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Spain: Segura River returned to its health

THE SEGURA RIVER AWARDED TOP 2016 PRIZE FOR RIVER RESTORATION IN EUROPE

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Table of Contents

1 Introduction

The Segura Basin is the driest in Europe. With 365 mm of annual rainfall, this basin has the lowest rainfall in the European Union. Nevertheless, it is also a region which exports fruit and vegetables. The Segura River is thus the main water sources for irrigation. Since the ancient Arabians, inhabitants have improved the irrigation infrastructure and developed their life linked to the river despite the lack of water. With a natural availability of 400 m3/capita/year, the water environment has historically suffered from a great pressure which led to a water deficit and extreme environmental conditions. In addition, the unfavorable conditions were intense due to pollution from urban waste water discharges.

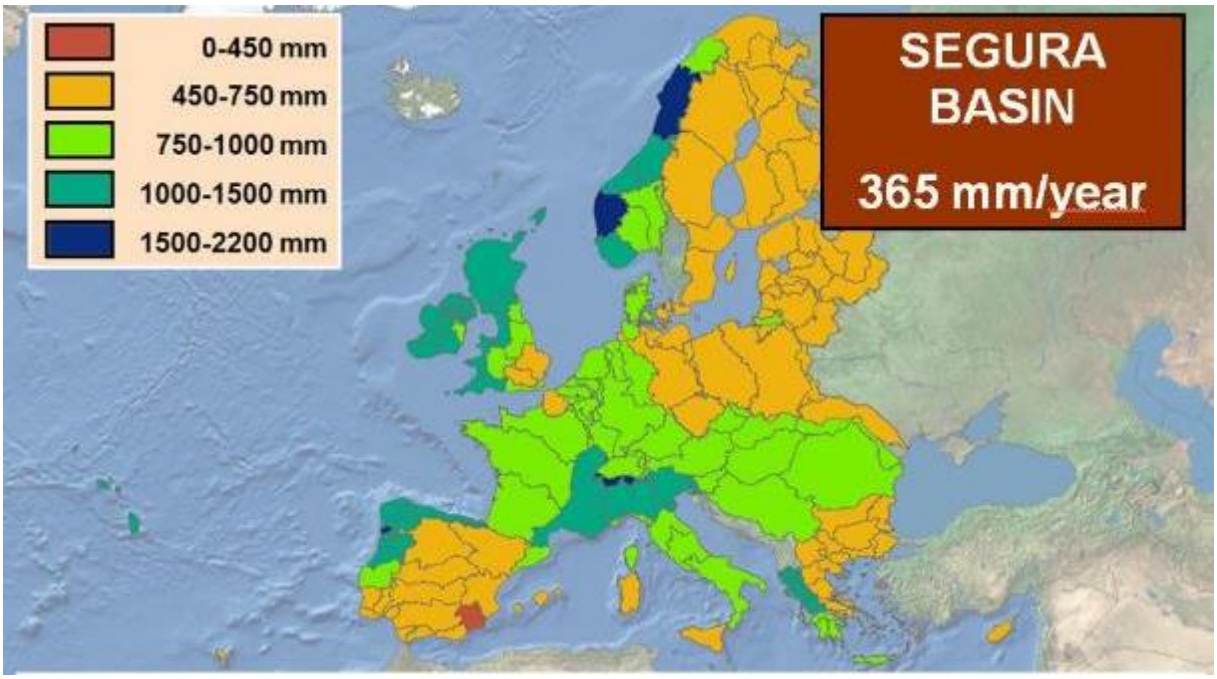


Figure 1: Hydrological Basins in the EU

In the 1980s, there was an extraordinary increase in irrigation activities and in the activity of the associated canning industry, which coincided with a long period of severe drought (especially severe for the year 1992-1995). This had twofold impact, on the one side, river flows diminished and on the other side, industrial and urban discharges increased, with insufficient treatment systems. As a consequence, the self-purification capacity of the river collapsed, originating a widespread and persisting contamination issue, lethal for the river life in the middle and lower courses. Environmental degradation of the riverbanks took place, along with the presence of foul smells which affected riverbank populations, especially the City of Murcia (400,000 inhabitants), causing great social discontent.

