Arctotheca calendula* (capeweed), which is a daisy that we have to rip out by hand before it blooms and gives fruit because it produces a fruit that can float a lot in the air. The other is the Century Plant (agave) that is introduced very much through gardens, and though we do not remove it continually we do take action on it from time to time.

Question 4. What are the zones that could potentially connect La Devesa and the Park with other areas of high ecological value? Is work being done to achieve this possible connection?

The General Plan is an urban plan of Valencia city only for the municipal area. We do not know the connections it could have with other parks or if the Plan takes into account, for example, the link with the old Turia river bed. For example, along the bicycle path and pedestrian path, to link up the city, the port of Valencia, the old Turia river bed and the Albufera's Devesa to be able to arrive on foot or by bicycle.



Question 5. Has it been possible to establish any population of Valencian toothcarp in the area?

Their reintroduction is included in the Life Projects. In fact, it is a way of boosting the project itself. Europe values the introduction of these species highly, and they have been introduced into two lakes. For now the population is going well.

Question 6. The north and south of La Devesa are different because the north has housing. Are the two zones managed very differently?

Yes. The PRUG, which is the Guiding Plan for Use and Management of the Albufera Natural Park (“Plan Rector de Uso y Gestión del Parque Natural de l’Albufera”), is a plan with scope in the autonomous region in which two zones are differentiated. The south is a reservation area with very restricted uses related to education and research, whereas the north may have different uses. From the point of view of management, vehicles can no longer enter the southern zone; there is simply a car park at the beginning and the rest is visited on foot. In the north zone, vehicles can enter although the entrances are staggered; in other words there are entrances to a specific point but one cannot travel along the coast by car – you have to go back out to the main road and enter again at another point. This avoids erosion of the dunes and means less trampling as everybody is concentrated in the same place. At the same time, if there is an emergency it is much easier to locate the people or evacuate them if there is a fire.

Question 7. How is work being carried out in eliminating the eucalyptus trees? Is preference given to one zone or are other factors taken into account?

A great job was done over ten years ago in the elimination of the eucalyptus trees, when we eliminated more than 90% of the eucalyptus plantations. Between the first and second dune ridges of La Devesa, there are areas locally known as malladas which are depressions between the dunes that flood with rainwater in winter, and dry out in summer. As in any wetland, in La Devesa eucalyptuses were planted so that there would be no water and thus no mosquitoes. In our recuperation process for the whole area, we have to recuperate the malladas to be able to recuperate the dunes. To make the dunes we have to remove all of the sand from the malladas, eliminating the eucalyptuses. If the malladas are in a very deteriorated state, the eucalyptus is removed mechanically with machinery. Where they have not altered much, the eucalyptuses have been removed with animals, more specifically donkeys. Around 90% have been eliminated. For the rest, there is a brigade in La Devesa dedicated to eliminating the risk of fires and one of its jobs is to eliminate eucalyptuses. In the case of the Life Enebro project, there were malladas that still had eucalyptuses which have been eliminated, and they are being eliminated according to the zone where we are working at the time.

Question 8. When regenerating a zone, what questions are taken into account?

When regenerating, the first thing we do is office work. We work with old photos, we talk to people from the area and especially elderly people as there is a lot of verbal information that gets lost. We work with maps and written documents. Then we go out into the field and you



can see what you want to do. If there are areas to be recuperated in which there is not much experience, as with the dunes in the early years, then pilot areas are created. For example, to regenerate dunes we did not know the permeability that the barriers had to have to hold back sand. With plastic nets of different thicknesses we managed to discover that between 40 and 60% was ideal to allow sand to pass through while at the same time some was held back for the dune to grow. We also did studies of the ground and made pilot areas to see how the vegetation developed with different supplies of nitrogen, phosphorous, etc and others with nothing. On seeing the results from the pilot areas, and knowing how it was before and how it is now, action is taken. The action taken also depends on the economic resources you have. For example, in our case we have only carried out quite small jobs. With Europe subsidising up to 50% you can take more important action.

Question 9. What are the next big restoration jobs that La Devesa needs?

Well, there's a lot of work still to be done in La Devesa. When the first recuperation studies were carried out, one of the aims was to stop the ecosystems from dying due to the sea winds. For this reason the first intervention was with the first dune front to prevent the sea wind from reaching the ecosystems directly, and thus reduce the death rate. In the southern zone, action is still to be taken on the big central mallada zone: there is the Vial Central (Central Road), quite a straight road used by fire-fighters and services, which should be a lot quieter and have less impact.

As for the north, there are a lot of areas where action is to be taken: we still haven't managed to conserve the urbanised area well. There are gardens here and these gardens are a problem because they have aloctonous species. We, the technical officers, must agree to a plan for the zone with the neighbours. We could agree to something sustainable between those who live there and what must be preserved. The front-line dunes in the entire northern zone also need quite a lot of work.

Apart from the naturalistic projects, there are projects for awareness, for education. The projects we are carrying out involve a good amount of education, but I think that as a Service or a social body we are lacking a line of education or awareness for the citizens. This is because we think it is more and more important that people should know the area, and to know it they have to be educated, in order to be able to use the area well. I think the citizens are getting more and more involved in the matter, and a consensus has to be achieved between the users, the management, politicians and so on.

Question 10. Has the regeneration work carried out by the City Council been done by them alone, or have other Administrations participated?

There's a bit of everything. The first jobs, or what we called pilot experiences, were done by the City Council, specifically by our Service. Later, work was done by the Environment Ministry, the Coast Authority, in the Sidi area. This was an experience where they undertook the regeneration of the first dune ridge and we did the planting, monitoring and maintenance. Then there was work by the Ministry, the Autonomous Region Government department and the City Council in eliminating the big sea promenade and the motorways from the area north of El Saler. The three administrations acted, some providing money, others advising, and others providing plants,



etc. It was the most expensive project because really the sea promenade was eliminated where there were a lot of restaurants and quite a lot of services, and this was substituted with a big dune park. Recently, all of the activity in the southern zone has been done by the City Council independently or in agreement with Europe through the Life projects, above all Life Duna and Life Enebro.

Question 11. Within the management of La Devesa, to my mind the environmental restoration section is quite well solved and defined, but...do you not think that in the section on knowledge distribution, with respect to the importance of raising awareness and thus future conservation and converting this into work done, this section remains a little unfinished?

