

**AN IMPACT ASSESSMENT OF EFFLUENT FROM THE WATER  
TREATMENT PLANT PINEDO TO SUSTAIN THE ALBUFERA NATURAL  
PARK**

**(Dampak Penggunaan Limbah Air dari Pengolahan Air Pinedo di Taman Nasional  
Albufera)**

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**Abstrak**

Penelitian ini bertujuan untuk mengetahui dampak penggunaan limbah air dari pengolahan air Pinedo di bagian Utara Albufera di Valencia, Spanyol. Metode yang digunakan adalah observasi dan teknik wawancara. Observasi dilakukan pada dua titik pengamatan, di bagian utara dan selatan melalui perjalanan dengan menggunakan perahu. Hasil penelitian menunjukkan bahwa eutrofikasi terjadi sebagai akibat masuknya limbah dari pengolahan air. Para petani tidak mempunyai banyak pilihan dan cukup puas dengan sumber air yang konstan yang berasal dari danau Albufera. Nelayan menyatakan bahwa telah terjadi bencana sejak tahun 1970-an, tetapi sekarang terjadi perubahan yang positif dalam peningkatan kualitas air. Pemerhati lingkungan sangat khawatir mengenai dampak aliran air limbah. Sedang pemerintah sangat paham dengan kepedulian ini, namun dengan beberapa pertimbangan mereka beranggapan bahwa kualitas air limbah tidak perlu ditingkatkan. Pabrik pengolahan air Pinedo mengakui bahwa kepedulian ini baik, akan tetapi mereka meyakini bahwa kualitas air sudah memenuhi semua baku mutu limbah yang disyaratkan. Peningkatan kualitas aliran merupakan hal yang positif dan perlu dimonitor agar kualitas air tetap memenuhi standar tersebut.

Kata kunci: Taman wisata Albufera, pengkajian mengenai dampak, limbah air, persepsi pemangku kepentingan, kualitas air, kuantitas air, pertanian, perikanan.

**Abstract**

The aim of this research is to elaborate of the impacts on the use of the effluent of the water treatment plant Pinedo in the North of Albufera Natural Park in Valencia, Spain. Interviews and observations were conducted, which together created an Impact Assessment. To be able to see the influence of effluent on the water quality, an observation point in the north was compared to another observation point in the south. Besides that, a boat trip was made to observe the water quality on the lake. The result shows that eutrophication occurs as a consequence of the wastewater from water treatment. Farmers have no choice and are happy to have a constant source. Fishermen have experienced a disastrous change in the seventies, but now see an improvement of the water quality. Environmentalists are most negative about the effluent inflow. The government understands the concerns and wants a higher quality of the effluent, but they do not have means to improve it. Water treatment plant Pinedo recognizes the concerns either; however, the water quality already meets the requirements. Forecasting the future, everybody is slightly positive. The improvement of the quality of the effluent is a good thing and should carry on.

Keywords: Albufera Natural Park, impact assessment, effluent, stakeholder perceptions, water quality, water quantity, agriculture, fishery.

## INTRODUCTION

In the South East of Spain water shortage has increased over the last decades due to the population growth (Srinivasa Raju et al., 2000) and modernization of agriculture (Soria, 2006). Division of water is a tender topic shown by the demonstration of 2004 after the publication of new water plans (Plan Hidrológico) in cities like Zaragoza, Valencia and Murcia. More drinking water is needed for the growing population and flourishing tourism. At the same time, irrigation systems are modernized and using more water because of expansion of agriculture from surface water bodies and aquifers. The Albufera Natural Park receives surpluses from upstream irrigation systems, which are fed by water from the rivers Júcar and Túrria. Due to modernization of the irrigation systems upstream, more water is used upstream. As a result, less water flows into the Albufera. To compensate for this water shortage, effluent from the waste water treatment Pinedo was as irrigation water. Concentrations of nutrients and contaminations in the river water and the effluent differ. Changing the chemical composition of the original water source could affect an ecosystem (Cosme et al. 2014,8). It cannot only change its biodiversity, but also affect the users of that area by causing (new) health issues or changing the benefits they derive from that ecosystem. This is also the case in the Albufera. The use of effluent as an addition to the original inflow of the Albufera. The use of effluent as an addition to the original inflow of the Albufera, changed the overall composition of the water. Examples of sources, which influence the water quality, are the growing industry, urbanization of the city of Valencia, the emission of the effluent wastewater and tourism. The Albufera region several stakeholders are identified. The different stakeholders and involved institutes have different interests and so different perceptions of the required water quality and quantity to manage the natural park. These stakeholders experience different changes to their livelihoods by the change in water quality. This research is