2 Actions taken

The Segura River Project was an engineering, legal and sustainable plan to restore the river and supply reclaimed water to agriculture, developed by the Regional Water Department, with the participation of the Segura River Authority, town councils and European Union funds.

Between 2001 and 2010 one hundred treatment plants and 350 km of wastewater collecting system were built. The overall investment in hydraulic works made by the difference administrations amounts to 645 mil. EUR. Of those, 70% of this investment has been made by the European Union financial aid (the European Regional Development Fund and Cohesion Fund) and the remaining 30% by the Ministry of Agriculture, Food and Environment, the Murcia Regional Government and the Town Councils. The main achievement has been the radical transformation (in only 10 years, between 2001 and 2011) of one of the dirtiest rivers in Europe into an ecologically healthy river. Positive evolution can be observed by organic contamination analysis, like BOD (Biochemical Oxygen Demand) tests.

In addition, a regional Wastewater Reclamation Levy was established as an economic tool to finance their operation, maintenance and monitoring. This reclamation levy is a purpose-determined regional fee: a tax on the discharge of wastewater into the public sewage system. A single tariff is applied through the whole region. There is one fee for domestic discharges and another for industrial discharges. It applies the polluter pays principle and it is in force since 2003. The reclamation levy and the inspection procedures have proven to be an efficient tool in reducing the pollution load at source.

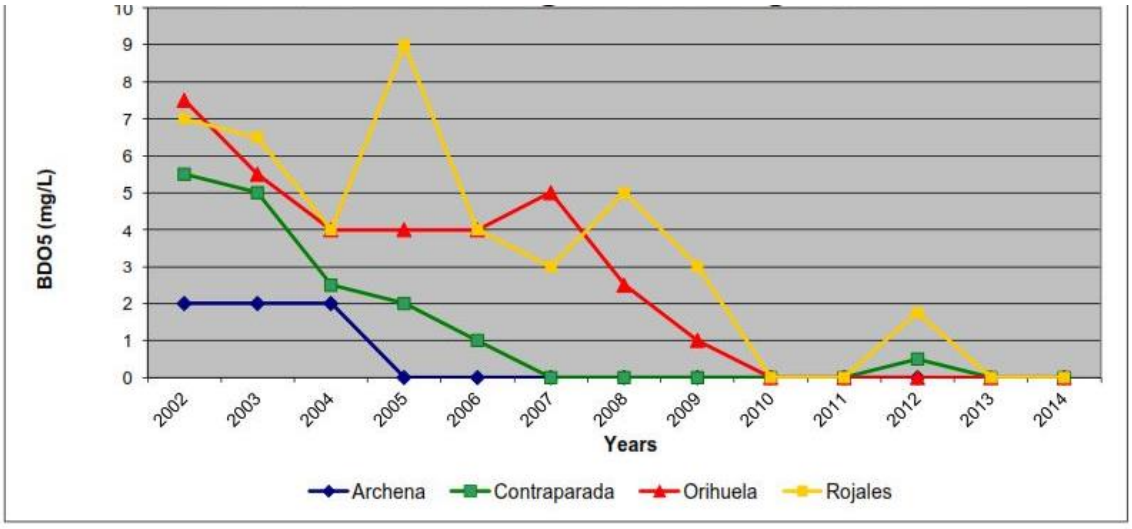


Figure 2: Evolution of the Segura River Organic Pollution

A major breakthrough was achieved in 2003 when the quality of the Segura's water started improving and since 2010 pollution is unnoticeable, leading to the recovery of fauna and flora. In addition, around 110 Mm3 of reclaimed water is reused annually in agriculture and two recovered wetlands linked to treatment plants have been included in the Ramsar Convention (now migration birds rest there during their journey between Europe and Africa).

