Book of transcripts for the Online Seminar: "Constructed wetlands: working with water for biodiversity"

UNIVERSITAT POLITÈCNICA DE VALÈNCIA
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Con el apoyo de:
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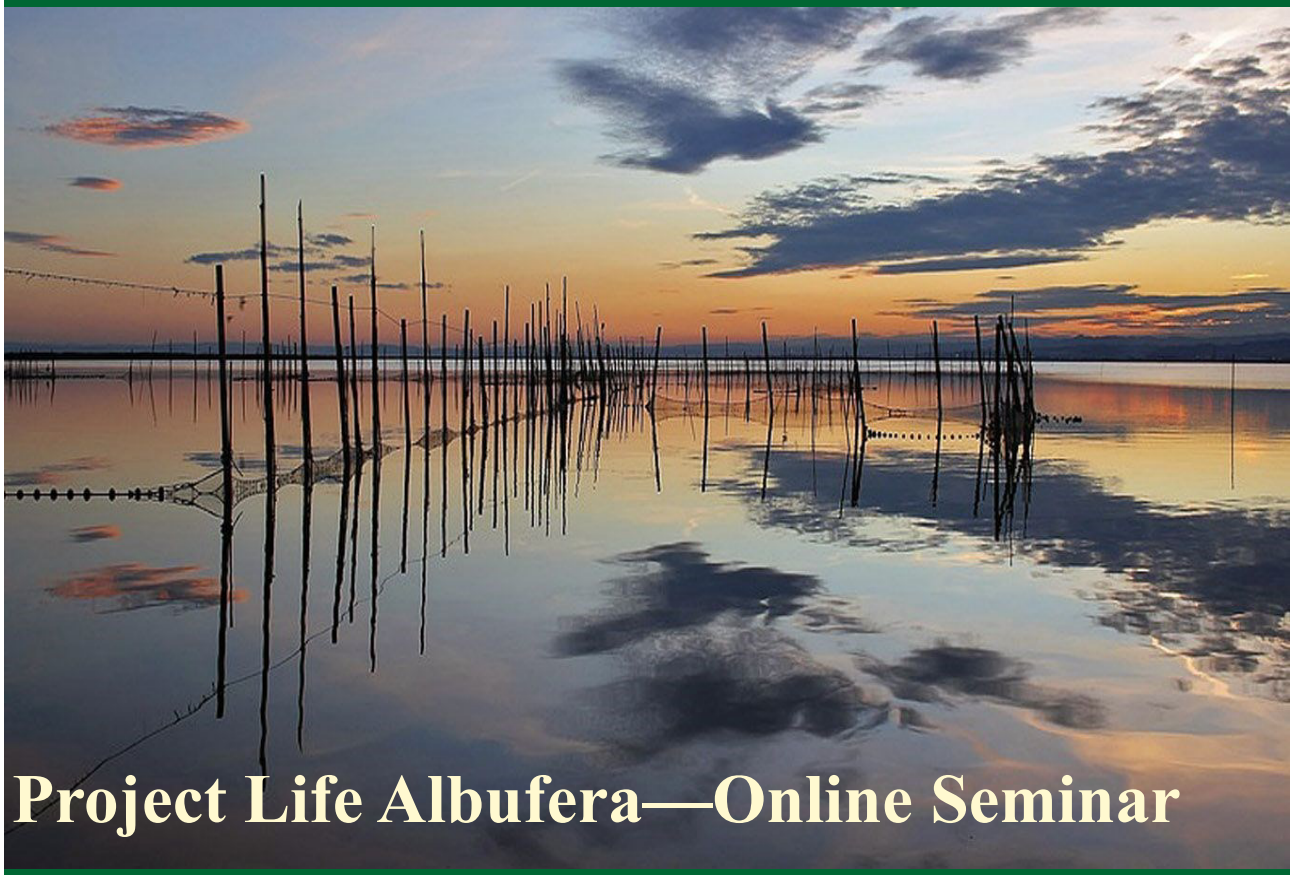

Project Life Albufera—Online Seminar

The online seminar "Constructed wetlands: working with water for biodiversity" consists of a series of 12 video presentations registered by renowned international experts dealing with different areas of constructed wetlands management (water, biodiversity, birds, overall management).

This book is a compilation of the Power Point presentations as well as the transcripts of the oral presentations.

Con el apoyo de:

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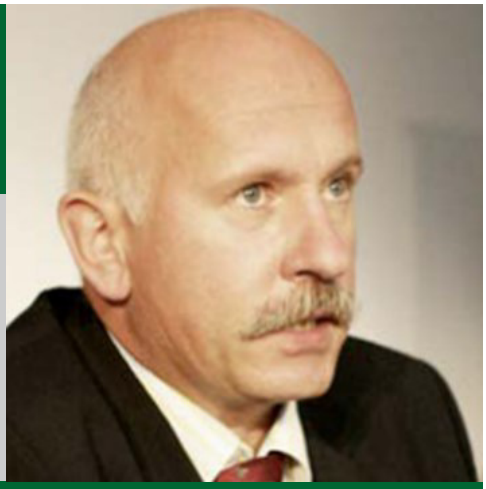
TOBIAS SALATHÉ

Secretary of the Wetland Convention (RAMSAR)



"Seeing what you have started to do with constructed wetlands in the large lagoon of l'Albufera allowed us to make sense of it"

"Big scale constructed wetlands can fulfill many functions beyond water treatment … providing new places for biodiversity …"

Abstract:

Tobias Salathé welcomed to the online seminar, highlighting the importance of constructed wetlands and their planning in an increasingly bigger scale.

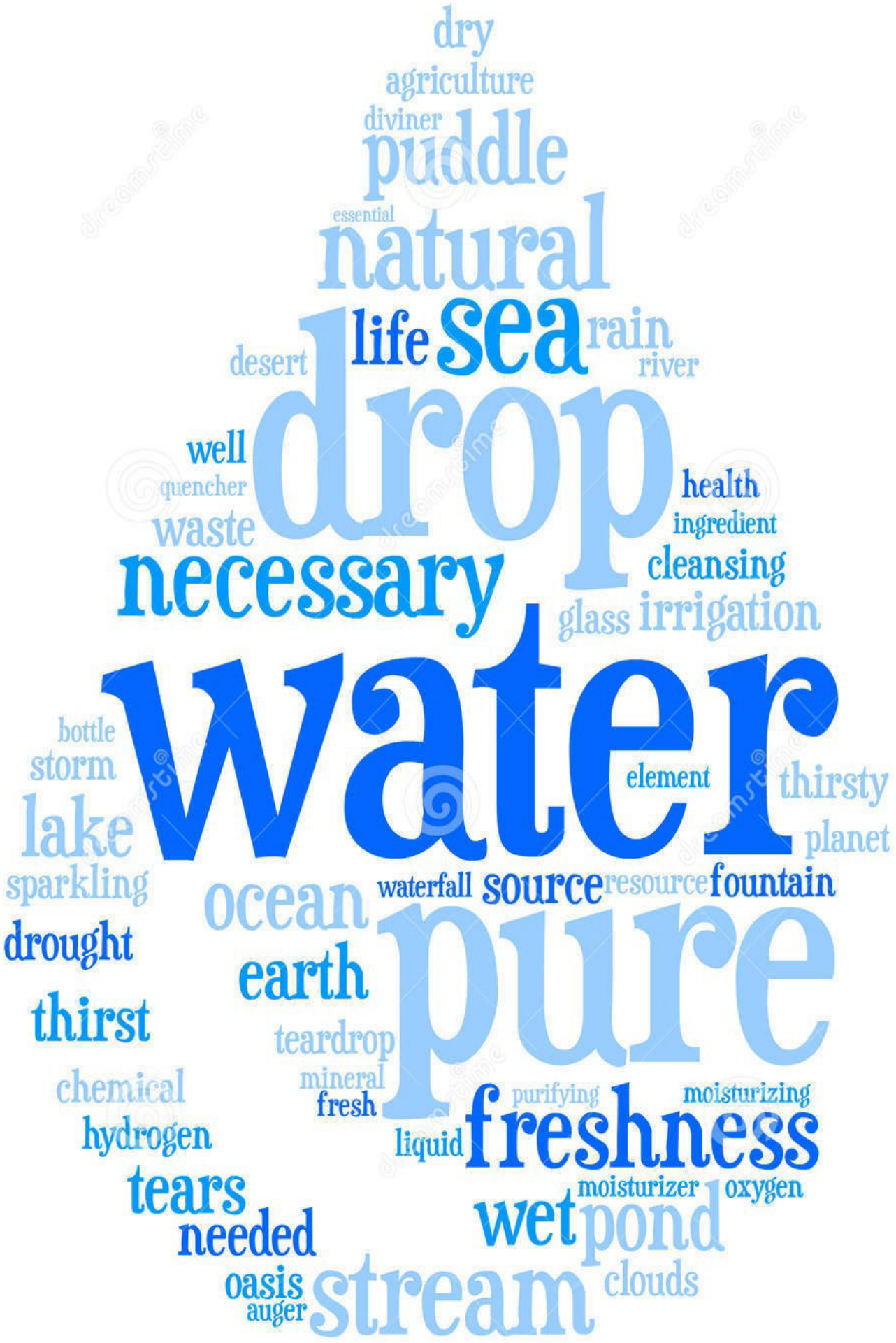
He showed his admiration for the work with the constructed wetlands of l'Albufera and esteemed their functions at a landscape level, encouraging the stakeholders to share experiences and results.

Constructed wetlands are important, but they should not only be about a small sewage treatment or a run-off treatment of some agricultural field.

Having them as you started doing them in the huge lagoon of Albufera does make sense, putting those constructed wetlands into a landscape scale where they can perform many functions beyond the water treatment and water clearance, like providing a better place for biodiversity, improving the fisheries result and similar things. So I think this project will have a lot of potential to show others, at landscape scale, what to do best and I really encourage you to share your different experiences and results across the world.

So enjoy this seminar and let's hear again afterwards how we can move from there.

Have good fun. Bye bye



ROB ROGERS

Broads National Park in England

"Only by working together we could take the necessary steps to improve the environment"

Abstact:

Rob Rogers is the Head of Construction, Maintenance & Environment of the Broads National Park in England. He coordinates the construction, maintenance and environmental design works in this park. For our on-line seminar, he has focused on the implementation of the European Water Frame Directive in the Broadland River Catchment. He identified the different structural water challenges that concern the Anglia River Basin District, the operational areas, the physical reasons that hinder the implementation of the European Water Frame Directive in the area, as well as some of the actions that are being performed to improve the catchment.

According to his view of the situation, he underlines the importance of the governmental funding for the land stewardship agreements with the owners in order to reach a sustainable rural development, thus reducing the risk of flooding and improving biodiversity.

I work for the Broads authority, and we look after the Broads National Park. My job is, as the head of construction maintenance and environments, a very broad. I look after the large teams that carry out the construction works, the maintenance works and also the environment design works within the Broads National Park. We carry out an extensive range of duties, including dredging of 124 miles of navigational waters.

We maintain boardwalks, moorings, foot ways, other countryside dredges and additionally we run an extensive Thane and March grazing program, using conic and Welsh ponies to help us, as well as large harvesters which cut the reed and sage.

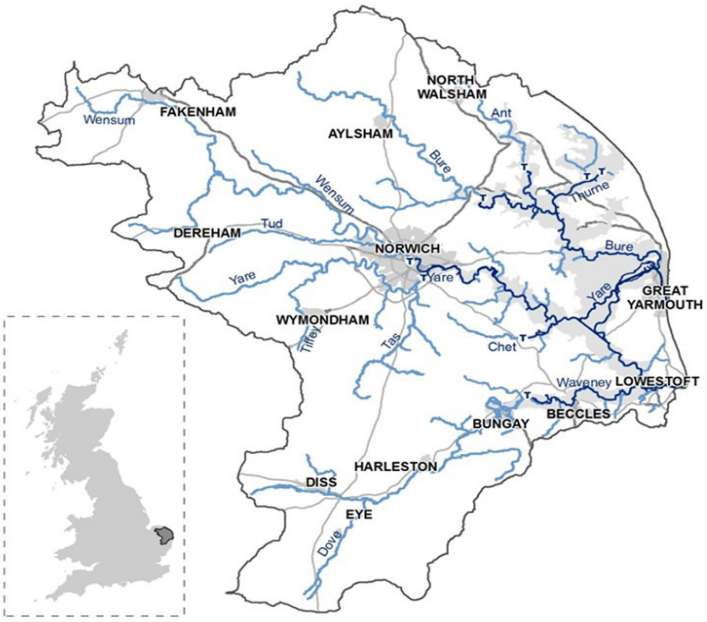
I'd like to thank the Life Project for inviting me to come and talk to you today about the Water Framework Directive in the UK. It's quite a wide subject, so while we're trying to do this presentation, it's actually narrowed down to the work that actually takes place within the Broadland Rivers catchment, which also features the Broad National Park.

My talk to you today is on the implementation of the EU Water Framework Directive within the Broads Rivers catchment. My talk is divided up into various sections. I want to be able to identify with you Water framework challenges facing the Anglian River Basin districts within the National Park. I want to share with you the catchment area and explain the geology relation within the UK, identify physical resources which are causing the water framework directive of the catchment to fail, explain what actions are being taken to make improvements, give you some further actions to demonstrate the partnership working is key to change, highlight some key projects that the Broads Authority is leading on and hopefully leave you with a positive message.

The issue that we face within the Broadland catchment area is that we need to improve the quality of the water in our rivers, streams, lakes, estuaries, coastal waters and groundwater. Only 27 percent of English water bodies are currently classified as having a 'good status'. The benefits of these are wide, but mainly include safeguarding jobs within the region, improving the natural habitats, improving ecosystems and the ecology of the area. And to do this, we used the EU directive, set up in 2000. It was established for the community action of Water Policy, or as we know it: the Water Framework Policy, better known as the Water Framework Directive.

In the United Kingdom, the Water Framework Directive is delivered throughout the river basin with management plans. There is one plan for each river basin. There are eleven River basin districts in England and Wales. And the Broads National Park is actually in the Anglian region and you can just about make it out. This is the Anglian region and the Broads National Park starts roughly where Norwich is. It's a large city, which is known as the capital of the East.

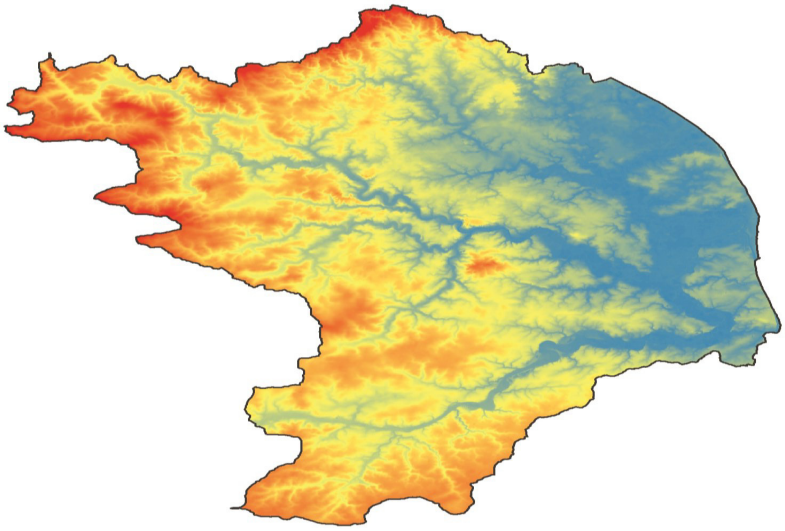
Figure 1: River basin districts of England



This map shows you the catchment, tidal limits, major settlements, roads and rivers all impacting upon the catchment into the Broads National Park and his rivers and shallow lake systems. It also shows the location of the Anglian River Basin and the geographical closeness of the Broad National Park to the North Sea. The small map shows Great Britain: Scotland at the top, Wales at the East and over here, which is that a little bit highlighted, we had the North Sea. If you draw a straight line roughly from Great Yarmouth, you end up in Holland.

Figure 2: The Anglian Region

The rivers within the Broads are tidal, and if surge tide events are happening at higher frequencies, salt incursion into freshwater system is increasing. The fresh water mixed with the salt water is creating a brackish habitat and in some Broads there's a change in the whole ecology of the area. Fish refugees have been created. Some agencies are taking actions to try and develop the construction of a tidal barrier. But high economic costs and the blocking of the navigation are a few of the major stumbling blocks preventing this ambitious project moving forward.



The Anglian catchment is very low-lying with its highest elevations being in the North-West, about a hundred meters above sea level, and with the lowest region of the catchment being in the east with an average height of less than 3 meters. So actually a majority of it is below sea level.

Figure 3: Topographical map of the Anglian Region, with the dark red representing the highest elevations (100m), and the darker blue the lowest elevations (-3m)

Rainfall in this region is relatively low, although recent climate change have meant for prolonged periods of heavy rainfall. The geology is largely chalk and 'crag', which is gravel and sand. But to the East, you find a more peat-environment. In general terms peats soils occur around the Broads and into the shallow river valley. In fact the Broads in the National Park were actually formed by peat digging in the past by ancient Britains.

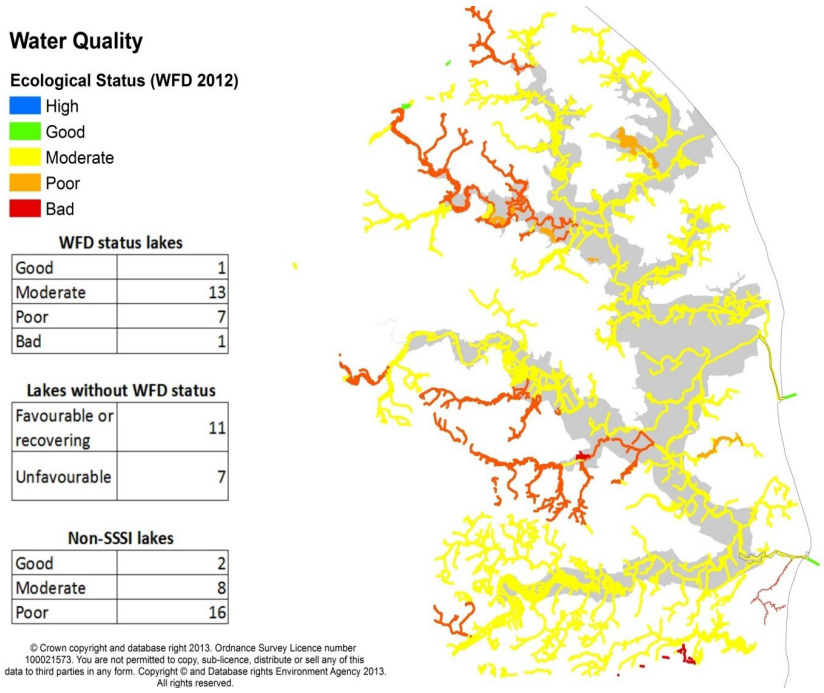


Figure 4: Water quality in the region´s watersheds

Our water environment is in a precarious state. Despite much investment, significant improvement in water quality and less nutrient pollution over the last thirty years our map is at moderate at best with some significant areas of poor and bad.

The Water Framework Directive of 2015 targets the Broads to have least 9% of its rivers and 28 % of its lakes to achieve a good status. We are currently failing that target.

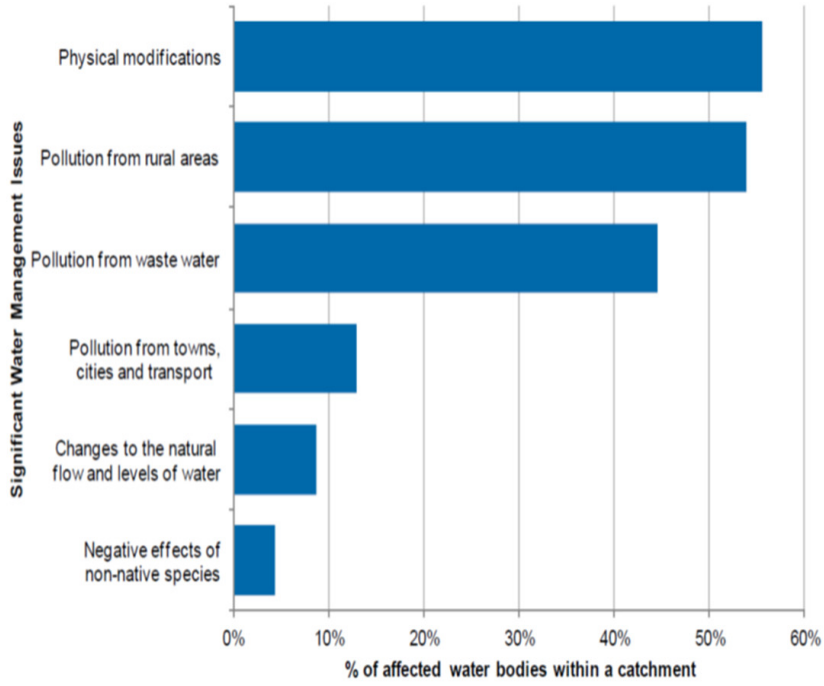


Figure 5: Significant issues affecting the 117 surface waterbodies in the Broadland Rivers Catchment

The broad is low-lying and at the bottom the catchment, and so is affected by upstream events as well as tidal surges from the North Sea. This slide shows you some the key issues affecting the Water Framework Directive within our basin, issues like pollution from towns and cities, natural flows from the North Sea and run-off intensive farming. Our whole highlight in the slide is having a major impact upon the river catchment.

To change the status of our waters we have to implement a number of actions. To do this we have what is known as the River Basin Management Plan. This is published by the Environment Agency, and it outlines the work that a range of organizations are undertaking to assist in improving Water Framework Directives. We have a water company business plan. Within our catchment area, Anglian waters is the sole public sewage provider. Its action plan hopes to maintain and improve sewage systems with the aim of further reductions in neutral release on land, and also into the water bodies.

And then there's the Broad Authority:

We have a five year strategic management plan, which is currently due for renewal in 2016. This is where climate change and sustainable use of the rivers and broads are some of the issues that we tackle. It also includes actions for a range of organizations, community groups and NGOs based on partnership work and sharing resources.

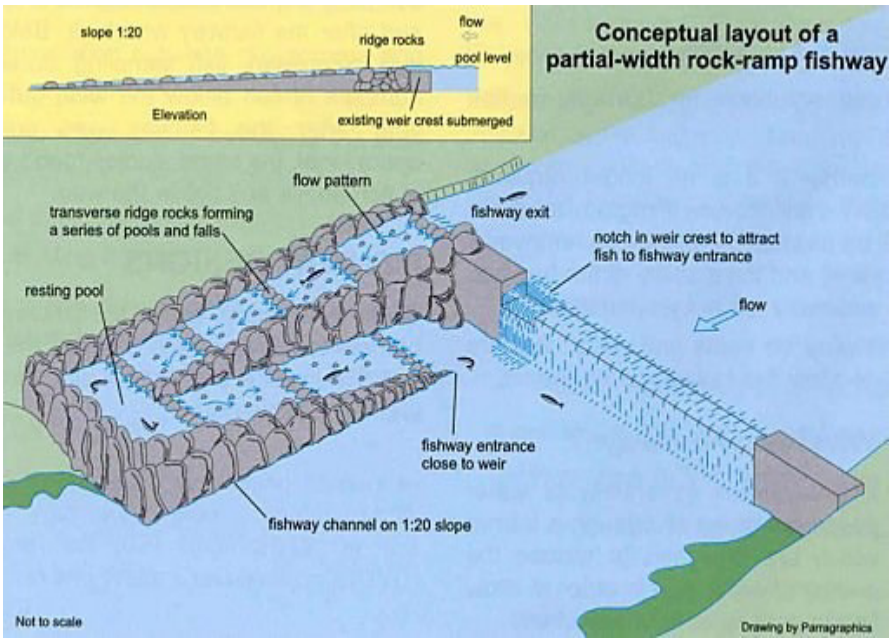
Three actions is never enough, so the following further three major actions have also been instigated to link land and water: The Land Management, carried out by several agronomists and land advisers working across the catchment, particularly assisting farmers to comply with good agricultural and environmental conditions and designed to strengthen the EU legislation.

Catchment Sensitive Farming is a partnership between Natural England and the environment agency, and it's working to reduce pollution from agriculture and it delivers practical solutions and targeted support.

And finally we have Environmental Stewardship. These are central government's funds, which are used to pay landowners to preserve or improve landscape, wildlife and access.

The Broads Authority removes over 50,000 m^3 a year from 124 miles of navigational waters. Removing nutrient rich sediment has direct benefits to improve water quality, and it also helps to stop mutability of the flood isolation of loose ends at the water column, which stirs up and makes the water look muddy and brown.

We also have the non-native species program. This was launched in 2008 to promote prevention, control and eradication of alien invasive species. Partners collect and monitor data on the distribution and spread of these species. They help control and develop eradication programs from that strategy.



And we also have fish barriers. Now, over the last three years, 150 fish barriers have been assessed, some removed and some bypassed. In particular eels have suffered a huge decline in our area since the 1990s. Under the Eel regulation, any water intake has to be screened and have structures made possible for eels.

Figure 6: Scheme of fish barriers

So my concluding slide is a rather beautiful picture of Heigham Sound, one of the largest shallow lakes within the Broads National Park. It was subject to a rather ambitious program to reinstate some eroded land, lost via geese and wind erosion.

Figure 7: Lake Heigham Sound, Broad National Park

This project is on the Broads Authority´s website, and I'm happy to take further questions on that in particular.

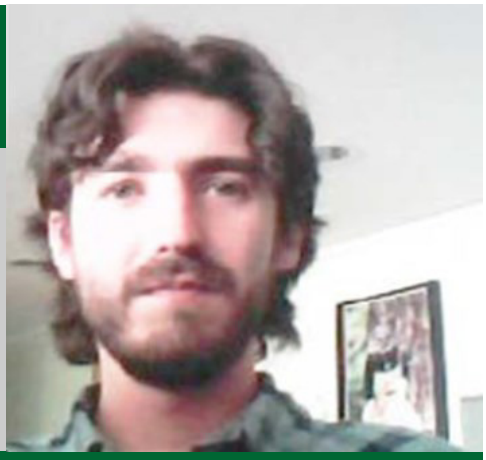
But in conclusion I want to say, the management of land has evolved in a piecemeal fashion over the centuries. And it occurs in specific regions and sectors or districts; and boundaries do not reflect the natural boundaries of the catchment. In some circumstances the planning of improvements of the water ecosystems failed to make used of the knowledge of those who live and work in the catchment. To sustain long-term solutions linking Rural Development, Flood Risk Management and Environmental Stewardship funding around hydrological boundaries, in my opinion is required.

By working together, we can make the necessary leaps and bounds needed to improve the environment, provide benefit to society and strengthen the economy.

Thank you very much for listening to me today and if you have any further questions, then please get in touch.

FELIPE VALDERRAMA ESCALLÓN

NGO "Fundación Humedales" (Colombia)



"Basically, they transform organic matter into bacteria and vegetation"

Abstract:

Felipe Valderrama, Environmental Water Engineer, works for the NGO "Fundación Humedales" (Colombia) which is dedicated to the conservation, restoration and rehabilitation of wetlands. This foundation is implementing projects of wastewater treatment using simple technology such as the "Green Filters", also used by the partners of the project LIFE+ Albufera. The researcher exposes the basic concepts defining the sustainable strategies for wastewater treatment for small villages in developing countries. Through the example of the high Andean lake Fúquene, Felipe Valderrama shows the advantages and disadvantages of the Green Filters in his presentation.

The presentation is going to be about sustainable strategies for wastewater treatment in small villages in developing countries. This technology is called "Green Filters", a type of technology that we discovered through the Living Lakes Network. The Spanish Fundación Global Nature is a part of this network and they introduced us to the world of Green Filters.

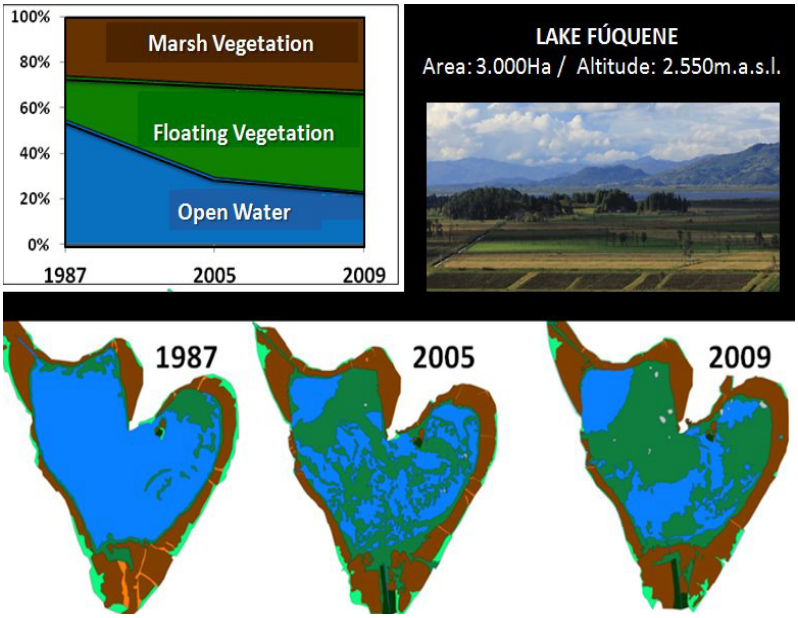


Figure 1: Lake Fúquene

I'm going to set this in context. We work in the Fúquene Lake, where we focus our efforts. It is a high Andean lake, 2500 metres over the sea, with an area of 3000 hectares. It is a shallow lake, and due to all these features, as it is shown in the images at the bottom of the slide, it has suffered a process of strong eutrophication. Most of the water mirror is covered by floating vegetation, which is also surely invasive and alien.

This was caused basically by the input of domestic waste water, farming waste water and, in some cases, water produced by the fairly traditional wool works, pouring into the lake. This input of organic matter or this exceed of organic matter and nutrients is changing the characteristics of the ecosystem up to the point of silting and an invasion of aquatic plants and additionally to the loss of the physicochemical quality of the water. This is terrible, basically because the Fúquene Lake is crucially important with respect to biodiversity. It is the last lake in a complex of lakes that still has a water body and also is decisively important when it comes to social services, because an effluent of the Fúquene Lake, called the Suárez River, is the source of drinkable water for a large rural population of 200.000 inhabitants.

Therefore we are in serious trouble with the management of this waste water, and we also have to face the usual circumstances of rural areas in developing countries, which are basically few money, little financial resources and very limited or inexistent technical means. Because of this, we needed strategies that would help us to overcome the mentioned limitations and to solve the complex problem of wastewater treatment, in order to save a water body of ecological and social importance.

In this situation, we discovered the Green Filters through the Living Lakes Network and, with the support of the Foundation Global Nature we could transfer that technology and apply it, with some modifications to adapt it to Colombia.

I am going to explain you now a little bit of what the Green Filters are about, what are they made of, why do they work and how we implemented the projects here in Colombia, what are the parts of a Green Filter system, and I will talk briefly about some projects in Colombia and finally what can we expect from a green filter.

What are the green filters?

They are constructed wetlands for waste water treatment that work with a slight modification in the hydraulic disposition of the system. They change a typical complete mix system for a plug flow reactor and this makes the biological processes of this wetland a little bit more efficient and, in addition, the wetland is generally more efficient in terms of area per population equivalent.

How do they work?

As I said, they have the same cycles of a natural wetland: nutrient recycling and transformation of organic matter. In this case, we are receiving organic, faecal matter. A part of it, the sedimentable part, deposits at the bottom of the very shallow channel. The rest is in contact with the roots of the plants. The plants are chosen for having long and plentiful roots where they can host the bacterial growth, and this organic matter flowing through the water comes in contact with this biota, then it is transformed into more available chemical forms, which are easier to assimilate by the plants to enhance their growth. Basically, what they do is transform organic matter into bacterial growth and vegetal growth. This growth happens, as we said, in the channels. The system is basically a web of shallow, narrow but long channels, that's the reason for their hydraulics being a plug flow type instead of a complete mix type.

This technique has some marvellous advantages, especially under the rural conditions of a developing country: the implementation is easy, very simple and very economic and it can be easily operated. This operation is basically a harvest. We will talk later about some other points, but the most important one is the harvest of aquatic vegetation.

Well, as you can see, its configuration is extremely simple and gives answer to our reality in these sites: few money and few technical means.

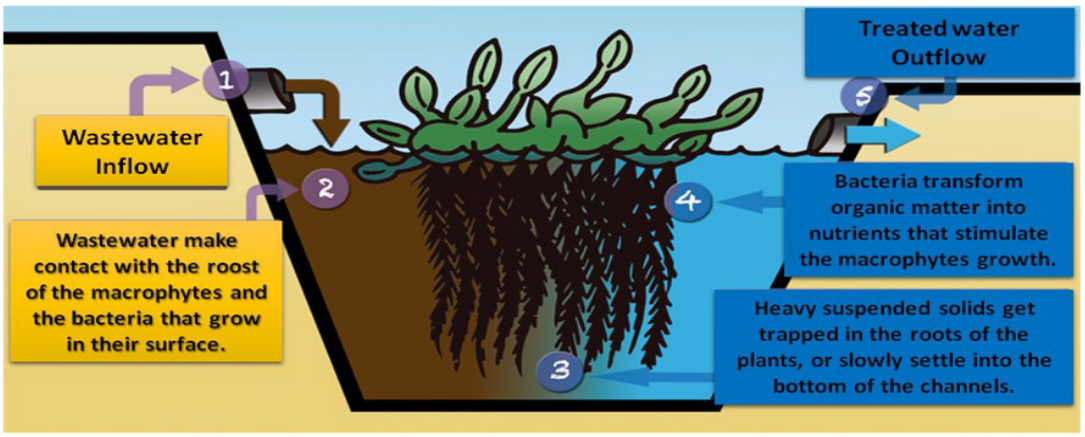


Figure 2: Configuration of the Green Filter

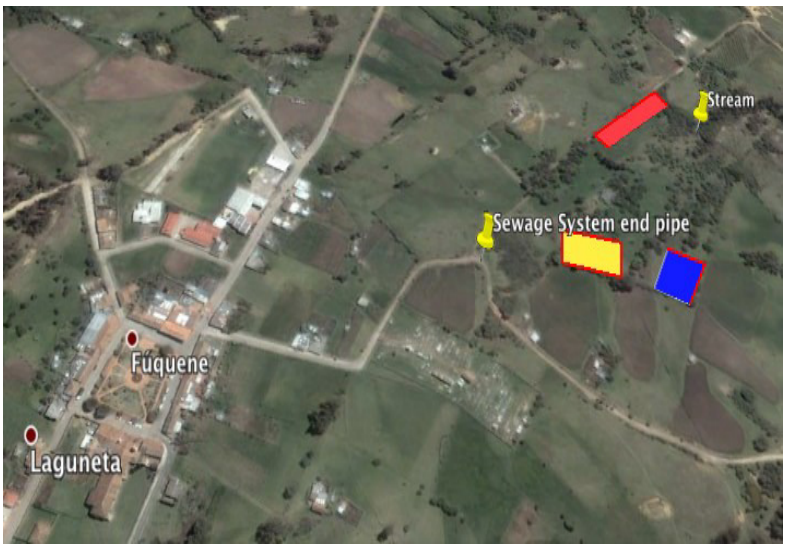
The implementation is made with little money and it can be operated by a gardener without any technical qualification, it also can be built by people without any technical qualification, a good foreman can perfectly make it.

Advantages:

- Low implementation costs.
- Low operation costs.
- Positive impacts in terms of biodiversity, it draws typical species of natural wetlands from the surroundings.
- It doesn't generate any odours if it's correctly operated.
- It doesn't require any energy if there's no need for pumping.
- And there's no need for any chemical to be used.

Disadvantages:

- It needs space because they are extensive strategies. Therefore the viability of the project depends a little bit on the quantity of the available area.



How do we set up a project like this in Colombia? Well, we chose the location where it can be useful, where the villages need it, and then we start with a viability analysis, which is first based on the availability of area, and then we finally get some plots. In this case this is a real village where we are currently working. There we got three plots.

Figure 3: Project sites near Fúquene

These plots were selected by the municipality, and we chose the most suitable one, according to hydraulic criteria and the proximity of the plots to human dwelling settlements. We will work on the red plot, which is far enough from the dwellings, and also its hydraulics can work only by the force of gravity. As next step we will need to approach to the community. Once we are clear about some issues, we can approach the community, and it hopefully might support and allow the implementation of the project.