executed for Fundació Assut, a foundation concerning the preservation and conservation of biodiversity, landscape and cultural heritage in Valencia.

## METHODOLOGY

### Observations

During this research, some observations are done in and outside of the research area. These observations focussed on the state of the water quality in the area. To be able to see the influence of effluent water on the water quality, an observation point in the north was compared to an observation point in the south.



Figure 1. Observation points for comparing the north to the south

Besides that, a boat trip was made to observe the water quality on the lake. The *Acequia del Oro*, the canal that diverts effluent water into the Albufera, was followed in order to see whether there is a direct connection between the water treatment plant of Pinedo and the lake. In figure 1, the observation points are showed.

### Interviews

To gain knowledge on the perceptions of stakeholders, interviews were held with individuals from important stakeholder groups. During these interviews the emphasis was put on the impact of effluent water from the Pinedo water treatment plant with enough space to also talk about what the interviewees wanted to discuss. Furthermore, desired and undesired future situations will be treated. By putting

it in a time perspective, dissatisfaction about the present state could come forward and possible ways to deal with desired and undesired situations.

**RESULTS AND DISCUSSION**

**Selection of elements for the impact assessment**

Based on literature review, expert knowledge from our commissioner and a workshop followed by the team and supervisors. Four elements were selected following stakeholder priority, completeness and the feasibility of the research criteria. First, water quality and quantity. High amount of nutrients can turn a lake into a eutrophic or even hyper-eutrophic state. This change has a consequence on the original environmental conditions. The Albufera Natural Park, a wetland, fully depends on water. A continuous and certain water amount as inflow of water is essential to preserve the

park. The issues on water quantity are concentrated on the northern part of the Albufera Natural Park. The current sources of water are the Turia River and the effluent of the Pinedo water treatment plant. Second, agricultural production. A large part of the natural park consists of rice fields. All members from the *Comunidad de Regantes del Túria* depend financially on the agriculture. Besides, Valencia is famous for the dishes made with the rice that is, partly, produced in the Albufera, which implies a high cultural value for this production. Third, fishery. A traditional method was introduced on fishing since 1970s making the Albufera Natural Park becomes famous. Likewise rice farmers, the fishery is necessary for the area. Finally, biodiversity degradation. The inflow of treated waste water could affect the biodiversity. A different composition of water can affect the biodiversity in longer term. Are changes visible and what could happen in the future?

<i>Impacts of waste water on:</i>	<i>Rice farmers</i>	<i>Fishermen</i>	<i>Environmentalists</i>	<i>Government</i>	<i>Observations</i>
<i>Water quality</i>	More nutrients which is positive, Though of less quality than river water	Water is of bad quality, there are no 'vitamins' in it now More water inflow causes a faster renewal of water	Very high negative impact, the lake is hyper eutrophic	Still of bad quality	No impact
<i>Water quantity</i>	Good, but more water is better	It does not matter, the water level in the lake is fixed	It is never enough to feed the lake, besides it is totally irrelevant, because of the bad quality	Very good, the Albufera really needs water	Positive impact: water from water treatment plant Pinedo
<i>Agricultural production</i>	Very good, otherwise rice farming would not be possible	-	It is good, because it is the only source of water, doubting the quality of rice	There are no negative impacts in our research area	Rice fields are green and grow well. Rice plants in the south are lighter
<i>Fishery activities</i>	-	1 No positive impacts 2 Inflow of waste water is alright	Catastrophic decline in fish amounts and species	No pure water Decline in fish consumption Origin fish species disappear, new species stir the bottom of the lake, which causes the turbidity of water	-
<i>Biodiversity degradation</i>	No negative impact, there is still fish in the channels	There is a decrease, fish which can live in salt and fresh water will not enter the lake	Huge decline of organisms and species	Decrease of fish and species	-

In brief, following table describes the summary of the whole interviews done by the five stakeholders and impacts of wastewater on the five elements.