Yes. One of the things we are lacking in this Service is, on one hand, being able to transmit the important knowledge, and on the other sitting down with the citizens, in other words working with them. There is already a certain connection with the citizens because we are the City Council and this administration is in greater contact with the citizens. We have always considered that every project that is undertaken must be accompanied by an information campaign, because if you explain to the citizens what you are going to do, why, and what your objectives are, they understand it much more. It is true that not only projects but also all our line of work should always be accompanied with information. The Service lacks this, and I believe the Administration's services in general.

Question 12. During the 1980s, the so-called Prior Studies were carried out, which included many aspects of the zone. Do you think enough time has passed to organise another big study that includes many aspects or has this been done little by little when it has been necessary?

In the 1980's the Prior Studies were carried out, which ended up saying that La Devesa could be recovered and that it was necessary to set up an administrative structure to take charge of carrying out other studies to keep working. The Special Plan for the Monte de la Dehesa in El Saler was thus drawn up and approved in 1982. This Plan created regulations and a strategic plan for the zone, which has served as a foundation to manage the area. Later, the Autonomous Region's government department presented the Guiding Plan for Use and Management of the Natural Park, which eliminates the previous Plan, and which is the one that must now be followed. We have always followed these Plans when taking action. However, it is true that you discover and introduce new factors, above all at management level. For example: before, only the primordial values, the ecological ones, were taken into account, but now there are other values like social ones, cultural ones, etc. which get added to the projects, even when taking action in a very specific zone.

Question 13. What does the City Council manage in the Albufera's lake?

The Albufera lake is property of Valencia City Council. The thing is, there are a great variety of responsibilities, that is to say the City Council owns the lake but the water management is run by the Júcar Hydrographical Confederation (Confederación Hidrográfica del Júcar), pollution



studies (if there is any contamination problem) are carried out by the Regional Government Environment Department, waste water and sewage discharge comes from any of the thirteen towns included in the Park, and water also comes from the Júcar and Turia rivers. There are a lot of interests within these, a lot of problems, and many Administrations with whom the City Council until now has only carried out analyses of the lake's waters. We have tried to carry out regeneration activities on some bushes or island on the lake, and lastly, the only thing that they clearly run is the Regulations of Water Craft for the lake (whether they be for leisure, fishermen, private use, etc.). There is a Municipal Guard to monitor these Regulations and also to prevent hunting, as this is forbidden, and to raise the alarm if there is an increased death rate among animals, etc. The City Council does not have a lot of responsibilities with regard to the lake.

Question 14. Once the execution of the Life Projects has ended, how will the City Council get involved in the regeneration of La Devesa?

The City Council is completely involved in regenerating La Devesa. In fact, it is they who have been carrying out the regeneration, once alone, at other times accompanied by other administrations and lately by the Life Projects. The thing is, when the City Council has big economic support like a Life Project it can take more important action. When it doesn't have this, it carries out the management tasks and small interventions, but it does so.

Question 15. What zones of La Devesa that have still not been restored have good potential to introduce more junipers?

According to what has been said these days, the marine juniper's habitat is in areas near the sea where the sea air has an influence but at the same time the dunes are more or less stabilised. If we look at the maps of La Devesa and apply all of this, we can see that in the whole area more junipers can be reintroduced in this strip of more or less stabilised dunes near the sea. These zones must be found and strengthened, at least in La Devesa. The juniper populations are decreasing on all levels. For example, I have seen some areas of the Mediterranean and above all in Greece and Italy, where the juniper population is now growing only right next to the sea. They are very large specimens and they do not have long to live because they cannot withstand such strong sea air, so they will be disappearing. Moreover, natural germination is difficult to see in La Devesa. There has been some natural germination in areas where there is a stronger population, such as in the north.

Question 16. Do you think that the citizens of Valencia city are aware of or knowledgeable about the natural area you are managing?

I think they are more aware than people from outside Valencia because they appreciate it more. But that happens to all of us, we talk a lot about what we have but we don't often know about it. I talk about the Albufera as if it were the Miguelete or any other area. I can assure you that the visitors to La Devesa are now more aware than before and this can be seen in the use they make of it, in their behaviour. There are possibly more and more people coming and they are using the area more correctly, which indicates that there is more and more awareness. The staff dedicated to Environmental Education have done surveys and ask people what their interests



are. Little by little, the people who are coming to the zone are doing so out of environmental interest or awareness.

Question 17. The big actions taken in La Devesa are partly financed by European Projects. Are there plans to apply for more?

Yes. The big activities we have carried out in La Devesa have been financed by Europe. These activities have been: the Life Duna and the Life Enebro projects to restore dune habitats, Life Ecolight in which all of the area's illumination was changed to avoid light pollution, and lastly Life Biocompost and Life Ecorice which were related to rice straw. All were financed by Europe to a greater or lesser extent.

This year we have applied for four European Projects. We cannot say what they are about until they are approved. We hope that at least one of them is approved to be able to continue working along these big lines in La Devesa.

Question 18. First LIFE DUNA, now LIFE ENEBRO... is the regeneration of La Devesa and its beaches complete with this? If not, what is the next action to be taken?

The regeneration of the first dune ridge of La Devesa's southern zone is completed, and also some areas of malladas. Nevertheless, one of the Life projects that has been presented, for example, is for the regeneration of the malladas of the entire Devesa .

As for the beaches, we can say that what the Life Projects are doing is to transform a beach that was very urban into a totally wild beach. Since Life Duna was carried out and Life Enebro has been underway, the beach receives more visits than before, possibly because there is a kind of user that is quite conscientious and likes the beach to be more wild and natural. With the dunes you manage to make the beach more or less natural, with scenery, and you also recuperate (as in this case) a habitat like that of the juniper, but you don't improve the beaches.

The fact is that on a world level 70 % of beaches are regressive. There are a lot of factors involved: global warming with the rising sea level; the reservoirs that retain a lot of sand which before reached the sea; the predominant sea current which in the case of Valencia goes from north to south, and if we have an obstacle to the north sand accumulates on one side and you create a shadow effect to the south as in the case of our Port of Valencia. We are talking about a whole series of factors that come together to make the beach more and more regressive.

Question 19. What monitoring is being carried out for the Life Ecolight project, and how satisfied are the users and/or inhabitants of the Park's environs?

The Life Ecolight Project was a project in which in which public illumination was eliminated because it was a pollutant to some extent. This illumination was created by lampposts that shone light upwards instead of only downwards, they used mercury bulbs, etc. On one hand, this project has created Local Regulations for the use of light in the Natural Park, and on the other it substitutes all the illumination for a kind of lighting (wooden posts and lighting with light shining downwards) that avoids light pollution. It is yet to be monitored because we are still in the finishing stages.