We are also interested in getting the community involved from the beginning on, because they are going to build and operate the system. If we involve the community we somehow warrant the functionality of the long-term operation of the infrastructure built in the projects. This happens in every kind of project, and it has to be said that in developing countries the political willingness changes easily, is very unstable and temperamental. Every four years or each period it changes radically, so if we don't have the support of the community, the projects are not going to be feasible in the long term. Maybe they could work in the short and medium term but not in the long term, so this point must be regarded as critical for the projects.

Well, this is me, giving a talk.

Figure 4: Felipe Valderrama giving a talk

This is the village of Cuítiva, Boyacá, on the shore of the Tota Lake, also a very important lake. It provides the water for a town called Sogamoso, one of the most important towns in the area. As I was saying, in these workshops we involve people.

How do we involve these people?

Basically, we want them to understand what this technology is about, what consequences it is going to have for them, in this case its construction and operation, and after they agree to the implementation and its consequences we start working and selecting a team from the community for implementing the project. Once this is done, when people are on our side, we get the designs set.

These designs, as you can see, are very simple.

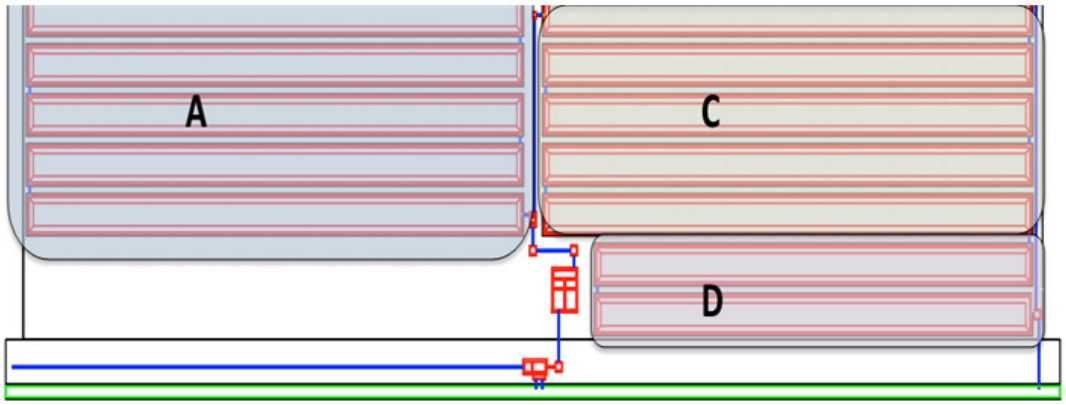


Figure 5: Project design for a green filter

The system is a net of channels where the water arrives after passing through the preliminary treatment and the primary treatment structures. I'll show you later the preliminary treatment. It consists in screening, grit removal and overflow channels.

The primary treatment is a septic tank with lots of compartments for grease removal. These septic tanks are shallow and simplified, basically because they move the maintenance of the sludge removal to the first stages of the channels. It is much easier to do the maintenance, to remove the deposited sludge from a channel that is less than a metre deep than from a septic tank that is 2 or 3 metre deep.

Here you can see that the channels are very narrow if we compare with their length. In this case it is 3.5 metre wide, 0.8 metres of actual depth and almost a kilometre long. You can see some examples of the trapezoidal crossed section of the channels and also a septic tank with its compartments.

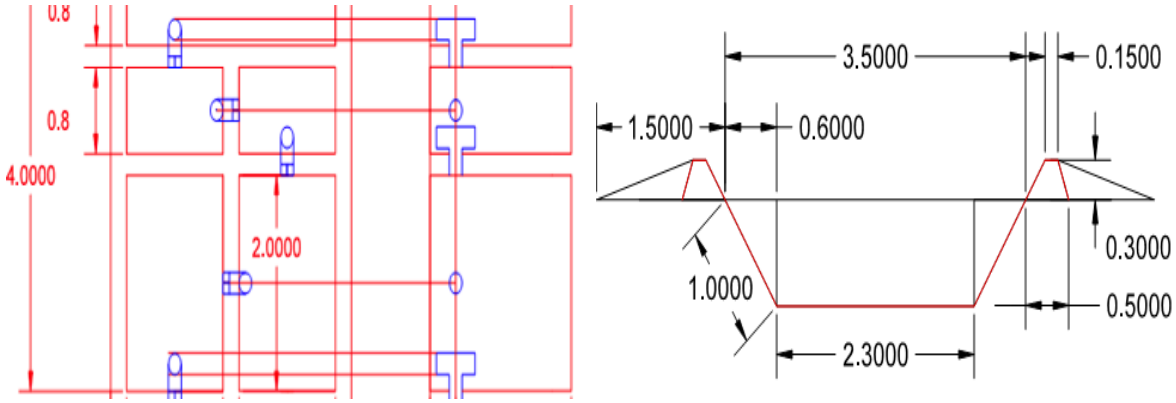


Figure 6: Measures of project design

Its construction is very simple. As I said, it can be built by any foreman even if he doesn't have any technical qualification, obviously with the technical support of an environment engineer or someone with training for these kinds of systems.

Firstly an embankment is made, then the channels are excavated and geosynthetics, geotextiles and geomembranes for waterproofing and protection of the channels are installed, then the preliminary and primary treatment systems are built.

This is an example of the design that I showed you before, this is Susa Cundinamarca. It is a project for approximately 1.200 people, and its area for treatment in channels is slightly over 3.500 square metres.

Figure 7: Project in Susa Cundinamarca

Finally, we do some workshops for community training focused on the operation, maintenance and additionally handling of biomass. As I was saying, the maintenance responds the production of vegetal biomass and bacterial biomass. We harvest this biomass every two months, because we are in a high altitude. In lower altitudes the harvests must be more frequent.

In this case, we harvest the aquatic macrophytes every one or two months, and this matter is supposed to be used for alternative production strategies, such as paper waste production, production of briquettes for combustion, handicrafts, organic fertiliser for soil recovering and ornamental plants. In addition, the water is reusable: it can be used for pasture land watering or fruit tree watering. As I was saying, the workshops are focused on the operation and maintenance.

What exactly is the operation and maintenance?

Training on harvest times, maintenance of the structures of preliminary and primary treatment, frequency of the removal of solids, which in channels usually needs to be done approximately every one or two years, depending on the physicochemical quality of the water. During the workshops there are also some explanations or lessons on the use of the biomass and water generated through the process.

All of this, all the approach to the community, the approach workshops and the training workshops, has as an exclusive target the long-term sustainability of both: the operation and the utility of the green filters system. As I said, we cannot rely on the administration, because politics are always changing, so we directly address the community, which will always be there.

These are the treatment units: a screening unit and an overflow channel, a shallow septic tank with several compartments for grease removal, inflow and outflow boxes and channels.

Figure 8: Green filter components

Now I am going to talk about our projects in Colombia. This is a view of a moorland.

Figure 9: Moorland in the Colombian high Andes

Moorlands are typically high Andean ecosystems. Most of the moorlands of the world are in Colombia and they are water factories. Their whole organisation is adapted to retain water from the atmosphere and transfer it to the ground. There are lots of wetlands and lakes and they are a good example of the most important high Andean ecosystems.

Well, actually the most important in social terms, because these ecosystems collect water for such big cities as Bogotá, with a population of 9 million.

In our first project or pilot project that we made, we got help by the Fundación Global Nature. Here in the picture you can see Yago García.

He is a Spanish technician who came to Colombia to help us. We assembled a very small and very simple system. This system embraces a pre-existing facultative pond that wasn't working and now it is working as a green filter. The municipality modified it to work as a green filter. We then worked in the surroundings of the pond, we excavated an U-shaped channel, and there we received a volume of a litre of water per second in a channel that is 140 to 145 metres long, 3.5 metres wide and one metre deep. It has six days of hydraulic retention time and a total area for treatment in channels of 500 square metres. It serves a population of approximately 400 inhabitants.

Figure 10: Yago García from the Fundación Global Nature

What to expect from a Green Filters System?

PARAMETER	Public Services Company San Miguel de Sema (dry season)			Provincial Water Plan of Boyacá (wet season)		
	Inlet (mg/L)	Outlet (mg/L)	Efficiency (%)	Inlet (mg/L)	Outlet (mg/L)	Efficiency (%)
BOD	261	11	96	19	2	89
COD	343	44	87	60	10	83
TSS	206	22	89	500	180	64
F&O	56	42	25	9	2	78

Figure 11: Green filter efficiency

In this case, it was a pilot project but basically what we got from this system and this pilot was a really high efficiency in the removal of organic pollutants from 89% to 96%, average 90% a good elimination of total solids, greases should be dealt with a little better.

In the first filter we made, the grease trap system was not very solid so in periods with high volume of water the removal of grease were quite low. In this case, it is kind of the opposite of what I've just said, in the dry season we had low grease removal, but this is basically because the sample was incorrectly taken. It was taken in the wrong place, it worked finely for the removal of organic water but not very well for the removal of grease.

In the second case, in the wet season, we got 78% of removals but we usually get 80% or 85% of grease removal.

So, having these data and these percentages of pollutant removal, we got some more funding, mostly German funding and also some dissemination through our country. Because of that, the environmental department is now calling us and it is even funding some projects of implementation of this kind of technology in several places through the country.

Who helped us or who took part in it?

Basically, the Global Nature Fund put us in touch and filtered resources from firms like Karcher, the programme Clean Water for the World, filtered also money from the German Federal Ministry for Economic Cooperation and Development, the support in kind from the Swiss firm Sika, through the Living Lakes Foundation, that came to us as Fundación Humedales and also the initial technical support of the Fundación Global Nature.

Well, I hope my presentation has been useful and it hasn't taken too much time. If you have any question or you need any material related to the presentation, my contact details are here. Our website is in Spanish, so if you want some information in English, please contact me directly.

I hope you are well, thank you very much and see you soon.

MARÍA CARMEN REGIDOR PERONA

Representing the Júcar Basin Authority

"It also seems more likely that the next revisions of the plan will focus more specifically on the environmental objectives".

Abstract:

María Carmen Regidor Perona, representing the Júcar Basin Confederation, a co-funding partner of the project LIFE+ Albufera, presented in detail the Water Frame Directive, which objective is the achievement of good conditions in every surface water or groundwater. This European Directive includes the basic principles ruling the water policies of the European States and it has been applied to the Spanish Regulations by means of the consolidated version of the Water Law. María Carmen Regidor used two examples of specific measures included in the Hydrological Plan in order to fulfill the environmental objectives in the wetland of l'Albufera of Valencia: establishment of a minimum hydrological requirement and definition of an ecological water volume for the Albufera Lake.

To begin with, I'd like you to know that the Júcar Hydrographic Confederation is an independent body in charge of water management of rivers, lakes, reservoirs and also of subterranean waters of a vast territory. It extends to some 42 850 km² and comprises all hydrographical basins pouring into the Mediterranean Sea between the mouth of the River Júcar and the River Turia.

In the Hydraulic Planning Office of this confederation we develop hydrologic basins plans, amongst other things. This has quite a lot to do with the topic of this presentation.

To that end, I've prepared the following index. In the first place, I'll talk about the objectives, or the main objective of the Water Framework Directive (WFD) and the implementation of the Water Framework Directive in the Spanish legal system. Then I'll talk about the Hydrologic Basin Plan, mentioning also a couple of aspects of the Hydrologic Plan. Then we will see a few examples of its implementation. And last but not least, I'll conclude with a couple of reflections.

The Water Framework Directive (WFD) is the European Directive that establishes the framework collecting the principles to guide water policies in Europe. Its main objective is to reach a good condition of superficial and subterranean water bodies. This is the main objective of the WFD, on which I'm going to focus my presentation.

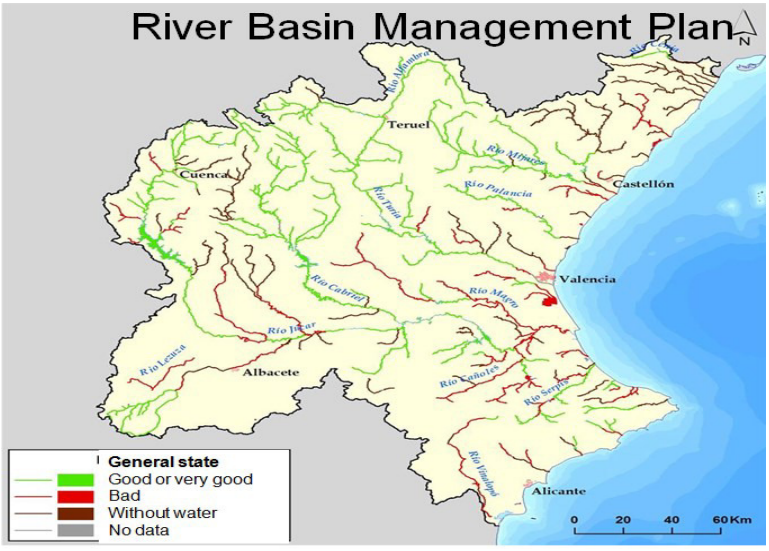
The WFD has been transferred to the Spanish legal system through the consolidated text of the Water Law, which is the norm that regulates water management in our country. In this law, among other things, the objectives and contents of the Hydrologic Basin Plan are presented. In the end, the Hydrologic Basin Plan is the tool that will help to implement a specific water management to reach the objectives of the Plan.

What are the objectives of the Hydrologic Plan?

Well, this is a specific aspect in our country. In the consolidated text of the Water Law: what happens is that it maintains the traditional objective of the Hydrologic Basin Plans, which was to satisfy water demands. It incorporates the objective determined by the Water Framework Directive, which is more of an environmental objective for the adequate protection of the public hydraulic domain.

What happens then? Sometimes, it seems that those two objectives, satisfying water demands and protecting the public hydraulic domain, are incompatible. However, this is how the Hydrologic Basin Plans were defined and this is going to make it more complex when it comes to establish management rules to try to reach both objectives simultaneously. The consolidated text of the Water Law also defines the contents of the Hydrologic Basin Plans. But I'd like to insist only on a couple of elements of the hydraulic plan. On the one hand, the environmental objectives directly related to the theme of this talk. We have seen already that establishing the good condition of all water bodies as an environmental objective was a direct consequence of the implementation of the WFD. Besides 2015 was established as a deadline. However, it is possible to extend the period to achieve these objectives to 2021 and 2027 as long as it is duly justified, including some exceptions. It is also possible to establish less stringent objectives when it is clear it won't be possible to achieve the fixed environmental objectives by 2027.

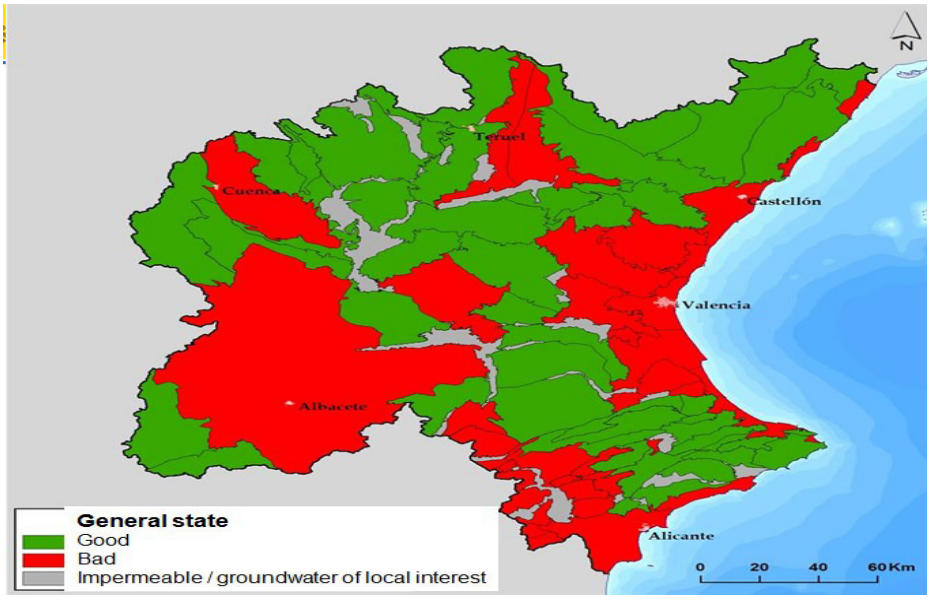
In the case of the demarcation of the Júcar, less stringent objectives we re-established for three flows of subterranean water. Quite a quantity of subterranean water is affected by high levels of nitrates. We observed through mathematic models that even by applying the most restrictive scenario, which supposes that no nitrate enters these flows of subterranean water from now on until 2027, we wouldn't achieve to decrease the nitrate concentration to the established level of 50 mg/l.



In order to know whether we are achieving the environmental objectives, the first thing to do is to get know the condition of the water bodies. If we look at the illustration, we can see the current state of the superficial water bodies. We can see that 45 % of the superficial water bodies are in a good condition, which are represented in green. 26% of them are in a bad condition, and 21 % are classified in the samplings as "without water".

Figure 2: General state of water bodies

This listing may appear unusual, and the percentage may appear high, but if we take into account that we are in a Mediterranean zone, which is characterised by long periods of drought and short periods of torrential rains, this is not that uncommon. These are temporary, non permanent water bodies, and determining their ecological status cannot be done by using the same indicators or methodology as for permanent water bodies. In fact, there isn't one specific methodology. On 8% of the water bodies we don't have any information, consequently we cannot determine their conditions and they haven't been evaluated.



In the following map, we can see that 53% of water bodies are in a good condition, those are the ones in green. And 47% are in a bad condition, represented in red.

Figure 3: General state of water bodies

Among those in bad condition, it's possible that they do not achieve the objectives in quantitative terms or chemical terms, and in some cases the water bodies do not achieve either of these conditions.

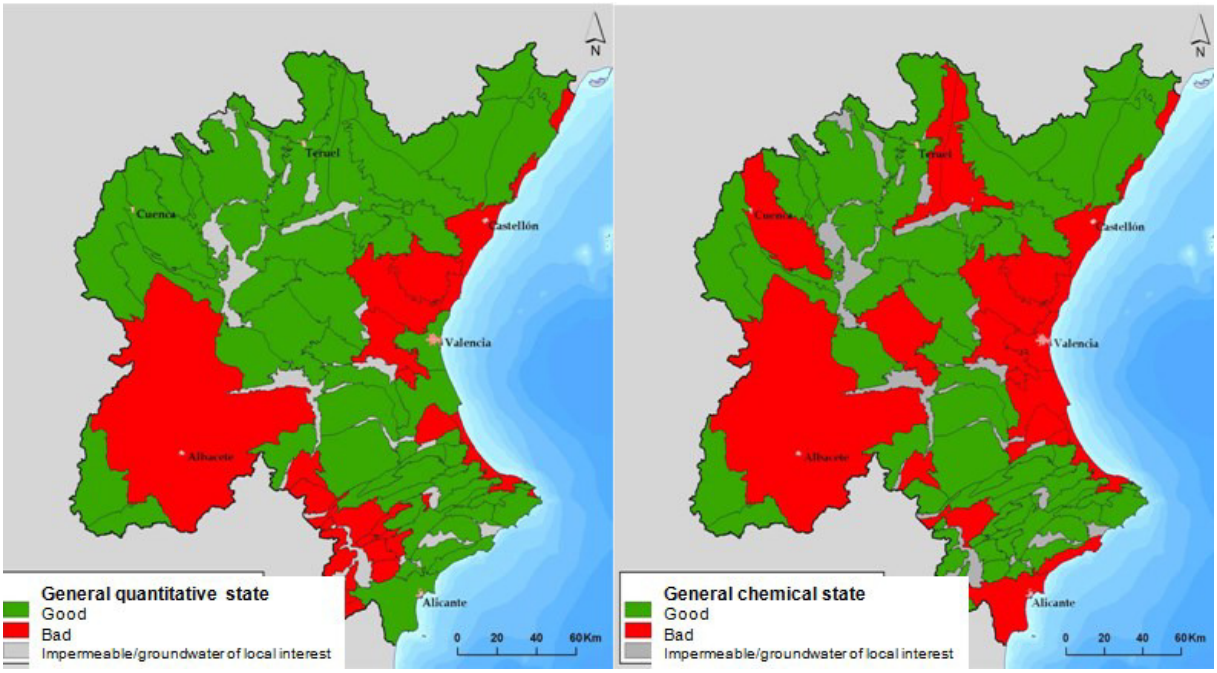


Figure 4: Quantitative and chemical state of water bodies

In order to achieve the environmental objectives, it was established a Plan of Action, and this is the second aspect of hydraulic planning I'd like to talk about. The Plan of Action collects all the measures, all the necessary actions to achieve the expected objectives. For both objectives: the water demand and the environmental aspect. These measures have been budgeted, and an estimation of the investments needed in order to achieve these objectives was made. If you look at the graph, it represents the investment that is required by the administrations to develop the Hydrologic Basin Plan.

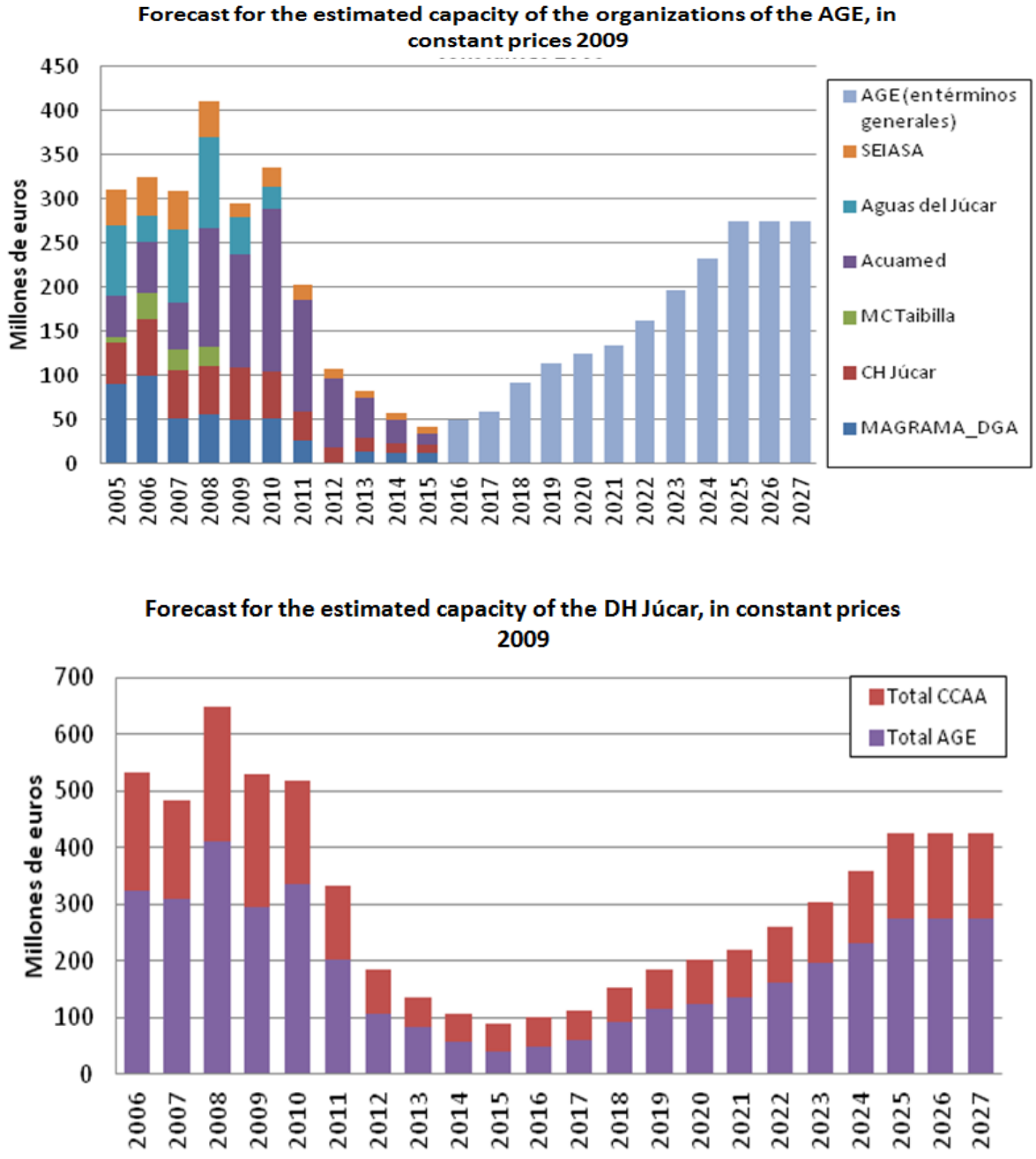


Figure 5: Prevision of the project spending by organizations of the AGE (top), and the DH Júcar (bottom)

Well, at the moment, the estimated investment is under 50 millions, but it is expected for the years to come to keep rising. For the Plan of Action the different measures are organised in fifteen different groups, depending on the end result they pursue. All of this is detailed in the following table (Figure 6).

Measure typology	Investment 2009-2015 (M €)	Investment 2016-2021 (M €)	Investment 2022-2027 (M €)	Total investment 2009-2027 (M €)
1. Point pollution	333,62	210,50	129,72	673,84
2. Diffuse pollution (nitrates from agriculture)	2,10	3,25	1,75	7,10
3. Diffuse pollution (pesticides from agriculture)	0,60	1,79	1,79	4,18
4. Diffuse pollution (remediation of polluted areas)	0,00	1,79	1,29	3,08
5. Hydromorphological: Improvement of longitudinal continuity	2,73	19,67	2,79	25,19
6. Hydromorphological: Improvement of hydromorphological conditions	182,56	125,01	50,00	357,57
7. Hydromorphological: Flow regime improvement	2,76	4,02	1,05	7,83
8.1. Water quantity: Improvement in irrigation efficiency	237,37	196,96	343,03	777,36
8.2. Water quantity: Improvement in urban and industrial supply	57,31	82,89	66,64	206,84
8.3. Water quantity: Conventional resources increase	285,46	344,67	413,49	1.043,62
8.4. Water quantity: Non-conventional resources (reutilisation) increase	124,19	62,82	105,20	292,21
8.5. Water quantity: Non-conventional resources (desalination) increase	235,69	27,58	12,00	275,27
9. Progress in pricing policy measures (urban, industrial and agricultural)	1,25	2,61	0,00	3,86
10.Other measures: Service of advice in agriculture	0,79	1,65	0,15	2,59
11. Other measures: Drinking water protection measures	114,39	53,84	47,19	215,42
12. Other measures: Research and knowledge improvement to reduce uncertainty	89,26	51,27	58,65	199,18
13. Other measures: Measures to reduce emissions, discharges and losses of priority hazardous substances	0,00	0,90	0,90	1,80
14. Other measures: Measures for treatment of industrial wastewater	0,00	0,00	0,50	0,50
15. Other measures: Structural measures of defence against floods	312,16	93,64	670,22	1.076,01
TOTAL	1.982,26	1.284,86	1.906,36	5.173,47

Figure 6: Project spendings

Additionally it was calculated the expected amount of continuous investment over the years. If economic forecasts are fulfilled, and the plan of action will be implemented as proposed, the expected forecast of fulfilment of the environmental objectives would be the following (Figure 7):

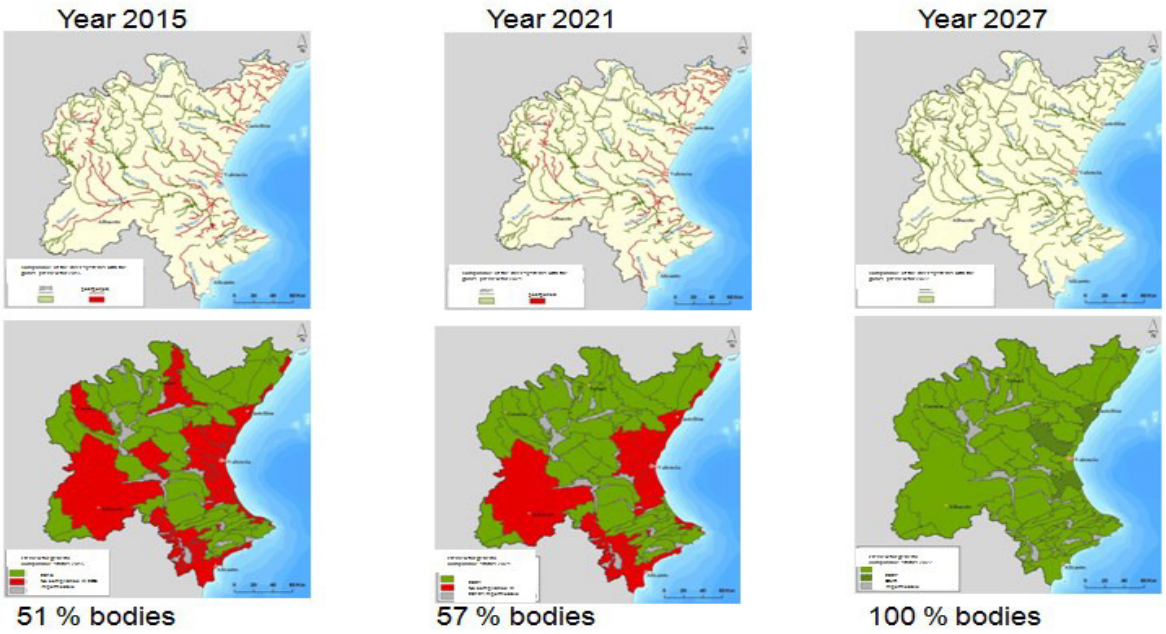
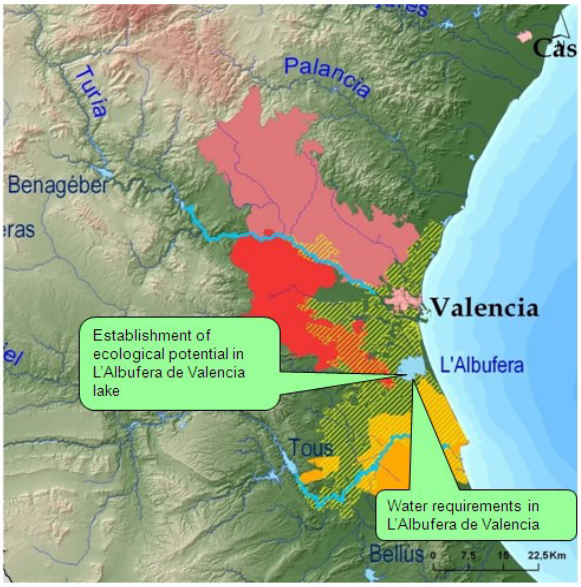


Figure 7: Fulfilment plan for environmental objectives

Currently, 51% of water bodies reach a "good condition". In 2021, if the forecast is achieved, this percentage would rise up to 57%. And in 2027, 100% of the water bodies should fulfil the environmental objectives, except for the three water bodies, which will fulfil the less stringent objectives that we commented on.

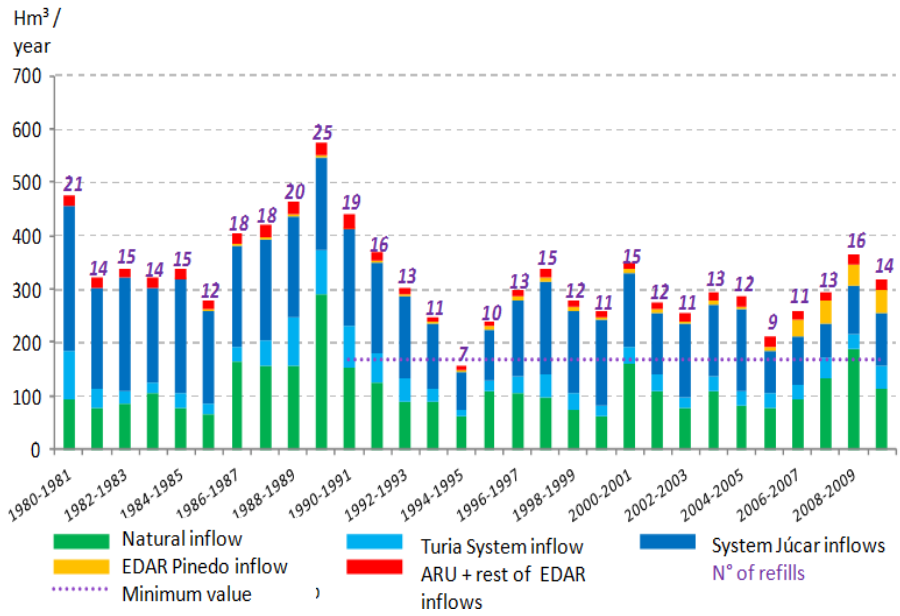
Well, these were the forecasts expected in the Hydrologic Basin Plan, and now we have to implement them, to see if we fulfil the sixty predictions. To conclude, we're going to see a few examples of already implemented actions from the Hydrologic Plan.



I chose the ecosystem of the Albufera, since it is the representative wetland of the Life project, which is the framework of this online seminar. I wanted to mention that the wetland of Albufera of Valencia is the most emblematic wetland in the area of demarcation. It is situated in the south of the city of Valencia, and has an extension of approximately 21000 hectares, the major part of its surface being rice fields. The most peculiar element is a shallow lake, which is situated more or less in the centre of the wetland. It occupies approximately 2500 hectares, and has an average depth inferior to a few metres.

Figure 8: Location of the Albufera close to Valencia

At the moment, this water body is not in good conditions, since it has a high level of eutrophication. For this reason intervention measures were implicated in order to fulfil the environmental objectives. To do so, the Hydrologic Basin Plan, on the one hand, established the minimal water requirements of the Albufera, and on the other hand, established the ecological potential of the lake. The water needs that were established for the lake of Albufera are 167 hm³ of water per year, which is the volume of water that needs to reach the lake.



The establishment of this minimal water requirement was fixed at 95% of the series of the annual entries in the lake in the period between 1980 and 2000 (Figure 9).

Figure 9: Water volume that enters the lake yearly

It is important to know that this volume of 167 hm³ is a minimal water requirement, and therefore has the priority over whatever other use and cannot be reduced, since the area is under environmental restrictions. This doesn't change the fact that it might be necessary to make extra water inputs if needed, in order to fulfil the expected environmental objectives of the Albufera.

What are the objectives of the Albufera? This is the second aspect I'd like to talk about, in relation to other implementation issues. The hydrologic plan defined precisely an environmental objective for the lake, through the chlorophyll indicator, which measures the level of eutrophication of the lake waters. This objective is set in two phases. In the first phase, the chlorophyll concentration is limited to 90 mg/l in 2021, and in the second phase the chlorophyll concentration is limited to 30 mg/l in 2027. In order to reach this, on the one hand, in the rules set in the hydrological plan, the concentration of phosphor is limited to 0,6mg/l in the outputs of the wastewater treatment plants that have an influence on the Natural Park. The phosphor concentration is regulated because it is the limiting nutrient for the eutrophication of the lake. On the other hand, it was also included in the rules of the plan that public administrations, within the range of their expertise, will have to lead the implementation of a "special" plan, which main objective is precisely to fulfil the expected ecological potential. This special plan might include washing practices or water treatment. The exact measures will be specified in the coming years.

To conclude, only a couple of thoughts based on the experience of the recently approved Basin Plan, which was approved in last July, and is currently being implemented. I want to say that the plan proves that it is possible to unite the two objectives of the plan: to satisfy water demands and protect water bodies.

Nevertheless we also have to admit that there's still a lot to do in order to fulfill the environmental objectives. And even if the first steps have been made to set up measures to fulfill them, it is true that there is needed more expertise in satisfying water demands and thus more progress on this matter. For this reason, it also seems more likely that the next revisions of the plan will focus more specifically on fulfilling the environmental objectives.

On that note I finish the presentation. I hope it has been interesting. I have left a link in the last slide for those interested in receiving more details about hydrological planning (**http://www.chj.es/ES-ES/MEDIOAMBIENTE/PLANIFICACIONHIDROLOGICA**).
Anyway, if you have any doubts, you can contact me. Thanks very much for your attention, and I hope you enjoyed it.

JUAN JOSÉ SALAS RODRÍGUEZ

Responsible for R+D+I in the Foundation "Centro de las Nuevas Tecnologías del Agua" (CENTA, Seville)

"Another kind of use for the constructed wetlands, which is just starting in Spain but is quite developed in other countries, is the treatment of run-off water from the roads".

Abstract:

Juan José Salas Rodríguez, expert in Soft Technology and Water Treatment in small Towns, and currently responsible for R+D+I in the Foundation "Centro de las Nuevas Tecnologías del Agua" (CENTA, Seville), talks about the wastewater treatment using constructed wetlands, which allow the artificial reproduction of the water cleaning processes that happen in the natural wetlands. Juan José Salas talks about the processes of implementation of the constructed wetlands and their possible uses as well as their advantages and disadvantages.