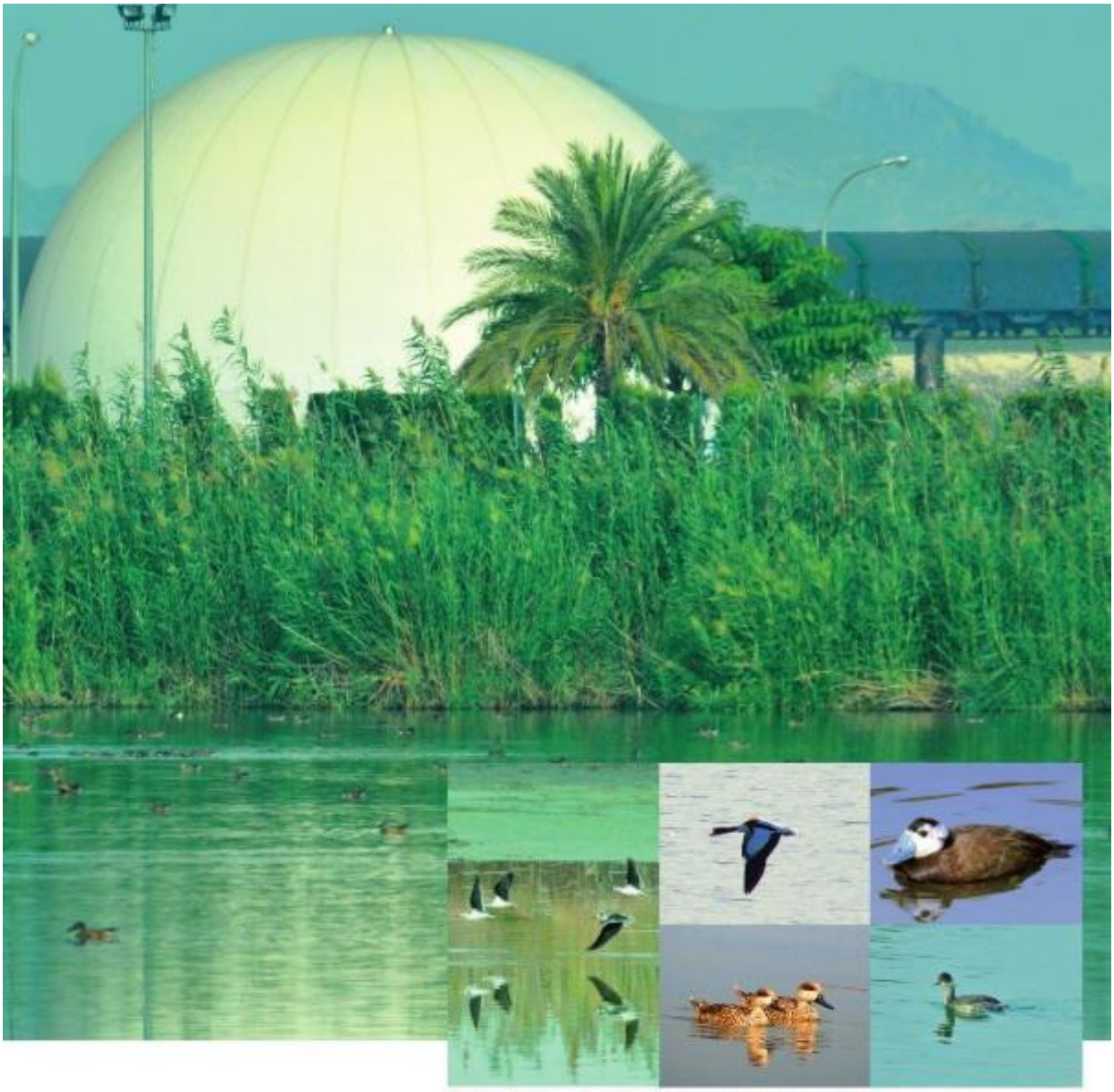
Actually, the Segura River Project has already 15 years and has not finished. Now the aim is to make the most of the water quality and quantity improvement to restore the ecosystem linked to the river. Those are two different Life+ programs funded by the European Union: the *Life+ Segura Riverlink* and the *Life+ Ripisilvanatura*. The first one, Segura Riverlink, aims to improve and strengthen connectivity between natural ecosystems, working on returning the river as close as possible to its natural state, while Ripisilvanatura intend to control the expansion of alien invasive species that are present on the banks of River Segura, and to promote the colonization of the riparian forest by native species. At the same time, prompt interventions in the urban stretch of the Segura River were made, the main one in the city of Murcia.