There are users who congratulate us because they think that there was too much illumination



and that it was unwisely used. There are others who complain, I think due to lack of information. When you talk about good, correct illumination, people think there is going to be more illumination installed, and what has happened has been to use less (a decrease in energy consumed has been achieved) and to appreciate the lighting that already existed more, in other words to make the most of the light because it is shone downwards. I don't know if people thought that all the urban area was going to be illuminated. We are still at a very early stage.

Question 20. What other endangered species are there in La Devesa that deserve projects or recuperation plans?

In terms of vegetation, we have the endangered species of *Euphorbia paralias* (Sea Spurge) in the front-line dunes. When I started working here in '82, there was still a population of this species in the south of La Devesa which later died, although seeds were collected and it was introduced again. It has now been reintroduced with a project carried out by the autonomous regional government's Environment Department to the north, which is known as l'Arbre del Gos and is doing well there. This is the only species that we can say is in danger of extinction because the other one there was, *Otanthus maritima* (Cottonweed), only remained in a three square metre patch but is a plant that goes very well from cuttings, so we put it in and now it's all over La Devesa.

Question 21. The area of pine woods is also very degraded. In this case, are there plans to regenerate it?

People normally know La Devesa as "la pinada" (pine forest), because the pine is the plant that gives shade and which people like. However, La Devesa has 360 different species of vegetation and we value them all equally. We see the "monte de la Devesa" (Devesa countryside area) as an ecosystem made up of a great many species. From the point of view of their ecological worth, all the plants are important, such that our aim or that of the City Council is to achieve an ecological yield, not an economic yield. It can be understood that a section of countryside is not clean when you want to get an economic yield by producing wood. I mention this because people say that the countryside isn't clean, and as humans we can have specific interests (asparagus to eat, pine for shade, etc.). When there is talk of degradation I think people are referring to the pines that are damaged by the salty sea wind, but since the first dune ridge was regenerated and now with *Life Enebro*, the pine is going to benefit. There is no longer going to be such a negative influence from the sea air, so that it is going to develop better.

As for regeneration, in the scrubland and pine area we normally make plantations every year on Tree Day. It is recuperating perfectly. With respect to the fires during the first years, we did not touch anything and now with monitoring if we see that all the vegetation is going well, then nothing is done except that if there is a lack of pine, then pines are planted (this is the only plant does not produce new shoots; it must germinate).



Question 22. Are there other zones in the Natural Park that are not in La Devesa where marine junipers could be reintroduced? How long will it take to know if the junipers that you are now planting represent an autonomous population that does not need human help?

The Dossel de Cullera is possibly an area where the marine juniper habitat could be reintroduced; it would need to be studied.

At the moment, the few specimens that exist are an autonomous population. In Racó de l'Olla, for example, there are over 100 specimens and they are doing perfectly well. It is difficult to get marine juniper to germinate, but when it is planted in the country it does well.

Question 23. Has the activity on the coast of the Pinedo municipal area offloaded the intense influx of people from the Albufera N.P?

I don't know how to answer that question, but that is why it was done. In Arbre del Gos and all the northern area of the Park, an attempt has been made to recuperate the beaches in order to divert the people and visitors from the southern area. I can assure you that l'Arbre del Gos is a beach that is visited, so I imagine that apart from the people that never used to come, many of them are from La Devesa area.

Question 24. Do you think that some day the juniper population will be viable without the help of the Park management?

I hope so and I think so. It's what I was saying before, I think so.

Question 25. For me, it is vitally important that citizens should be aware and interested in this natural area. If this is not the case, the restoration work gets deteriorated and of course the conservation work is wasted. Do you think there is some formula to bring Valencian citizens closer to this necessary interest in maintaining these surroundings?

Apart from the formula that I mentioned, before throwing a line to reach the citizens and look for them, I think that citizens should make a move themselves more. If we used public instruments there would possibly be more participation, but the thing is that sometimes the citizens are not aware of this. That is why I said that our Service should include the participation of citizens in all projects, because if we sit down with them and explain what we are going to do, and everybody gives their ideas, then it is more difficult for them to oppose the projects.

Question 26. Are the most adversely affected areas more protected than the other areas?

No. The most affected areas are not more protected than the other areas. The southern area of La Devesa is the most protected area but it is not the most affected. The most affected areas are usually near the sea and especially in the northern zone. To recuperate them, as I told you before, the entrance points are "staggered", and sometimes we open some and close others etc. According to some studies from the 70's in Andalusia, 20,000 citizens treading over a dune



for one year make it disappear and this is possibly true, but I can assure you that La Devesa receives more than 20,000 citizens any weekend in spring or summer, and the dunes don't disappear. If you let people enter the beach and the coast and you make them aware, you manage to make these areas last a lot longer.

Question 27. I understand that the Gola de Pujol Lake is artificial and that in the urban development plans of the 1960's, which was when it began, it was planned as a marina. What do you think should be done with it in the near future?

Yes, it's true that the artificial lake was going to be a marina that would have had access to the sea (la Gola (Canal to sea) de Pujol) with 5 star hotels. Now we are left with it, situated in the south, in the Reservation area. We have thought of many possibilities for this lake but we have not reached an agreement. Amongst the technical officers ourselves we are not at all sure. The lake is situated in an old depression, a mallada: Do we eliminate the lake and reconvert it into mallada? Do we maintain it and, as we often mention to the autonomous region's environment Department, when an injured dolphin or turtle appears put it here until it recovers? Do we leave it as it is? Well, we are not sure what to do with the lake.

Question 28. Given the high number of fires in El Saler, do you think they represent a danger for the junipers?

It's true there are quite a lot of fires in El Saler, but let's say there are no big fires. The biggest fires have been of about 5 hectares, but La Devesa is also very small. Of course they are a problem for the marine juniper, because it is the only juniper that does not sprout new shoots again when it has been burnt. In fact, we have verified that junipers have died in some fires.

Question 29. The PRUG designates zones of restricted access for people in large areas of La Devesa. Are there plans to put in place specific measures in order to help carry out this legislation of the Natural Park?

