

Technical Memory

Presented at
UNIVERSITY FRANCOIS RABELAIS of TOURS

MASTER: European Continental Hydrosystems Engineering Diploma
By
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Action Plan 3: Project DOÑANA 2005

Vegetation Restoration in Partido stream floodplain

(Andalusia, Spain)



Partido stream (July 2004).

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MINISTERIO
DE MEDIO AMBIENTE

DOÑANA
2005

DIRECCIÓN GENERAL
DE OBRAS HIDRÁULICAS
Y CALIDAD DE LAS AGUAS

CONFEDERACIÓN
HIDROGRÁFICA
DEL GUADALQUIVIR



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1. INTRODUCTION

The Partido stream is located in the north-west corner of the Donana National Park (Spain), an area which was recently acquired by the Park. During the Eighties the stream was canalized. This resulted in an alteration of the hydrological regime and a degradation of the riparian vegetation. As a part of the large European project "Donana 2005", in the next future the artificial banks will be removed and a rehabilitation of the original course will be accomplished. The aim of the present work was to indicate the best procedure to restore the vegetation in the area under the stream's influence.

2. DONANA NATIONAL PARK

Donana National Park is the largest and best known of Spain National Parks. Along with the World Heritage sites of Ichkeul, and the Danube Delta, Donana is the one of the top three wetlands in the Western Palearctic in terms of diversity and abundance.

Donana is located on the south coast of Spain, in the area delimited by the towns of Sevilla, Huelva and Cadiz, between the right bank of the Guadalquivir River and the Atlantic Ocean.

The area of the National Park is of 50 720 ha, the peripheral buffer (Park Natural) covers 26 540 ha. The park and its buffer zone were accepted as Biosphere reserve in 1980. It's was declared a Ramsar site in 1982 and a UNESCO World Heritage Site in 1984.

The climate is Mediterranean with warm dry summers and cool wet winters. Mean annual temperature is 17° and annual precipitation 600mm.

Donana occupies the right bank of the Guadalquivir River at its estuary with the Atlantic Ocean. Major habitats consist of lagoons, fixed and mobile dune fields, scrub woodland and "maquis". Moreover the park contains the last marshes of the Guadalquivir unaltered by agriculture or development.

It support an important resident populations of the following threatened species: Spanish Lynx *Lynx pardinus*, Adalbert's eagle *Aquila adalberti*, marbled teal *Marmonetta angustirostris*, white headed duck *Oxyura leucocephala* and vegetal species: *Linaria turisca*, *Micropyropsis tuberosa*, *Gaudinia hispanica*, *Vulpia fontquerana*.

Black vulture and *Aegypius monachus* and red kites *Milvus milvus* are also present, as large breeding colonies of waterfowl, herons, egrets and waders. It's the most important wintering site in Spain, receiving hundreds of thousands of visitors annually, and a major stop-over route to and from Africa for migrating Palearctic migrants.

In general the state of conservation of the Park is satisfactory, but it does face numerous threats including its increasing isolation by agricultural development, tourism, poaching, over-grazing and illegal exploitation of crayfish. The former has been partly allayed the declaration of Donana's surroundings as a Natural Park, managed by the regional government of Andalusia.

A total of 116 staff is employed at Donana, including a Director of Conservation and 60 guards. Despite the high staffing level numerous small-scale management level remain: exploitation of ground water and tourist development in the surrounding area. There is a management plan and the park has an organized visitor education program.

3. DONANA 2005 PROJECT

The Guadalquivir marshland have experienced through the century continuous transformation and degradation of human intervention (alterations in the river course, rectification, riverbed dredging and canalization, marshland drainage and cultivation, deforestation of riverbeds and drainage basins, aquifer exploitation, water pollution). All this has involved not only a drastic decrease of its original surface (approximately 150 000 hectares) but also a threat to the persistence to the conserved area, due of water quality. The situation is still more relevant taking in account that marsh constitutes a fragile and vulnerable ecosystem, with a great natural value.

The civil administrations have undertaken several attempts at regeneration. However, it has been as a consequence of bread of the mud pool at the Aznalcollar's mining accident that a global restoration has been raised. Immediately after this catastrophe the Environmental Ministry outlined a global recovery plan: Donana 2005 Project.

Its objective is to restore and rehabilitate the complex hydraulic system of the marshland, allowing the system's evolution with the highest possible degree of naturalness and freedom, within the environmental, social, economic, administrative, technical, cultural determinants. It not limited to the regeneration of the areas affected by the

mining accident, but goes beyond and also seeks to recover water contribution and restore riverbeds and watersheds.

It composed of 11 Action plans. The project is perfectly integrated with other actions simultaneously carried out in the area, particularly the Andalusia Government project for the creation of Green Corridor ("Corredor Verde") along the Guadalquivir river.