Firstly, I would like to show you the centre where I've been working for 25 years, the centre for R+D+I that the Foundation CENTA manages in Carrión de los Céspedes, a small town with a population of 2.500 inhabitants which is 28 km away from Seville.

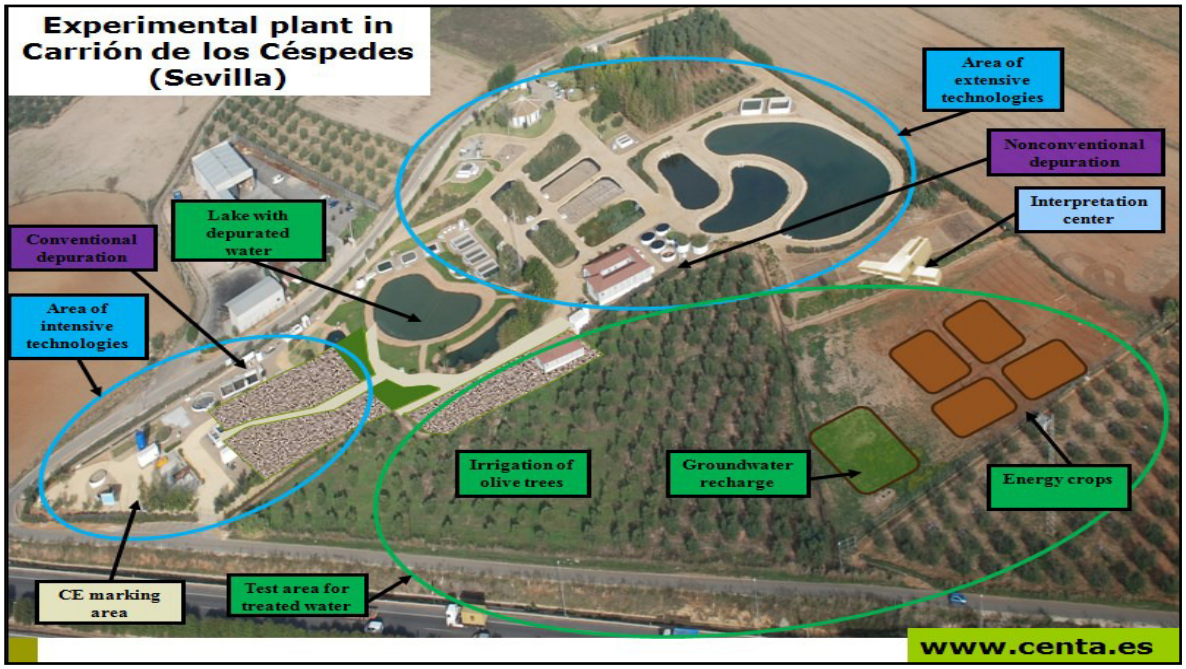


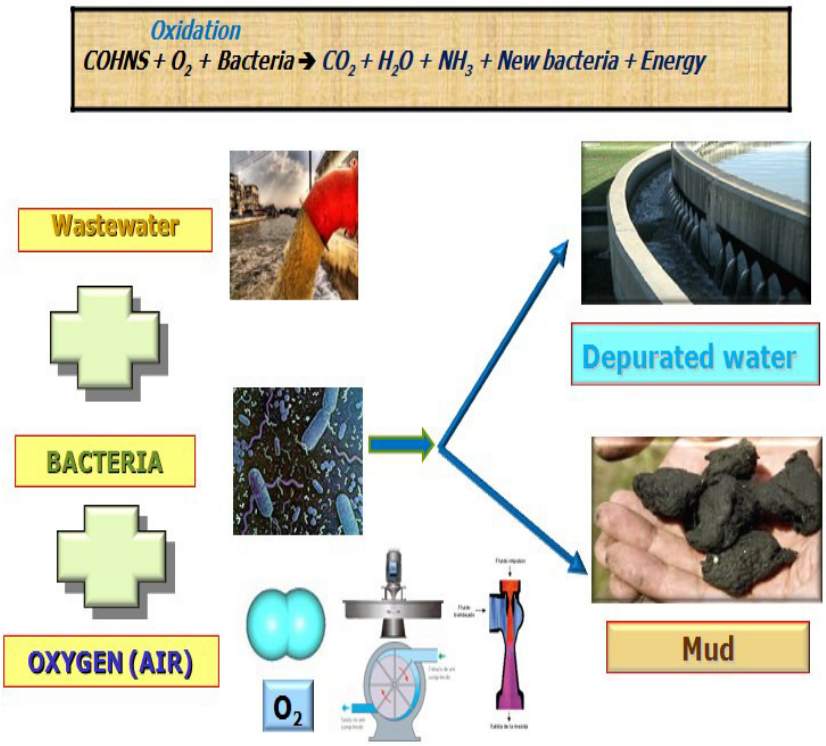
Figure 1: The CENTA R+D+I centre in Carrión de los Céspedes

This experimental centre, with an area of 5 ha, contains a wide range of technology for the treatment of wastewater. The simpler ones are the extensive technologies, including green filters, segregated natural lagooning, several types of constructed wetlands, sand filters, gravel filters, peat filters, etc.

Intensive technologies are including extended aeration, membrane bioreactors, sequential, bioreactors and so on.

A specific area for watering tests using treated water, both for farming watering and aquifer recharge, an "in situ" laboratory and an important area for CE marking, being the only Spanish institution with an official European authorisation for CE marking in units with water treatment facilities under 50 population equivalent.

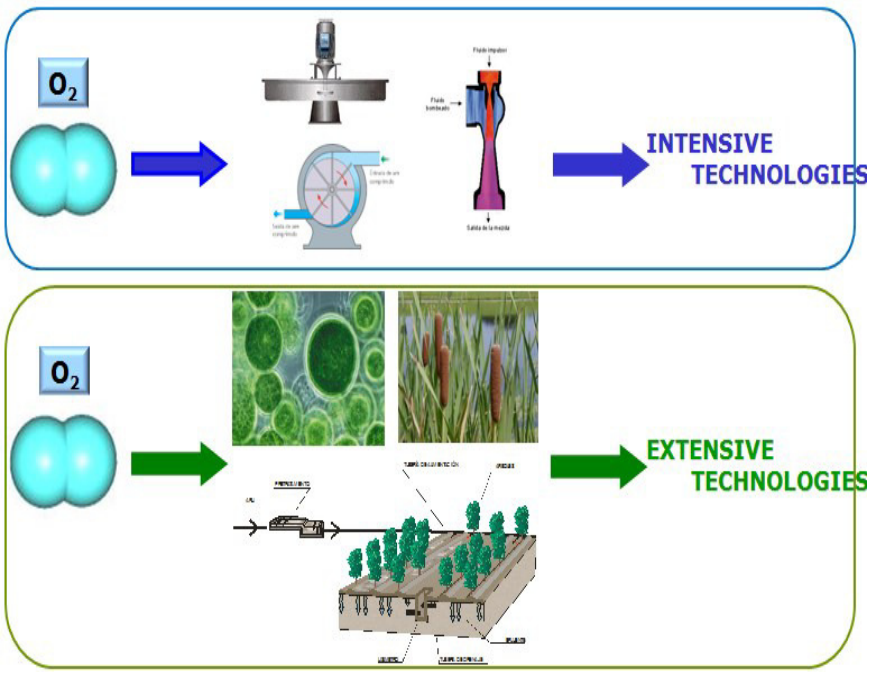
Before speaking about wastewater treatment, firstly I would like to consolidate some basic concepts.



In this slide you can see a graphic showing a biological wastewater treatment process. It is as simple (or complex, depending on the point of view) as mixing the right proportions of the three components: wastewater, bacteria and oxygen, but in a special case where wastewater and bacteria are combined in the same stream that reaches the water treatment plant, whereas providing oxygen for aerobic treatment is the more complicated and expensive part of the process.

Figure 2: Biological wastewater depuration

Well, in these aerobic conditions, the bacteria in the wastewater are going to use the biodegradable substances in the water as a substrate, they are going to grow, reproduce, join and flocculate, which makes it possible in the last stage to reach separation by gravity of the treated water in the top of the decanter, and the solid component (sludge or mud) at the bottom of the separation system. This sludge is virtually made from exceed of bacterial biomass, grown after the consumption of the contaminants of the wastewater.



Depending on how the oxygen is provided for the aerobic work, there are two different types of technologies. When we use surface aerators, compressors, injectors, electromechanical systems, we are talking about intensive treatment technology.

On the other hand, if the oxygen input is made by natural processes (such as photosynthesis), we are talking about extensive treatment technology.

Figure 3: Mechanisms for oxygen provision

The next slide explains the reasons for using these adjectives.

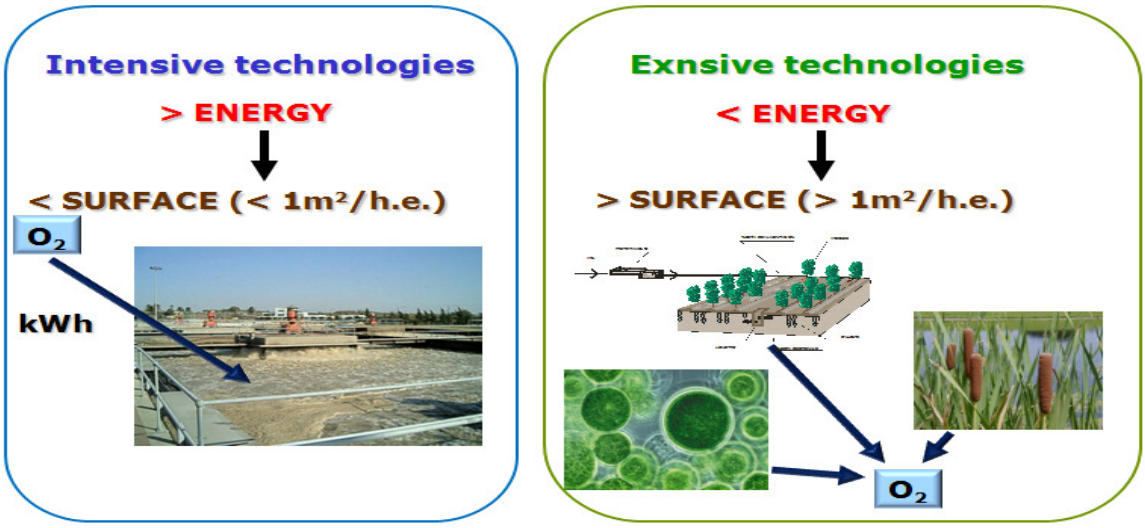


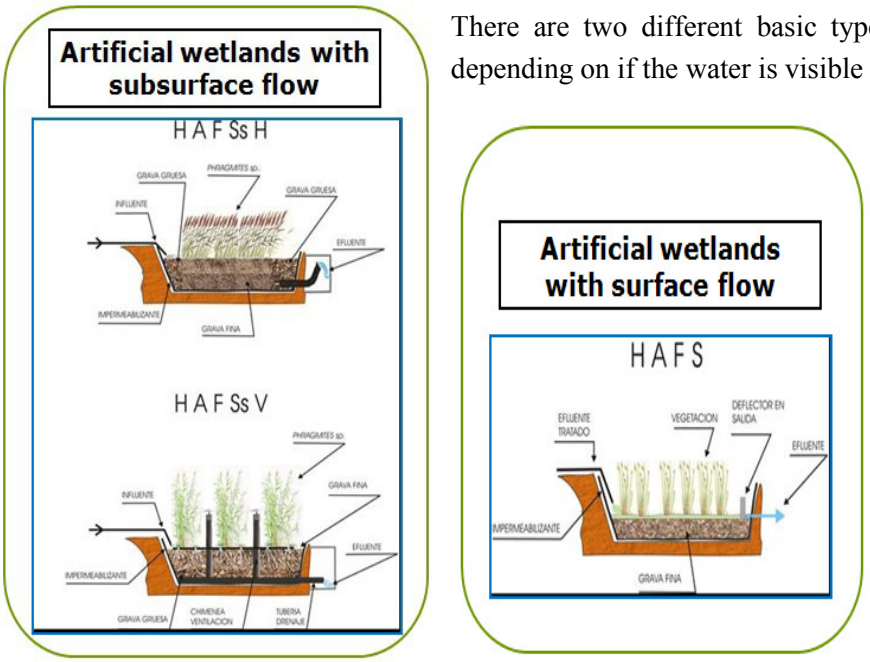
Figure 4: Intensive vs. extensive technologies

In the intensive treatment technology, (an example of extended action, a superficial aerator) the oxygen needed is provided by introducing energy (kilowatts-hour) in the system. The treatment process is being accelerated and, additionally, it can be carried out in a smaller area. We are using less than a square metre for each population equivalent treated.

On the contrary, if we use natural sources of oxygen, the system needs very few energy, even none, but, in exchange, it needs a large area. This means we spend in energy what we save in land, and vice versa, that's why they are called extensive and intensive treatments.

The land requirement is fundamental when choosing what type of treatment can be settled on a specific plot depending on the available area.

Let's move forward on our main subject, the constructed wetlands. We can say that it is a relatively new treatment technology, developed during the 60s in Germany. It reproduces artificially the cleansing processes occurring in the natural wetlands. We are going to use, among others, a feature of the plants living in flooded areas, which allows them to pump oxygen from the atmosphere into the root area, where an aerobic biomass is going to be developed. Later the waste water is going to meet the biomass and the oxygen provided by the plants.



There are two different basic types of constructed wetlands depending on if the water is visible or not. If it is visible on the surface of the wetland, it is a surface wetland or free-water wetland.

On the contrary, if the water is not visible, if the water flows through the substrate, it is a subsurface-flow wetland.

Figure 5: Types of artificial wetlands

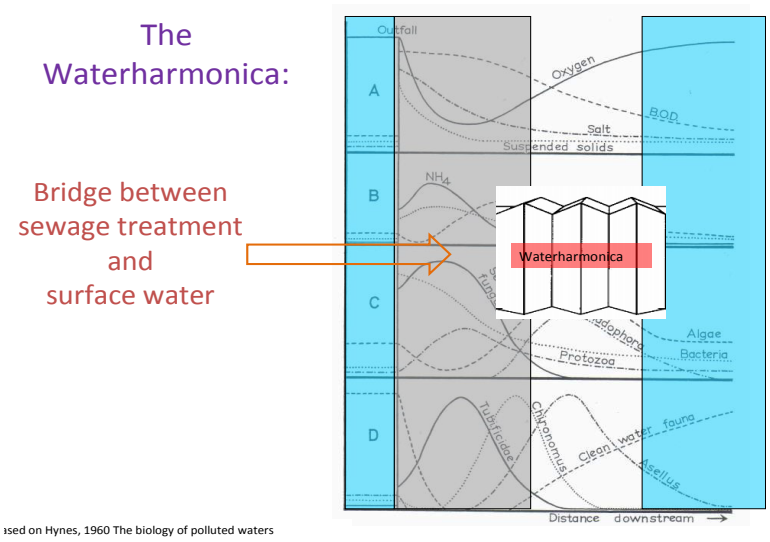
With two different types of subsurface-flow wetlands:

In the first one, the water flows through the wetland horizontally from the head to the end, that's why they are called horizontal flow wetlands, in the second one, on the contrary, the water moves vertically from top to bottom, so they are also called vertical flow wetlands.

Surface-flow wetlands consist in excavations (big excavations, generally many hectares) protected with an impermeable line and generally with an inert substrate at the bottom to allow plants from wet zones to root there.

Their specific feature is that the water flows through the plants but the water level is kept low, always under 40 cm of water, like in a lagoon, but using a much lower depth of water and with plants rooted at the bottom of the wetland.

This type of wetland technology is often used as a refining treatment receiving water that has been previously treated in a secondary level and, through the wetland treatment, would achieve better physiochemical and microbiological quality.



The surface-flow wetlands are playing the role of what is called "water harmonica", a new philosophy for wastewater treatment that says that it is advisable, after treating the wastewater with an intensive or extensive treatment system and before pouring it back to its course, to transfer the water through a system working as a buffer, like an accordion, in order to let it "adjust or adapt" to its new category as natural water.

Figure 6: "Water harmonica" principle

Regarding the subsurface-flow wetlands, we are going to talk first about horizontal flow wetlands. This is a diagram showing a horizontal flow wetland:

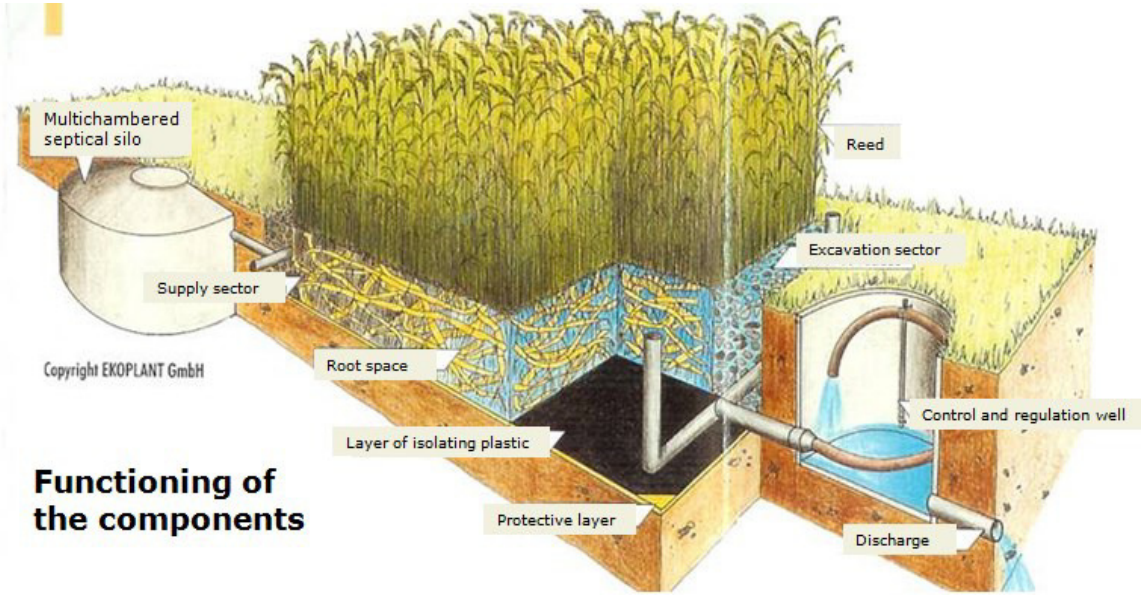


Figure 7: Functioning and components of horizonthal flow artificial wetlands

The wasteland input arrives here, first it is subjected to a decanting-digestion treatment in an Imhoff septic tank, a basic treatment to achieve a good elimination of sedimentable bacteria, that otherwise could cause an early silting of the substrate of the wetland. After the filtration process the water arrives at the wetland.

The wetland consists in an excavation on the ground with a lining and an inert substrate of gravel or chippings where wet area plants, mostly reed, root.

After decanting, the untreated water flows through a tangle of roots, rhizomes, gravel and stuck biomass, and gets filtered, with the help of the slope, 2% from the head to the end, and, at the output area, the treated water is collected by a drainage pipe which carries it out.

This is a fundamental issue:

The device at the exit that allows to control the water flood level in the wetland. It keeps this level over 10 cm under the surface. This makes the water invisible, avoiding mosquitoes, smells and the contact with people or plants.

It is fundamental in horizontal flow wetlands to keep this level under the surface, but remember that in this type of wetland all the substrate is flooded except the first centimetres of its thickness.

In vertical-flow wetlands the picture is quite similar:

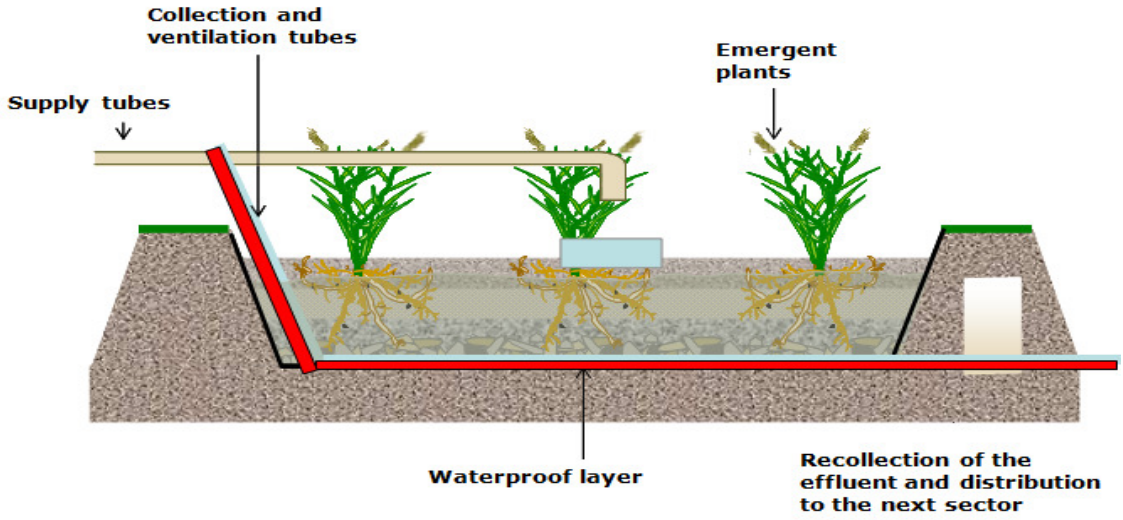


Figure 8: Functioning and components of vertical flow artificial wetlands

An excavation on the ground, a lining, an inert substrate, wet zone vegetation, but in this case the intake is made from the upper part of the wetland from top to bottom. So the water flows through the substrate and, after been filtered, is collected by a drainage pipe that carries it out, being the drainage pipe also connected to the atmosphere, allowing then a better oxygenation of the substrate.

The main difference from horizontal-flow wetlands is that in vertical-flow wetlands the intake is not continuous but intermittent, usually from 12 to 24 inputs per day.

This way of working allows that, in the pauses between inputs, the substrate receives a bigger amount of oxygen than the amount provided by the plants, that is, in vertical-flow wetlands; oxygenation is virtually due to the intermittence of the intake, being the input from the plants secondary in this case for the aeration of the substrate.

Advantages of this treatment system:

Apart from what has been said above, the system has a low or non existing demand of energy, which is very important when we treat water for small towns. It also has the advantage of a very simple function and maintenance, because it only needs a periodical removal of the deposited sludge in the primary treatment and the Imhoff tank or septic tank every one or two years. Additionally, when the vegetative cycle is over, the planted vegetation gets harvested by hand or by electromechanical means and removed subsequently. The production of biomass is estimated around 4 kg when dried per square metre of plantation and year.

As well as its simple functioning, another important aspect of the constructed wetlands is its excellent environmental integration.

Here there are some houses with wetlands for water treatment. The garden is now virtually a water treatment plant, so we are observing a new concept regarding to small scale water treatment. In the past, water treatment plants were hidden assuming that they were filthy places with bad smells, insects, rodents and so. Nowadays, the concept has changed and the treatment plants are shown, due to the excellent integration of the wetlands.

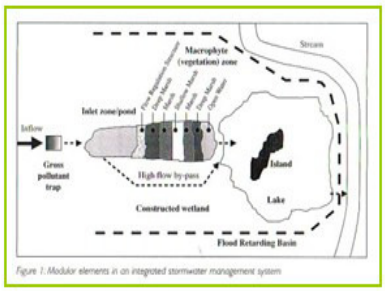
Figure 9: Integration of green filters into the scenery

What are the wetlands used for?

Treatment of urban and industrial wastewaters

Restauration and creation of aquatic ecosystems

Stabilization – drying of mud

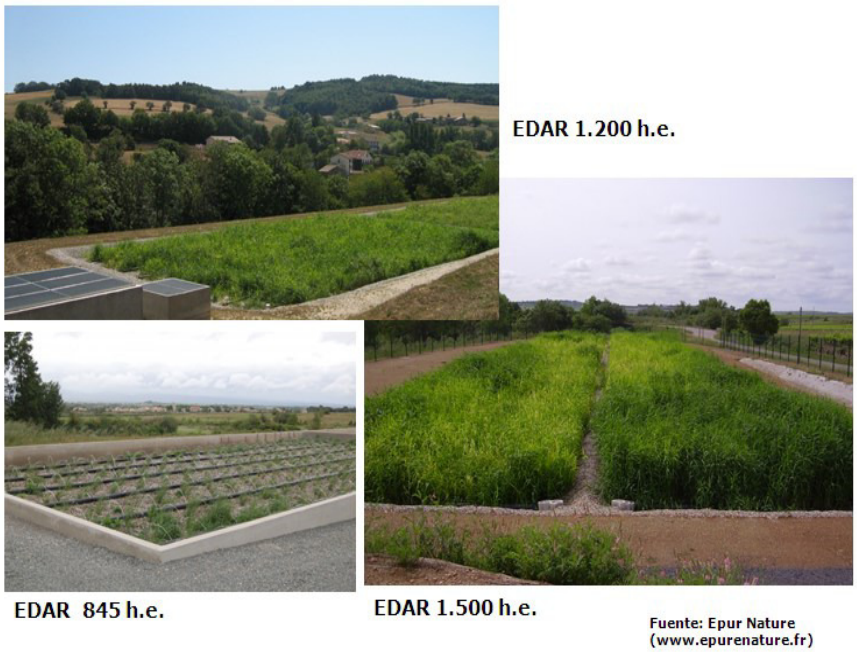


Treatment of storm water runoff

This technology treatment, for some time now, has been the most spread around the world among the extensive treatment technologies and is used for many things, including urban and industrial water treatment, restoration and creation of aquatic ecosystems, stabilisation and drying of mud and rain water treatment.

Figure 10: Uses of artificial wetlands

Let's see some examples:



In these slides we can see several wetlands, vertical-flow wetlands in this case, treating wastewater in towns between 800 and 1.200 population equivalents.

In Europe, the biggest currently existing artificial vertical-flow wetland treats an equivalent of a population of over 4000.

Figure 11: Examples for urban watewaster treatment projects

This is also a paradigmatic example of the use of wetlands for treating industrial wetlands:

Rose Acre Farms (Indiana). A 30,000-gpd constructed wetland system provides pretreatment of process wastewater generated by a soy bean processing facility. A second 60,000-gallon-per-day constructed wetland system treats up to ½-inch of rainfall generated over 4.5 acres. The system also treats water from their truck-washing operation. The Beanmeal Processing Facility system was one of the largest subsurface-flow constructed wetlands installed in the US for stormwater treatment. In 2006, the facility was awarded the Indiana Governor's Award for Environmental Excellence. Fuente: Bernardin, Lochmueller & Associates,Inc.

A facility for processing soya beans in Indiana, USA, with two subsurface flow wetlands, one for treating the water from the soya beans processing and the other for treating the water used for cleaning the trucks and the rain water collected from the surface run-off on the paved part of the facility.

Figure 12: Wastewater treatment example from Indiana

Another excellent example of wetlands is the already famous Tancat de Milia in the surroundings of the Valencian Albufera, with a 40 ha. area and built in a former rice field.

Here the polluted water is taken from the Albufera, introduced into the head of the surface-flow wetland, it passes through several sections and comes back treated to the Albufera.

Figure 13: Tancat de Milia in the Valencian Albufera

If natural wetlands are called “the kidneys of the Earth” by some biologists, we can also say that the Albufera is having “dialysis”, because the polluted water is taken, filtered through an “artificial kidney”, which is the wetland, as a treatment and flows back again to the Albufera after being treated.

Another kind of use for the artificial wetlands, just starting in Spain but quite developed in some other countries, is the treatment of run-off water from the roads.

Roads are an important cause of pollution, because the road traffic leaves traces, shattered metal, grease, oil, fuel, wasted goods, etc. When it rains, the water sweeps these pollutants into the riverbeds near the road system. In order to prevent this, ponds for initial water accumulation and decanting are being built near the roads, and, subsequently, the water passes through artificial flow wetlands in order to get treated before it reaches the nearest riverbed.

Here, at right, you can see the use of wetlands near the roads and in the intersection area between roads.

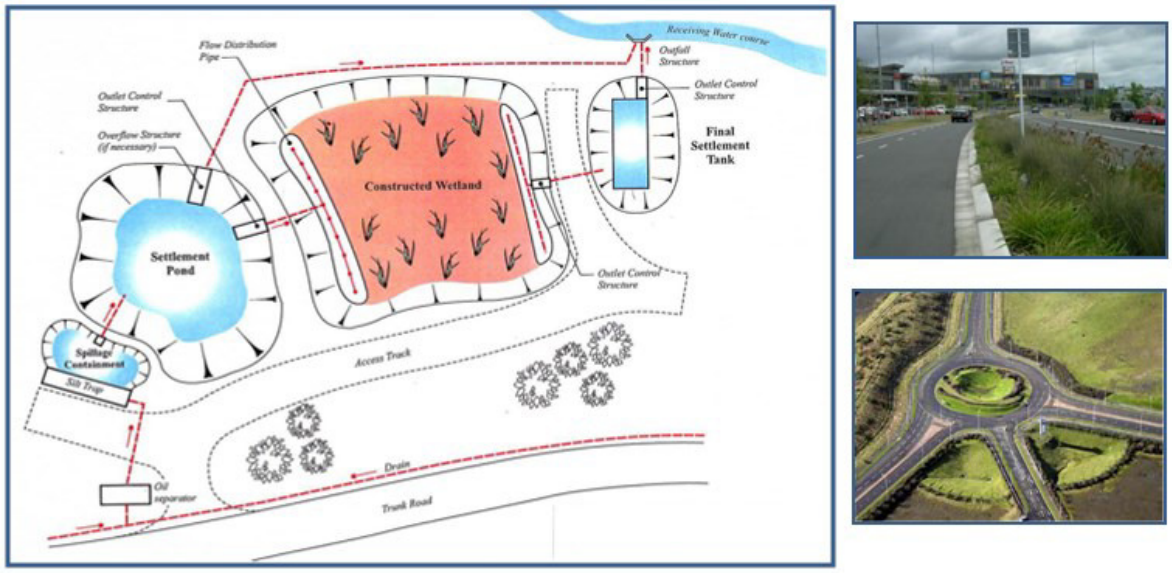


Figure 14: Treatment of road runoff waters

Another important use of the wetlands is the drying and extraction of mud. In a small scale, we often see the famous drying ones, a devise consisting in a basin dug in the ground, filled with sand or gravel, where mud is deposited for draining and drying.

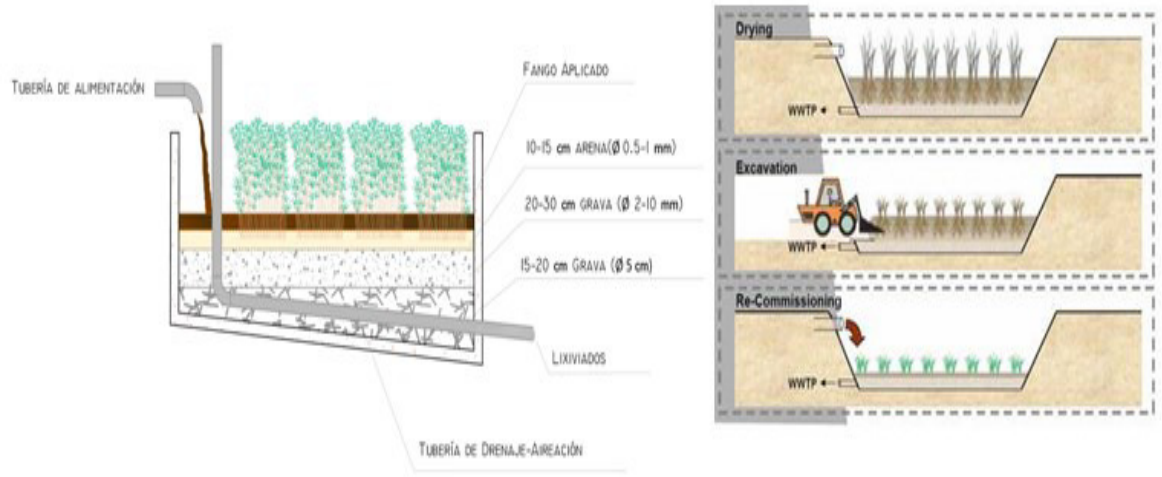


Figure 15: Mud extraction in wetlands

This works better if some vegetation is planted in the drying area, like in a wetland. In such a way we deposit the mud up to a certain level in an active wetland, which stops working when it reaches a certain level and a previously stand-by wetland starts working. The wetland left in stand by evaporates then the water, using the high capacity of transpiration of the planted vegetation, while the oxygen provided by the root area stabilises the mud.

After the stabilisation period, some equipment removes the plants and the upper part of the stabilised mud, and composts the mixture of the stabilised mud and the removed vegetation.

Here below, we can see a picture of the mud in the wetland, and in the middle and on the right we see two wetlands which are placed in Denmark:

Figure 16: Wetlands for mud extraction (EDAR Hadsten&Scobvy in Denmark)

Further details: the operation of removing the stabilised mud together with the aerial part of the vegetation and the subsequent composting.

There are two noticeable aspects: first, this is Denmark, with an unfriendly weather for mud drying, but the second one is its size. This is a facility serving a population of 50.000, so we see that wetlands for removal or drying and extraction of mud can be used on a bigger scale.

Figure 17: Process of mud extraction in EDAR de Greve (Denmark)

Finally, as an example of the advance of the extensive technology, I am going to show you two ongoing investigations from our experimental centre, based on the application of bioelectrogenic techniques to artificial wetlands.

Artificial wetlands are extensive technology and have got the same handicap as all the extensive technologies when it comes to its implementation. On the one hand, the required area, several square metres, which often limits its implementation because of the price of the land.

Another handicap of the extensive technology is its failure to respond to overloading. While using intensive technologies, we can change parameters such as the oxygen input or the mud recirculation, which is not a possibility in extensive technologies.

Both issues, the requirement of area and not-responding to overloads are being solved by using bioelectrogenic techniques.

In the slide that you are currently watching, we can see the Aquelectra project, an already finished project, included in the Innpactocall that achieved a significant reduction of the required area for a wetland by using bioelectrogenic techniques.

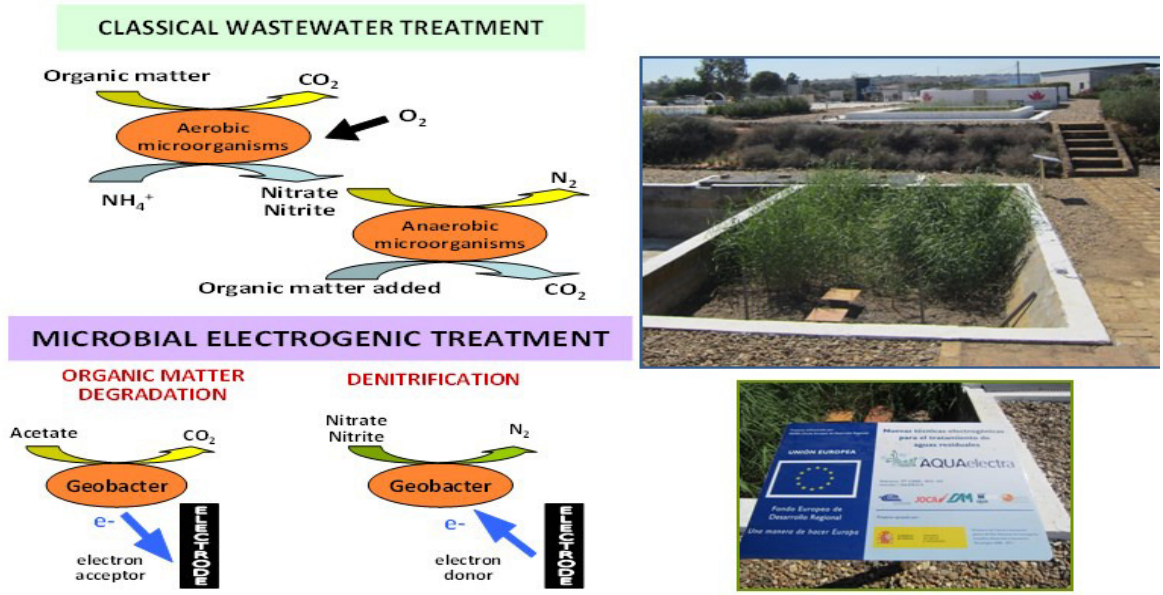


Figure 18: Bioelectrogenic wetlands

The next slide presents the Smart Wetland project, currently in process in our facilities, which achieves a reduction of area and something more.