The PRUG designates restricted access zones in the southern area, known as the reservation zone. At the same time, cars are allowed to enter the Casal d'Esplai, a nature information centre. This is a problem for our Administration, which is the body that conserves and maintains the zone. Cars passing through means opening the chains, giving a key to the users so they can enter and leave, if they leave the chain open another car can get in and it has to be removed...in other words, the PRUG has some errors as with any other Plan, which have to be corrected, and I think this is one of them. Now I'm speaking as a person and not a technical officer; I think that if interested people are allowed to visit an area, where they go on foot, this area will certainly remain well conserved. I do not think that restricting all access to people is a wise solution, and in all of the Plans and the PRUG this point of view should vary.

Question 30. So... All of the Otanthus maritimus presently in La Devesa comes from cuttings from a 3 X 3 m patch?

Yes, all of the Otanthus were in the Gola del Pujol in one patch. Cottonweed is a species that



always needs to have sand on it because it ages very fast if there is no movement of sand. When the sea promenade was built and the sand was held back, this plant disappeared. In the nursery, when you have it in a pot for a long time and you don't cover it with sand it dies on you. In Catalonia it disappeared through medicinal use, as it is a plant that is used a lot for the kidneys, while here in Valencia this use of it is not known.

Question 31. I think I have heard that the edges of the El Saler road are going to have their vegetation replaced. This could affect the duck populations that cross the road to the Albufera Lake in these spring months, increasing deaths among them. What plans are there with regard to this?

We have always opposed the maintenance of roadsides carried out by the Roads Authority. Let me explain: when the machines go past and cut the bushes, the grass is left behind. This grows and dries out in summer, which makes it a fire hazard for any cigarette butts. If you leave species such as mastic and other species that have a higher water content near the road, then you create less possibility for fires. In the end, an agreement has been reached with the Roads Authority to plant these species and create a hedge so that the maintenance and fire risks are lessened.

With respect to the deaths, I don't think the vegetation has anything to do with the deaths. The Mallard is a duck that breeds in La Devesa and then the mother crosses the road with the ducklings to go back to the salt marsh and the Albufera. Studies have been carried out about deaths with the University, but the solutions cannot yet be seen. There are various possibilities, the most important being to slow down the traffic, although it is a tourist road that is used a lot. Another thing being done is to find which are the most important crossing places along the road in order to make underground passages for crossing.

Question 32. Would it be good for the junipers if they were repopulated in the dunes of the El Saler golf course?

Yes, the problem is the use of the golf course. Within the golf course there are dunes whose potential habitat would be for the marine juniper, but they are occupied by lawn to play golf. There are others that are not occupied by lawn, and in these there is rockrose and mastic and other species, where there could be juniper with no problem.

Question 33. Is there any certainty in the Albufera Devesa Service that action is to be taken (regeneration) in the zone called "La Creu"? If so, what would be involved in the regeneration?

La Creu is a zone north of La Devesa that at the moment is occupied by a municipal sports centre. It is known that the sports centre is going to go out to the city of Valencia - this is dealt with by the autonomous regional Department - but at the same time the City Council has to provide land. I think it is more of a political decision than a technical one. We do know what would be done if the sports centre went, but while this sports zone is here I can't answer you.



Question 34. It seems that rabbits are eating the juniper saplings. Is any action planned?

We have proof that rabbits can gnaw the branches' bark and thus kill them. It doesn't only happen with the juniper, but is also happening with many other species, especially the mastic. One characteristic of the marine juniper is that it is not like a tree with a single trunk, but has various main branches. Moreover, when a branch is buried, it bends, in other words it takes root and becomes another plant. If the rabbit gnaws on different branches but not the entire juniper, it will continue to live. I have not seen any juniper die due to rabbits, but I have seen this with mastic.

Question 35. Generally speaking, what should be done so that the way Valencian citizens use El Saler is compatible with its recuperation?

A section of Valencian citizens already know La Devesa, but I think there are still many that have not seen it and do not know it. They have heard talk of it, but have never been. Schoolchildren come a lot, and also young people, and elderly people that have been coming all their lives and are still using it. I think we have managed to make its recreational use compatible with the recuperation. There may be people who do terrible things but that happens everywhere.



ENVIRONMENTAL EDUCATION AND DISSEMINATION WITHIN THE FRAMEWORK OF THE LIFE ENEBRO PROJECT

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The Life Programme particularly insists on the dissemination of the actions and results of its Projects to promote citizens' awareness of environmental matters.

The Life Enebro Project has had two lines of work, one aimed at recovering the dune habitats of marine juniper and the other focused on providing these dunes with the typical vegetation of the coastal juniper fields.

Recovery of the dunes has been helped by the work realised in the previous Life Dune project (2001-2004), which began the regeneration of the first dune alignment. The area of action is adapted to the user and the environmental education programme consists of constant information to these users about what recovering the dunes meant, how it was done, why the works were carried out and how the transformation of the area could affect them. The Life Enebro works have been understood as a continuation of that project to achieve the total recovery of the area.

But Life Enebro also incorporates a living element, marine juniper. This has been the common theme throughout the environmental education programme. It has allowed us to make contact with the youngest and oldest people in the local populations; it has made students think about how man can destroy and recover, it has allowed visitors to contemplate a lost landscape...

The aim of the environmental education programme of this project has been to raise awareness of marine juniper as a typical species of the La Devesa dunes. At the same time, working with the marine juniper and its habitat has also allowed us to:

- Promote positive attitudes and respect towards living beings in general.
- Enjoy the natural environment using the acquired knowledge.
- Combine the recreational use of La Devesa with the conservation of its natural values.
- Make citizens participants in recovery and conservation projects.
- Promote awareness and understanding of Red Natura 2000 as the main instrument for nature conservation in the European Union.

The methodology followed has been specific for each group in question:

Primary and compulsory Secondary Education Students.

Work has been done with this group on the whole marine juniper problem. From its growth, flowering, pollination, fructification, seeds, germination, to how the alteration and destruction of its habitat has come about. The idea has been to make them aware of the current state of the marine juniper and what solutions can be taken.

• Marine juniper workshop

Using three different models, this workshop worked on the environmental characteristics of the marine juniper habitat as well as the main threats and causes behind its regression.

It has taken place within the Schools as well as in the facilities of the Municipal Greenhouses. In the latter the "Environmental Education Module" located in a prefabricated classroom has been equipped with all the material relating to the activities that take place during the visits.



The models are: "*Formation of the shoal*", "*La Devesa Eco-systems*" and "*The marine juniper population*".

Each model has some worksheets for teams of students to write down observations and reach conclusions after doing the activity.