Summary of the outcomes from the impact assessment

To support data analysis from the observations and interviews, literature study was made in advance in order to gain fundamental knowledge about the previous condition of the Albufera lake. Based on Hulsof (2012), the Albufera wetlands are located in the South of Valencia, Spain where water is scarce. The river management plans in the past was getting worse because of the large amount of water from the traditional Júcar and Túría irrigation system were diverted to other river basin and other, new, irrigation systems. The surpluses of the traditional irrigation system formed a water source for the Albufera wetlands. Due to modernization of the traditional irrigation systems in the inland agricultural areas, the Júcar river surpluses have decreased and therefore the inflow of water for the Albufera wetland has decreased from 700 to 200 Hm<sup>3</sup>/year over the last 50 years (Water Resource Management Chairgroup, 2014). This impact assessment only the relevant information is used concerning the five elements. Several sources that influence the quality of water might be the upcoming industry, urbanization of the city of Valencia, the standards for the treatment of wastewater in the treatment plant and tourism (Vicente, 1992).

### Water quality and quantity

These observations only describe what was visible in the rice fields, lake and canal. Based on the literature study, conclusions are drawn, while keeping in mind that there could be other explanations for a certain observation. Comparing the water in the rice fields it can be said that there are slight differences. In both cases, the water was transparent; however, in the south the water was more greyish. In both fields, algae were present, which indicates a surplus of nutrients. In the north algae appear surrounding the inlets of the water, while at the observation point in the south algae were everywhere in the field. The colour of the crops in the north and in the south were dark green, but sometimes the

crops in the south were lighter which could be an indication of a deficit of nutrients or the presence of weeds. This observation contradicts the presence of algae. Instead of algae, the northern rice fields were mainly covered by duckweed. In the south duckweed was less prominent. During the boat trip not the whole lake was visited. However, this trip entered the part where water from the study area in the north flows. The trip also went through the southern part of the lake. A change of watercolour was visible between the northern and southern part of the trip. The northern part had a green colour, while the southern part of the lake was grey. The green colour could indicate a surplus of nutrients in the water. The water had a light smell, but it was not identifiable. Algae were only visible on some parts of the boundary of the lake. These were only small amounts. In the irrigation channel from Pinedo, the water was transparent and it had a light sewage smell. During observation, all water seemed to be divided over the rice fields. There was no direct connection with the lake. At the end of the channel, an accumulation of duckweed was present. The stream flow in the beginning of the channel was high. This could explain that no accumulations of algae and duckweed appeared.

### Agricultural production

This analysis is based on the provided information from Mr Plannells Pons, the secretary of Acequia de Riego del Rio Turia and Mr Gascó, rice farmer in the Northern area. The use of treated wastewater from Pinedo is seen as a necessity. Farmers do not have a choice. A higher quality is always better, but it should also be affordable. Without this inflow, there would be a water shortage for the rice fields in the northern part of the Albufera. The Túría River, the original source of water, does not deliver enough water anymore to provide the rice fields. The water quality is good; it is more or less equal to the water from the rivers. The last years, the quality increased because of the tertiary treatment in the water treatment

