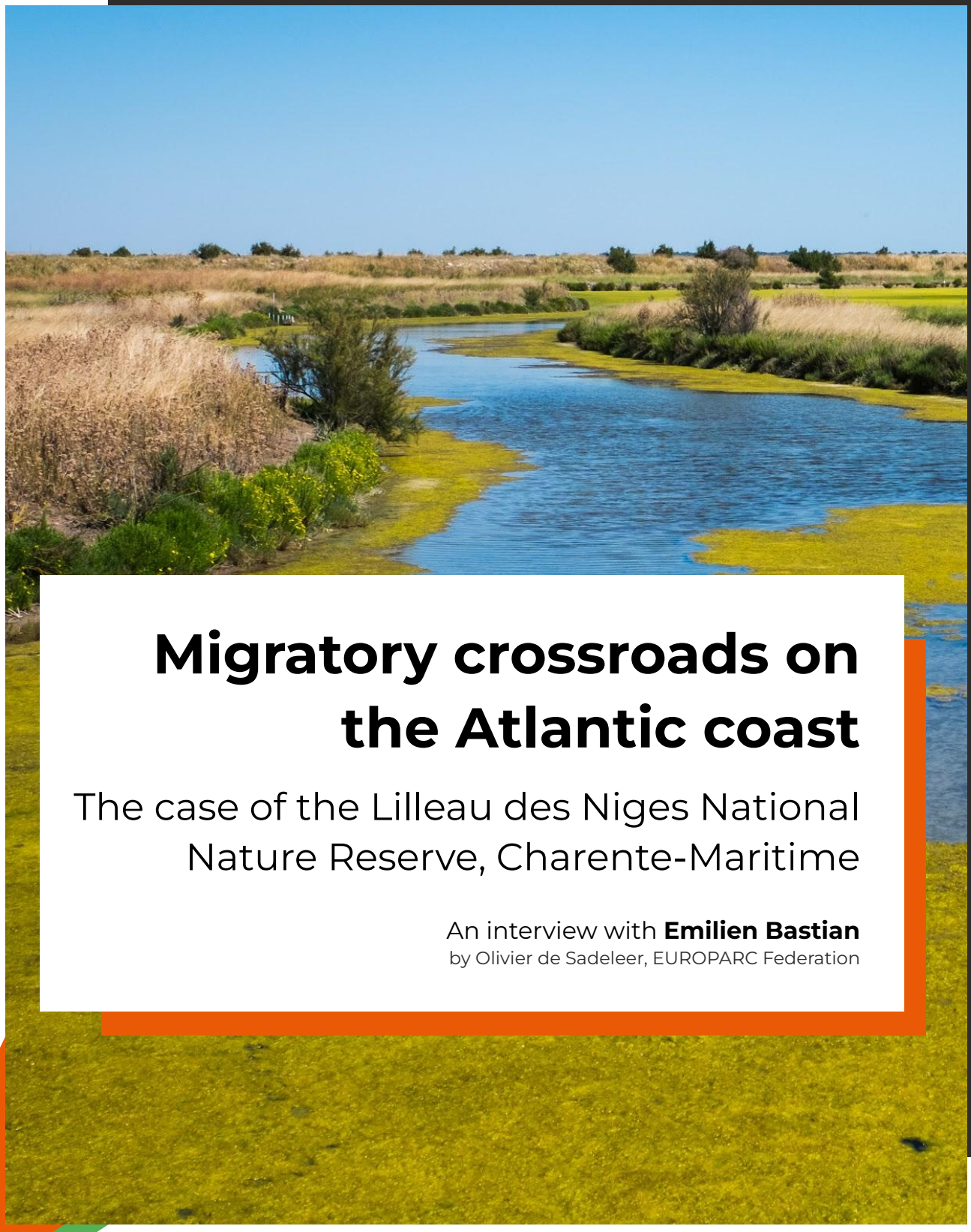
LIFE NATUR' ADAPT

Adapting to climate change in Protected Areas



Migratory crossroads on the Atlantic coast

The case of the Lilleau des Niges National Nature Reserve, Charente-Maritime

An interview with **Emilien Bastian**
by Olivier de Sadeleer, EUROPARC Federation

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Lagoons on Lilleau des Niges NNR
©David PACAUD

Salt marshes, salt meadows and mud flats on the Ile de Ré

The Lilleau des Niges National Nature Reserve (NNR) is located north of the Île de Ré, an island off the Atlantic coast. It protects the natural environments of the low-lying coast, salt marshes, salt meadows and mudflats over 235 hectares. Its mild climate and its location on a major migration route attract large populations of birds in all seasons.