All the worksheets as well as their objectives and assembly process are available on the project website.

All the Life Enebro Project staff are authors of the models, each one has contributed ideas, skills, care and resources to make them.

- Guided tours

Guided tours around the project area seeing *in situ* the works, results and problems of the marine juniper.

Also to the facilities of the Municipal Greenhouses to carry out practical activities with the plants.

The tours with all their necessary information as well as the Entry form to request a visit are available on the website.

- Plantations. "Day of the tree"

Carried out to promote awareness of the biodiversity of plant species in the La Devesa dunes and that each species needs a certain site or place to develop.

Work has mainly taken place with Schools in the towns within the Nature Reserve.

Beach users

A continuous effort has been made to provide information to all the people who, one way or another, have been involved in the project works. Making these citizens participate in the recovery and conservation of the area has been fundamental.

During the summer of 2006 a survey was done of all the users to find out their opinion on the works and their implications. To the question:

If the beach did not have the shower, fountain, first aid station, nearby parking, etc., would you continue visiting?

67% said yes, which gives us an idea of the positive acceptance of the project.

The remaining 33% objected to the elimination of the car parks, no provision of services and that access would require walking a greater distance.

To provide a satisfactory alternative for this percentage of users and taking advantage that there are beaches around Life Enebro of great landscape value and that have traditionally been used very little, a leaflet was published entitled "*Beaches of Albufera Nature Reserve*", which contains information on the services provided by each of the beaches.

With the help of the Brigade personnel, the Information Campaigns took place during the weekends of July and August, when there are more visitors.

local population

The inhabitants of the local towns have always had direct contact with La Devesa. Exploitation such as removing firewood, vegetable dyes, forage for cattle, wild fruit, etc., has occurred throughout history. These days enjoyment of the landscape and the beaches by visitors to this natural area is also "exploitation" for these inhabitants.



Raising awareness of marine juniper and of the project among these people has been possible thanks to associations such as "Amics de la Casa de la Demanà" from El Saler, which has shown great interest in the project from the start.

Environmental workshops and games for children and youngsters, talks, visit to the best marine juniper population in La Devesa, entertainment activities, tours, etc., have brought the project closer to this group.

The interview with the Navarro Dasí brothers must be highlighted, in which they gave us a lot of information about the area of action of the Project and marine juniper.

Other groups

• Family

All year round and coinciding with significant dates, leisure days or activities have been organised to encourage families to visit the Nature Reserve.

"Day of the tree" on 31 January, "Environment Day" on 5 June, "Days of the birds" on the first Sunday in October and the "Expojove Fair" in December-January.

• University

The methodology followed in the recovery of dune habitats and in the establishment of a marine juniper population is a very important resource for subjects of several university degrees.

Talks and guided tours to the dunes, malladas and slacks, complemented by a visit to the facilities of the Municipal Greenhouses (seed workshop, seed bank, nurseries and production areas).

• Technical.

Participation in:

- International Town Planning and Environment Trade Fair (TECMA). Madrid, June 2006.

- International Conference on the Restoration and Management of Coastal Dunes. Santander, October 2007.

- 1st Coastal Planning Seminars. San Vicente Mártir, Catholic University of Valencia. Valencia, May 2006.

• Organisation of:

- Life Enebro Virtual Workshops. Valencia, April 2008.

Here one can take part in a real-time on-line forum together with the speakers and other registered participants. Information on:

<http://lifeenebro.com/lifeenebro/ESP/jornadas.htm>

• Workers

Groups of workers of different specialities and categories have taken part in the project, making its execution possible. All of them have been trained one way or another so that their work causes a little disturbance as possible to users as well as the flora and fauna affected by the action.

From the company commissioned with the execution of the works, Valencia City Council



Municipal Playgroup and Local Police to the operators exclusively dedicated to the Project, the "Life Brigade".

DIVULGACIÓN DEL PROYECTO LIFE ENEBRO

To disseminate the Project actions and their results to all the visitors or interested parties, a series of tools have been used such as:

- Internet, through the websites:

<http://www.lifeenebro.com>

<http://www.lifeduna.com>

<http://www.valencia.es>

The number of visitors to the project website since May 2005 to March 2008 has been 19,870.

The number of visitors has been progressively increasing as can be seen in the following data:

Number of visitors to web in february	
2006	111
2007	894
2008	1743

The Project website hosts the Life Enebro Virtual Workshops.

- Local and national press.

A dossier of news articles appearing in the press is kept. These can be consulted on the project website.

- Television.

- "La Albufera, El Parque Estresado", broadcast on the programme "El Escarabajo Verde" by Televisión Española. January 2006.

- "El Jardí de les Dunes", broadcast on the programme "Medi Ambient" by Punt 2. March 2008.

- Official Life Enebro video.

- Leaflets:

- Information leaflet on the Life Enebro Project. In Spanish, Valencian, French and English.

- "Life Enebro" leaflet. In Spanish, Valencian, French and English.

- "Beaches of Albufera Nature Reserve" leaflet. In Spanish and Valencian.

- Principe Felipe Museum Interactive Kiosks.

Collaboration between Valencia City Council, Devesa-Albufera Service and the City of Arts and Sciences for the dissemination of the different Life projects led by Valencia City Council in Albufera Nature Reserve.



None of this environmental education programme could have taken place without the help of a large team of people who have put a lot of time and effort into it. The operators of the Life Brigade, the Municipal Greenhouse staff, the Municipal Playgroup, the technicians of the Devesa-Albufera Service, etc.

QUESTIONS RAISED IN THE SPEECH

Question 1. Perhaps creating a team of volunteers to work continuously on the environmental awareness tasks would be an interesting idea?

Yes it is a very interesting idea. All the volunteer networks being created in the nature areas respond to a demand of society to take part in environmental activities.

Valencia City Council has not organised this network of volunteers because, on the one hand, there are the volunteers that have to sign up to a list, but on the other there needs to be organisation, a coordinator, who organises everybody, who schedules the activities, prepares the material, etc., and particularly ensures that all the volunteers are covered by insurance when carrying out the activities in case there is an accident.

At the moment, Valencia City Council does not have this organisation but I think it would be very interesting. It is something that needs to be done.

Question 2. Can schools or interested groups visit the regeneration areas to receive information on the project?

My work as an environmental educator within the Life Enebro project has mainly been exactly that, accompanying groups of all kinds on tours or visits around the project action area, informing them and making them see and understand the works being done and how they affected users. This has been one of the most important parts of the project.