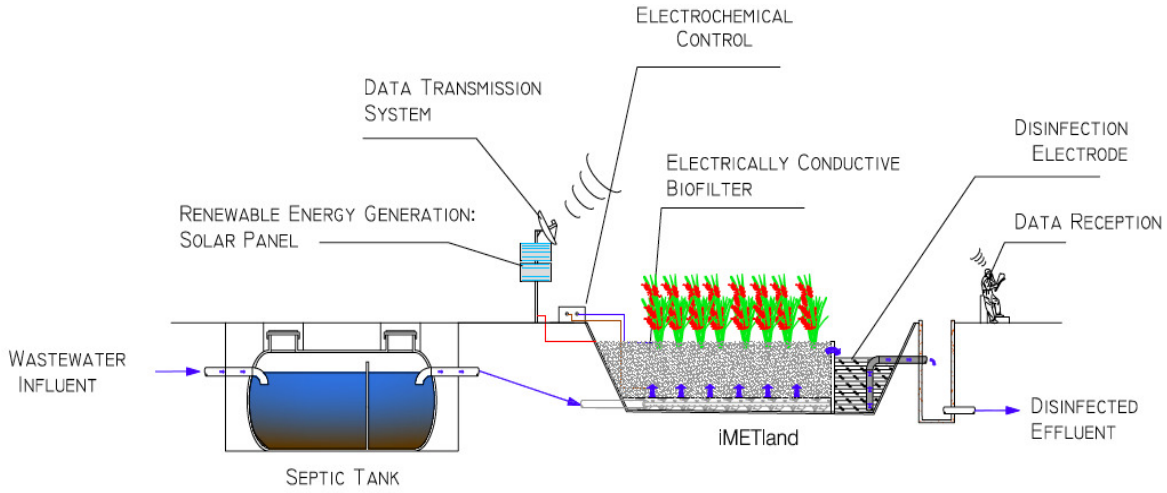


Figure 19: Smart Wetland project

Now, the system formed by a primary treatment and the electrobiogenic wetland makes us able to detect, by means of some special sensors, the arrival of an overloading to the system. The system informs the operators and has an automatic response capacity, because of a nearby system for capturing energy by a photovoltaic panel and a battery system. So when the system detects an overload, it responds taking off the captured energy to respond to the overload.

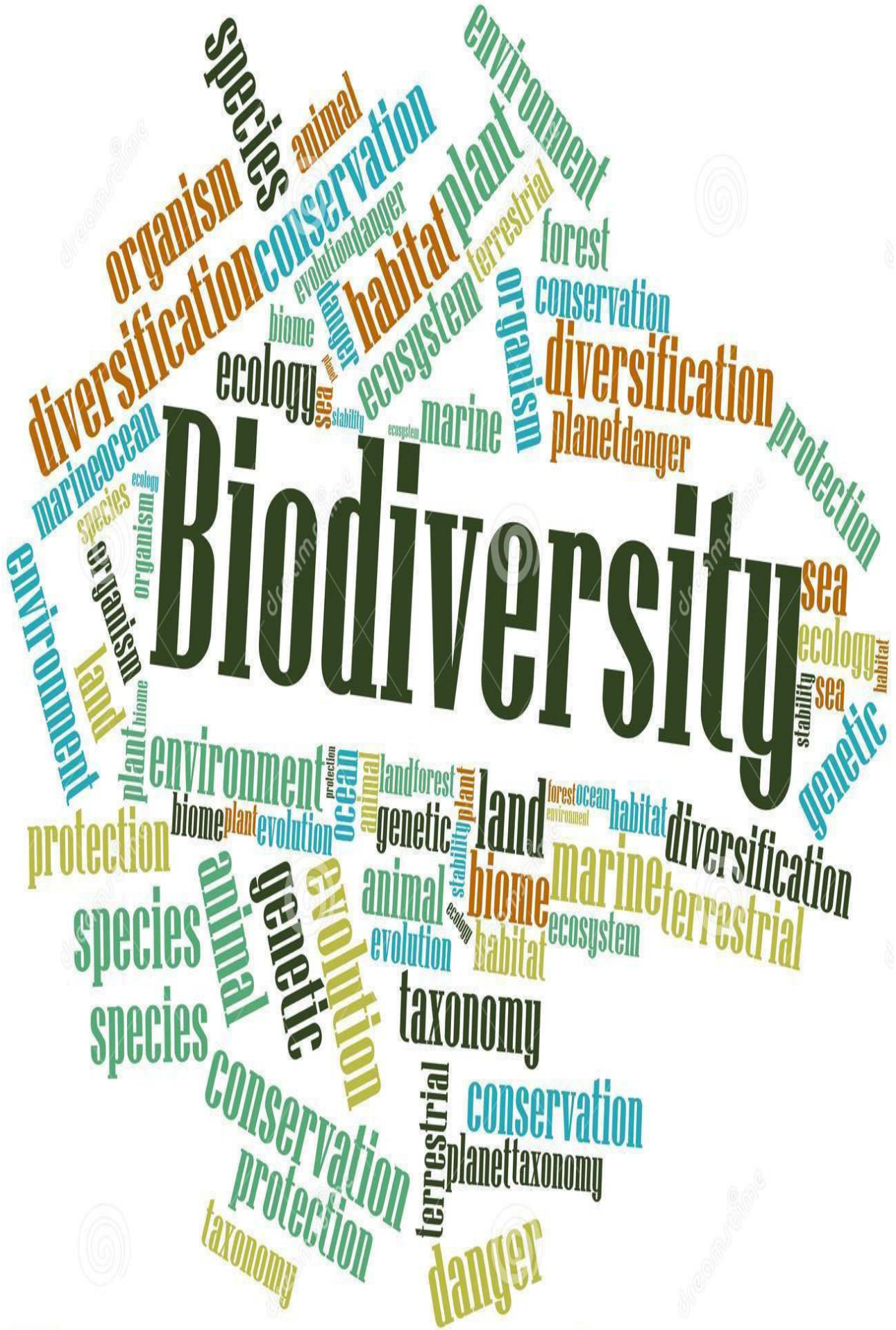
That's why I said that we are expanding the possibilities of using wetlands by reducing the above mentioned handicaps of requirements of area and not responding to overloads.

That’s all. Here you can see my email address (jjsalas@centa.es).

Please contact me at any moment if you have any question.

I would like to finish saying goodbye and I hope succeed in convincing you of the advantages of the treatment technology that uses wetlands for wastewater treatment.

Thank you very much and goodbye.



Con el apoyo de:

MAGALI BOYCE

Life+ LAG'Nature

"Wetlands are complex and multi-functional lands: flood alleviation, self-purification of water, economic and recreational supports."

Abstract:

The project Life+LAG'Nature has been implemented from 2009 to 2013. Coordinated by the Conservatory of Natural Lands in the region of Languedoc-Roussillon (CEN L-R), it was focused on establishing a network of Nature 2000 demonstration sites, as well as on improving the conditions of the lagoonar, peri-lagoonar and dunal habitats. The areas of intervention have a widely recognized high value, they have great biological richness and they hold traditional economic, touristic and leisure activities. These areas present a visible intersection between essential biodiversity and socio-cultural heritage, so then the external pressure is primarily important. The project Life+LAG´Nature analyses the common problems of these areas: urban pressure… Several specific actions were performed to restore the habitats for the long term. The project generated a huge interest in the coastal area, thus new partnerships and LIFE projects (Milouv y Envoll) were established. The results overcome the initial goals, and the partners are engaged to maintain these results.

I'm proud to be the coordinator for the European project Life+LAG'Nature. It was a five-years project in the south of France which aimed to create a network of lagoon and dune demonstration sites along the Mediterranean, and now I am animator for the Pôle-relais Lagunes Méditerranées, which designates itself to make ecosystem managers meet, share and exchange experiences about coastal landscape in France.

So we will start the presentation. The presentation I propose aims at presenting the land stewardship from the Life+LAG'Nature project in the south of France.

We will see three parts: first, the birth of the project, context and opportunities of actions: lagoons and network of land managers; second, results and outcomes of this project, and third, land stewardship: We will see that it was an efficient strategy.

First about the context: Mediterranean lagoons, lands of contradictions. These lands are located in 3 regions and 9 coastal districts in Languedoc-Roussillon, South of France, 22 lagoon complexes, whereby 11 are in Languedoc-Roussillon, which represents 130.000 hectares, within them half in Languedoc-Roussillon where the project was implemented. Those lagoons represent the land-sea interface at the end of the watersheds. The area contains 74 natural habitats, wherefrom 60% are declared as European Community Importance and 10% as Priority European Importance.

These lagoons are providing habitats for 70% of the bird species of France and 40% of the amphibian species of France. They are complex and multifunctional lands: flood alleviation, self-purification of water, economic and recreational supports. They meet strong demographic pressures, attendance and urbanization and conflicts of use. There are in risks of sectorial uses, trivialisation, degradation and declining attractiveness. They benefit from many planning and management tools (SAGE, Land contracts, Natura 2000...).

In this context, at the origin of the project was a program which we called Pôle-relais Lagunes Méditerranéennes. This program aims at "pooling, inform exchange and share to better protect wetlands" and it concerned 40 lagoon managers and 130.000 ha in regions in the south of France within Languedoc-Roussillon, PACA and Corse. The birth of this program was in the year 1995, when presence of the continuous regression of the wetlands and effects on local public policies motivated the French State to design and implement a National Plan of Actions for Wetlands. There were created 5 wetlands that we call Pôles-relais within the Mediterranean lagoons project. The Life+Lag'Nature project was born in the context of the Pôle-relais Lagunes Méditerranées project, allowing it to gain high protection and coordination standards.

So we have this program, and we have also lagoon managers from common concerns. Their shared interest is the need for action together, and the motivation to coordinate the program more precisely. The CEN L-R, which is the Conservatory of Natural Lands in Languedoc-Roussillon, was the association which coordinated the program. The different partners and we identified the LIFE+ program as an interesting tool for this project and cooperation with other financial partners as well. That’s it for the project timeline.

The aim of the Life+LAG'Nature from 2009 up to 2013 was to establish a network of lagoon and dune demonstration sites along the Mediterranean coastline of Languedoc-Roussillon.

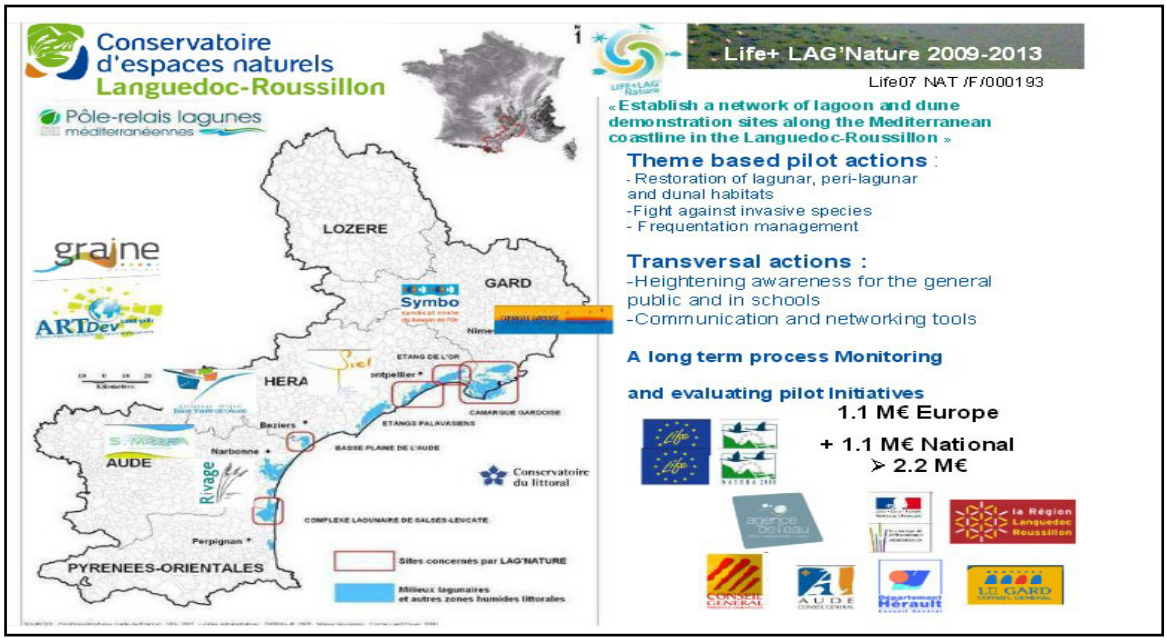


Figure 1: The Life+LAG'Nature Project

Theme actions were the restoration of lagoonar, peri-lagoonar and dunal habitats; secondly, to fight against invasive species, and third, the frequentation management. And in parallel to this theme based pilot actions were some transversal actions, which means increasing awareness of the general public and in schools, using communication and networking tools. It was a long-term process monitoring with scientists and colleagues in the CEN L-R, the coordinators of the project, and we evaluated each pilot initiative. It was a 2.2 million Euro project and it concerns 5 natural sites all along the coastal land in Languedoc-Roussillon. These different natural N2000 sites were managed by a community of several towns and cities together, who care of our wetlands.

So far I told you about the context and the actors of the project, now what about the results?

The project implemented 66 actions. As result the network of lagoon, perilagoon and dune sites was rehabilitated in Languedoc-Roussillon, the state of conservation of the sensible habitats was improved. As an example, we reached the restoration of two dune sites, we restored as well the hydrological connections, we have many places where we fight against invasive species (animal and plant species), and we had sixty monitoring systems which were set up. The public which was attending the sites was accompanied, management plans for the attendance were elaborated and we worked in four of the five sites, implementing gannivelles, decking, unpacking, exclosure, directional signs, etc.

Two cases were arranged for the reception and public awareness. A specific awareness campaign with the vehicle "Aucèl" that could permit the awareness of 13.000 persons, and it was the GRAINE L-R, which is an associational network in Languedoc-Roussillon for education to environment who piloted this specific action. For the frequentation it was the ART-Dev, the Laboratory of Research, who piloted this action.

As another result of the project, we arranged meetings with the stakeholders in order to exchange and inform. In total there were 31 local meetings in the 5 territories, which were attended by 500 persons. The target group was composed of policy makers, farmers, professionals of tourism, law enforcement and legal literacy.

We developed many communication tools like "mémo polices", the technical final guide and a web-site which is called www.lagunesettourisme.org. All those tools are available at the website www.lifelagnature.org.

Resources for the lagoon territories were quite important, considering the 2.2 million Euros that were spent, 40% for investments. We also created employment: 25 persons who work in this project, well, many more than 25 persons worked in this project, but there were 25 of what we call ETP, which is équivalent temps plein or full time work. The sex ratio was more feminine in these projects.

As global outputs the Life+LAG'nature project brought experience and technical knowledge to the region and its sites in general. Studies of the frequentation were conducted, a network for the monitoring of species and habitats was created, and relations with stakeholders and new collaborations were created. There are also two other Life+ projects who will start after this project: it is Life+ Milouv which is as well coordinated by the CEN L-R, and the Life+ Envoll coordinated by a structure in the Paca region, the Narbonnaise region and which is responsible of lagoon sites, as well as it is a partner of CEN L-R.

Land stewardship is the third part of this presentation, and it was a very, very efficient strategy for this project. We spoke about "common goods" as a nation patrimony. This includes the lagoons, perilagoons, the dune sites and all the plant and animal species that live there. There was a wish for action in a collaborative way with a conscience of these common goods. The people, who worked at these projects, our partners, came from very diversified backgrounds concerning status and competencies. It was an integrated approach with citizen implication.

The project had very important results, well shared among the lagoon land managers of the Mediterranean coast, but also among all the land managers in France, as well on regional as on international level.

I want to thank all the people who helped us in this project, thanks to this program the Pôle-relais Lagunes Méditerranées, thanks to the financial tool Life+, thanks to our many financial partners, very different ones in the region, who were motivated and all those partners worked together for this very successful project. Thank you very much!

DAVID HOWELL

SEO/Birdlife

"We will be in need for patience and determination on these recovery programs, because in Loch Leven it took about 40 years. Finally, we need to maintain that improved state with clear policies and measures designed to protect the improving water quality and the improving conservation condition."

Abstract:

David Howell has been part of SEO/Birdlife for already seven years after a long-time experience in other companies and structures dedicated to water, such as the Scottish Nature Agency or the Centre of Ecology and Hydrology in Edinburgh. His presentation in the seminar provided an interesting comparison between Loch Leven (one of the Nature 2000 network sites) and l'Albufera. It was focused on the experience of implementation of the Water Policy and the Birds Directive in Loch Leven. He talked about eutrophication in the Special Protection Area and compared the experience in Loch Leven in order to find some keys for the SPA of l'Albufera.

My name is David Howell. I'm from SEO/Birdlife, I've worked here for seven years in the Environment Policy team and before joining SEO/Birdlife I worked in Scotland for twenty years on Freshwater Quality and Conservation, firstly in a laboratory in Edinburgh, in the Centre of Ecology and Hydrology, studying lakes and freshwater fish, and then for 18 years in the Scottish Nature Agency, working especially on freshwater policy and technical issues on Natura 2000 sites. For example, the selection, declaration and management of the loch and river sites for the Nature 2000 Network. What I'd like to do here today is compare the experience of one of those lochs, lakes or lochs as the Scots call them, with the case of the Albufera.

What I'd like to talk about here is the experience in the application of Water Policy and Birds Directive in Loch Leven which is a site in South-eastern Scotland. What I would like to discuss here is the eutrophication problem in this SPA system, and compare the experience here at Loch Leven to see if we can find some key messages for the Albufera de Valencia SPA.

So, here we have Loch Leven in Southeast Scotland, not far from Edinburgh, and in this first photo on top we can see a lake with a largely agricultural catchment, fields typically planted with cereals, oilseed rape or potatoes, and on the highlands about the loch and hills, some grazing and forestry activity. The lake is obviously a very important fishery for brown trout, it is well known around the world for to the quality of its red trout fishery. It has also a declaration as National Nature Reserve and Site of Specific Scientist Interest in the UK Conservation Declaration.

It is also a Ramsar wetland of National Importance and a Special Protection Area under the European Birds Directive.

Figure 1: Location of Loch Leven

The reasons for that interest are, under the Birds Directive especially for overwintering wildfowl, many thousands of pink-footed geese spend their winter here on the loch. It is also important for every wintering whooper swan and for many species of small wildfowl, specially the ducks. Here we have these two examples of diving duck species, the pochard and the tufted duck.

In the table we can see a few data to compare different variables of the two lakes, Loch Leven and l'Albufera.

	Loch Leven	L'Albufera
Area (ha)	1330	2320
Volume (hm^3)	52.4	27.1
Mean/maximum depth (m)	3.7/25.5	<1/1.5
Flushing rate (volume/year)	2-3	7-20
Mean annual rainfall (mm)	780	450-500
Mean annual total P loading (T/year)*	8-20	80-400
Mean annual TP concentration (µg/L)*	30-100	230-490
Mean annual chlorophyll-a (µg/L)*	20-100	160-270
Internal P loading (T/year)*	0.3-7.3	??

Figure 1: Data sheet of Loch Leven and L'Albufera

So we see Loch Leven is smaller than half the size of surface area of l'Albufera but twice as much water, twice as large a volume because Loch Leven is much deeper, reaching a maximum depth of 26 metres at one point, compared to the very shallow Albufera.

On the other hand, the Albufera has much more water input, mainly because of the rivers flowing in being much bigger as well as the irrigation, return water from the rice fields, and the resources such as groundwater inputs at the depth of the Albufera and the discharges from sewage in other points. While as in Loch Leven the influents are quite small streams, and the run-on, the water coming into the catchment from outside of it, the rainfall is quite similar, drier of course in the Albufera area.

And here we see another main difference, during the last 34 years: the eutrophication question in l'Albufera being much more serious, phosphorous enrichment, the lake being hypertrophic during many years, maybe the most hypertrophic in the world at one point, while as here in Loch Leven, we can see that the problem is less severe. However, there is some industry, causing the range of these figures of phosphorous loading and concentration and chlorophyll, both figures correspond to the most recent years of restoration (Figure 4). This is the problem for me to l'Albufera and also to Loch Leven. The main symptom of eutrophication, perhaps, for the public is the surface growth of blue-green algae often reaching very high levels and toxic levels at danger for public health as well as it is for water.

Here we see a very detailed study that was carried out in 1985 and published in 1987 of the phosphorous budget, the phosphorous balance, in the lake.

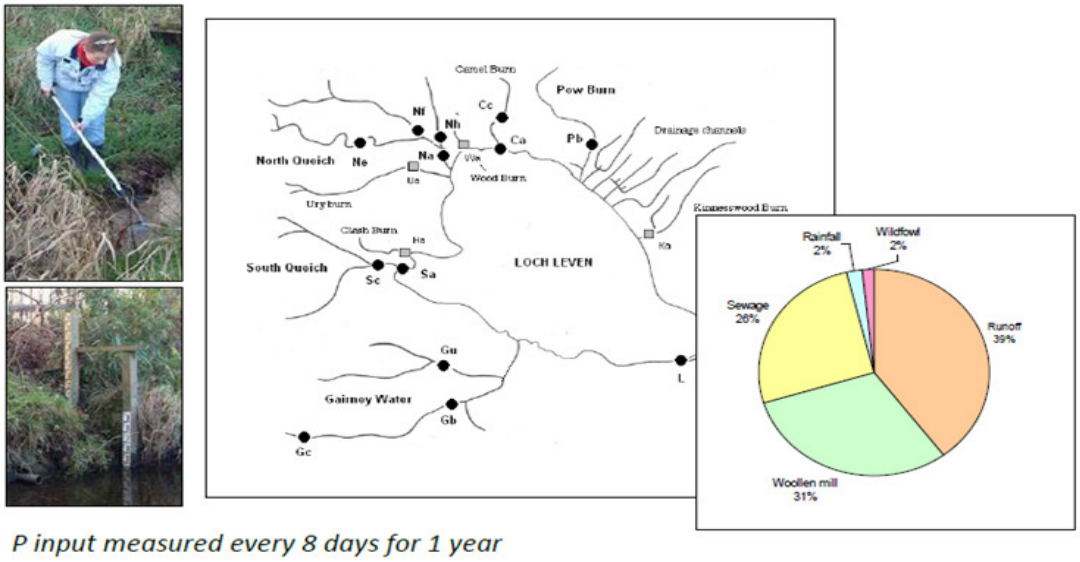


Figure 3: Loch Leven SPA phosphorus budget (Bailey-Watts&Kirika, 1987)

The phosphorous level was measured every 8 days in the all influents coming into the lake, quite short and small influents. It was measured every 8 days for a whole year. We can see the 40% of the load of phosphorous coming from runoff from the farming land, 30% coming from a woollen mill, which used a phosphorous compound for processing the wool in the factory a quarter of the phosphorous coming into the loch came from sewage treatment works in the villages and towns around the shore of the lake, and a remaining small amount rainfall (2%) and wildfowl (2%) of the remaining of the total phosphorous budget of the loch in 1985.

And here we see two phases revealing the eutrophication story at Loch Leven: the relationship between total phosphorous and total chlorophyll for a period until 1985.

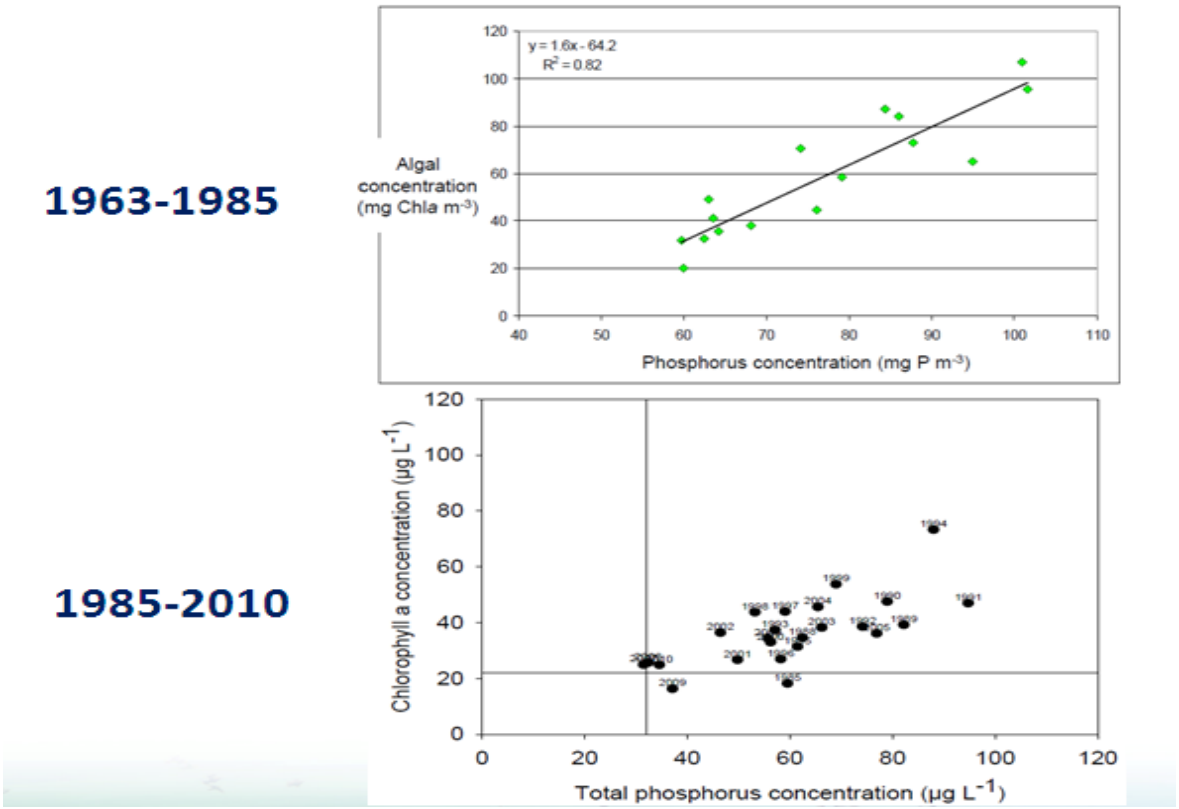


Figure 4: Loch Level SPA phosphorus/chlorophyll-a relationship (CEH data)

We see the phosphorous levels annual mean of total phosphorous from 60 to 100 micrograms/litre during this period and the chlorophyll from around about 20 or 30 up to over 100 micrograms/litre, while in more recent years we see a much lower, specially lower, minimum levels but also maximum levels of both phosphorous and chlorophyll as the restoration takes effect.

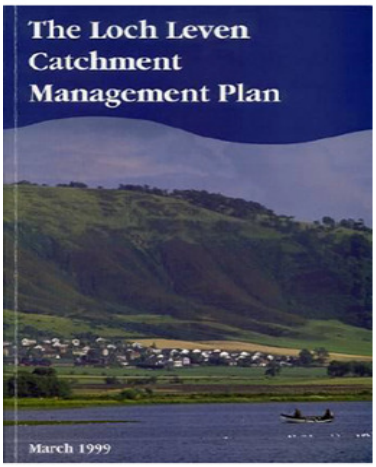
I continue with a quick summary of the stages of the eutrophication recovering program. Starting in the 1980s, there were successful attempts to remove phosphorous from the process in the wool mill, and that removed industrial inputs completely. At the same time, the sewage treatment works around the lakeshore were being gradually improved and there was some idea around the population that the lake would be recovering.

But then in the 1990s, in June of 1992, on a day I remember very well because I was there, it was a Natural Heritage Festival organised to celebrate the loch. There were many thousands of people coming to enjoy themselves on a Saturday morning. And when they arrived they found that the loch was completely bright green with the whole surface covered by a toxic Microcystis cyanobacteria bloom. They put warning signs by the lakeshore for people not to come into the water and activities such as canoeing, fishing and raft racing were cancelled. And this really happened because the festival at the weekend came after a week of sporting days of warm calm weather. As it warmed the water up, at depth of the loch, oxygen levels had fallen and sediment had released large amounts of phosphorous into the water resulting in this toxic blooming of algae blue.

There was a massive public reaction. The local people, the press, NGOs, the local politicians and the public authorities were demanding the need for action. This resulted in quite a long process of building question consensus and ideas with public and private sector and general public all involved in identifying and prioritizing the restoration actions straight forward into a Catchment Management Plan for the loch. This was then put into action from 1990 in 1999 actions were accelerated until the present day with successfully removing of phosphorous from the main inputs, particularly the sewage and industrial inputs, then the actions spreading out to farming practice, agricultural practice, to continue this monitoring program to check the actions that were being taken and checking the effects in the loch, and all of this published on a regular basis in a generally accessible language and in scientific terms to track the progress of the recovery program. And then, back to the present here, these measures, of course, incorporating the management of Nature 2000 sites SPA and these water policies.

Loch Leven has its targets and objectives in a monitoring program under the Water Frame Directive. The Catchment Management Plan was approved in 1999, the priority actions focused on reducing the phosphorous inputs, the point sources from sewage, they remained limit housing growth until the phosphorous removal was in place and in works. The focus is set on the agricultural inputs reducing fertilizer use and soil erosion from surrounding fields, monitoring the actions taken and the effect on the loch. Controlling public access to water during times of this toxic bloom because of the health hazard and a regular process of keeping all parties informed of what was happening and the results of the demonstration program.

And here, as you can see, targets were established:



LLCMP prioritYactions

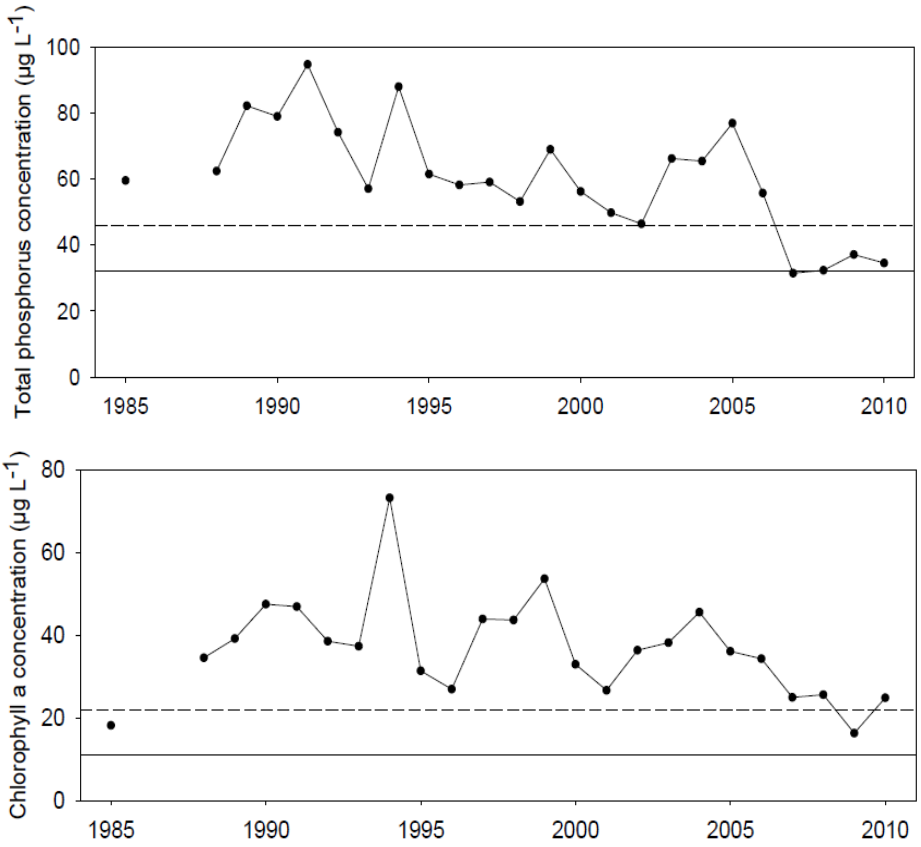
- Reduce P loadingfromsewageinputs: P removal, limithousinggrowth
- Agriculture: reduce fertilizer use &soilerosion
- Monitor actionstaken and effectontheloch
- Control publicaccess in times of healthhazard
- Informallparties at regular intervals

LLCMP indicators and target values

Annual mean total phosphorus	40µg/L
Annual mean chlorophyll-a	15µg/L
Annual mean watertransparency	2.5m
Annualmaximummacrophytegrowthdepth	4.5m

Figure 5: Loch Leven Catchment Management Plan (LLCMP)

The other main actions are focused or are mostly related to the enrichment, the eutrophication problem and the recovery process. So, the idea being to reduce the total phosphorous amount to 40 micrograms/litre annual mean, 15 micrograms/litre of chlorophyll-a as a measure of the activity of the algae, and to increase the water transparency to 2,5 metres and the maximum depth of macrophyte growth, the water plant growth, to 4,5 metres.



Now a series of graphs that shows the progress of those targets from 1985 to 2010 and you see the gradual reduction of the total phosphorous towards the target level and the same with chlorophyll-a concentration level, because there is a close relationship between these two variables.

Figure 6&7: Phosphor (top) and chlorophyll (bottom) concentrations in Loch Leven

Here it is a more complicated graph, a proportion one, Graph C here shows, from 1970 to 2010, the gradual reduction of phosphorous during this 40-years period, starting in the time where no management action was taken back in the 1970s, then up to 1980s focus on the industrial inputs of the wool mill, then up until the end of the 1990s the focus was on reducing the phosphorous inputs from sewage treatment works and then, the recovery period, with the focus on the agricultural catchment until a time about ten years ago.

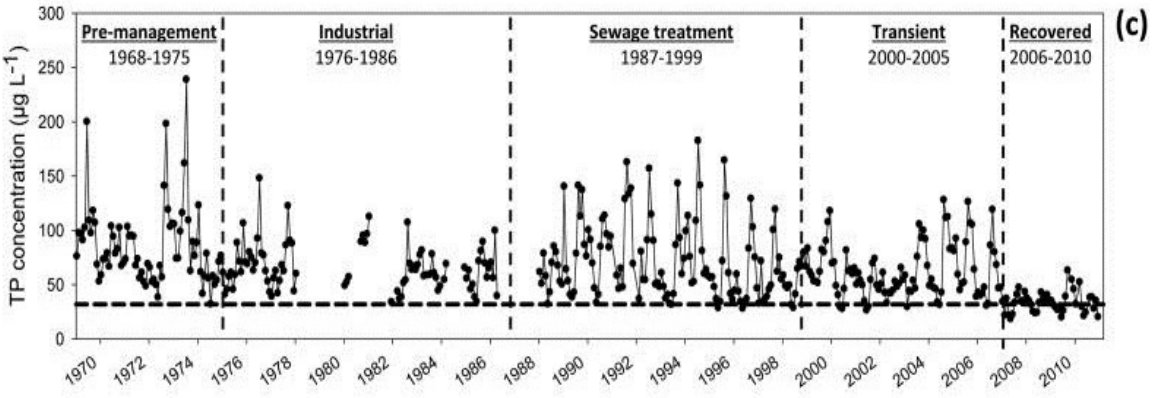
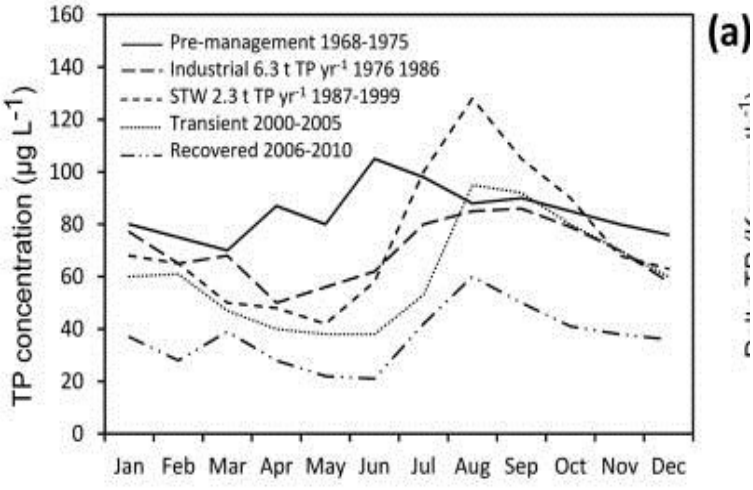


Figure 8: History of phosphorus concentration in Loch Leven

And then certainly we see the loch perhaps shifted to a different state, perhaps to water clarity state with plants recovering, phosphorous levels much lower as we can see here, reduced to a level which is around about the good to moderate ecological states boundary under the Water Frame Directive for this type of water in the UK.



And here in this graph A, we have really just one thing to show here. How the phosphorous during the year, from January to December, how it reaches a peak in the summer periods. Especially in most recent years with the reduced inputs from the catchment area and in summer periods, this summer peaks represent several releases of phosphorous in the warm and calm air conditions in the summer when oxygen levels fall.