The Lilleau des Niges NNR is located inside a large, almost enclosed bay, Fier d'Ars. The landscape has two main environments: former salt marshes surrounded by grassy "humps" on the land part and a succession of salt meadows and mudflats covered at high tide on the sea part. A dyke crosses the site. If it were to give way, this land part would become maritimised during high tide.

What are the main issues?

Managed by the Ligue de Protection des Oiseaux (Birdlife France), the reserve plays an important role in the conservation of migratory and wintering birds. In winter, the reserve is one of the top ten sites in France for waterfowl. At high tide, the reserve serves as a resting place for 70% of the birds wintering on Ré (numbering approximately 50,000). In spring and autumn, tens of thousands of migrating birds come to the reserve to rest and eat before resuming their journey.

What about human activities?

In order to provide a quiet area for birds, the land part is not accessible to the public. However, the water of one of the reserve's marshes is used to produce salt by a salt-maker located off-site.

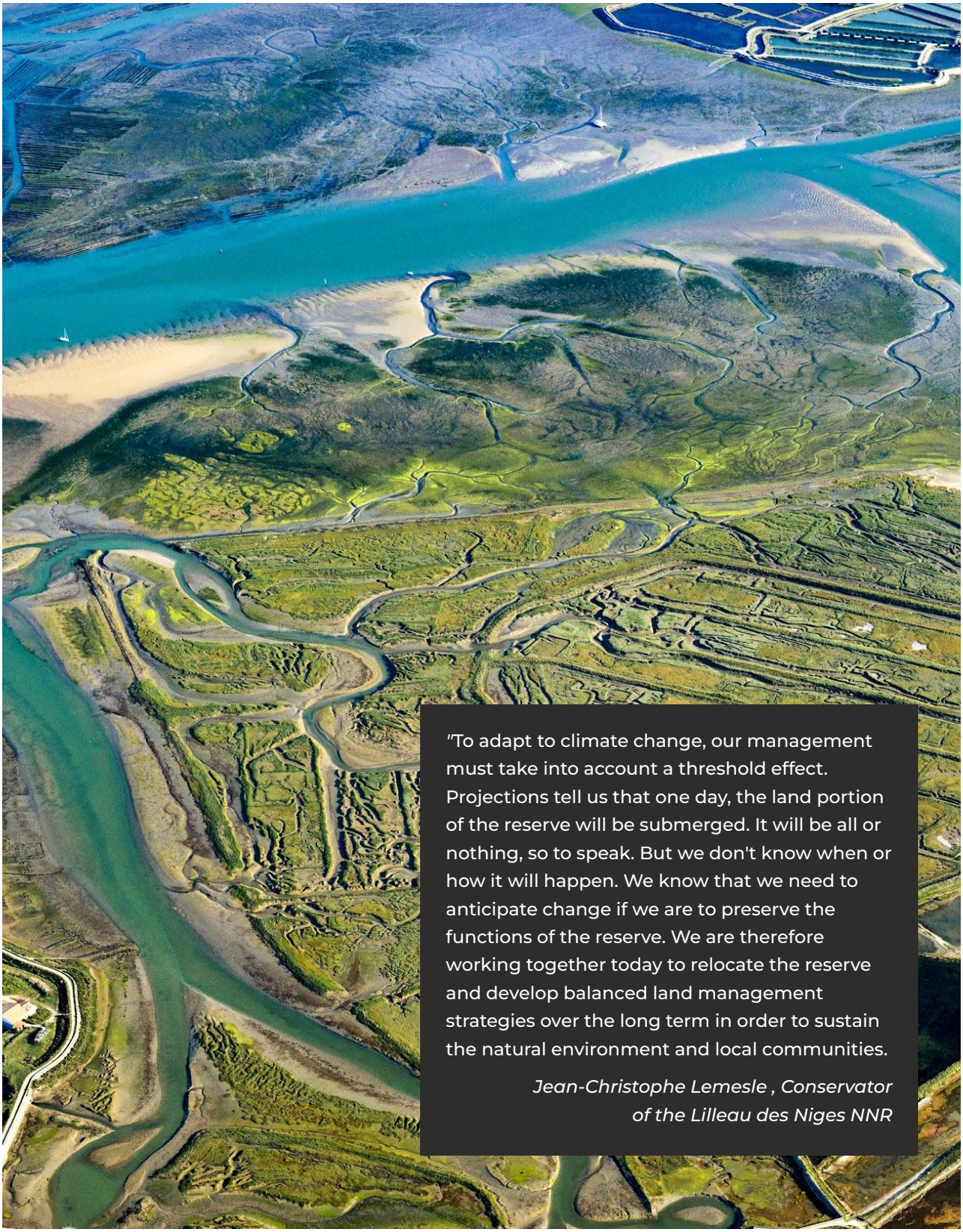
Access to the reserve is highly regulated. Only fishing on foot to collect shellfish (cockles, clams, etc.) and non-motorised navigation are authorised on a portion of the maritime area.