Question 3. Do you think that the El Saler beach-goers respect the recovery projects realised?

People who have seen my paper know that the users, particularly the beach users, are one of the groups with which we must work and that must be done tactfully. They are directly affected by any works and when I say works, I refer to the closure of a path, having to walk further to get to the beach or encountering difficulties in their routine activities when they go to the beach.

Yes, generally, they respect the regeneration projects of the natural areas. Citizens are far more aware. La Devesa is very small, there is little beach, and there are always some people who feel the works affect them negatively or who are annoyed by the plants and animals. But, generally, I would say that users respect all the regeneration projects we are working on.



Question 4. Do you think that the beach-goers are aware of the fact that human activity affects the dune regeneration and that their presence limits the existence of nest-building birds?

Well, during the work done for the previous project “Life Duna” a great deal of attention was paid to users, in the sense that people went to the beach, saw a dune cordon with little plots, some little squares marked out, and they went inside the squares with their towels and beach things: this plot is mine and this is where I’m going to sunbathe! Work was done to inform users that the area was cordoned off to recover the flora and fauna, and not to mark their sunbathing areas.

As for the limitation or existence of nest-building birds, it is true that all human presence has some influence over the nest building of birds, particularly on the beach. Firstly, because they share the space: the beach towels and nests, and secondly, because people walking along the beach scare the adult birds. Users are becoming aware of the matter but I think we have really emphasised the don’t-step-on-the-vegetation aspect and that of the birds is a matter that must be worked on now. People do not realise, they do not know that there are birds that raise their young on the beach.

Question 5. Is there an area that is completely closed to the public, even temporarily, so as not to disturb the birds during the breeding season?

In La Devesa there are some enclosures that include parts of the beach or even the scrubland that are closed to people. From north to south there is: El Tancat de la Creu, an enclosure of vegetation that does not include beach. It is behind the El Saler sports centre. El Tancat de la Rambla does not include beach either but does include the first line of dunes. The next would be El Tancat de Pujol where there is a formation from the first line of dunes to the vegetation of the fixed dunes. The last enclosure is El Tancat de la Punta where there are some wooden posts and signs informing the public that it is a breeding ground for birds such as the plover and little tern, although the right-of-way cannot be prohibited. During the breeding season the public are advised not to enter so as not to disturb the birds.

Question 6. Can my daughter’s school still ask to take part in any of the activities you do with school students?

Yes and no. Let me explain. The Project finishes at the end of June. When we do activities with schools some 40, 50 or 60 schoolboys and girls arrive on a coach. One of the premises of the Devesa-Albufera Service is that when doing activities or tours great attention is paid to the quality of the service provided.

Although I am the project educator, up to now I have been working with the team formed by the Life brigade staff, who were already involved in Life Duna. They are highly trained at doing tours and environmental education activities of all kinds. They helped us with these routes. The brigade’s contract has already ended.

If the group is small or is an adult group then ok, but if it is a school busload then it cannot be done as La Devesa cannot possibly provide a quality service in this way and the visit will not meet the proposed objectives.



They can call the Devesa-Albufera Service and discuss it. Each visit has very different characteristics, objectives and conditions.

Question 7. What type of surveillance is carried out in these areas and what resources are used?

Valencia City Council has a Municipal Police Station inside the Reserve which, although it is not very big, has its surveillance routes. However, I think that users have to be made aware of their impact on these areas, how they disturb the birds, rather than having one or two guards to ensure people do not enter. I think that by putting up signs, advising and informing the public that birds breed in the area, we should be aware that we cannot enter.

Question 8. Do you think the government should invest more in educational and dissemination material for La Devesa and L'Albufera? something like the investment spent on advertising the "America's Cup"?

Yes, the government, and more specifically Valencia City Council, does need to invest more in environmental education and dissemination. There is an increasing demand. During the years I have been working a dynamic has been created, a small environmental education programme has been implemented for working with schools, the local population (which has been and continues to be the pending subject) or users. A pattern has been established: people call us, they already consider us, they already know about us. That all of this should disappear is something that should be carefully considered, and the channels that are now open should be established and maintained, particularly with the population from the Reserve area. Yes, more should be invested.

Comparing it with the America's Cup, well everyone has their own interests, but yes, it is something interesting that benefits the Reserve and us all.

Question 9. Do you think that the people from Valencia are easier or more difficult to educate than other people?

I don't know. I have always worked directly with the people from Valencia and I do not think we are more difficult to educate. What is true is that when we try to explain or raise awareness among La Devesa users about the Projects being realised there, there is a feeling of "El Saler is mine" (I suppose that comes from when the Monte de la Devesa development project was stopped under the theme "El Saler for the people"), a feeling of ownership. Some believe that for this reason they can do what they want, but these cases are anecdotal.

I do not think that the people from Valencia are more difficult to educate, I think that once we have understood things and assumed them, we are understanding and there is no problem.

Question 10. Do you think that the people who are not worried about walking from the car to the beach are more willing to participate in the recovery of El Saler?

I have answered this question in the forum. We surveyed beach-goers before starting the project works. First, they were told what the works would imply: less parking spaces just behind the beach, construction of more dunes, limiting access, users having to park further away and walk to the beach. Then they were asked about what they thought about these measures, would they still come. A high percentage said yes, they would keep coming and it would not be a problem.



Some people, and this is understandable, go to the beach with their children, and bring chairs, parasol, cool box, lilo, etc. If you have to walk far, you think twice.

At the same time that the beaches to the south of La Devesa are limiting access or it is becoming more difficult as the parking is further away, the beaches to the north of La Devesa (Arbre del Gos, El Saler, etc.) are being provided with wall kinds of services and people are accepting them quite well.

Question 11. Are the dissemination and awareness programmes carried out with the same effort for the mainly foreign tourists who visit the area?

Tourists are not a group that require our services very much. When we work with them, my personal opinion is that they are surprised that we are so happy with the works and what we have in La Devesa, L'Albufera or the Nature Reserve, particularly when they go to La Devesa. We are so happy with our dunes, "malladas", the juniper, etc. and they are very surprised and say the area is very small, it has roads, a lake, restaurants, a bicycle path, that it is full of man-made elements. Our attitude surprises them.

When they know what the area was like and everything that is being done, this is when they really understand our attitude, but they are not fully aware of the meaning. They are surprised by the great conservation efforts being done in such a small area.

However, as I said, it is not a group that requests many visits.