Figure 9: Annual dispersion of phosphorus concentration in Loch Leven

And here with the water quality recovering as well, back up it was 2,5 metres depth of water we can see, the target set by the Catchment Management Plan and the same reflected in the maximum depth of plant growth. It is really an encouraging sign when the plants growing in deeper and deeper water as the water clarity improves and light reaches deeper into the lake.

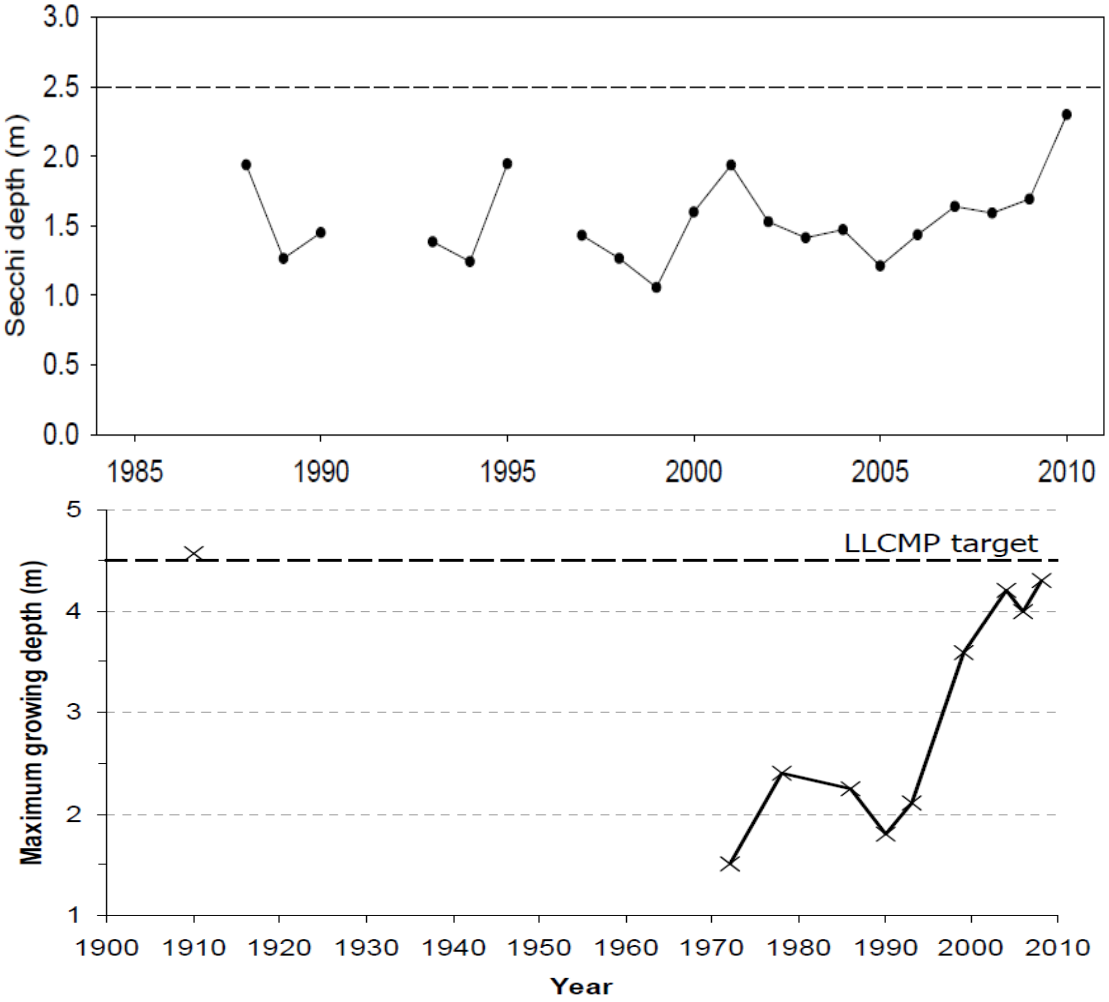


Figure 10&11: Secchi depth in Loch Leven (top) and maximum growing depth in Loch Leven (bottom)

And finally we can talk about the SPA, the Special Protection Area, and the birds in the lake, here just to focus on some graphs, graph D and graph E, D representing two diving ducks species, the tufted duck and the Pochard.

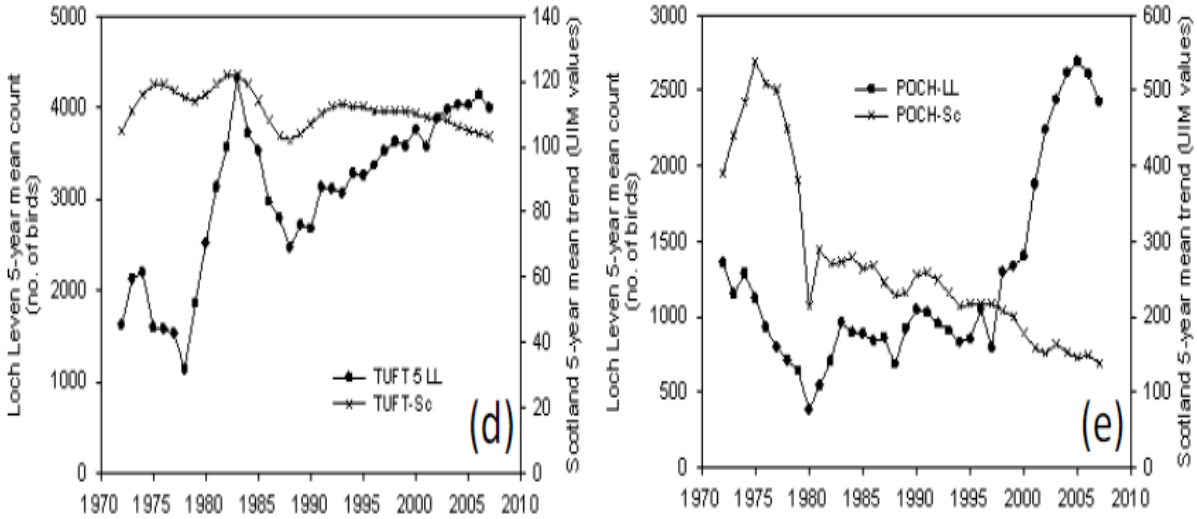


Figure 12: Tufted duck and Pochard population in Loch Leven

There are two different curves: the darker line with the black dots is Loch Leven itself, the numbers of birds in Loch Leven, where we see an increase from 1970 to 2010 and similarly for Loch Leven, an increase in the same period of tufted duck; the crossed line falling here, this is the Scottish national mean level for Pochards in this case in graph E, and up in graph D is the Scottish national mean level for tufted ducks and in both cases we see an increase at Loch Leven but a different trend at national level in Scotland. We think this is possibly a respond to increased water quality and water clarity in Loch Leven, because these diving ducks will be able to see more successfully in a greater depth through the water to find the food they need from the plants and invertebrates living on the loch depth.

Here we have a few key messages which I think we can draw from the Loch Leven experience and apply to the Albufera de Valencia program to try to conserve the SPA and the rest of the Nature 2000 interests and improve the water quality of the loch.

Firstly, what I would like to point that it was very important to Loch Leven the long history of monitoring record which tracks the full eutrophication recovering story and it has really been a solid basis for designing a recovery program well-understood nutrient and water balances. Strong and politically quite independent position from the UK and Scottish authority, the nature authority responsible for the Nature 2000 and the water catchment authority responsible for managing policy and water quality. With their impulse, along with the strong input of local political leaders in the area around the lake, this led to a specific Catchment Management Plan for Loch Leven with clearly prioritized actions and decisions being taken quite selflessly for the public benefit.

This, combined with the public participation, high interest from wide Scottish public and the public authorities and politicians being closely scrutinized and held to account and this public participation included the input of the farming community, is very important as one of the main sources of external phosphorous input.

So this resulted on a Catchment Management Plan, with lots of support and quite clear objectives, actions and indicators in a time scale, responsibilities being designated, taken from the authorities, based in science and built from a process of consensus.

Another key message from Loch Leven, it is very important to bear in mind that even while the external pollution sources have been reduced in the catchment from the 1980s to the 1990s, the influence of weather, rainfall, flushing rates and all of that on sediment release of phosphorous within the loch was very important and this complicated the recovery a little more than something we expected. This question of water balance, phosphorous balance, and the internal process of phosphorous within the sediments in the Albufera are going to be absolutely crucial to its future.

I think we all have to be prepared for some surprises, that may be good, or may be bad, sometimes we will be in need for patience and determination on these recovery programs, because in Loch Leven it took about 40 years. And we must not be complacent; finally we need to maintain that improved state with clear policies and measures designed to protect the improving water quality and the improving conservation condition.

So this indicates that Loch Leven, for example, means a fair example for the habitats of Birds Directive and the Water Frame Directive by public authorities in the catchment of the lake and full application in particular of the Article 6 of the Habitats Directive which is designed to prevent any damaging activities being approved.

So all the public authorities are aware that they should consult the Scottish Natural Heritage, the nature authority, about any activity which may result in further phosphorous inputs in the Loch.

And this way, hopefully, we can be sure that no further phosphorous additionally reaches the loch and it can be conserved for the future generations as a healthy Special Protection Area.

Ok, thank you very much for your interest¡

I hope this talk has been useful and a useful addition to the program of the seminar and, of course, we will be happy to respond to any questions that you make.

Thank you again!

BELÉN LÓPEZ PRECIOSO

Avinença, the Valencian Association for Responsible Land Stewardship and Management.

"The Land Stewardship by non-profit organizations is a tool for preservation."

Abstract:

Belén López Precioso works for Avinença, the Valencian Association for Responsible Land Stewardship and Management, which aims to foster and promote the use of land stewardship within the provinces of Castellón, Valencia and Alicante. During the on-line seminar, she focused on the presentation of the Habitats Directive, considered a keystone for the policies of nature preservation of the European Union. The Habitats Directive develops four lines of work: the Nature 2000 Network, the establishment of a strict regulation of protection of species, the use of some caution when introducing autochthonous species in the natural environment or when releasing alochthonous species and, at last, the checking of these lines of work through surveillance and reporting. The spokeswoman for Avinença says that, in spite of all the effort that it is currently being done to implement the Habitat Directive, there is still a lot to do in Spain.

I have prepared this speech with the contribution of another colleague from Avinença, Ciro Pascual Garrido. He is a forest engineer, I am a lawyer and we both have been participating in the processes of site planning for the Natura 2000 network for some years. We are currently part of the technical bureau of Avinença.

Avinença is an association which aims to foster and promote the use of land stewardship within the provinces of Castellón, Valencia and Alicante. Its partners are basically land stewardship entities, that is, non-profit organizations that use this mechanism of preservation.

Land stewardship promotes an active management, oriented towards the preservation of the landscape, natural and cultural values of the fields, whether public or private, mainly through the signing of agreements between owners, holders of a right of use or users of the fields and the land stewardship organisations.

As I said, in this seminar I would like to talk about the Habitats Directive. For this, I am going to share a presentation. I don't know if you are going to see me again because this is a little tricky, but I'll try, and at least, you can hear me. Let's go!

What is the Habitats Directive and what are its aims?

The Habitats Directive, as you probably know, is a European Directive that, together with the Birds Directive, serves as a milestone for the policies of nature preservation of the European Union, which are legal norms that are binding for all Member States of the European Union.

Its aim is to contribute to the protection of biodiversity through the preservation of natural habitats, as well as wild animals and plants living in the European Union. This Directive also specifies the objective of any measure.

As it is mentioned in the 2nd Article, the main objective is to keep or to restore a proper preservation state of the habitats and the wild species of animals or plants, which have been selected as being of Community interest.

How does the Habitats Directive achieve its goals?

Essentially by the means of four lines of work:

On the one hand, by creating and implementing the Natura 2000 network.

Another area of work is to invite the Member States to establish a strict regulation to protect these species, generating a series of restrictions that can be eventually lifted.

An additional area of work in the Directive is the enforcement of a series of complementary orders, not as important as the laws above, but showing some caution when introducing autochthonous species in the natural environment, or when releasing autochthonous species. Furthermore they talk about the need of informing the citizens about the need of biodiversity preservation.

And the fourth area of work is related, according to the Directive, to the evaluation of the issues above. The Directive controls the preservation state of the natural habitats and species, and elaborates some reports every six years, reflecting the state of preservation of these species. That means the Directive has got a really specific target to achieve and this target is periodically evaluated.

All the described four areas of work can make an important contribution to the preservation of wetlands, with the first two areas being the most crucial ones.

To begin with we are going to see how the previsions of the Directive regarding the protection of species can help to preserve the wetlands.

In this sense, article 12 of the Directive is remarkable, which compels the Member States to establish a strict system of protection for the species in the list in Annex 4. Annex 4 includes species at risk of extinction, rare or vulnerable species, etcetera.

In the slide you can see two examples of species in this annex: here we have the Samaruc, and we can see the aquatic turtle over there, both species living in the Valencian Community.

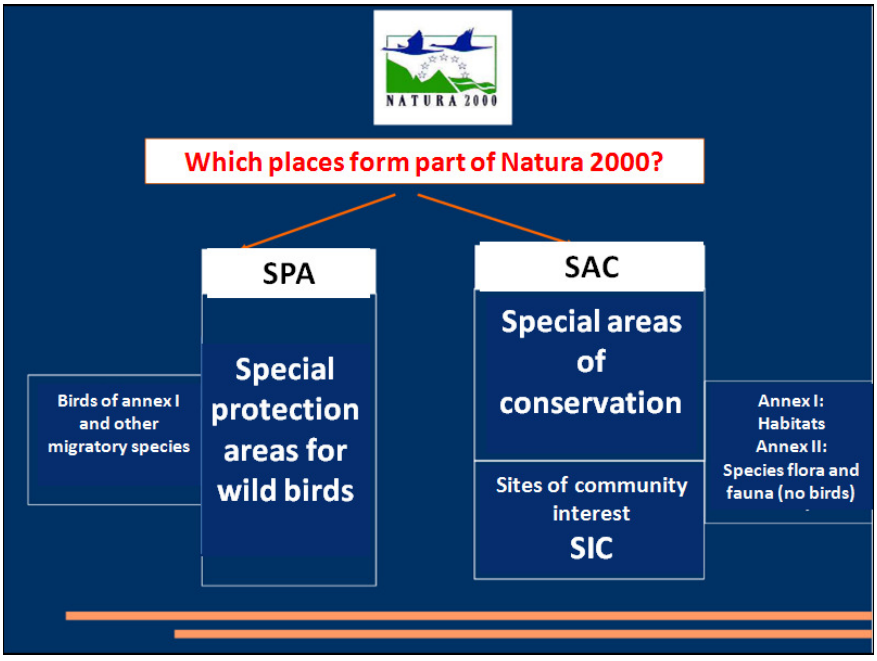
Figure 1: Protected species (Samaruc and aquatic turtle)

What does the Directive say?

It says that the Member States, when establishing this strict system of protection for these species, must ban certain behaviours, including one that is especially interesting for the wetlands, which is the prohibition of any damage or destruction of the reproduction or resting areas of these animals. In this sense it is important to highlight that certain species included in Annex 4, like the ones in the photos might live in wetlands, and consequently the directive implicates the protection of these ecosystems as resting and reproduction areas.

However, the legal mechanisms that are more related to the preservation of the wetlands in this Directive are the previsions related to the Natura 2000 network.

The Natura 2000 network is defined in the Directive as a consistent ecological network created to ensure conservation of a good state or, if necessary, the restoration of certain types of natural habitats being home to certain species.



Which places are parts of the Natura 2000 Network?

On the one hand, the sites or spaces created by the Habitats Directive. You can see them on the right side of this slide:

Special Areas of Conservation (SAC) and a less protective figure, also created by the Habitats Directive, the Sites of Community Importance (SCI).

Figure 2: Natura 2000 Directive

These sites and areas should be chosen, as the Directive says, in order to keep the good state of preservation of the natural habitats of community interest included in Annex 1 and habitats of the animals and plants included in annex 2, which doesn't include birds.

Why? Because birds are protected by another directive, which is called the Wild Birds Directive. Because of that, the Habitats Directive also includes, as part of the Natura 2000 network, the legal entity for the protection of habitats created by the Wild Birds Directive, the SPAs, or Special Protection Areas for Wild Birds, whose aim is the protection of the birds included in Annex 1 of the Birds Directive, and also of those migrant species that come regularly to the territory of the Member States even if they are not included this annex. There are also endangered, rare or vulnerable species included.

Why is the Natura 2000 network so interesting for the preservation of the wetlands?

Because many of the natural habitats of species included in Annex 1 of the Habitat Directive are wetlands, and also because many of the Species of Community Importance included in Annex 2 of the Directive are linked to, associated to or dependant on the wetlands for their survival.

Why is the Natura 2000 network so interesting to Avinença and other land stewardship entities?

On the one hand because the Directive includes some types of contracts for the implementation of active conservation measures for the sites of the Natura 2000 network. On the other hand because the land stewardship and also stewardship actions are carrying out compensatory measures for the reduction of negative effects that may be caused by the implementation of the plans, programmes and projects of the Natura 2000 network, as we will see later.

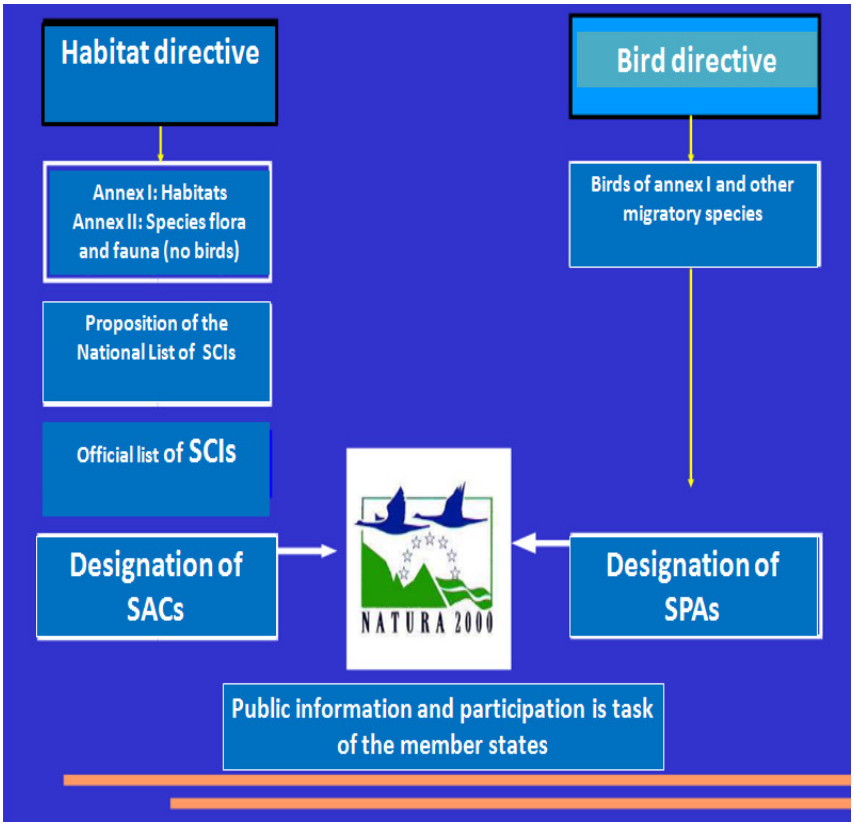


Figure 3: Designation procedures for Natura 2000

In this slide here, you can see the procedure of appointment of the areas in the Natura 2000 network.

On the right side of the slide you can see the declaration process of the SPAs.

As you can see, it is very quick and automatic procedure. The Member States are considering the birds in Annex 1 of the Birds Directive and the migrant species and also if an area has been designated Ramsar Wetland, appoint the SPAs and, automatically and immediately, they become part of the Natura 2000 network.

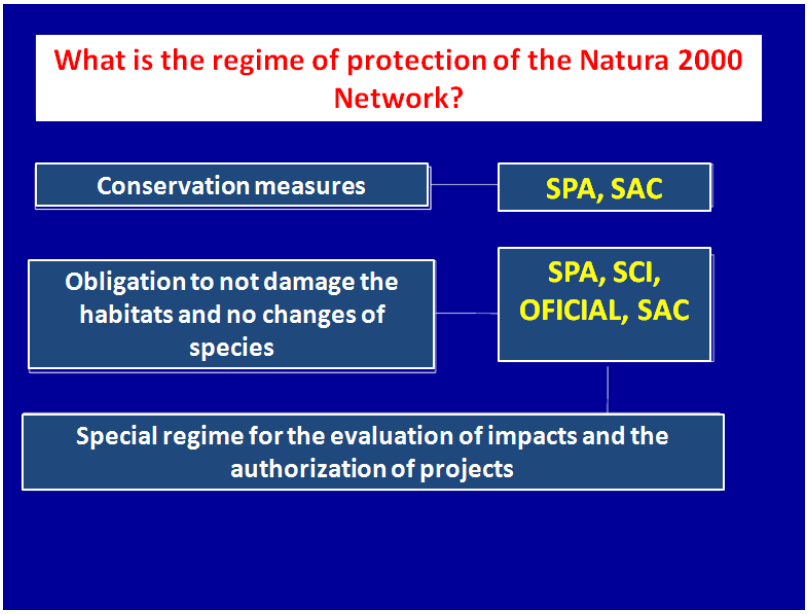
On the contrary, the declaration process for the SACs, Special Areas of Conservation, is a little bit different. The Habitats Directive designed it deliberately in order to influence the formation process of the network.

This process works as follows: The Member States, for each one of the biogeographical regions existing within its territory (the European territory includes eight regions), the Member State has to develop a proposal for a national list of Sites of Community Importance.

After searching for the habitats of community interest and the habitats of the species included in Annex 2 of the Directive, and applying the criteria established in the Directive, they will bring up a proposal of Sites of Community Importance for each region. This list is sent to the European Commission, where it is analysed with the help of technicians and at the same time, after the agreement, the official list of Sites of Community Importance for each biogeographical region is passed. This list is published in the Official Journal of the European Union and, starting from the publishing date, the Member States have six years for including them in the list of Sites of Community Importance and for declaring them as SACs, turn them into SACs, and arrange measures of conservation.

What is the legal regime of protection of the sites of the Natura 2000 network?

Well, this regime includes on the one hand measures for active or proactive protection, and on the other hand measures for prevention or passive conservation.



The passive conservation measures are at the bottom of the slide.

They are some obligations from the Habitats Directive for the states to prevent any damage the natural habitats and any alteration to the species that caused their inclusion into the Natura 2000 network of sites.

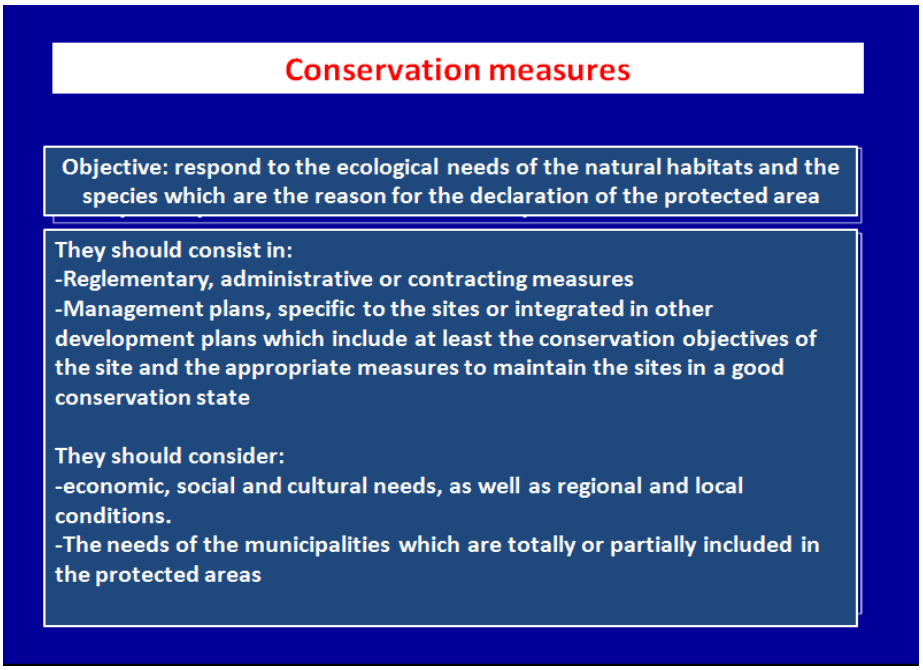
Figure 4: Regime of protection Natura 2000

There is another branch in this regime of protective prevention, which is a special regime of impact evaluation and authorization of projects that you can see below.

This preventive regime is applicable to SACs and SCIs that have been definitively approved, but also applies to Sites of Community Importance that have been officially included in the Natura 2000 network.

That was the regime of passive protection, but Natura 2000 network also has a very important part of active management, including the states' obligation of enacting measures of preservation for SPAs and SACs.

Let's see how it works:



In this slide you can see a combination between the content of the Habitats Directive and the content of the Spanish Law 42/2007 for the Natural Heritage, which has applied to the Spanish legislation the Habitats Directive.

Figure 5: Conservation measures

What aims do the measures of conservation for Special Areas of Conservation and analogically for Special Protection Areas for Birds have?

The measures of conservation that are going to be applied must respond to the ecological specifications of the natural habitats and the species that were the reason for the site's declaration.

What must these measures include and how must they be enacted?

The Directive says that the measures enacted must always be regulatory, administrative or contractual, and this is the part of the Habitats Directive that is important for the land stewardship.

The Directive also says that the states can, if they want to, elaborate management plans.

The Spanish legislation compels these management plans to be elaborated in each and every case.

The management plans might be specific for the sites or be integrated into other development plans but they must include the site's conservation aims and the appropriate measures for keeping these sites in a good state of preservation.

Before taking conservation measures, the Directive says that the economic, social and cultural requirements and every local or regional particularity in the territory should be taken into account and the Spanish legislation also says that, before taking these conservation measures, the needs of the towns that are included, totally or partially, in the sites of the Natura 2000 network should be taken into account.

As I said before, land stewardship is quite interesting in the Habitats Directive, because it makes it possible for the conservation measures to be applied through contractual means and, in fact, there are several steward associations in Avinença that are effectively implementing preservation projects in wetlands.

For example, we have the Foundation Global Nature, which is running the Tancat de Milla and Tancat de l'Illa, as part of this LIFE organizing this seminar.

We have also SEO/Bird Life, also running together with Acció Ecologista Agró the Tancat de la Pipa as part of this LIFE-Albufera.SEO/Bird Life is also carrying outland stewardship actions in other places in Spain, like, for example, the ornithological reserve in Las Marismas Blancas or in Riet Vell, Tarragona. Acció Ecologista Agró is also carrying out stewardship actions in other wetlands, like the Marjal of Almenara or the field of Casa Peña in Sagunt.

We also have examples from other stewardship associations carrying out stewardship projects in wetlands, like Fundación Assut," Asociación de Amigos de los Humedales del Sur de Alicante" or Fundación Limne.

Included into a more passive or preventive regime of conservation by the Habitats Directive for the Natura 2000 network, is the special regime of evaluation of impacts from the use of plans and programmes.

According to this regime, all those plans, programmes or projects significantly affecting a site in the Natura 2000 network, must be properly evaluated. If this evaluation turns out to be dangerous for the integrity of the site, which means that the site is going to stop being ecologically functional, the Member States are compelled to not give their conformity to this plan, programme or project. However, the Directive established a series of previsions or reasons that justify that these projects affecting the integrity of the site could be implemented.

The Directive states that, if there is no other option and there are some imperative reasons of first order public interest, including social and economic reasons, for implementing this plan, programme or project, then the Member States or the authority in charge can show their approval on the condition that compensatory measures ensuring the coherence of the Natura 2000 network are enacted.

The Directive also establishes some warrants:

If, in a site of the Natura 2000 network that is going to be affected by a plan, programme o project, there are enlisted habitats or species, only reasons related to human health, public safety or positive results for the environment can be alleged, and if some other reasons such as social or economic reasons may be alleged, the European Commission must be previously asked. Thus, this special regime of evaluation of impacts from the use of projects, plans and programmes is important for the preservation of the wetlands because it warrants that every project concerning wetlands, evidently included in the Natura 2000 network, is going to be evaluated. In the case that this wetland is included in the Natura 2000 network it might be seriously affected and these plans, programmes or projects could be implemented only if compensatory measures such as the restoration of other wetlands are enacted in order to provide the value that is being lost because of the execution of the project.

Regarding the stage of application of the Habitats Directive, we can explain that in Europe all the biogeographic regions already have their lists of Sites of Community Importance approved or even updated. Some of them affecting Spain have been updated for the eighth time, and therefore, as the lists are approved, the process for appointing these Sites of Community Importance as Special Areas of Conservation has already started.

If we look at the more recent data from the Eurobarometer of the Natura 2000 network, published in the Natura 2000 newsletter in January 2015, we will learn that there are more than 27.300 sites in the Natura 2000 network, including both SCIs and SPAs, covering more tan1.100.000 square kilometres of territory. They are covering over 18% of the terrestrial space of the European Union.

If we are talking about the stage of application in Spain of the Habitats Directive and regarding the Natura 2000 network, it must be said that the Directive has been incorporated to the Spanish legislation through the Law 42/2007, about Natural Heritage and Biodiversity.

About the state of the network, according to the information given to the European Commission for the elaboration of the priority action framework for the funding of the measures of conservation of Natura 2000 network, it is currently known that there are 598 SPAs included in the Natura 2000 network, 1.449 Sites of Community Importance, having 334 of them already been appointed as SACs, and over 27% of the Spanish terrestrial area has been included in the Natura 2000 network.

As I have said before, we are in the middle of the process of turning the Sites of Community Importance into Special Areas of Conservation.

Spain has already been sentenced by the Court of Justice of the European Union due to not having appointed as Special Areas of Conservation in time and not having taken in time suitable measures of conservation for the biogeographic region of Macaronesia, which mainly affects the sites of the Natura 2000 network placed in the Canary Islands. Also recently the European Commission has opened an infringement proceeding against Spain because of the delay of the declaration of SACs and the starting of measures of conservation for these SACs in the rest of Spain.

As I have said before, the Habitats Directive demands periodical evaluations of the state of conservation of the natural habitats and species in order to check if their state of conservation is good or, in the case it is bad, if a positive trend is visible.

According to the information published by the Ministry of Environment (MAGRAMA) in a report from Spain that encompasses the period between 2007 and 2012, reports on 430 species have been redacted. However, the analysis of 22 of them hasn't been possible, basically because apparently they weren't in Spain during the inventory of species existing in Spain of the Directive, and only 20% of the 430 reported species are in a positive state of conservation, 33% of them are in a poor or deficient state of conservation, 19% of them are in a bad or disfavourable state and 29% of them are in an unknown state of conservation.

There is obviously a lot to be done in Spain: SACs must be declared, all the measures of conservation must be taken and we also have to try to improve the state of conservation of the species and the natural habitats that we are compelled to preserve here in Spain. Well, I am going to try to close the presentation and look at you again. I hope that I have given you some insight on the Habitats Directive. There is a lot of preservation work to be done in the wetlands.

If anyone has any questions about land stewardship or about this presentation, please contact Avinença.

Thank you very much for your attention.

JAVIER PÉREZ GORDILLO

Coordination Team of the project LIFE + INVASEP

"How much does an ecosystemic service cost? How much does polinization cost? How much does the fertilization of the soil cost? How much does a species cost? It's really difficult to estimate these elements but the loss of a species or the loss of an ecosystemic service is an economic cost that we must NOT afford."

Abstract:

Javier Pérez Gordillo represents the Coordination Team of the project LIFE + INVASEP, coordinated by the Directorate General for the Environment of the Government of Extremadura. In his presentation, Javier Pérez Gordillo spoke about the problem of the invasive species, giving facts such as a 76% increase of the alien invasive species in Europe for the last 45 years. This problem, caused by globalization, has three kinds of impacts: ecological, economical and human-health impact. The economic impact affects all the socioeconomic sectors without distinction, even sectors that in some cases are responsible for introducing these species. There is a need for cooperation and teamwork from governments and nations in order to increase the amount of economic studies that could explain this so unnoticed fact.

I would like to thank the organizers of this seminar LIFE + Albufera for inviting me to give this talk. I will speak about the economic and environmental costs that the invasive alien species cause.

As everybody knows, invasive alien species are the second cause for a loss of biodiversity in the world, as well as the responsible for 39% of all extinctions until today. But if we look backwards, invasive alien species are almost as old as humankind itself, since people have carried species or seeds throughout the world since ancient times.

However, it wasn't recognised as a serious problem until a few decades ago, and this is because of globalization, when the borders were opened for free trade, as well as the high mobility of people from one place to another in the world. Just think about the amount of tourists travelling from the Antipodes to the other side of the world, sometimes carrying as a souvenir some seeds or some animal or vegetable species.

Well, in the last 45 years, there has been an increase of 76% of the amount of alien invasive species in Europe. This has obviously raised the alarms and, of course, a problem that was more or less being buffered over time, during the last decades has become a serious problem. This globalization hasn't just boosted the transportation of species from one point to another in the world; it also has increased the frequency of those introductions, that have become more and more common; and also the different amounts of introduced species.

Alien invasive species are a problem that sometimes runs quite unnoticed. When I talk about unnoticed I mean that it is difficult to detect or to address. One should say that most invasive species, when arriving at a natural environment, keep initially a very small population that is very difficult to detect, therefore addressing them in the large natural environment that we could have is complicated. In addition, we are talking about alien species that, sometimes, the technicians or people in charge of the management of the environment can hardly identify, even more so if we are talking about groups like invertebrates, algae, fish and some grasses.

On the other hand, this silent menace was born from the meagre knowledge that we have on the biology and ecology of those new species, we don't know exactly how they are going to settle in our natural or urban environments.

There is also an additional problem. This kind of problem is widely undetermined. Why? Because those species might have specific effects on specific sites but these effects aren't the same in every place. And what does this bring about?

We don't know what is going to happen when a new species is introduced, whether it is going to be invasive or not, and finally the fact that some species are not “soundly invasive”. When I say "soundly", I refer to those species that arrive, get settled in the environment, become naturalised, breed and cause a direct impact. But there are species that arrive, get settled, keep very residual or small-sized population, and stay latent there for many years. Then when they meet their suitable conditions, the demographic explosion and the final impact occur.

So when we talk about what impacts can we find related to the alien invasive species, there are three main types of impact: ecological impacts, the most known impacts on the environment and society and these impacts on biodiversity, that is, on the species and habitats, or on the ecosystemic services that nature provides.

As well as these already known impacts, we find economic impacts. Economic impacts haven't been much studied and some of the facets that we are going to see through this presentation are happening to be very important because of the initial lack of awareness on this kind of impact.

And finally there is the impact on human health. This impact has been barely studied and it's really important because of the zoonosis. Well, we are not going to talk about this in this presentation, but I want to highlight that it is becoming more important for the society.

When we are talking about ecological impacts, we have already said that there are impacts on biodiversity and impacts on the ecosystemic services. Well, in the impacts on biodiversity by the species brought into an environment, the alien invasive species, the most noticeable impacts are the reduction of the population of the autochthonous species. If these autochthonous species have a very small population or if they are settled in very specific sites, some species might even get extinct. On the other hand, some species cause an impact on the habitat, not just on the species but on the whole habitat.

The mechanisms that these species generally use, are the competition of resources, either food, breed sites, territory, sun-dry sites, or predation on other species, as is the case of the American mink. Also hybridization is a very cryptic impact, which is barely noticed because genetic pollution is very difficult to detect until it reaches very advanced stages. Another mechanism is the invasive species itself being a disease or parasite vector or the disease itself.

If we are talking about the impacts on the ecosystemic services, we need to refer to the interference with the supporting services, that is matter cycles, nutrient cycles or ground formation; the interference with the supplying services, such as water supply for the population or wood production in silviculture, the interference with the regulating services, such as the polinization of the autochthonous plants and crops, the regulation of the water system (we can see how many species hinder the natural regulation of the water courses), and the control of the erosion (obviously if the forest bodies are damaged there is going to be also a damage in the control of the erosion), and finally the interference with the cultural services (by cultural services we mean the landscape, our ideas about some aesthetic values).

Figure 1: Invasive species might have impacts on important ecosystem services like polinization or water regulation

But if we plunge into the economic impacts, which are the subject of this presentation, we must establish an important difference: we can talk about direct impacts, which are easily recognizable, or about indirect impacts, which are more difficult to identify.