The island of Ré has fifteen thousand inhabitants all year round. In summer, the population can be multiplied by ten. Tourism and recreational activities on the outskirts of the site are therefore important. The "Maison du Fier" (the nature centre of the island of Ré) is located at the entrance of the reserve. At the height of the summer, more than 2,000 bicycles use the cycle path that runs alongside the site every day. Some birds still nest just a few metres away, but others are very sensitive to human presence and are only present at night.

Emilien Bastian, tell us a little about yourself.

I am 31 years old. By training, I am an agricultural engineer. I also have a master's degree in ecology from Montpellier. As part of my studies, I did internships in Kerguelen and Reunion. I worked for a few years in the food industry. Then, after a long trip to New Zealand, I returned to my first love, nature conservation.

Emilien Bastian, Project Manager, LPO / Lilleau des Niges NNR



"To adapt to climate change, our management must take into account a threshold effect. Projections tell us that one day, the land portion of the reserve will be submerged. It will be all or nothing, so to speak. But we don't know when or how it will happen. We know that we need to anticipate change if we are to preserve the functions of the reserve. We are therefore working together today to relocate the reserve and develop balanced land management strategies over the long term in order to sustain the natural environment and local communities.

Jean-Christophe Lemesle , Conservator of the Lilleau des Niges NNR

Aerial view of the maritime part of the Lilleau des Niges NNR

Rising sea levels and extreme events

According to the main scenarios, the average air and water temperatures as well as the number of hot days should increase. However, the most structuring effect of climate change for Lilleau des Niges will certainly be the rise in sea level and the number of marine submersions linked to storms surges.

How will the climate change?

Today, the climate of the island of Ré is marked by mild temperatures, less rainfall than on the mainland and an amount of sunlight similar to that of the French Riviera. To imagine the climate in the future, we have analysed the average evolution of climate indicators and their extreme values (heat waves, storms, etc.). The results of our analysis are organised in three categories.

The "Certainties"

Regardless of the model or scenario used, the local evolution of air temperatures seems to be in line with the global trend. Thus, an increase in average annual temperatures and in the number of heat waves is expected. Based on IFREMER studies, we have also identified that the temperature and acidity of sea water would continue to increase.

For the marine part, the rise in the average sea level can already be observed today. Studies show a 21 cm rise between 1860 and 2010. Measurements also show that the phenomenon is accelerating. The level rose by 10 cm between 1970 and 2010. If the trend continues, between 2010 and 2050, we will see an additional rise of 25 to 30 cm.

The "Uncertainties"

Whether in terms of cumulative rainfall or the number of rainy days, how precipitation will evolve is difficult to predict. This does not depend on the choice of the IPCC scenario, but on the model used.