Question 12. Is the Nature Reserve legislation available to users or should one find out more information on the limitations of use?

The legislation of L'Albufera Nature Reserve is on a very different level to that of the users. Every day people are more aware of what they should and should not do, particularly those things they should not do and they act in such a way that is increasingly more coherent within the Nature Reserve.

I think that rather than inform about limitations or restrictions, users have to be engaged in collaborating and made to feel that the Reserve is theirs. Putting up signs that you cannot light a fire, cannot pick flowers, cannot enter here, cannot ... there comes a time when you no longer feel comfortable in an area and we have to start from that comfort: you feel comfortable here, then let the plants, animals and other users feel comfortable when you are here and when you aren't. That is how the matter should be dealt with.

Question 13. Have all the objectives set out by the Environmental education campaign been met?

In general, I would say yes. All the proposed objectives have been achieved. We have worked with different groups, some in more depth or with greater expectations, which have not always been fully completed. For example, the Marine Juniper Workshop commented on the project Website. Here some models were made to be used with students. The idea was that the models would travel well and would be taken from school to school. However, they did not turn out as expected: they are heavy, they need space (a laboratory, classroom, etc.) to accommodate them, working with the well requires several days with the group, etc. Not all the schools have this



availability of time or space. Perhaps not all the objectives of the Workshop have been achieved but I think that working on environmental education is not something that can be achieved and finished in three years. It is open lines, open a path to the local population (as has been done with El Saler and that needs to be done with El Palmar), it opens doors, but one cannot say that it is completed in a Project lasting three or six years.

Question 14. The Volunteer network seems to be a good idea, but a permanent Environmental Education team is essential.

I think it is fundamental. As Antonio Vizcaino has said, within the Devesa-Albufera Service we need people dedicated to environmental education. A team and not one environmental educator, as one person (as with the Life Projects) has to deal with the leaflets, the Website, visits, workshops, symposia, etc. If I had not had the team of colleagues and technical staff of the Service, not to mention the "Life Brigade", we could not have taken part in the Expojove Fair, in the Day of the Environment or the Tree, etc.

Question 15. It seems obvious that if there is a team it should be permanent. If it is not, how can it spread the message? Or should environmental education only be given when associated with projects and paid by Europe?

The environmental education programme that exists in the Service these days has been set up with these European projects, such as Dune, Enebro, Ecolight and Ecorice. Environmental education is like restoration works, it has had a great boost with these projects. It is the result of the work that has been done since the Service was created and that, recently, everything is done with these Projects. That does not mean to say that from now on the Service staff will take back, within their possibilities, the environmental education activities.

Question 16. To what extent can El Saler be recovered if we do not also educate the people who use it?

If we do not provide education, if one person is not educated on the matter El Saler cannot be recovered. That person is not going to appreciate the teamwork done by the rest.

I would like to take this opportunity to say that when I am asked or comments are made about El Saler I imagine they refer to La Devesa or L'Albufera Nature Reserve. El Saler is an area inside the Reserve. I believe that things have to be assumed in order to value them, let us talk about La Devesa, L'Albufera, about the Nature Reserve or El Saler. From that first knowledge of things (their name) we can show respect and value what we have.

I educate about people's everyday lives, not just on environmental matters.

Question 17. La Devesa must be one of the most visited natural areas due to its proximity to Valencia and because of the beaches. There should be continuous education.

I agree with Jordi. La Devesa is 15 km from the city of Valencia and is one of the area used by many people from Valencia for leisure and holidays. The trampling causes the greatest impact on La Devesa. Continuous education should be given, there are always things to do. The



governments have this duty, firstly, because they manage these natural areas and, secondly, because they have the most tools and possibilities for reaching a greater number of users.

It is clear that within the L'Albufera Nature Reserve there are associations that do a great job to raise awareness among users, but the governments should be pioneers and take the lead with all the information and awareness tasks.

Question 18. And it is obvious that an Information Centre cannot replace a team of educators.

Rather than replacing a team of educators I think they carry out different tasks. An Information Centre is just that, a centre where people can go to receive or look for certain kinds of information. The centre is permanent and is an information service. A team of educators realises much more direct work with a group, as association, with people. We are talking one-on-one. The Information Centre is controlled by people but, generally, people go there for information of the kind, I want to eat or go to the beach, how can I reach it by bus, etc.; it is "practical" information. An educator's task is one-on-one, bearing in mind the objectives and values of each; it is more familiar. This contact is fundamental.

Question 19. Don't you think that the Life Enebro project requires more signs, particularly explaining the distance between the sea and the cars, to avoid the shortcuts through the regeneration areas?

Yes, of course. It is one of the things that we must do before the Project finishes: put up signs. Users must be informed of the distances to the beaches, the available services, accesses, etc. The Project has published a leaflet on the services provided at the different beaches in the Nature Reserve, from Pinedo to the National Parador hotel, each has different services: number of car parks, showers, first aid station, etc.

Question 20. What activities are done on these tours?

The activities of each tour depend on the objectives to be met. And working with children or adults is not the same. What is true is that all the guided tours have some general information guidelines on the Nature Reserve: eco-systems, vegetation, fauna, management, impact, etc. always adapted to the level of understanding of the group. Activities with schoolchildren range from taking samples of the soil, adaptations of plants and animals, etc. Some people prefer to do something from the self-guided tours set up by La Devesa. It will always depend on the group's objectives.



Question 21. It is good that work is done with all kinds of groups, schoolchildren, associations, etc., but it should be focused on beach-goers/visitors, so they understand the actions being done and, therefore, to make them more aware of them; normally they do not respect accesses, they trample on the most fragile areas, causing paths or shortcuts through the middle of regeneration areas.

Beach-goers are very particular visitors with very clear interests and objectives: go to the beach and spend the day or the time swimming in the sea and sunbathing. The first problem that is raised in access to the beach, if it is far or difficult to park.

Work has been and continues to be done with them. It is an easy group in the sense that once they understand the actions being done by the Project in the area, they take them on board and do not cause any major problems. Direct handling is required, hence the Information Campaigns require us to talk to them and ask for their opinions and points of view.

The Life Dune and Enebro projects were very well accepted by beach-goers for these reasons. It is a group with which work must continue.

Question 22. There are some car parks that are packed on Sundays, do you think that someone who loses their patience because they have nowhere to park the car will be easily made aware of the situation? Is this a problem? If so, how would you solve it?