If we talk about direct impacts, there are first of all: the losses in agriculture, forestry or ornamental plant production, such as the losses produced by species like the apple snail, the pine wilt nematode or the red palm weevil. Furthermore a reduction in the amount or quality of the extractive activities might occur. There are lots of activities such as fishing being affected by invasive species by lessening the volume of fish that can be taken during a season, the destruction of stored material or damages to infrastructures and heritage. This is an important fact, because it hasn't been counted as an economic impact until recently. It is not rare to find certain trees such as ailanthus on some castle walls or just in some streets, damaging these infrastructures.

If we are talking about indirect impacts, the impact on health care costs, as we said before, is a cost that hasn't been evaluated, but it could indeed be affected by the presence of alien species. Furthermore the might occur losses in indirect sectors such as tourism or leisure, where the impact from these species hasn't been estimated but is real; or the costs of control and elimination of the alien invasive species, which are generally very high.

But we also have tangible impacts or intangible impacts, which are those impacts that can be economically evaluated and those impacts that cannot be. If we are talking about the tangible impacts, the ones that can be economically evaluated, in several studies about some invasive species, such as Pimentel's or Kattunen's studies, we can see that they are undervalued. Why? Because they haven't been taken into account many data from the indirect sectors, which we have previously mentioned.

Some data about the costs of alien invasive species: in Europe they have been estimated around 12.000 million Euros per year and in EEUU around 137 billion (with a B) dollars.

But in addition, performing an economic study about an invasive species implies difficulties for a detailed calculation.

Why? Because we obviously make quite conservative estimations, because indirect impacts are not considered, because there is few or poor information about certain groups of species and about certain productive sectors which haven't been studied. What does this cause? It obviously causes uncertainty when calculating economic losses. But this uncertainty is also added to the fact that there are no generic models for all the species, but each species needs a generic model for its impacts. There is also no knowledge about the impacts depending on species and sites, and mainly also in short, medium and long term. And finally, because the available information comes from the administration and not from the sectors. If we add to this the intangible impact, that is, the one that cannot be quantified, the economic would be really much higher.

An example of intangible impact: How much does an ecosystemic service cost? How much does polinization cost? How much does the fertilisation of the soil cost? How much does a species cost? It's really difficult to estimate these elements but the loss of a species or the loss of an ecosystemic service is an economic cost that we cannot afford.

After having analysed some specific aspects of the economic impact, delivering a definite quantity is apparently easy, but we will see some issues that are going to make it more difficult. For example, the economic cost of the biological invasions, doesn't follow a linear growth, which means 2 times 2 is not 4.

We are going to see as an example, the costs produced by zebra mussels in the river Ebro (Figure 2), which was in 2001 28.000, almost 29.000 Euros, and in 2009 the cost has been almost 4.400.000. What does this mean? In nine years, 29.000 Euros were not multiplied by nine, but this cost was multiplied 150 times. So, the cost that was initially estimated was much smaller, in less than 9 years it has turned into 14.3 millions of dollars, and the estimate for 2025 is that the cost will grow up to 110 millions of Euros. As a consequence we can see that the initially estimated cost of an invasive species is always going to be smaller than the final cost.

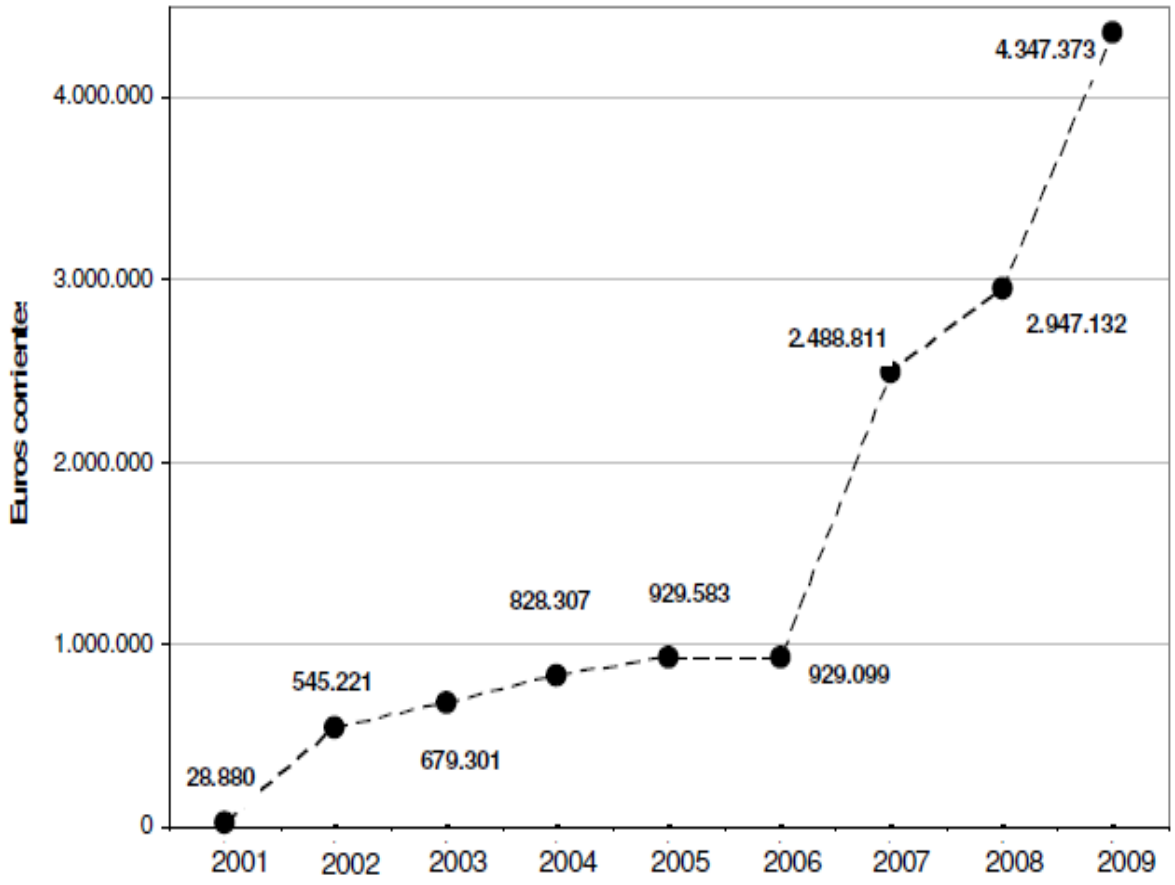
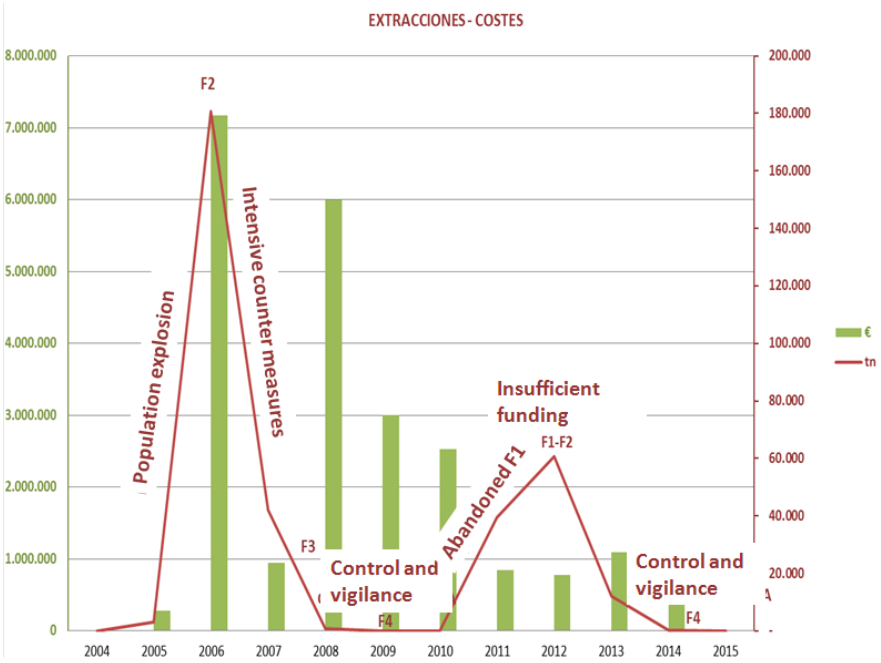


Figure 2: Costs caused by the Zebra Mussel population in river Ebro

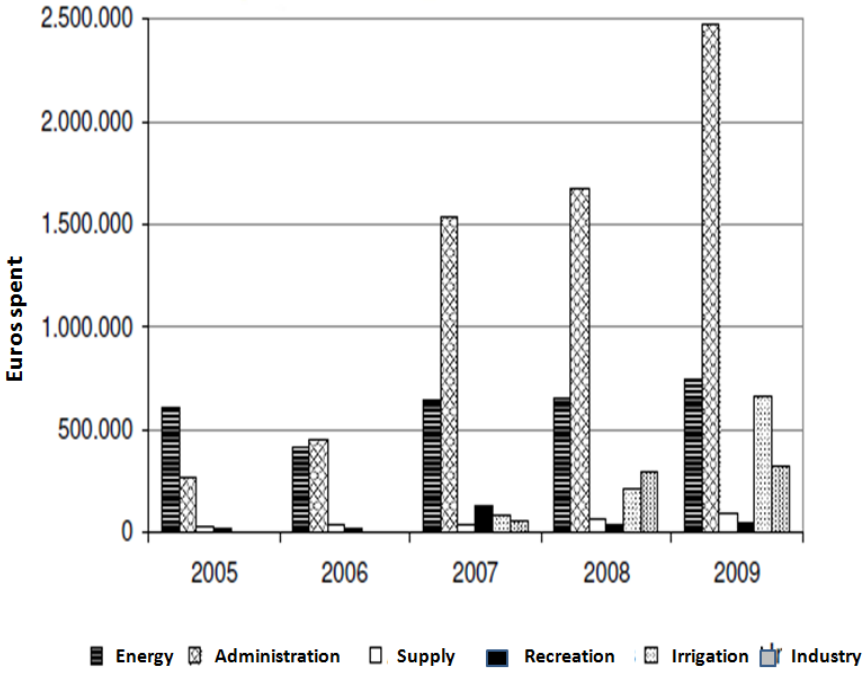
But also when we deal with the economic costs, we have to watch the control systems that are going to be used for the species. As the control systems are the most specified systems, it is very important while dealing with an invasive species to maintain a continuous control with a minimum investment.



Like in the case we have here, which is the control of the brown seed Paspalum in the Guadiana River between Merida and Badajoz in Extremadura, as you see in the graphics, a red line represents the extracted tonnes and the green bars represent the money invested to fight this species.

Figure 3: Paspalum population in the Guadiana River and money invested to fight the expansion

The species appeared in 2004 and 2005, and grew slightly and according to the investment made. The species took advantage and had an amazing increase of volume and spread through the river almost reaching 180.000 tonnes. The subsequent investment, almost 7 million Euros, reduced the population to its starting level in 2008, so the investment was maintained. But in 2011 the investment was drastically reduced, causing thus the growing and raising of the spread of the population. What am I trying to explain? That a continuous control is obviously necessary, or we will always be working with unexpected growths of investment and population.



It is also interesting to see that the sectors are going to have a very different influence on the invasive species along the invasion, as you can see in this graphic on the costs produced per sector because of the Zebra Mussel in the river Ebro.

Figure 4: Costs produced in different sectors by the Zebra Mussel population in river Ebro

There are such different sectors as the administration or the energy sectors, agriculture, forestry, nursery, and even there is a sector missing, that would be healthcare. As you can see, there has been an evolution for a long time, mainly in the administration, because of the increase of the public expenditure for controlling this species.

Finally, looking at the future and intending to reduce the costs or economic impact, I think that there are several recommendations to be followed: mainly, implement preventive actions to prevent the introduction of new species. This is going to boost a better cost/benefit ratio in case a new invasion happens.

Development of effective early warning systems: that the invasions of new species could be detected in their early stages, when eradication is still an option. If we don't act during these first stages, we only can take control measures along time.

Application of effective control/eradication measures: There are a lot of bibliographical references, not every system works in every place, but it is very important to be sure about what works where and to know its derivate costs.

International and interregional cooperation: there is no need to say that the alien invasive species don't care about borders, so collaboration between administrations is absolutely necessary, and finally, the increase of the number of economic studies that allow us a clear idea about these species.

This way, I say you farewell and I hope I have helped you to have a clearer idea about the economic impact that these species can have on our natural and urban environments.

See you soon and thank you very much.

Con el apoyo de:

ALEX SALKI

Lake Winnipeg Foundation, Canada

"Wetlands are being lost and degraded more quickly than any other ecosystem type."

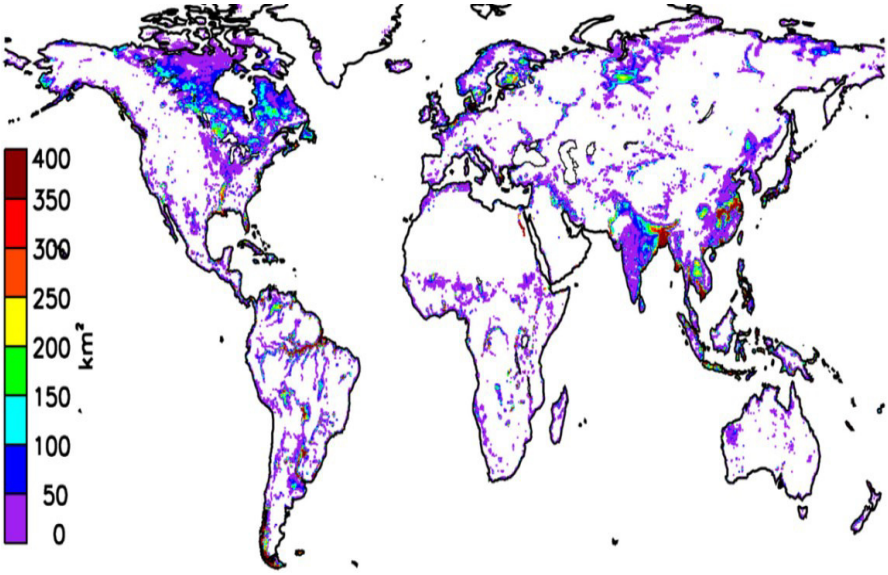
"A first phase in restoration projects is to bring scientists, academia, government and other stakeholders together to exchange available data and views on potential solutions"

Abstract:

The Lake Winnipeg Foundation is a Canadian non-governmental non-profit organization with a vision to protect, preserve and restore Lake Winnipeg in Canada. Alex Salki, member of the Science Advisory Council of the foundation, starts his presentation with such alarming data as the disappearance of over half of the original wetlands of the world or a 40% decrease of the wetland surfaces of the world since 1970. After this contextualization and an explanation of its causes, his presentation is focused on the different participatory models in Canada that exemplify community actions for the recuperation of degraded lakes and wetlands, as well as on the importance of the restoration of these wetlands.

The Lake Winnipeg Foundation was established in 2005 by a group of citizens concerned with the failing health of the lake. The foundation has a voluntary Board of Directors and a Science Advisory Council, where I have a chair, and we have four staff members. During my career I was a research biologist with Fisheries and Oceans, Canada, at the Freshwater Institute in Winnipeg, I conducted a whole ecosystem research at the Experimental Lakes Area and on several hundreds of lakes throughout Canada. It is a pleasure to participate in the Life + Albufera seminar and speak about participatory models in Canada that exemplify community actions for the recuperation of degraded lakes and wetlands.

Today I will focus on why we need to act on wetland restoration, provide examples of Canadian agencies working to protect wetlands, outline some wetland studies and initiatives in our local region and conclude with our Lake Winnipeg Foundation restoration project currently underway on Netley-Libau Marsh.



Wetlands occur on every continent and cover between 5% or 10% of the Earth's land area. Wetlands are particularly common on North-temperated latitudes of North America and Eurasia and in the tropical regions of India, Malaysia and China.

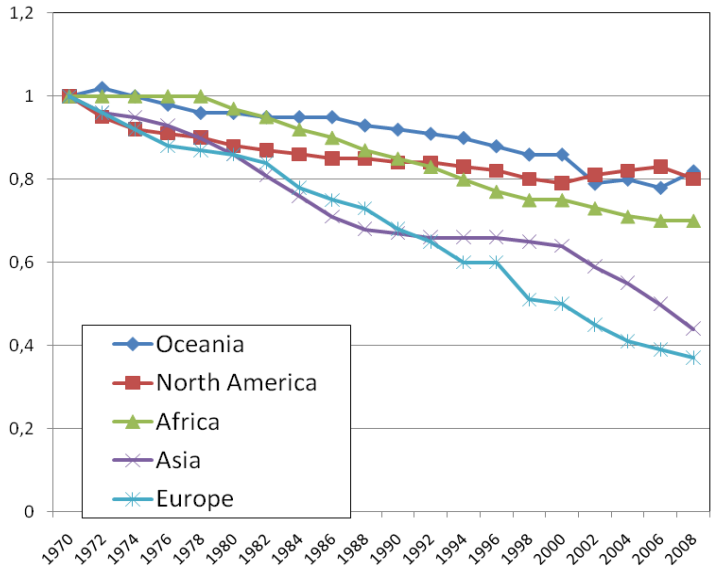
Figure 1: World map of wetland distribution

Canada is endowed with approximately 1.5 million square kilometres of wetlands, covering 16% of Canada´s land area and accounting for 25% of the world remaining wetlands. 37 of Canada's wetlands, covering almost 131.000 square kilometres in area, have been designated as wetlands of international importance.

Figure 2: Map of wetlands in Canada

Some trends in Wetland Distribution and Abundance:

Wetlands are being lost and degraded more quickly than any other ecosystem type. More than half of the world's original wetlands have disappeared. The number and area of wetlands is expected to decline with climate change and increasing land use, resulting in losses of the waterfowl production and other wetland biodiversity functions.



In this figure, the wetlands extent index prepared by the Convention for Biological Diversity shows that wetland areas throughout the world have shrunk on average about 40% since 1970. In Europe and Asia more than 50% of wetland areas have been lost.

Figure 3: Worldwide abundance of wetlands

A similar analysis by the World Wildlife Fund, their Global Living Planet Index of Wildlife Population Trend shows a decline around 30% from 1970 to 2007 in nearly 8.000 populations of 2.500 species of birds, mammals, amphibians, reptiles and fish. All of the declines are associated mainly with habitat loss and human intervention.

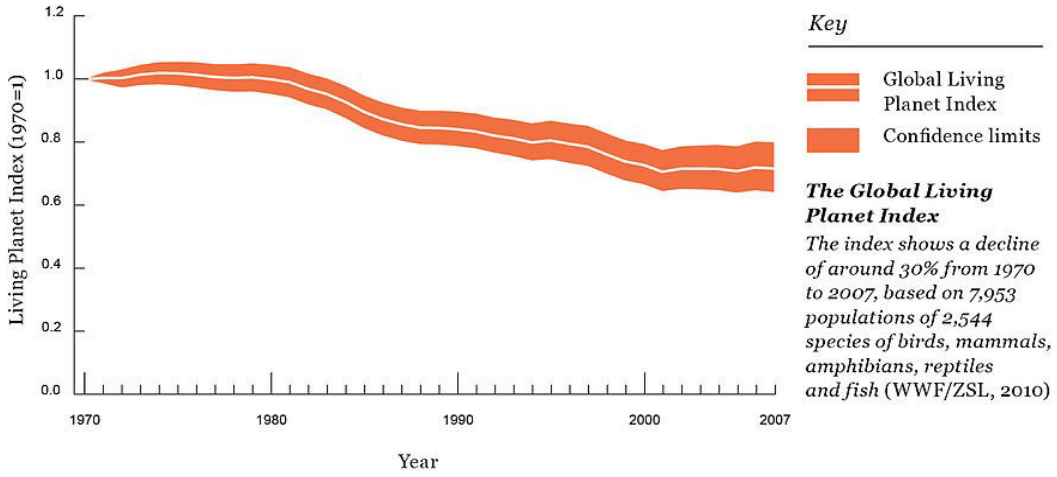


Figure 4: Global Living Planet Index, WWF

Now, I will go on with some models of wetland restoration activities by Canadian not-for-profit organizations. The first is Nature Conservancy of Canada (NCC). Who were they? What do they do?

They are Canada's leading private, non-profit, land conservation organization that partners with individuals, corporations, other non-profit organizations and all governments to protect important natural areas that sustain Canada plants and wildlife. NCC secures properties through donation, purchase, conservation agreement and manages them for the long term.

After forty years, total area conserved is nearly 966.000 acres providing habitat for 173 species at risk. NCC marked 2015 World Wetlands Day in Manitoba by celebrating their protection of over 7,000 acres of wetlands across our province. Here is a map of Canada showing the sites where land has been conserved under the Natural Areas Conservation Program.

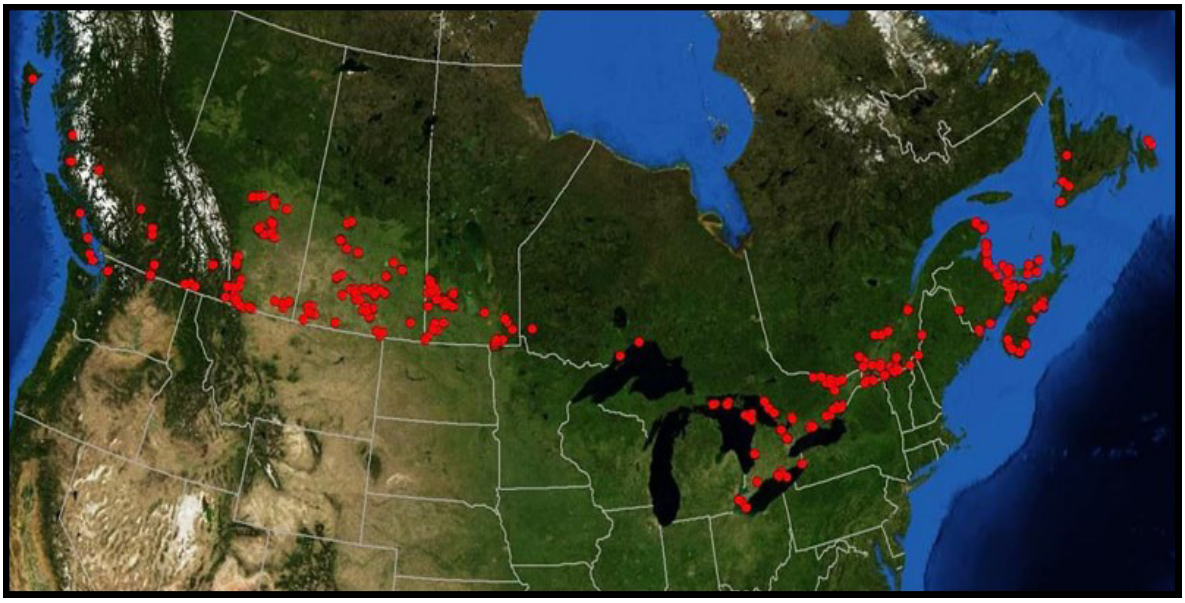


Figure 5: Lands conserved under the Natural Areas Conservation Program

The NCC is also actively involved in the North American Waterfowl Management Plan, an international collaboration between Canada, the US and Mexico to protect wetland and upland habitats for migratory birds and waterfowl.

A second agency especially focused on wetland restoration is Ducks Unlimited Canada (DUC), a registered charity that partners with government, industry, non-profit organizations and landowners to conserve wetlands that are critical to North America's waterfowl and also beneficial to other wildlife and people. DUC has completed 9.557 habitat projects and conserved 6.4 million acres of wetlands and associated habitat. DUC's scientific Institute for Wetland and Waterfowl Research finds answers to important environmental questions and establishes the value of wetlands. Canada loses an average of approximately 80 acres of wetlands every 24 hours.

Ducks Unlimited also contributes to the Canadian Wetland Inventory which was established in 2002 to help answer questions such as: Where are Canada remaining wetlands? How much area do they cover? What types the wetlands are they? And are they being threatened?

DUC also offers online an interactive wetland map showing the status of the Canadian Wetland Inventory in particular regions of Canada. A good example of DUC's efforts to better understand the impacts of wetland drainage and loss of freshwater ecosystems is the Broughton's Creek project.

The study findings showed significant impacts resulting from wetland drainage, such as a 37% increase of peak flow following rainfall events, a 62% increase in water flow, a 32% increase in phosphorous loading from the watershed 57% increase in nitrogen loading from the watershed, 85% increase in sediment loading on an annual average, a 28% decrease in waterfowl production.

A good example of an agency focused on protecting lakes, wetlands and water resources across Canada is Living Lakes Canada, a relatively new agency founded in 2012 by Wild Sight in British Columbia, the Lake Winnipeg Foundation and the Global Nature Fund. Its 10 members across the country represent Canada´s four major river sheds.

In what activities is Living Lakes Canada involved?

Transfer science to the public and foster stewardship actions by raising awareness, educating and engaging citizens and proposing innovative policy changes to assist Canada's four levels of government that manage lakes and their watersheds. Living Lakes Canada's leadership at a national scale has been recognized by the federal government as a best practices example, a community-based ecological monitoring.

The Winnipeg Foundation is a member of Living Lakes Canada, as well as a co-founder, with a focus on Lake Winnipeg and it's very large watershed of 1.000.000 square kilometres. Much in the watershed consists of rich prairie soils, used to produce grains for export to the world. The use of inorganic fertilizers and the drainage of wetlands in the basin are the main causes of the eutrophication of Lake Winnipeg, designated GNF threatened Lake of 2012.

To restore the health of Lake Winnipeg, the Lake Winnipeg Foundation Health Plan calls for improving through Land Management. Effective management requires good data. In 2011 the Lake Winnipeg Foundation collected physical, chemical and biological data to document the Lake Winnipeg South Basin shoreline features. This figure shows the 300 kilometre long survey route along the shoreline and the field sampling crew and their boat.

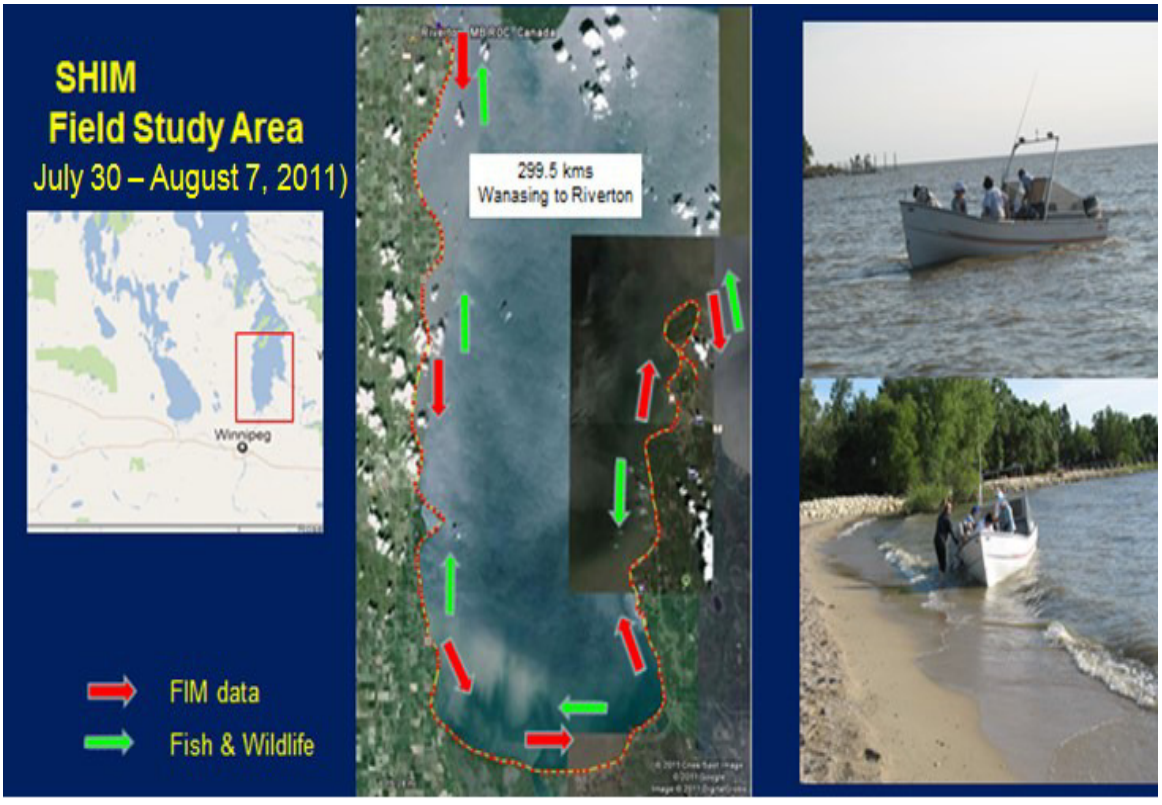


Figure 6: Field studies at Lake Winnipeg

This map shows how the Lake Winnipeg shoreline was subdivided into 50 segments based on the types of dominant shoreline substrate, land-use, modification and level of impact.

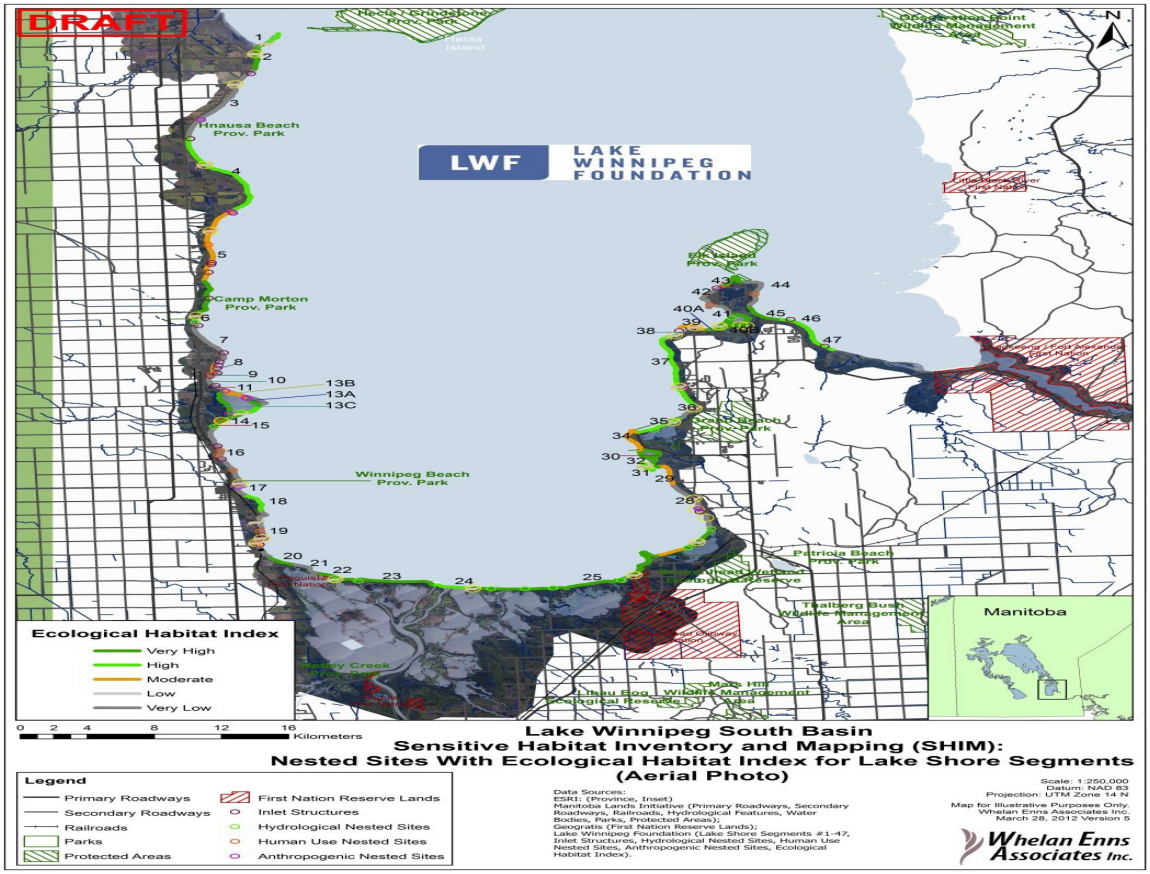


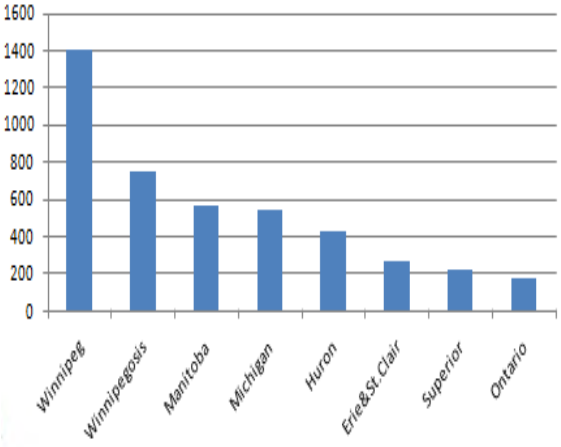
Figure 7: Lake Winnipeg Sensitive Habitat Inventory and Mapping (SHIM)

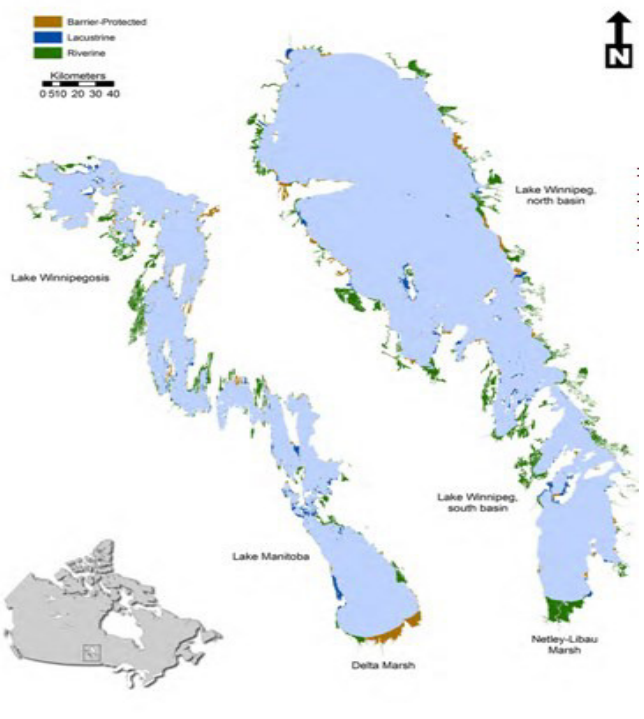
Each segment was rated using ecosystem criteria and assigned a sensitivity index intended to guide management decisions. Netley-Libau Marsh was part of the survey, visible at the bottom of the map.

Wetland restoration is also a priority of the Lake Winnipeg Foundation. In 2014 it began a project on Netley-Libau Marsh, a large 10.000 hectare ecosystem which had deteriorated substantially over the past several decades. On the picture you can see the Red River which flows into the marsh from the south and carries about 6.000 tons of phosphorous into Lake Winnipeg annually.

Figure 8: Red River flows into Lake Winnipeg

Manitoba's three large lakes have many wetland areas as shown in green around the periphery (Figure 9), considerably more than the coastal wetlands found in the Laurentian Great Lakes as seen in the figure to the right (Figure 10).





Figures 9&10: Total coastal wetland area in km² and wetland areas in Manitoba´s 3 Great Lakes

Netley-Libau Marsh is particularly important and valuable for several reasons:

It's a major breeding and staging area for waterfowl in North America, it collects and hold floodwaters in the spring. It filters toxin, sediments and nutrients. It provides culturally important medicines and food, stores carbon, it's a source of biomass, it protects endangered species and importantly it's a nursery for forage fish species that support the commercial fishery in Lake Winnipeg, which is the largest walleye fishery in North America.

This is what a functioning marsh look like: dense stands or emergent vegetation interspersed by small water areas. In its degraded state, Netley-Libau Marsh now looks like this: relatively sparse cattail and large open areas of water.

Figure 11&12: Functioning Marsh (left) and degraded Netley-Libau Marsh (right)

The flyways of many important bird species including geese and ducks pass through Netley-Libau Marsh.