2.1 Investment projects

The Segura River Project included the construction of a new treatment plant in the Borough of Molina. The reclaimed water from this new infrastructure is stored in five artificial ponds before its use in irrigation. This continuous flow of water has created a rich ecosystem called the Campotejar wetland. A great achievement was the Ramsar Convention Site declaration in 2011.

Figure 3: Waste Water Treatment Plant of Mazarron

The construction of the Mazarrón treatment plant gave rise to the Las Moreras wetland, thanks to an artificial pond that stores the reclaimed water, which then flows into the Las Moreras dry river (the treatment plant is located in the central western part of the wetland). This spot was declared a Ramsar Site in 2011. It is an important area for the wintering, staging and reproduction of many species of waterfowl, including the internationally endangered Whiteheaded Duck (*Oxyura Leucocephala*), and the vulnerable Marbled Duck (*Marmaronetta Angustirostris*), which nest here. Furthermore, the site offers habitat to many different species of fish, amphibians, reptiles, mammals and invertebrates, including endemic and threatened species such as the Spanish Toothcarp (*Aphanius Iberus*), endemic to the Iberian Peninsula.



Waterfowl at the lagoons of the Wastewater Treatment Plant in Molina de Segura - Campotéjar.

2.2 Management framework

The basic reference plan of the Segura River Project is the “Master Plan for Urban and Wastewater Sanitation and Treatment in the Murcia Region 2001-2010”.

The local legal framework was the Segura Basin Hydrological Plan, the National Sewage and Water Treatment Plan (1995-2015), the National Hydrological Plan and the National Sewage Sludge Plan (2001-2006). At the European level, European directives such as 91/271/EEC and 2000/60 provide the basic legal framework for the plan and were included even though their application was not mandatory at the time of drafting.

However, the most innovative aspect of the project and what made it pioneering in Spain and Europe was the use of the reference values of the Title 22 of the Californian Water Code (1978) to the wastewater tertiary treatment. These criteria had deserved worldwide scientific recognition and was only included in the Spanish water law years after the Segura's plan. A stringent pollution removal policy like the Californian one was critical to the Segura River Basin, because here treatment is as important as reuse, due to the lack of water. The application of this framework allows the Segura's flow to increase by direct discharge of treated water, hence the improvement of ecosystem conditions and, additionally, more water for irrigation.

2.3 Social and economic aspects of river management

The social and economic sustainability of the Segura River Project can be summarized in two main innovations: a regional Wastewater Reclamation Levy and a supportive wastewater treatment tax. A Wastewater Reclamation Levy was passed to guarantee the principle "the polluter pays". This was a measure aimed at industry, to guarantee that companies which use large volumes of water pay according to how much they contaminate. This means that if their wastewater production rises, they have to pay more. As a result, these companies do their best to reduce the wasting of water resources and they install their own treatment plants to reduce the pollution of their discharges into the sewage. These infrastructures are far cheaper than paying the pollution levy. Thanks to that, there is less water to treat and fewer nutrients to remove from the water in the treatment plants, which means less expenditure for the taxpayer.

Taxes are also the key of the other innovation. The cost of water regeneration is cheaper in big cities - where few kilometers of the wastewater collecting system are needed to connect all the buildings and facilities - than in small and dispersed towns. But to allow water treatment throughout the region, a supportive wastewater treatment tax was approved. Big cities help small towns. Therefore, the unit price of wastewater treatment is the same no matter where you live, and you only pay more if you use more water than your neighbor.

Both measures mean a reduction in the wasting of water and the cost of regeneration and make the project economic and socially sustainable over time.

2.4 Institutional Framework

The Segura River Project plan was carried out by many stakeholders (Murcia Regional Government, Segura River Basin Authority and town councils), owing to shared responsibilities between administrations in the Spanish water policy. The size of the project, its complexity and the budget requested meant this partnership made sense. The Regional Water Department (Dirección General del Agua or DGA) falls under the jurisdiction of the Murcia Regional Government. Within the scope of its authority, the DGA manages the treatment plants and the wastewater collection system, as well as the Wastewater Reclamation Levy. The wastewater treatment was originally a responsibility of town councils, but a regional law was passed to transfer it to the regional agency Esamur, due to budget problems in small villages. Regional funds were very important to the project.