plant. The reuse of wastewater is always a good thing. It is an improvement that now the water is used three times; once for domestic use, once for irrigation and once to feed the lake. Before, the wastewater was black and irritated the skin. Nowadays, it is transparent and more fertilizers and pesticides are necessary. The water contains less nutrients, so fertilizers need to be applied to provide the rice plants of sufficient amounts of nutrients. The amount of fertilizers applied in the fields is more or less equal throughout the Albufera NP, claimed some farmers that have fields throughout the park. The difference of water source, from the river or from the wastewater treatment plant, does not influence the amount of fertilizers needed. The lack of nutrients can also be an advantage, because it can be regulated manually. In this way there will not be too much nutrients in the water which lead to the growth of other plants. The use of pesticides has increased, ever since burning of the plant remains became prohibited. Without burning bacteria, viruses, insects and fungi are not being exterminated and they will affect the rice growth of the following years. The water quantity in the north is sufficient at the moment; however, more water is always better. Rice needs flowing water: water renewal is essential. The use of this treated wastewater also helps to prevent intrusion of salt water, which would be catastrophic. Flooding the fields in winter also contributes to the ecosystem. It serves as a natural habitat for birds in these circumstances. No real negative impacts are experienced by the use of wastewater as additional irrigation water. The water flowing into the Albufera Lake has a good quality. The rice fields have a purifying function. After passing through the rice fields, the water also contains more oxygen. Water from the river would have a better quality for the lake; nevertheless, treated wastewater is always better than no water for the lake.

### **Fishery activities**

This analysis is based on the provided information from Mr. Caballer,

president of the community of fishermen El Palmar and Juan Vicente, fisherman of El Palmar. Concerning the water quality, the first thing mentioned by the fishermen is the difference in present water quality and the water quality before the seventies. Both fishermen that were interviewed note that the water used to be clear, it was even drinkable and there were a lot of water plants. With the introduction of industries around the Albufera NP the water turned into a 'green soup', water plants disappeared and algae took over. From the moment that the wastewater was collected and treated in the Pinedo water treatment plant onwards, the quality has increased but the fishermen claim that water cannot be produced. It is a natural thing that comes from the mountains and contains 'vitamins' from the soil and air from the atmosphere. Water coming from the Pinedo water treatment plant has no 'vitamins' and even though people say the quality is fine, the fishermen doubt whether that is correct. Fish that are able to live in both salty as fresh water will not enter the lake when the water quality is bad this causes the low biodiversity of today. There is a positive impact of this wastewater. Contaminants in the lake, mostly concentrated in the sludge, will be 'washed out' by the new water that enters the lake. More wastewater means a shorter residence time of the water and thus less contaminants in the future. Since less water is to be received from the Júcar River, the decline has to be compensated for by wastewater, according to mister Vicente. Mister Caballer, president of the fisher community of El Palmar, on the other hand, claims that the wastewater from the Pinedo water treatment plant should never be used. For the fishermen, the use of waste water does not really influence the water quantity. The water level is determined by the sluices, and they will open on moments that the water level increases. More input of water, in this case, does not mean more water in the lake. Mr. Vicente even claims that less water will cause the fish to concentrate in the deeper areas, which makes it easier for the fishermen to catch the fish. Now that the wastewater has increased over time, it has no negative

impact for the fishermen. A decline of fish production and number of fish species has already occurred during the seventies and eighties, but this decline has now stopped.

### **Biodiversity degradation**

This analysis is based on information provided by Mr. Sanchis, from the Polytechnic University of Valencia and Eduardo Vicente, from the University of Valencia. The last interviewee is Mr. Rueda, who has been involved in consultancy works on the Albufera during the last decade. Both Mr. Vicente and Mr. Rueda agree that the use of wastewater is undesirable. From the seventies onwards the lake became hyper-eutrophic. The history of the lake was told and in particular how the industrialization of the area around the Albufera caused the lake to become hyper-eutrophic. With the present concentrations of phosphor, this hyper-eutrophic state will not change. At the moment the water fits the legal concentrations as formulated by the European Union, but according to these environmentalists these concentrations will still result in a hyper-eutrophic lake. As an example of how the quality is still decreasing mister Rueda showed us a *triops cancritorimis*. This organism, that used to live throughout the whole park, got extinct around the year 2005 due to the contamination of pesticides in the lake. According to Mr. Rueda this could possibly have a relationship with the increase of pesticide use after the prohibition of the burning of straw. During the interview, pictures were shown of the Albufera lake, full with macrophytes. At the moment, there are hardly any water plants left in the lake. Decline of biodiversity is the biggest problem caused by the use of (treated) waste water. Studies have shown that in *la Devesa* (the dune area between the sea and the lake) 225 types of organisms are present. This is more or less the capacity of the biodiversity in the natural park, says mister Rueda. In the water that enters the lake, 130 different species have been found. In the rice fields 40 species have been distinguished and in the water in the middle