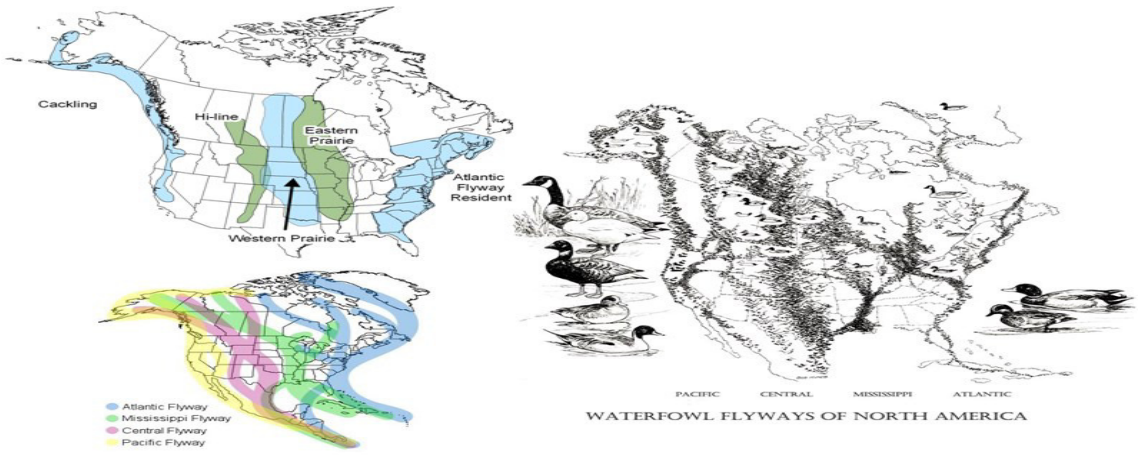


Figure 13: Flyways of bird species through the Netley-Libau Marsh

Recent trends in Canada's bird populations are depicted in this figure.

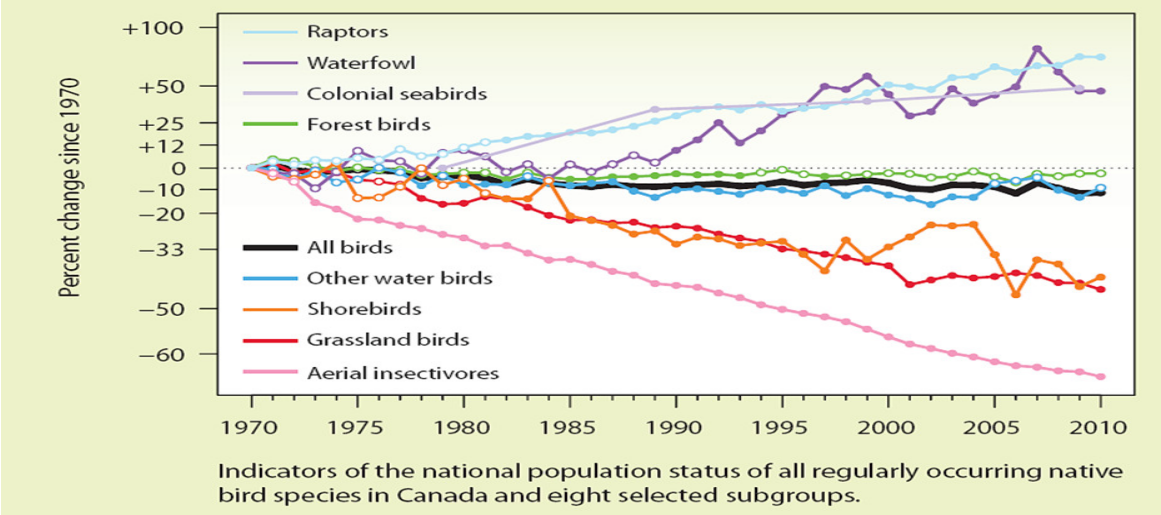


Figure 14: Trends of bird populations in Canada

Of the nine groups of birds, six have declined during the 1970 to 2010 period. The general increase in waterfowl observed in other parts of Canada is in contrast to the declines observed in the Netley-Libau Marsh area. Observations of Canada geese and snow geese at Netley-Libau have fallen dramatically from more than 100.000 in the past to less than 2.000 birds in 2012. Numbers of other globally significant bird species such as Forster's tern have also fallen significantly at Netley-Libau Marsh.

Healthy marshes offer not only wildlife habitat but also other ecosystem services, such as nutrient sequestration and biomass production. Research conducted in Netley-Libau Marsh by the International Institute for Sustainable Development in Winnipeg and the University of Manitoba revealed that harvesting cattail biomass can remove 20 to 60 kilograms of phosphorous from litter and sediment per hectare per year.

A further benefit can be gained from using harvested cattail biomass for bioenergy feedstock to displace fossil fuels used for heating or electricity. As well, the potential for harvesting phosphorus from the burned fuel ash is being explored for use in fertilizers. The harvest of cattails could diversify rural economic activity while also providing increased energy security and access to phosphorus.

A final participatory model is the recent Lake Winnipeg Foundation project undertaken to restore Netley-Libau Marsh. Phase one of the project was a workshop that brought scientists, academia, government and other stakeholders together, to exchange available data and views on potential solutions for this major challenge.

The next few figures show the progressive change in the marsh from the 1920s to the present. In 1923 most of the marsh was covered with a marshland type of species, bull rush, with open water mainly in small lakes.

Figure 15: Netley-Libau Marsh in 1923

This map show a series of small lakes that still existed in 1934.

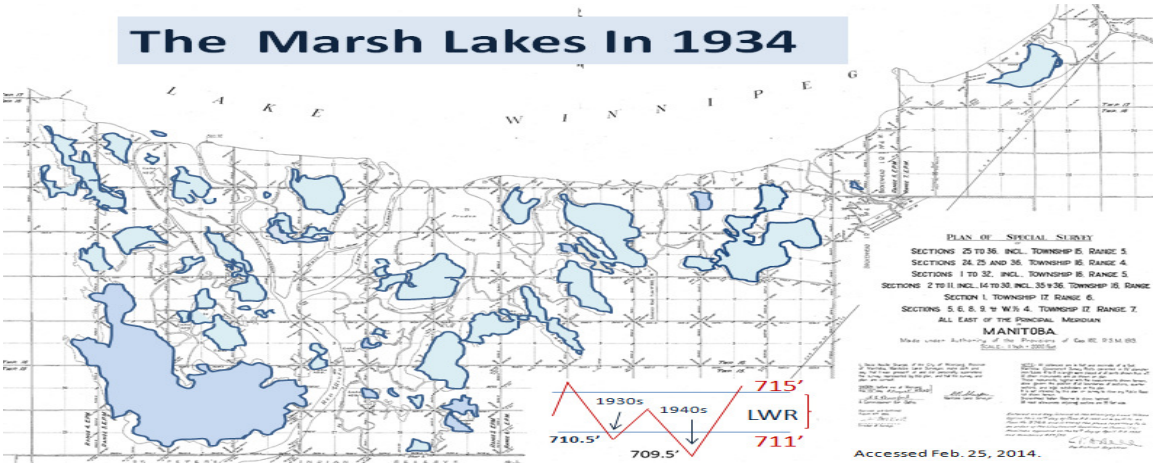


Figure 16: Netley-Libau Marsh in 1935

By 1979 many of the smaller lakes had coalesced and bull rushers were less common and by 2001 most of the Marsh was open water.

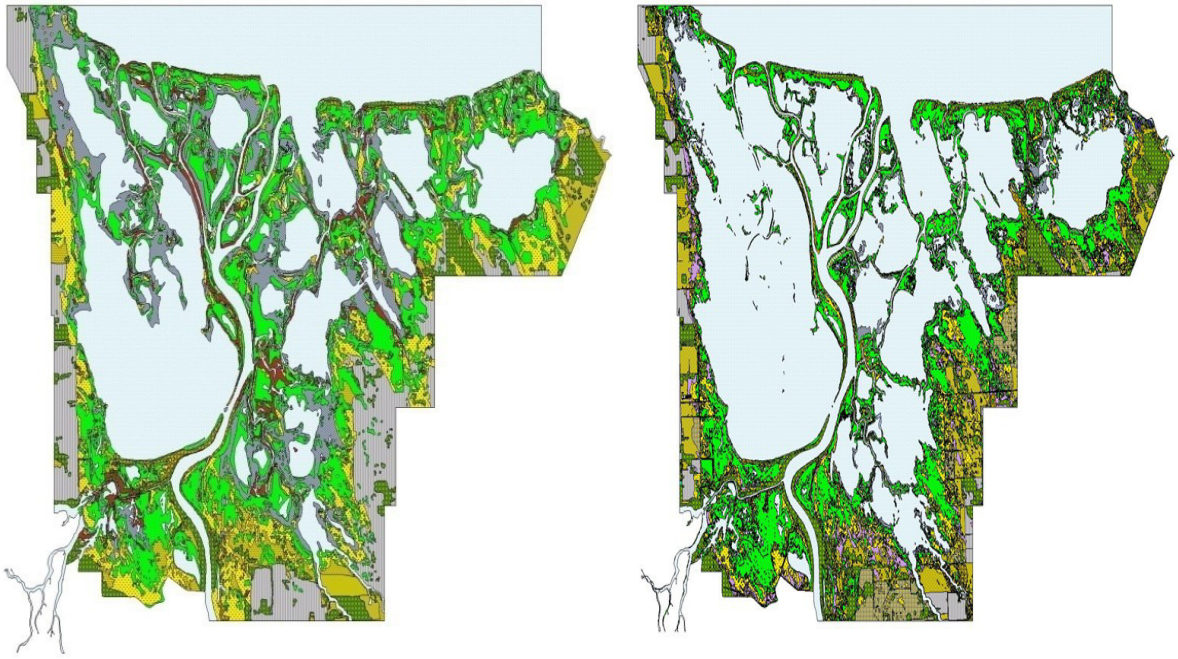


Figure 17: Netley-Libau Marsh in 1979 (left) and 2001 (right)

Two aerial views of the Red River and Netley Marsh the upper (left) showing the initial changes to Netley Marsh in 1923, 10 years after the cut was made in 1913 in the west bank of the Red River.The lower (right) photo shows major changes to Netley Marsh that occurred by 2009 and continue to the present.

Figure 18: Netley-Libau Marsh in 1923 (left) and 2009 (right)

Some satellite observations are providing additional glimpses of changes to Netley-Libau marsh between 1987 and 2013: .

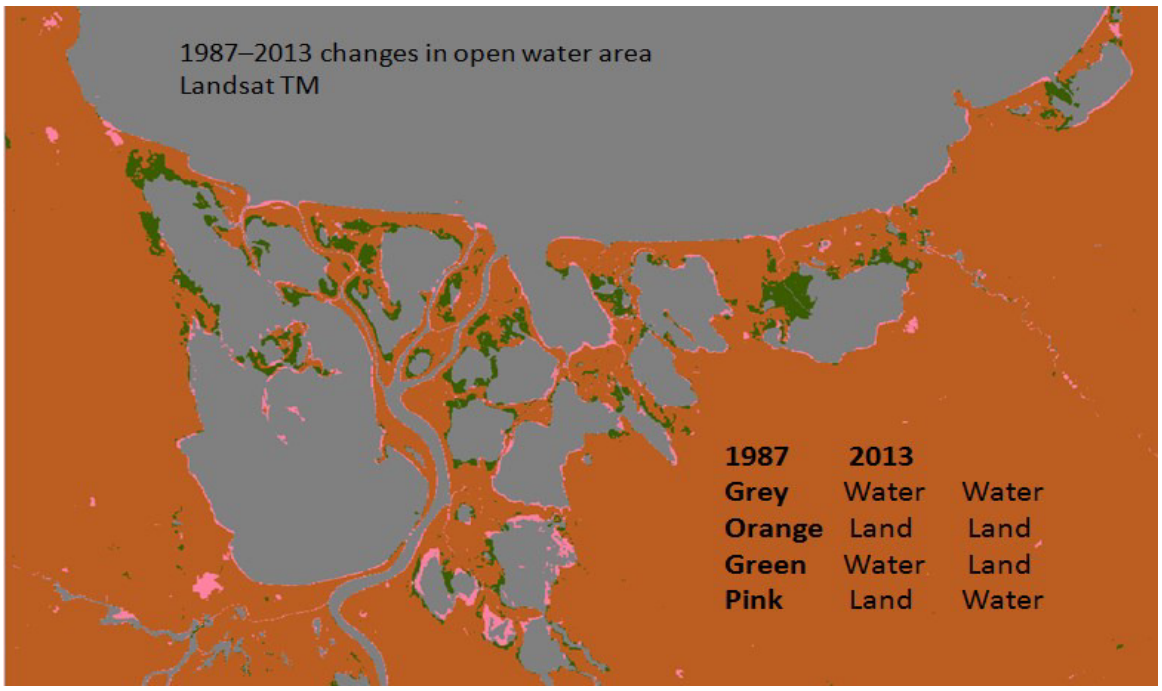


Figure 19: Changes in the Netley-Libau Marsh between 1987 and 2013

Changes in the boxed area are visible in the next image. These views provide evidence of some depositional processes occurring in the east part of the marsh.

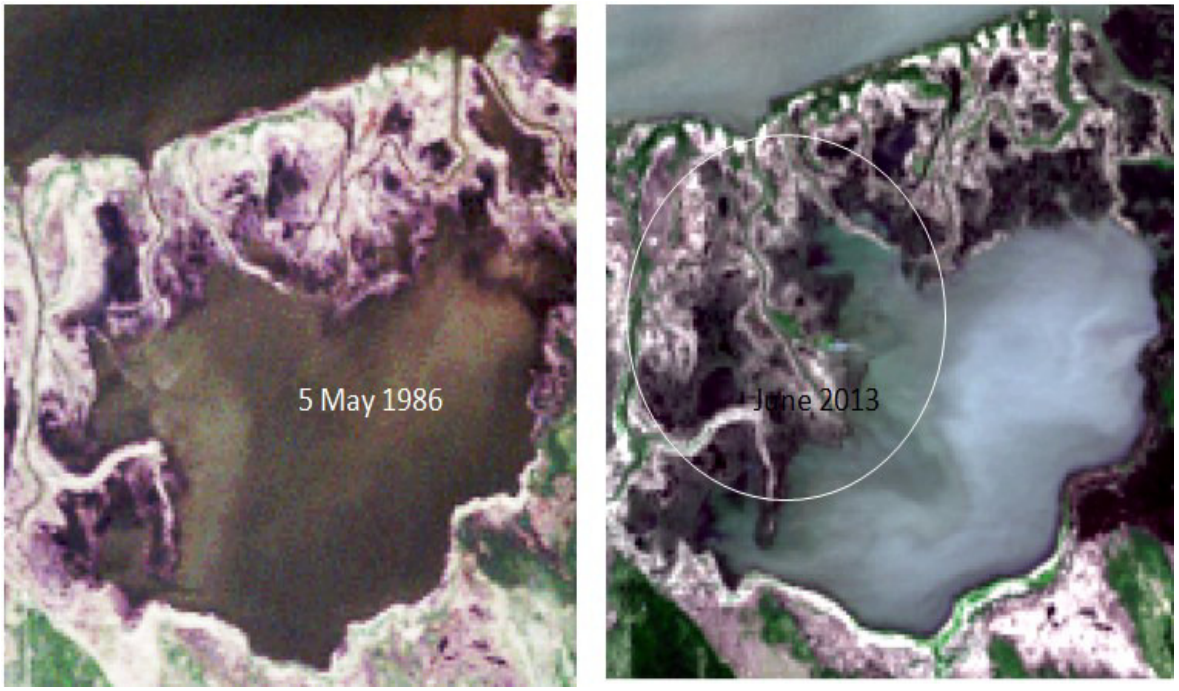


Figure 20: Satellite images of the Netley-Libau Marsh in 1986 and 2013

Phase 1 - April 2014 – March 2015
- **Workshop - completed**
- **Report - completed**

Phase 2 - May 2015 – March 2016
- **NLM Science Steering Committee Selection**
- **Consolidating Phase 1 science and Literature Search**
- **Developing governance mechanisms**
- **Pilot Field Study**
- **Selection of Remediation Strategy**

Phase 3 – May 2016 - ?
- **Apply to National Wetland Conservation Fund**
- **Implementation of Remediation Strategy**

With the phase 1 workshop completed and reported, phase 2 will get underway this summer: including selection of a permanent Steering Committee to manage the project, consolidation of phase 1 science and the literature search, developing an overall governance mechanism, conducting a Pilot Field Study and selecting a feasible remediation strategy. Phase 3 implementation will depend on successful funding application in 2016.

Figure 21: Netley-Libau Marsh Remedation Project Plan

The Pilot Field Study this summer will generate data on Red River flow through Netley cut, water levels in the marsh, phosphorous sequestration in the marsh and sedimentation rates in the marsh. All of this information will help us to define a restoration strategy.

That's a brief recap from efforts by non-profit organizations to recuperate wetlands in Canada. Thanks for your attention.

Please contact me at the Lake Winnipeg Foundation if you require any further information.

JOHN PINDER

Consultant-ex ENVIRONTMENT AGENCY, UK

"There has to be a transition from government or administrative leadership and funding down, to one of local stewardship. From a one-way linear mechanism to an exchange model."

Abstract:

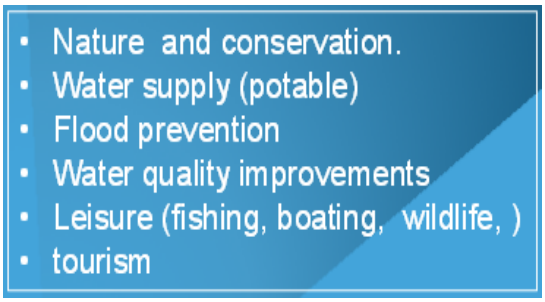
Partnerships (agreements on land stewardship) and collaborative approach are concepts that should be present in the title of the projects for recovery of ecosystems, or at least be somehow expressed. However, according to John Pinder, former consulter of the ENV AGENCY, in fact, the making, maintenance or even understanding of partnerships is still starting and there is a lot to learn about the way they work. It is true that the acknowledgement of their need is increasing and there are progressively more evidences that the collaborative approach can lead not just to success but also to long-term cultural changes that are more and more necessary. According to his expertise as Lakes Manager at the English Lake District, this work introduces some of the theories from social science on group negotiation and the establishment of common targets for organizations related to the recovery of lakes and wetlands. The presentation doesn't focus on the technical specifications for recovering wetlands, but explains some key rules for groups and organizations to enjoy their commitment and for different partners to see the benefits of the collaborative work.

I've been asked by the Albufera management team to give a short presentation as part of that seminar that's being broadcast for the Life + program.

I've worked in the water industry for forty years and a large part of that time I've been involved in the Lake and Water protection. More recently I've been working for the UK and Ireland Lakes Network and also as an adviser to the Global Nature Fund. So that's my background.

I'd like to now share my Power Point presentation with you, and about some of the experiences that I've had with creating and maintaining partnerships. So hopefully you can see the Power Point that I got opened.

Historically, we go back to the 1970s. Windermere is one of the largest lakes in the Lake District of England. How the situations were by the rivers? They were of high-quality, going in and out, and yet the river, the lake, was deteriorating. There were no objectives or standards and therefore lakes were really left out of the monitoring network that existed across the UK. This lack of ability to protect them is even more pronounced when you look to Shallow lakes with the associated wetlands, where there are even fewer objectives. And all of this was in the light of being a very highly important area for visitors, with already 20 million visitors per year. So no protective strategy and no action plans, therefore not even funding to actually resolve those problems. Additionally it was very difficult to apply legislation that was adequate, and it wasn't identified if lakes or wetlands were damaged in any way.



Since then, we have a significant amount of legislations, and now from the EU, such as the Water Framework Directive. And a range of new objectives appear to all of us which collectively command (you have them in Figure 1) ecosystem services.

Figure 1: Objectives for ecosystem management

So now I would say that, in addition to the water quality criteria, we're having a whole range of objectives that we need to fit in, such as just water supply, flood prevention, and objectives such as tourism and leisure, so multiple objectives is what we look at. But traditionally of course, the initiatives were only taken that level. They're fine for compliance with legislative requirements and also local government level, for ensuring that a minimum amenity is supported and achieved. For many of the other objectives and values there was no obvious driver, and so rather than from the central government level, lower down organizations such as non-governmental organizations and local groups can play a large part in protecting these environments. So this suggests that we have a potential matrix between organizations and values, and it's a fundamental point of creating partnership.

		Organisations		
		Government / Gov. Agency	NGOs	Local Groups
Values / Objectives	Legislation	✓		
	Amenity	✓		
	Nature		✓	✓
	Education		✓	✓
	Local Interest			✓

Figure 2: Task distribution between entities

A figure you could be fairly familiar with is the three-cornered approach to sustainability between the environment, community and the economy.

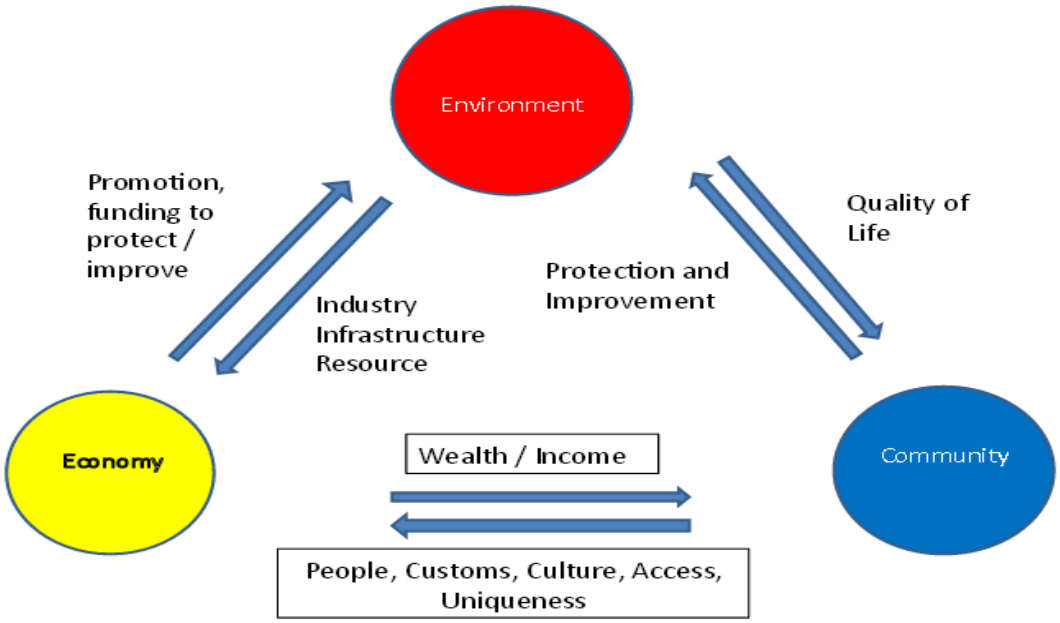


Figure 3: Three pillars of sustainability

We talk about the balance between those, but in achieving the balance there has to be an exchange. Those exchanges are not different from going into a shop with money and buying something, so the shop gives you some goods and you give them money, and there's an agreement that there is a value between you, about that exchange. And so, similarly, if you look through the processes in the social sciences, rather than in the pure sciences, you find that these exchanges are still valid when you talk about the link between environment and economy, economy and community, or community and environment. It's a useful and valuable exercise to actually identify what those exchanges are.

So the national level is the one we're all familiar with, but is actually still applicable down the local level between administrations and community groups and NGOs. And then it becomes more complicated because in reality with ecosystem services, there is a whole range of different organizations that are important players in protecting and restoring their sensitive environments (see figure 4).

Figure 4: Exchange model for sustainable Wetland catchment

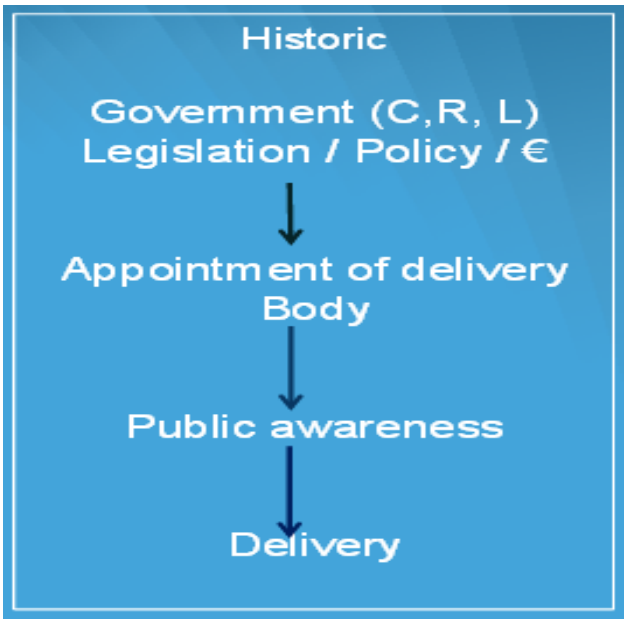
When we started off it was essential that we have a sort of statement, “vision” statement or “mission” statement, to get some buy-in. So we set some basic rules to move that forward. This first statement was owned by all organizations, and some who were not even partners. Each word needed to be meaningful to the people served by those partner organizations, and not just complying with a corporate policy. And in starting the process of getting exchanges, it was also necessary to understand where businesses partners understand their priorities and their positions, and what they could actually support and invest in.

Another point was that, whilst projects tend to be short lived, Finance programs which are relevant to restoring this sort of environments take a long time and effectively constitute a number of projects. Communication was, as an endeavor, very importantly involved in, as well as the language, which really fits together with both the exchange concept and also communicating with the public. So for Windermere, the mission statement that we came up with: A Healthy Windermere Catchment for now, forever. ‘Healthy’ because that was a different definition for each objective; ‘Catchment’ because the community where really unfamiliar with the whole idea of watershed, involvement in watershed management. And then, it's a timescale where things need to be done now, but for a sustainable approach things need to be done also in the long-term, hence ‘forever’.

And in the other aspect, it wasn't the only about project, this was about a cultural shift in the communities that lived alongside and used the lake and got value from it. So the cultural shift was necessary, and that was going to be slow, hence the requirement for that commitment. With respect to the partnership, it needed to be reliable and with very active requirement to ensure that those long-term programs were continued. It was necessary to acknowledge partners because some of them might not be in there for a long time, some maybe permanent, but everyone is a piece of that jigsaw, of the big picture, and each one plays its place, and should be valued for that. We also found that quantifying the overall time was just as important as the investment in monetary terms. Therefore we quantified actually how much visitor and volunteer time was put in, first by us and it was then adapted by all our partners and the community at large, how much investment was going on. And we included also the small investments, which could be part of a much larger investment, because they were part of partnership.

Celebrating achievements is essential for generating future engagement and to actually and maximize the energy from the different partners.

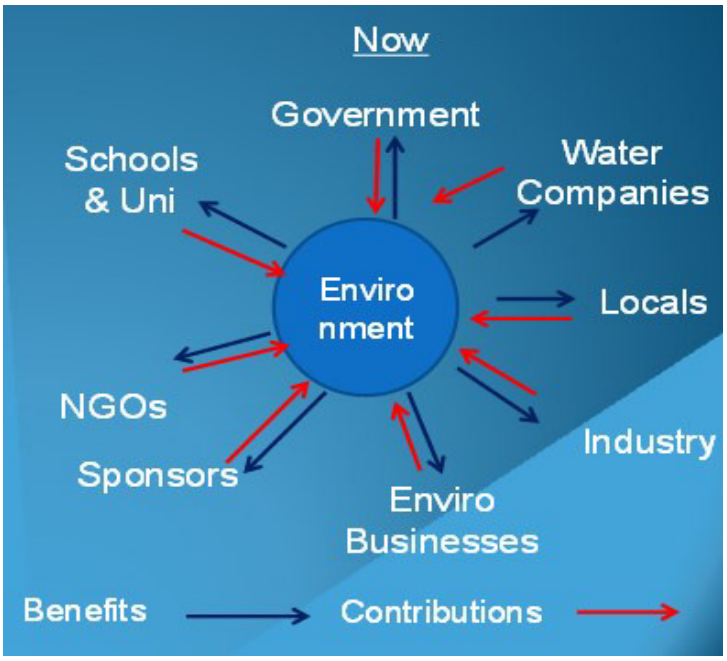
And also focus towards local stewardship. In the long term, government bodies and administrations are not going to be able to afford or have the drive for supporting or leading on many of these restoration programs. And there has to be a transition from government or administrative leadership and funding down to one of local stewardship. And to go along with that is necessary to nurture leaders for the future. And dynamic education right from sort of young children right throughout the universities is a good way of actually generating those leaders.



So we have traditionally a model where environments were led by the central region or local government, through legislative requirement or political requirement. They also supplied the money. They appointed a Delivery body to do work on that environment; possibly there was a delivery, so it was a one-way Mechanism (Figure 5).

Figure 5: Traditional approach for ecosystem management

That is the model from now, whereby lots of organizations are involved in it, of course government and other water companies are ones of those; but also local people, industry and businesses and so on.



And again, looking at this exchange model there are many contributions out of that environmental program. Many of these, many successful environmental developments across the globe are using this sort of model now rather than in the line of the traditional linear model which has limited benefits and actually how it takes no regard of these expanding values associated with the ecosystem services.

Figure 6: New approach for ecosystem management

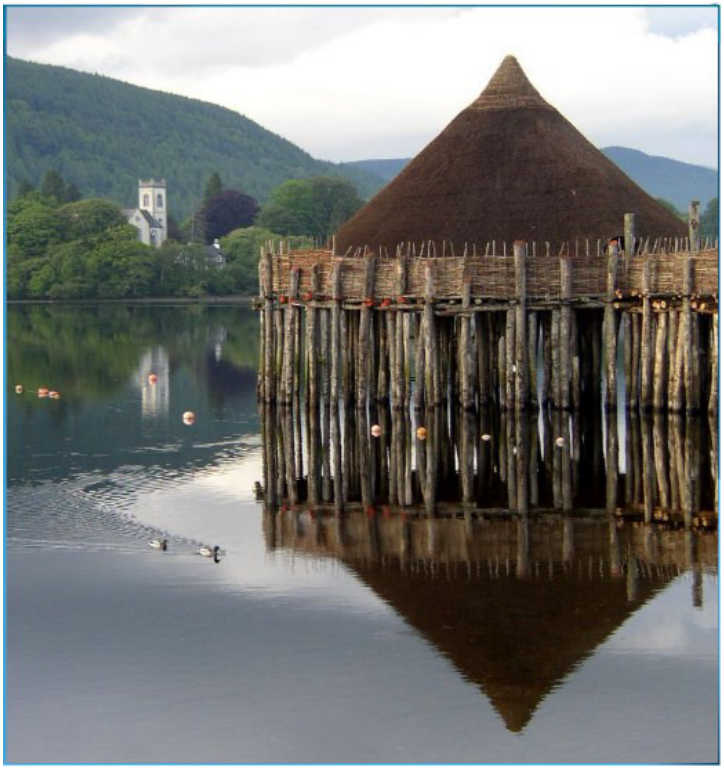


Figure 7: Reconstcted Crannog on Loch Tay

So finally, I will end with a little picture of a reconstructed Crannog, on Loch Tay. This was built by Neolithic man 3000 o 5000 years ago, for a variety of purposes, and these purposes now would call ages services to flood protection, food, water shelter, access, navigation probably and most importantly well being.

So Neolithic man were aware of the value of lakes and wetlands as a whole. Hence they preferred a place that provided those services. We've probably just discovered it but certainly the concept of partnership was almost certainly part of the way they use to live then.

Thank you for your attention.

Bye bye.

SARA BORT

TYPSA Project Officer specialized in water quality

"These constructed wetlands have been designed in order to emulate the existing conditions during last century's seventies in l'Albufera, looking for an environmental integration but also for a cultural and social integration."

Abstract:

Sara Bort, Project Officer specialized in water quality, explained that the constructed wetlands implanted in the rice fields of La Pipa, Milia and L'illa in the National Park of l'Albufera in Valencia are the product of an exhaustive process of technical, social and administrative agreement that wants to be at the height of the great national and international importance of this environment.

The spokeswoman explained that the constructed wetlands in the rice fields of Milia and l'Illa have been designed for the post-treatment of the water outputs from the water treatment stations of South Albufera and Sueca. Their aim is to reduce the concentration of nutrients before the water flows to the recipient environment, which has had some serious eutrophication issues for decades. However, it has been designed to act on additional aims such as the improvement of the biological quality of the water and the creation of habitats of a high ecological value, thus improving biodiversity.

TYPSA, a consulting company that has taken an active role in the planning and design of both constructed wetlands, expounded the uses, advantages and disadvantages of this type of wetlands, as well as the previous conditioning factors, the decisions made, the accepted limitations and the evolution of the design, from a conceptual stage (information project) to the construction project.

We are happy to participate in this online seminar, as we have a solid experience about the design of constructed wetlands. In particular about two of the constructed wetlands that are currently part of the Life Albufera Project, namely those implanted in the rice fields of L'Illa and of Milia.

Therefore I'm going to give a short presentation about the design and the changes in the design of both wetlands, and I hope you'll enjoy it. I'm going share with you the presentation.

We're going to start with the records of the period of 2002-2004. In this timeframe the Ministry of the Environment put the Hydrologic Confederation Júcar in charge of a study for the sustainable development of the Albufera of Valencia, which served to establish the diagnostic of the current problematic of the lake. They established a series of measures aiming at achieving its sustainable development. Among the main conclusions, we find that the Albufera was a hypertrophic lake that receives non native organic matter and nutrients in excess, which will facilitate a strong primary production and brings problems like high levels of turbidity, disappearance of submerged vegetation in the lake and the substantial reduction of biodiversity in the aquatic environment. As a consequence it seems obvious that we need to reduce inputs of nutrients in the lake and to establish or encourage a certain rate of renovation in the water.

Facing this situation, the Ministry contracted the public company Acuamed to develop an immediate action plan to improve or restore the ecosystems of the lake. The measures of this plan are targeting a triple objective: improving the deficiency in sanitation and water treatment, reducing the inputs of sediments in the lake that are producing an important setting; and establishing certain networks for monitoring, according to the Framework Directive.

In the following they established a series of measures, and we're going to focus on two of them for this talk, which are the reuse of wastewaters from the wastewater treatment plant in Sueca, and from the wastewater treatment plant of Albufera Sur.

It is important to note that these measures were classified as "general interest" and as such are part of the National Hydrologic Plan. For this reason, they had to be included in the Action of the Hydrologic Basin Plan. Both measures intend to improve the quality of the waters that enter the lake, and to do so they opt for a combination of options.

In the first place, the improvement of the treatment of both wastewater treatment plants through the implementation of a third treatment, and in addition the implementation of a constructed wetland that will allow the post-treatment of these tributaries and will encourage a biological improvement. So the final idea is to create three big artificial wetlands on the site of the Albufera. One is the constructed wetland implanted in the rice field of la Pipa, promoted by the Hydrologic Confederation of Júcar, and designed to treat the waters of the Albufera and reduce its quantity and its density of phytoplankton.

On the other hand, we have the rice fields of Milia y L'Illa that are supposed to treat the waters coming from a terciary and improve their biological quality. They are currently working using waters from the Albufera in the first case, and from the Estanc of the Plana in the second case. This is because the terciaries have not yet been implemented. However, until they become operational alternative methods were implemented. Considering the differences between the three rice fields, it is important to take into account that they have a common goal, which is to create a habitat to restore the biodiversity the lake needs.

Regarding the pros and cons of this type of wetland, I want to emphasize two advantages: the low cost of maintenance repair in comparison with a conventional treatment, and it's high capacity of environmental integration, which is fundamental in this project.

Regarding the disadvantages: we need large superficies, because it's an extensive treatment, which needs to be built in a large scale. Additionally the systems are not confined, which implies that we have to consider in the design that due to the exploitation of the wetland we're going to face constraints, climatic or of wildlife, among other things, that we have to consider.

The actions are now defined, but before starting with the design, there are a few decisions to be made first. One of them is where to place the wetlands? One could think the ideal place would be near the tertiary treatment even though we mustn't forget that one of the most important objectives of these units is to restore biodiversity and habitats in the environment of the lake. This is why it was decided to place the wetlands near the lake in the case of the rice field of Milia and near the Estanc of la Plana in the case of the rice field of L'Illa of Sueca. Both have water connection, and hence both places are interesting in the perspective of the project. Well, as we saw that we don't have them near physically, we have to decide how to organize the water flows.

To do so, it would be possible to take advantage of the Drought Network which already exists in the environment of the lake and uses gravity to bring the water to the wetland. However, it was thought that the most interesting option would be to bring them via a pipeline through a pump, in order to make sure that the quality that enters the wetland remains equal when leaving the tertiary. This is why the wetlands have been designed like this.

The third important decision is the kind of wetland typology we use, and in this respect we use a triple sectorization: we use a sector A, which is in this slide I'm showing you.