The car parks are a problem. In fact, this problem arose in Life Enebro. In Life Duna car parks were also eliminated but they were closed to traffic, which did not affect beach-goers. However, in Life Enebro car parks have been eliminated where beach-goers did park (behind the dune). Another has been restructured, which is further away from the beach and has less capacity than those eliminated. This one does fill up.

My colleagues and I have found ourselves in situations with people who are very frustrated by the situation. In these cases, one should never try to convince them of anything, simply say they are right and explain the reasons behind the action. Some tact is required to give them the precise information but no more.

As beach-goers we should be more aware that there is a great number of us that leave Valencia every weekend to go to the beaches. If you arrive and there is no room then you will have to find another place that has been prepared. It is like the weekend traffic jams: we all consider them to be normal, there are lots of us and we do not all fit on the road.

How would I solve it? I think it is a matter of informing and raising awareness and for people to understand.



Question 23. With such controversy over water, so much talk about saving it, and yet on one summer's day thousands and thousands of litres of water are poured into the sand. Leaky taps, children playing with the showers, showers after every dip and, of course, a shower before going home... Until recently there were no showers on the beached and nobody died of itches on the way home. Also, we all know that everyone showers again on arrival as we all get hot and sweaty on the journey home. When will the showers be removed?

I also agree with removing the showers from the beaches. People who go to the beach know they will leave covered in sand and will have a shower when they get home. It is a waste of water and I cannot think of any reason for having showers on the beach.

Which ones will be removed and when? The managers have to make that decision, but users must also be aware of the matter. Removal of the showers must always be accompanied by informing the user that does use this service why they are being removed and get them involved in the measure.

Question 24. The origin of some naturalised plants in the dunes, with highly invasive behaviour, is from the gardens of the houses inside La Devesa. Should the owners be made aware of this or legislation brought in to prohibit the use of these plants?

The Devesa-Albufera Service has worked with some owners associations of the residential areas in La Devesa so that their gardens have native plants, that is, plants typical of the area. That they should stop thinking that "grass" is a necessary garden element as it is not the most suitable plant for the area as it needs so much water. Also, that they do not use other plants because, although they cope well in the sand, they are very invasive and can become a menace in La Devesa. The Service is open to all kinds of suggestions and plants from the municipal nurseries have been given to some associations.

An information campaign with leaflets, meetings, etc. would be a good idea to prevent the use of these plants and to encourage the use of native ones.

Question 25. What are the future plans for the dissemination of the area of action?

The Project finishes in June, in principle I do not think that any dissemination tasks will take place in the area this summer. The Devesa-Albufera Service will continue working, later, I imagine, it will continue publishing the necessary materials such as leaflets, posters, etc. They will continue to manage the area, when they see the need for materials of any kind, they will provide the solution.

Question 26. Do you think the actions and interactions with groups such as "LA CASA DE LA DEMANÁ" are important?

For those who do not know "La Casa de la Demaná", it is a youth association that has really allowed us to reach the population of El Saler. I think that the interaction with this association should be maintained and realised in other villages such as El Palmar, Pinedo or El Perellonet. The more contact that is made with representative groups of the local population, the better for the management of the Nature Reserve.



Question 27. Environmental education is given when there are recovery projects underway. As there are so many problems causing the degradation of our land, shouldn't environmental education be promoted even when there are no projects?

These days environmental education is considered to be a very important tool for society. It is a common theme in the school curriculum because it is one of the pillars that makes society respect not just the natural environment but also the urban environment. It is something that involves us all and everything around us.

It should be reinforced even when there are no restoration projects. I think it is being reinforced, it is a task that in 10 years time will leap forward when the younger generations take control.

Question 28. Regarding fires, it is known that the majority, if not all, are intentional. What is the profile of the pyromaniac or what interests move these people to deliberately damage with such malfeasance, and the question is whether anything can be done about it from Environmental Education?

We, as educators, always cover the topic of fires, particularly because visitors from the city of Valencia arrive with the general opinion that La Devesa is abandoned, very dirty, and full of weeds.

Our work is continuous as: these people should know that in La Devesa there are many species of important plants such as Pine, which they do know about. Eliminating this "weed" is to eliminate one of the values of La Devesa. Secondly, we inform them that this Mediterranean vegetation acts differently in a fire (re-shoots, reduces the flames, etc.). Finally, we make them aware that we all lose out when there is a fire, even people.



CONCLUSIONS

The Electronic Report is the result of the Internet Conferences (“Jornadas Virtuales”) held in Valencia from 14th to 17th April 2008, organized by the Valencia City Council’s Devesa-Albufera Service within the Life Project’s Restoration of coastal dunes with *Juniperus spp* in Valencia or “Life Enebro”.

This document aims to provide a practical Manual for restoration work on coastal habitats. The proposed methodology in the Life Enebro project to recuperate habitats for dune species is a useful example for other natural areas in Red Natura 2000. The proposed solutions can be applied to other Community areas with similar problems.

CONCLUSIONS

- 1 The internet Conferences were a pilot experiment aiming to put in touch all those people interested in the subjects of recuperation of coastal habitats and their species of vegetation.
- 2 A total of 42 people participated, from the Peninsula, Canary Islands and Portugal.
- 3 The number of people registered was 206, from all over the Peninsula, the Canary Islands, Balearic Islands, Portugal and Italy. However, the total that participated directly was much lower. We believe that one of the reasons that had an influence on this was the timetable. Having the Conferences in the morning made it impossible for many of those registered to be in front of their computer because they were at work.
- 4 The participants come from different backgrounds: University, administrative staff, students, private professionals, individuals, etc. The majority professions are: Environmentalists, Biologists, Environmental Education, Forestry Engineers, Forest Technical Engineers, Gardeners, University Lecturers, etc.
- 5 When carrying out the next Internet Conferences the following aspects must be taken into account:
 - Technical aspects (streaming, the possibility of connecting live via telephone with the main speakers, the use of software to give certain privileges to both the administrator and the moderator, etc.).
 - The distribution of information about the event must be carried out a minimum of one year beforehand so that the information reaches as many specialists in the matter as possible.
 - The best timetable to be followed must be agreed upon from the beginning between those interested in order to have as many participants as possible.



- Both written and video documentation must be available on the Internet quite some time before. Six months before the Conferences are held would be advisable.
- As well as the presentations decided on by the organization, participation must be extended by written communication to as many people as possible with information related to the subject in order to work on it from many disciplines and have all possible points of view. Thus, an enriching and dynamic debate can be set up in the Web's forum.