The Region of Murcia is the main regional authority in the Segura Basin, but not the only one (there are five other provinces, each with their own local government), thus the managing of the Segura River Basin is a national responsibility. Nevertheless, the action of the Murcia Government has been vital, because this region is the origin of the most significant urban and industrial discharges. Most of the treatment plants were built by the DGA and they coordinated most of the work in the 'Integrated Urban Water Reclamation and Reuse System'.

Town councils also take part in the plan. They hand land over to Esamur in order to build treatment plants and collecting systems there. Besides, they collaborated with local funds in a minor portion of

the budget and have built two treatment plants. The Segura River Basin Authority (CHS) has also built four big treatment plants.

The DGA and the CHS continue their collaboration nowadays. The Murcian Government manages the system and the Spanish Government guards against water pollution. The extension of plants, new collectors and European water policies are constant matters of discussion.

2.5 Challenges

The main challenge was the town councils opposed to the location of the treatment facilities. Therefore, great efforts have been made regarding environmental and landscape integration. All potential odor sources were located in closed buildings which are deodorized by means of gas extraction and treatment systems. Murcia government also organized visits to the first pilot plants where local politicians and neighbors could learn how they work and their low environmental, smell and sound impact.

3 Outcomes

The Segura River Project has successfully restored the health of the river, with advanced wastewater schemes now supplying reclaimed water to the agriculture industry which rapidly boomed after Spain became a member of the European Union. This once polluted and water-stressed river in Europe's driest basin has been transformed from an exposed sewer to a healthy, vibrant river, home to otter, migratory birds, and other flora and fauna, and the reuse of irrigation water has allowed increased agricultural, leisure and recreational activities.

The construction of a complete wastewater collection and treatment system has not only helped to recover the Segura River, but also generates around 110 cubic hectometres of reclaimed water destined to irrigation. That means 10% of the annual natural river basin resources (1.218 cubic hectometres). This is a positive outcome, a safe and sustainable flow of water in a region traditionally hit by droughts.

The Segura River otter population, endangered during 1990s because of pollution, has now recovered due improvements in water quality, flora and fauna thanks to treatment plants. Otter is often considered an environment quality indicator owing to their dependence on aquatic prey. They eat crabs, fishes and little mammals, animals which were scarce in the Segura when pollution increased, at the end of the 20th century. Otters disappeared from the low and middle course of the river, taking shelter upstream, where human impact where lighter. As Segura River project progressed, collecting wastewater, treating at plants and discharging into the river, the ecosystem linked to the riverbed was recovered and otter returned. It was a slow process, but in 2012 and 2013 otter excrement was found in the Segura low course. Finally, in 2013 otters were photographed in Murcia capital city and, after that, in Orihuela, even downstream.

The process to manage the social integration in the Segura River Project has been gradual as the river was 'returning to life'. During the worst years of water pollution, public opinion demanded a solution that the Government had not offered until that moment. But as the positive outcomes could be seen, the people started to join in activities and associations to enjoy the recovered ecosystem and to protect it. The involvement of riverside neighbors and farmers was also key to guarantee the upkeep of the improvements.

4 Lessons learnt

The implementation of the Segura River Project has contributed to neutralizing the negative effects of wastewater, thanks to advanced treatment, resulting in better water quality in the Segura River.

The Segura river management is a great example of an integrated approach with environmental, social and economic restoration activities. The established management framework includes a solid science foundation and shared governance, while the catchment management planning process was ahead of the European legislation requirement.

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Useful links

http://jwrd.iwaponline.com/content/4/1/50: Water Reuse and Desalination (IWA)

https://rsis.ramsar.org/ris/2035: Ramsar Site Information Service (Lagunas de Campotejar)
https://rsis.ramsar.org/ris/2036: Ramsar Site Information Service (Lagunas de las Moreras)

https://www.riverfoundation.org.au/riverprize_european.php: International/European River Prize

https://www.waterscarcitysolutions.org/wp-content/uploads/2015/08/WRG-Managing-Water-Scarcity-Catalogue.pdf: 2030 Water Resource Group reference