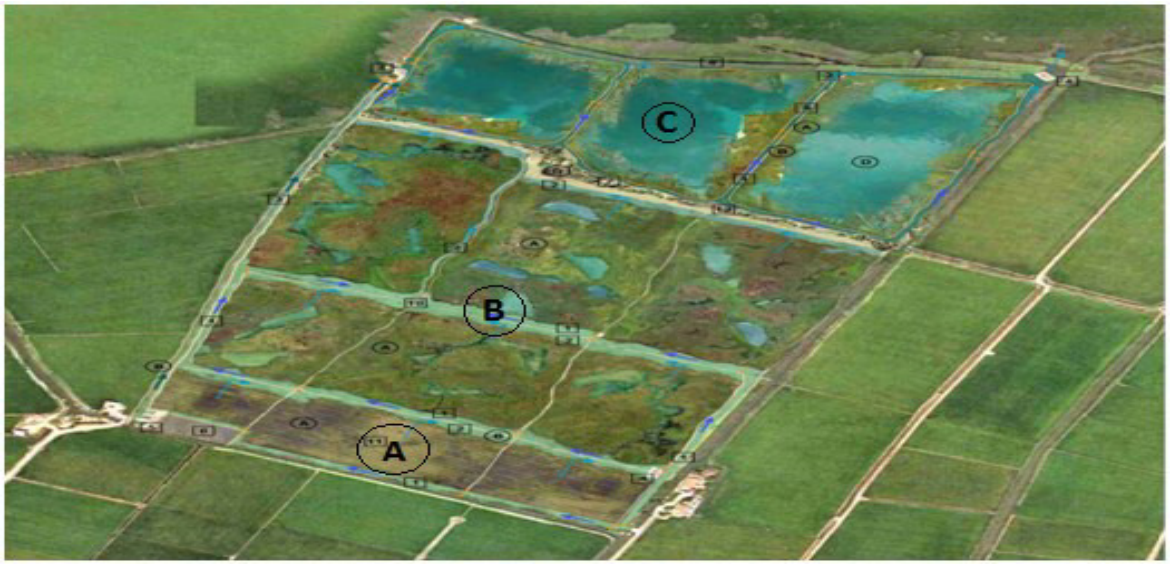


Figure 1: Aerial view of the Tancat de Milia showing different sectors

It is a horizontal subsurface flow constructed wetland which is being set up, thinking of the wetland protection in the case that the waters enter with the expected quality until they exit the tertiary. For example, it would be the actual situation that nourishes the Albufera.

The sector B is a surface flow wetland, which will be the main area of treatment within the wetland. And finally the sector C, which is a renaturation lagoon. It's an area, in which we try to reproduce a natural lake as exactly as possible. This sector is very important, because within the project we intend to reproduce the conditions that could have occurred in the seventies of the previous century in the Albufera, when we used to have clear and oxigenated waters, dominated by vegetation of charophytes and hydrophytes.

We also have some constraints that we need to consider in the design of this type of wetlands in the Natural Park. First of all, we cannot make the system artificially waterproof, which is why we can have a few losses or gains of water by subsurface flows. It's also important to consider that those systems are not only intended for environmental integration, but also for cultural and social integration. This is why the stream flows between different sectors are designed through a system of sluice gates, reproducing as much as possible the functioning of the rice field. For this reason, it's a system of flow control, less imprecise than what we would have in a conventional system.

And last, there's another aspect that we need to consider: we have big territories but low gradients and slopes. Therefore, it is important to consider for the design how we are going to deal with the sluice gates system, and how and where we are going to put them. All that are measures we implement in order to manage the water flows. This will have an influence at the end, and it's important to consider it.

Those treatment and environmental integration systems are designed, and until the moment they are implanted and definitely constructed it will take some time. This is due to the fact that it is a complex process with three levels: A technical level for the conception and design, an administrative level and also a social and an environmental level.

We have to consider that this is a Natural Park, member of the Natura 2000 Network, and as such it is important for the environment. But in additionally we have a lot of users, readers and institutions with various interests that we need to conglomerate in order to make them compatible, and achieve that everything works and is as operational as possible.

Here we can see the timeframe of the Albufera Sur project:

ALBUFERA SUR				
Diagnosis of the problem and definition of line of intervention: SSDAV (2002-2004).				
Project Phase	**Name**	**Developer**	**Contracter**	**Year of Completion**
Information Project	Information project on the reuse of treated wastewater in Albufera-Sur	ACUAMED	TYPSA	April 2006
Construction Project Draft	Production of the project and details of the works included in the urgent intervention 3.2.e, "Reuse of treated wastewater from Albufera-Sur", detailed in law 11/2005	ACUAMED	U.T.E SEDESA – COMSA	December 2007
Construction Project				May 2008
Start of construction: 2009 (1 year)				

Figure 2: Timeframe for the project Albufera Sur

And here the one for Sueca, which is similar to the one of the Albufera Sur Project:

SUECA				
Diagnosis of the problem and definition of line of intervention : SSDAV (2002-2004).				
Project Phase	**Name**	**Developer**	**Contracter**	**Year of Completion**
Information Project	Information project on the capacity expansion of water treatment in Sueca and resuse of waste water from the Sueca WTP (Valencia)	ACUAMED	TYPSA	February 2006
Construction Project Draft	Construction project for the capacity expansion of water treatment in Sueca and resuse of waste water from Sueca WTP (Valencia).	ACUAMED	UTE FILTRO VERDE SUECA (COPASA-LIC-PASSAVANT)	August 2007
Construction Project				May 2008
Start of construction : 2010 (1 year)				

Figure 3: Timeframe for the project Sueca

Then we are going to see a series of slides that show the changes suffered by both wetlands, the one of Sueca and Albufera Sur.

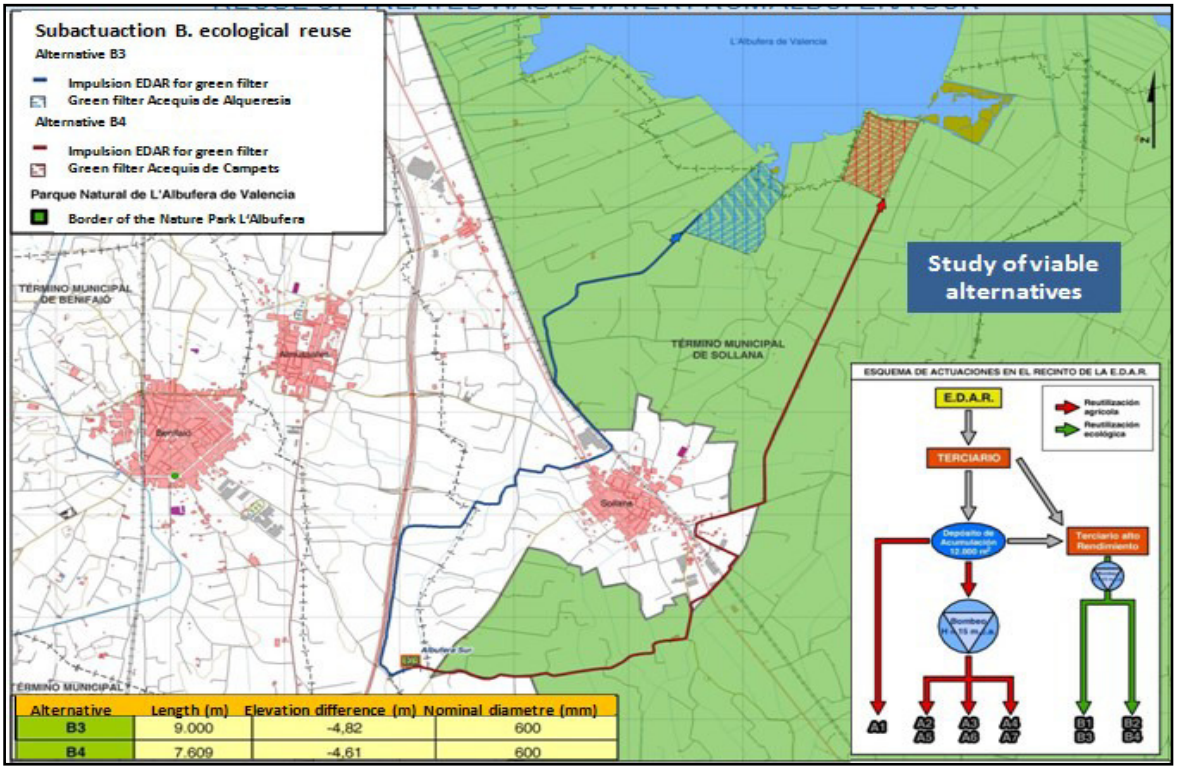


Figure 4: Studies of various possibilities conducted before the beginning of the project

About the training project to the constructions I'd like to tell you in the first place, that we did a study of alternatives in the Albufera Sur.

We have different ways to bring the flow from the Water Treatment Plant to the different alternative places that served for the constructed wetlands.

Among these alternatives, it was selected the most operational one.

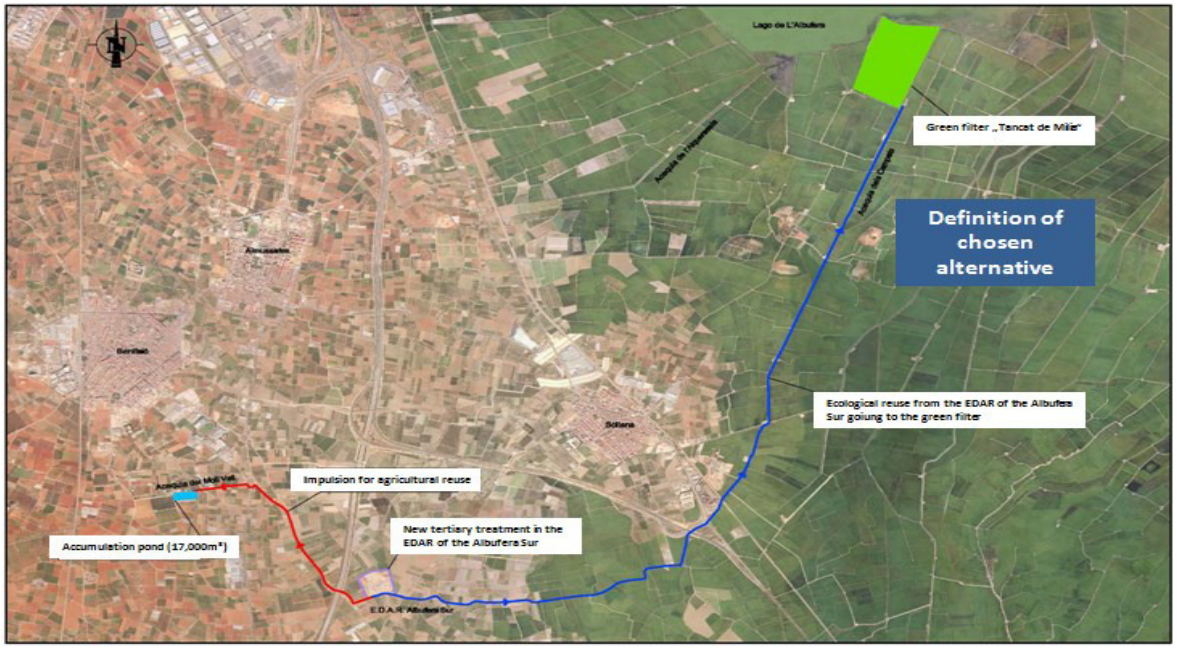


Figure 5: The selected alternative

Afterwards an in depth study was realized on the functioning of the rice field before the interventions. There was a double intention: being able to design a wetland as similar as possible to the actual way of functioning, which should consequently ensure that after the construction the impacts should be as low as possible if I can put it that way, considering that we already are in the banks of the lake.

We have a series of design criteria. It's important to consider there are no design criteria as such for constructed wetlands that are used as post-tertiary treatment. This is the reason why we had a look at past endorsed and well-known actions to elaborate criteria for the design that would be applicable to our wetland. We also started with various data that was available, like the medium flow of the treatment plant and the estimated quality at the exit of the tertiary once it's been implanted. There are also some constraints that we want to fulfill in the wetland, like its porosity and its average depth; and also some data, like for example the experimental data of necessary superficies per equivalent of inhabitant.

We started with two design hypothesis to establish the necessary superficies. The limiting nutrient in this study was the total phosphor content, considering that we have a very eutrophicated lake. Therefore, the main objective is to reduce phosphor.

We have a more idealist hypothesis, if I can put it that way, in which we establish the theoretical surface that would be necessary to eliminate all the phosphor in the system. It's obvious that it cannot be achieved, considering that a concentration will always exist at the bottom of the lake. This is why a more realistic alternative was established in which they estimated they could reduce the concentration to 0,1 mg/l. Considering the maximum theoretical surface and the surface of the second hypothesis they opted for a solution with three sectors, as we commented.

In the case of Albufera Sur, we have a sector A of subsurface flows of 4 hectares; one wetland of surface flow, which is sector B of 18 hectares and a wetland (a renaturation lagoon) of 10 hectares. These surfaces are total ones, not functional ones. Please remember that there is a factor of approximate 1.25 between this two values. Therefore, the useful surfaces are less numerous than what appears on the slide.

Figure 6: Aerial view of the Albufera Sur

On an informative level, we have an important detail of the area, which are the 3 plant profiles: a sector A, a sector B, a sector C. We´re going to go into more details later.

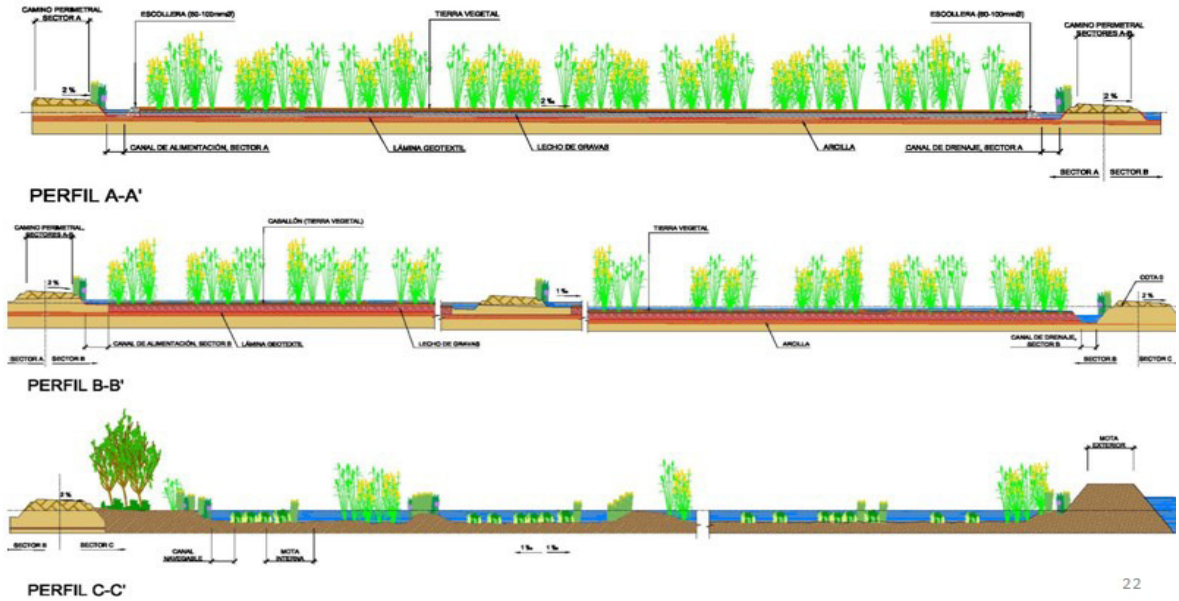


Figure 7: Plant profiles of the sectors A, B and C

In the case of Sueca the process is the same. They designed different viable alternatives, and then they defined the definitive one. They made a flow study of the rice field waters before intervention and they made the first design that we see on the coast, with the same elements than for the Albufera Sur, even though in this case the surfaces are minor.

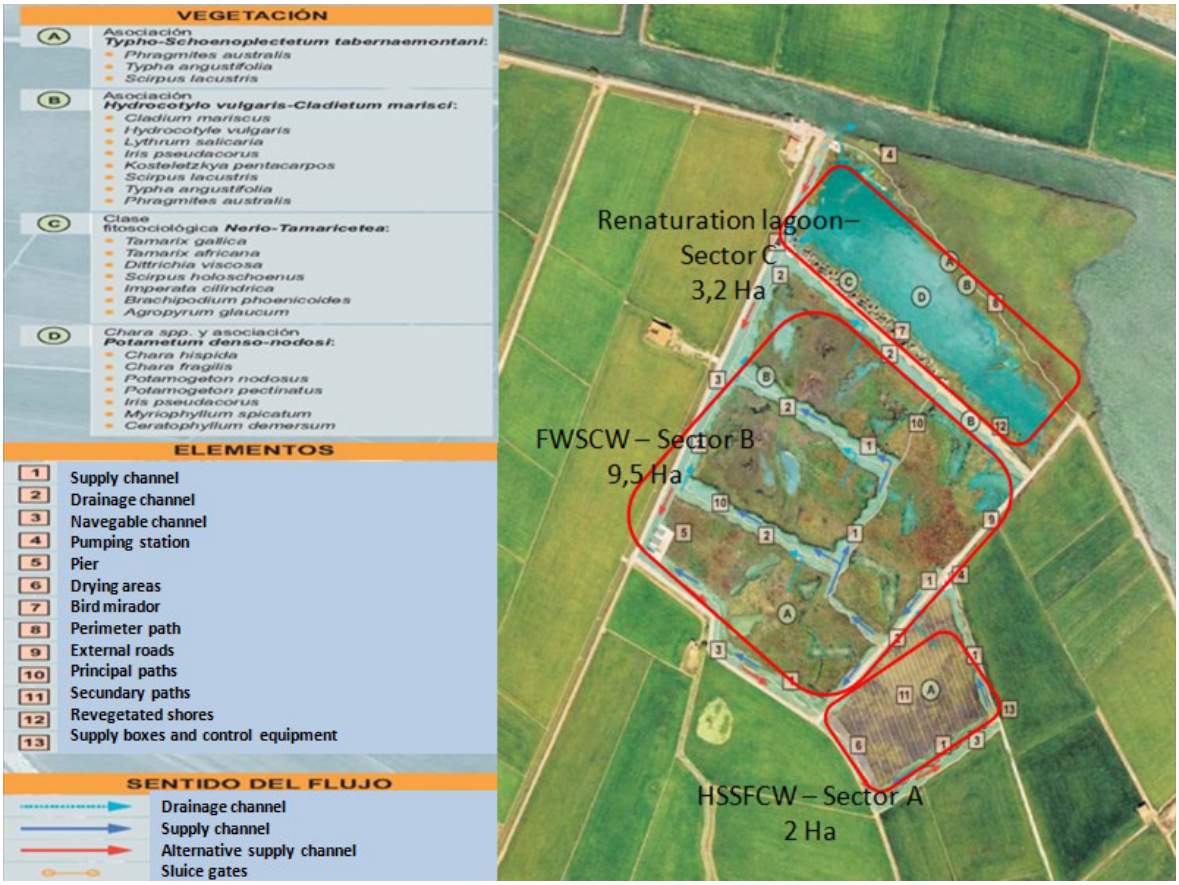


Figure 8: Aerial view of the Sueca wetland

Now we're entering the preliminary designs. Please note that in both types of wetlands, the changes in the preliminary designs are not substantial. In essence there are no big changes in the sectorization and regarding the wetland functionality it is true that it's going into more details of course, as it is proper of preliminary designs.

In the case of the Albufera Sur, it is true that they implanted more sluice gates to encourage a better sectorization of the different sectors that are part of the wetland. In the hypothetic case that we do have a functioning problem in one of the sectors, or explosion or a specific problem it would be possible to dry it out or abandon this wetland (also partially), without affecting the rest of the functioning wetland (see figure 6).

Ok, now, we have more details on the profile types, and regarding the surface wetland please note that we have an entrance channel, a breakwater that facilitates the passing of flows to the filter bed that has a slope of 2%.

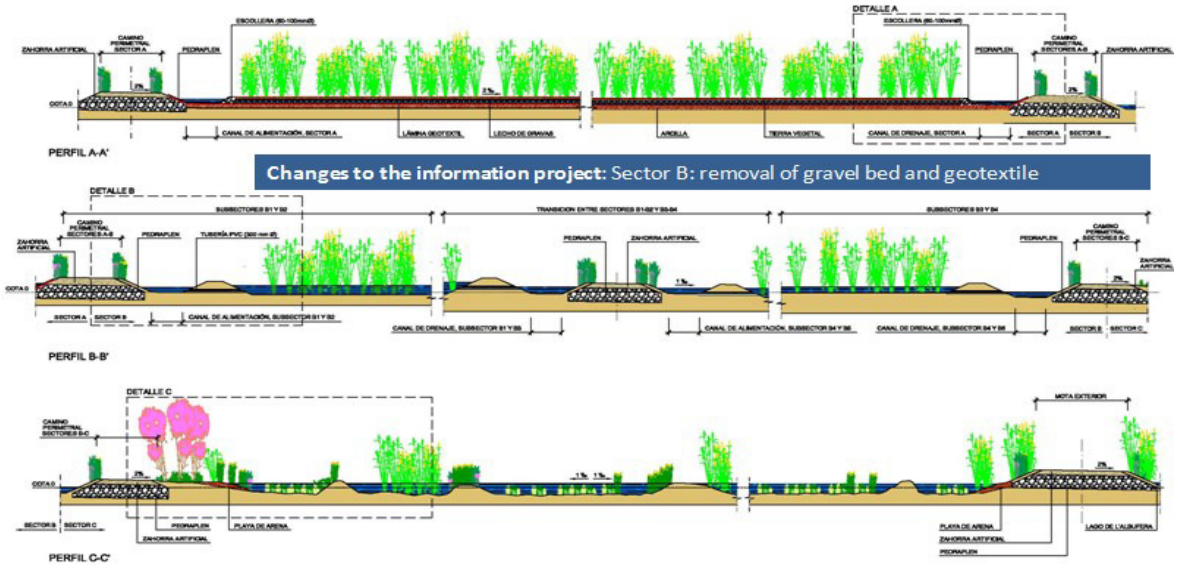
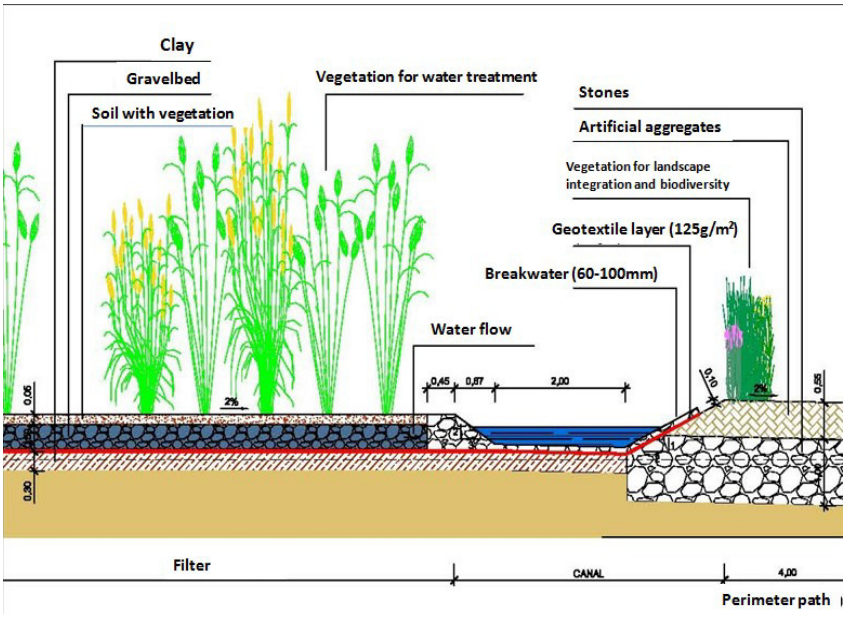


Figure 9: Profile types of the wetland

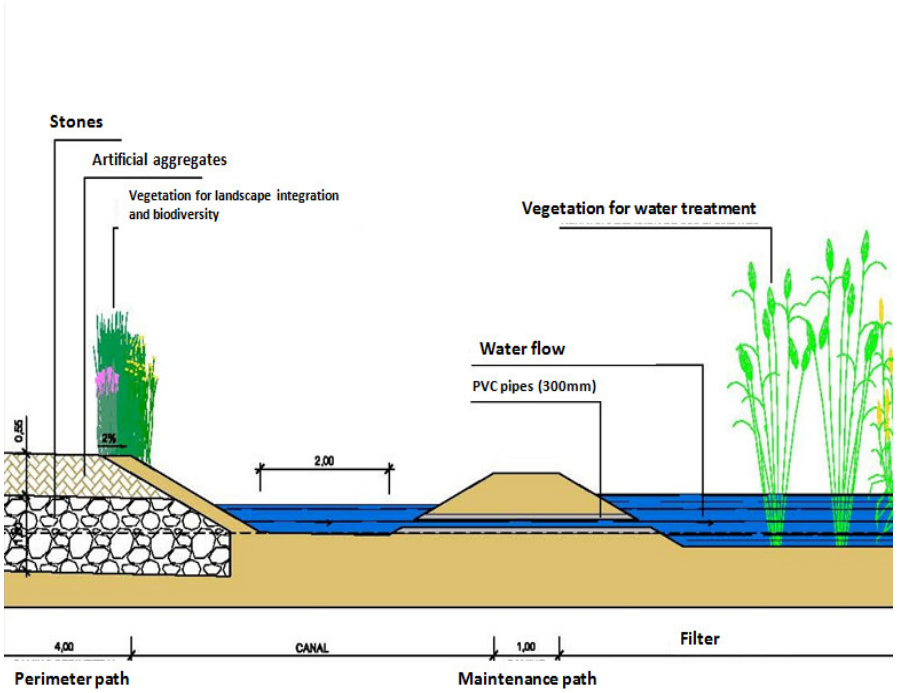
We can see it here in more details.



The section type will have a 30cm layer of clay from excavation, considering that in the natural soil of the area there is a large layer of clay at a certain depth. On top of it, we have a geotextile of 125, some experts think it is best to put a little more in the sun, but don't forget we want as much restoration as possible. Well, we thought 125 was enough. Then we have a 50cm gravel layer which diameter measures between 5 and 10mm.

Figure 10: Detailed profile view of sector A

And on top of it, a 5cm layer of loam to help grow the first roots and avoid nutrient deficits in the first steps of growing. We need to remember that these wetlands were designed to be alimented by a tertiary. This way, we avoid having nutrient deficits. To conclude, we have a breakwater. Some experts might think that it's not necessary, but we thought it is interesting having it. And last, a drainage channel. Here we have a maintenance path that delimitates the sector A, the subsurface one, with the sector B, the surface one.



Here we can see a profile, we have a slope of 1% an we can see that it's totally naturalized and there are no artificial elements, besides a leveling of the field in the construction phase, to allow a slope of 1%.

Figure 11: Detail profile view of sector B

The sector C, the most diverse sector in terms of vegetation, in order to provide a larger diversity of habitats, was designed to have an area of Taramix grove and sand to reach the growth of different vegetation. In the centre of the lagoons, there are different depth levels creating a more diverse environment, in order to get the important charales hydrophytes to come.

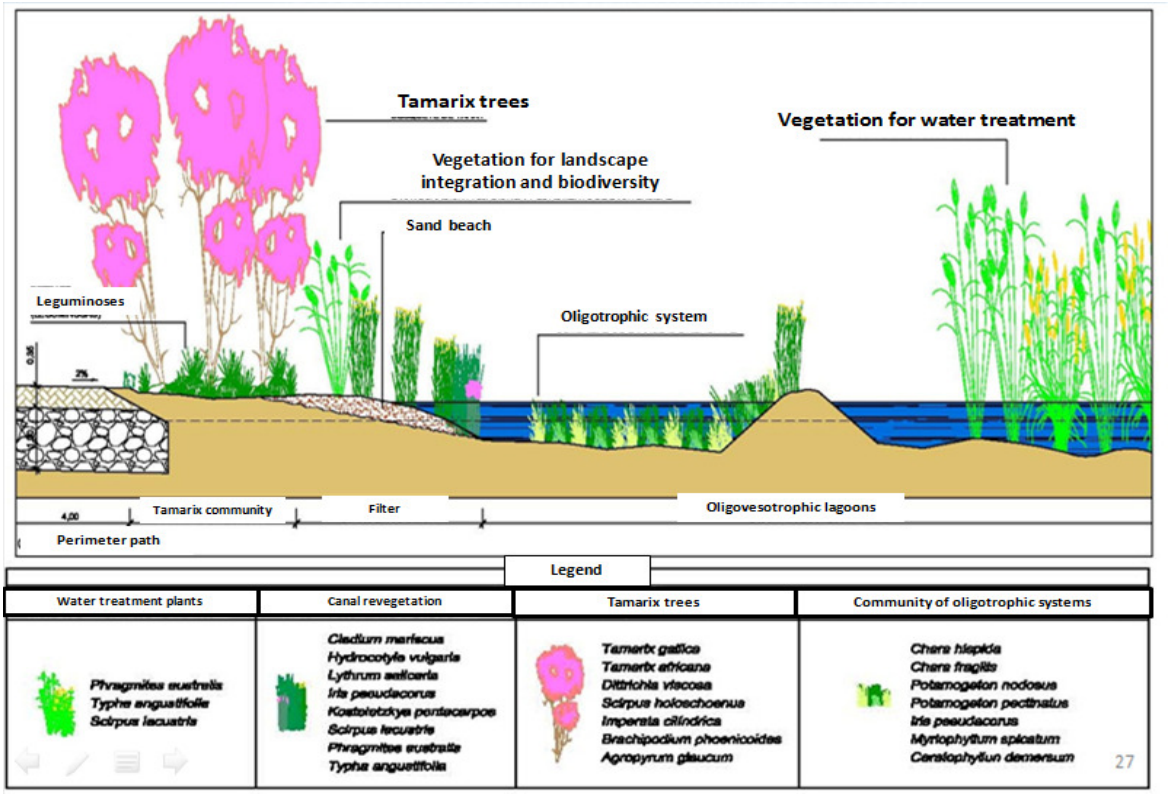


Figure 12: Detail profile view of sector C

In this project, concerning the wetland of Sueca, I wanted to say that again there are differences with the informative project in terms of number of sluice gates and other details. There are differences with the Albufera Sur, and they thought about dividing the sector B in two types of subsectors. One with the geotextile sheet and the gravel bed mixed with topsoil and the other as we have seen in the Albufera Sur. At the end, they decided they would take off both elements and leave it naturalized as it was the case in the Albufera Sur.

And to conclude, we're going to see more detailed the construction and we start with the Albufera Sur.

Figure 13: Differences between design and finally constructed version of the Albufera Sur

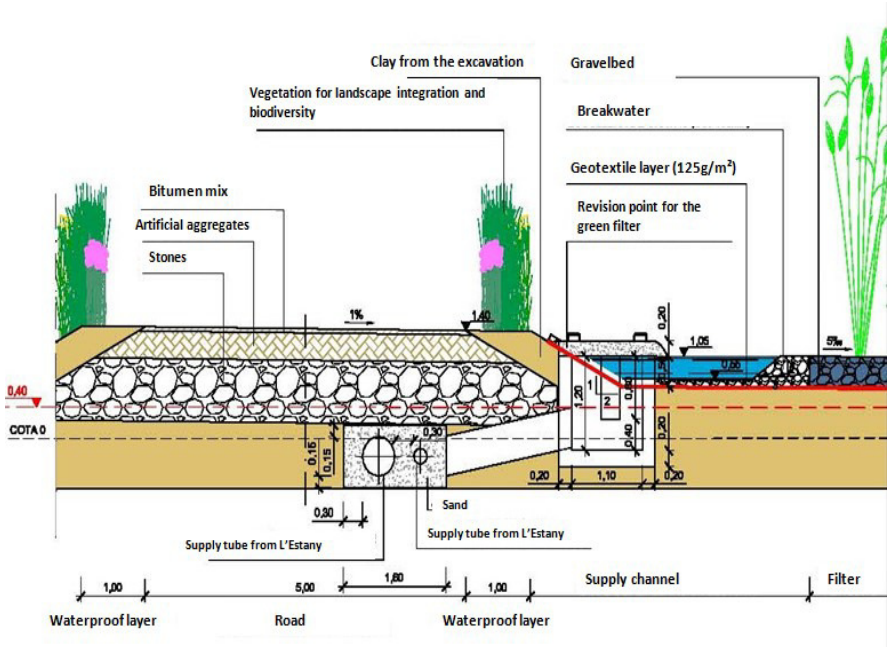
There are different meaningful changes in respect to the preliminary project. One of them is that the sector A has more independence, and also the different subsectors between themselves. In the sector B, there is a notable reduction in the number of sluice gates, leaving just one by sector, which can facilitate the management of the set of sluice gates. But maybe there is a higher versatility facing possible incidents or possible maintenance tasks with regard to what was validated in the preliminary project. And in the sector C, they opted to abandon the triple sectorization that was planned, and it was left as a unique zone of renaturation.

Concerning Sueca, some important changes were made as well, one of them is the small surface of the wetland. We can see that the result is very limited. For this reason they decided to give more space to the surface wetland and to reduce the subsurface one, which was moved from this area that I'm showing, to this one here.

Figure 14: Differences between design and finally constructed version of the Sueca project

With this, maybe it resulted a bit undersized. We'll have to analyze the data and see a little bit how it is working. There are also changes in the sluice gates system and a higher sectorization in the surface flow. Before there were four big subsectors if you remember, and now it has been divided a little more to facilitate the exploitation.

To finish, we present you some details on the construction for those interested.



For example, I can show you here the pressure breaking manhole in the case of Sueca, in which you can see the section type of pipe used for impulsion from the WTP of Sueca. And the pressure breaking manhole, the input channel of the sector A.

Figure 15: Breaking manhole in the Sueca project

Last, I want to show you what I commented upon the sector B, that finally we abandoned all the artificial elements and left the natural environment.

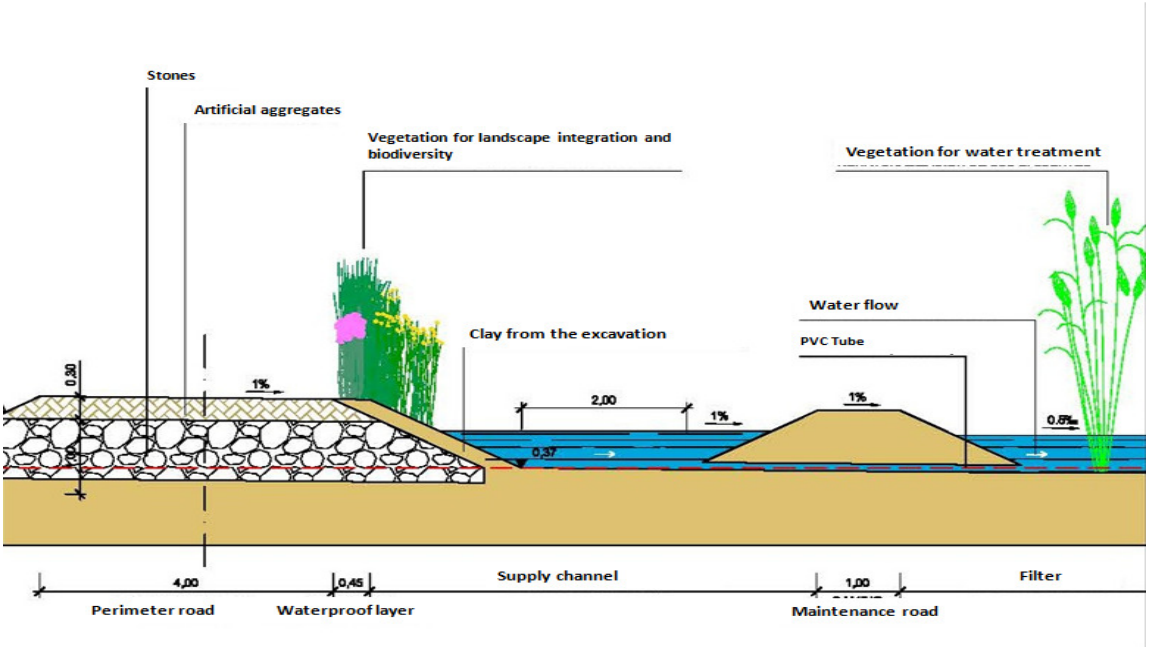


Figure 16: Changes to the Draft Construction Proposal: Removal of geotextile and gravel bed in Sector B.

On this note, I conclude this presentation. Thank you for your attention, and we stay at your disposal if you have any doubt or comments that you'd like to put in the question list. Thank you very much.

Project LIFE ALBUFERA

Integrated management of three constructed wetlands following the Water Framework Directive and the Directives concerning Birds and Habitats

Co-funded by the European Commisison under the Life+ program

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