Donana is born with a clear will of informative transparency. A procedure for the constant monitoring, control and integral environmental evaluation is foreseen for all the action plans from the start of the project.

The total estimated budget of Donana 2005 is 83, 51 million euros. It financed by the Government of Spain and the European Community. It's the most relevant wetland restoration plan currently being developed in Europe, and one of the most important in the world.

4. ACTION PLAN 3: PARTIDO STREAM RESTORATION.

The Action Plan n°3 of the Donana 2005 project concern global restoration of Partido stream.

The Partido stream is located in the north-west corner of the Donana Natural Park (Spain), an area which was recently acquired by the Park. It takes water supplies from 308 km² watershed with mainly torrential behavior, with great sand erosion, transport and sedimentation problems as a consequence of the agricultural transformations in the supply areas and rectification of riverbeds. As a result a great cone is forming, covering with sand and fine sediments the bank areas and the Madre of marshlands causing its situation, as well as the deposit of sand in the Matasgordas area, both inside the National Park.

The objectives of this project are:

- To control the erosion, transport and sedimentation processes in the watershed of the Partido stream, slowing down the advance of the sand cone into the marshlands, placing into the floodplain.
- To reduce the risk of flooding in croplands, by reinforcing the existing wall and building others.
- To restore completely a large area bordering the National Park. It involves agroenvironmental and forest restoration measures.
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The budget of the Action Plan n°3 is of 21, 73 million euros. Verifier les dates de commencement.

5. PARTIDO VEGETATION RESTORATION PROJECT

The aim of my DESS training course was to indicate the best procedure to restore the ecosystems in the area under the stream's influence, on the north side of el Rocío marshland. The study was carried out at the University of Seville, (Department of Biology), under direction of Pr. Francisco Garcia Novo.

The purpose is not the direct creation of (hypothetical) original vegetation but to establish conditions which allow to

plant communities to evolve under natural pressures and disturbances.

A theoretical model chosen to restore vegetation is represented by islands of thermo-Mediterranean plants which characterize many areas of the Park side. In order to identify most common type of islands, we collected from May 2004 to September 2004, data of species composition, vertical structure, individuals topology and distribution of species. In the study area, the matorral with shrub islands occurs in a *Pinus pinea* wood, which was planted in the Twenties. Some islands are totally under canopy, others are only partially under canopy, and finally other islands are in open space. As denser the canopy, as lower the "compactness" of shrubs which form the island. This is due both to the reduction of light and to the high acidity of soil (pine needles have a low pH and their degradation by microorganisms is very slow).

Species which characterize this matorral are: *Pistacia lentiscus*, *Rhamnus lycioides*, *Phillyrea angustifolia*, *Myrtus communis*, *Chamaerops humilis*, *Daphne gnidium*, *Cistus salvifolius*, *Cistus monspeliensis*, *Olea europaea* var. *sylvestris*, *Halimium halimifolium*.

The growth and survival rates were estimated and other development limiting factors were evaluated in an experimental parcel situated on the sand cone of the Partido stream. To understand vegetation dynamics, four experimental plots were established, three rounded and one elongated. Each rounded plot was divided in three subplots with different depth (0, -50 cm, -100 cm) to simulate the effect of water flooding. The elongated plot was excavated according to a terrace-design. In each plot, seedlings of different species were randomly planted; species were chosen from the main vegetation types of the Park: sub-humid forests, matorral noble, matorral seral and phreatophytes.

The most striking result coming from the first observations on these plots is the invasive behavior of *Tamarix africana*. In comparison to other species, tamarisk shows the most rapid growth, the most effective colonization strategy, and the highest rate of recruitment.

The final step will be to find a strategy to control the spreading of tamarisk all over the restoring area: for example controlling grazing by goats or planting a competitor.

The study demonstrates that an island is a qualitative, structural and functional unit, composed by recurrent species interacting to each other. The principal variables which restrict the expansion of vegetation are dryness, flood, grazing and animals stamping. These features are integrated to perform a restoration project. This proposition isn't ultimate

because temporal and spatial dynamics are unknown. The main questions are: 1) how islands are spatially related to each other? 2) How is the growth rate of an island? 3) How long does it take for two islands to become united? The field studies are still performed.

6. CONCLUSION

In purpose of restore original forest of Partido stream, we propose the regeneration of vegetation by islands of plants. This model takes into account natural and physical features of Natural and National Park of Donana. Thanks to this project we hope:

- Increase flood circulation resistance, laminar capacity of Partido floodplain and sedimentation process.
- Improve nutriments and pollutant filtration.
- Get better visual quality of the stream.