of the lake only 10 species are to be found. According to Mr. Rueda, this indicates the loss of species due to the use of (treated) wastewater. Mr. Rueda also claims it is not only treated wastewater from the Pinedo water treatment plant that enters the Albufera NP. Untreated wastewater coming directly from industries also enters the lake. How this untreated wastewater enters, the lake is not being specified. All ecologists understand the point of view of the farmers. They do not really have a choice, but to take the treated waste will have consequences on the quality of the rice, according to Mr. Vicente and Mr. Rueda. The use of (treated) wastewater has shown to be catastrophic for the fishermen. Not only did the amount of fish caught in the lake decline over the years, the species caught nowadays are less profitable. Mr. Vicente claimed that if fishermen would ever be in favour of the use of treated waste water, they would not have a clue about what is good for them.

### **Government policies**

This section contains the information provided by Paloma Manteache, the secretary of infrastructure and environment of Autonomous Community of Valencia. She is responsible for all wetlands in the Autonomous Community of Valencia. Water is important in the Albufera. The use of treated wastewater is not a good idea, however, for some people this is still a better option than no inflow of water. People are not concerned about the water quality, water quantity is more important for them. What is happening now does not bother people at all. Farmers are happy with the wastewater. They do not suffer droughts anymore. The water has a fertilizing function on soil and crops. The continuous inflow is also an advantage. In the northern area, there is no complains about the wastewater. People do not experience negative impacts. Fishermen are worried about the water quality. The water in the lake is not pure anymore. Nowadays, other exotic fish species do appear, while the original fish species are disappearing. The new species also stir the bottom of the lake,

which increases the turbidity in the water. Positive impacts are not present for the fishermen. For the environment counts the same: no water means no option. The use of wastewater is better, but still not a good solution. This will have a consequence for the ecosystems and biodiversity, but there is still enough water in the lake and rice fields, people do not see the danger of this treated wastewater. The whole problem is about the division of money and the recognition of the water problems. At the moment less water flowing from the rivers into the Albufera to gain a healthy ecosystem. In the whole Community of Valencia there is enough water for all crops, except for the Albufera Natural Park. Another issue which was brought to the table is the worse condition of the infrastructure surrounding the Albufera. The main tube transporting the wastewater of industries and villages to the waste water treatment plant Pinedo is broken. Untreated wastewater flows in the direction of the Albufera. This is only known by a few people. The treatment in the Pinedo wastewater treatment plant is only partly tertiary, water will not undergo through this process.

### CONCLUSIONS

Changes in water management upstream the Júcar and Túrria River had an impact on the inflow amount in the Albufera. The effluent of the Pinedo water treatment plant was a solution to overcome the decrease of water from the Júcar and Túrria River. This effluent itself is a point of discussion. Environmentalists claim for example that it has negative impacts on the environment and biodiversity. However, farmers need a certain water quantity to cultivate their rice and fishermen mention that the effluent is needed for the refreshment of the lake and to keep the lake on a certain water level. Farmers in the Northern part of the Albufera are dependent on the effluent of Pinedo. Without this effluent farmers cannot cultivate their rice fields. Negative impacts from the effluent of Pinedo are not experienced by the rice farmers. On the other hand, water from the

river is still preferred. It is still unknown what the contamination could be of, for example, heavy metals. Fishermen have experienced negative impacts in the seventies when industries surrounding the Albufera were upcoming. The last decade an improvement of water quality is experienced. The use of effluent is not directly experienced as a negative factor. Water renewal in the lake is important for the water quality. The effluent of Pinedo is seen as an important source. Nevertheless, the fishermen still prefer the higher water quality as it was before the 1960's. Environmentalists see the effluent of Pinedo as a problem. The water quality is insufficient to be used in a natural park. The effects on the biodiversity and on the environment are negative. The Autonomous government also prefer a higher water quality of the inflow into the Albufera. On the other hand, a certain water quantity is essential for the Albufera and therefore, the effluent of Pinedo is necessary. Forecasting the future, collaboration researchs need to be completed in order to get data and information related to effluent from the Pinedo water treatment plant.

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