Some point to a sharp increase and others a stagnation. This indicator is important for understanding the evolution of physico-chemical aspects (acidity, salinity, etc.). Precipitation has an impact on the freshwater input to the basins and therefore on the salinity that structures the habitats.

The "Unknowns"

There are two major unknowns. We do not know how the winds will evolve, and more specifically the number of days when the wind speed will exceed 100 km/h. This is useful for understanding the evolution of the frequency and power of storms. These are significant elements in the maritimisation process. The other unknown is the number of sunny days per year. However, this is less problematic for our analysis, because this factor does not influence adaptation planning much.

Will you be monitoring developments locally?

We will continue to monitor data from nearby weather stations with experts over a 10-year period. We are interested in trends, and these can only be seen over long periods of time.

Climate projections

Warmer air and water

Sea level + 25cm by 2050 and more frequent flooding

©RLilleau des Niges NNR

Vulnerability assessment

Ecosystems vulnerable to maritimisation

Although the time scale and process are uncertain, the risk of maritimisation is clear. Submersion will strongly disrupt the structures and ecological functions of the environments. The lagoons are at risk of disappearing. In that case, they would no longer fulfil their functions as resting and nesting areas for birds or as nursery areas for eels.

To understand the vulnerability of the reserve, we analysed the effects of expected climate change on bird populations and different habitats, such as lagoons (dyked salt marshes), salt meadows and mudflats. The analysis of all these suggests the terrestrial parts are highly vulnerable.

The **terrestrial part** of the reserve is the most vulnerable. The risk is essentially linked to marine submersion, which would cause the disappearance of lagoon habitats and their functions for the various species. Today, the site offers the possibility for birds (terns, stilts, small waders, gulls) to feed on the foreshore and to rest or nest on the land part.

How to predict flooding

To understand the impact of a sea level rise on the reserve, we created a simple model. We took the dyke heights and in particular the lowest points. We then took the maximum water heights recorded at high tide over the last 10 years. When we compare these data and assume that the dyke holds, the rise in sea level would produce an overflow in the short term at least once a year. By 2100, it could be once a month.

This analysis therefore confirms our intuitions, especially since we now know that the linear dyke that crosses the reserve and protects the lagoon will not be maintained. On the other hand, it is impossible to know with certainty when or how the flooding will take place.

For the future, we envisage two scenarios:

- As long as the dykes are maintained, the site will see little change or none at all;
- When the dykes are no longer sufficient, the land area will either be submerged by 2050 due to the average and progressive rise in sea level, or it will be submerged in stages, depending on the strength and frequency of the storm surges.

In the case of maritimisation, the ecotone will move "upstream". We can imagine the future of the terrestrial part by observing what happened on the area of the island that was depoldered 150 years ago.

Before that, several phenomena are likely to occur in parallel. Longer periods of drought will increase the eutrophication of aquatic environments and affect species dependent on these biotops and the food webs of which they are part. For nesting birds, heat waves can cause nest abandonment and increased chick mortality.

These various phenomena are likely to have negative consequences on the area's natural heritage and diversity. By losing the lagoons, the reserve will no longer be able to fulfil its functions as a resting and nesting area for birds and as a nursery for eels. And neither will it be able to support the tolypella salina, a very rare aquatic plant species specific to certain marshes.

The **maritime part** is less vulnerable. Of course, there are variations depending on the elements analysed. In general, it has a greater capacity to adapt. The example of the salt meadow located in front of the dyke is telling. Although it will be flooded more often with salt water, its level will remain relatively stable thanks to the phenomenon of sedimentation. Hence, it should be able to continue to fulfil its function as a feeding area for birds.

Who did you collaborate with in this work?

This prospective work was carried out in parallel with the renewal of the management plan. The reserve's management team was central. We also worked with experts and involved them on an *ad hoc* basis, on the natural heritage, the response of species to climate change and on how to integrate adaptation into the regulatory framework. We went to five different types of stakeholders to understand their perceptions of the vulnerability of salt production, water sports and fishing activities. The results of the climate analysis were presented to the advisory committee. We will also present them with the results of the vulnerability analysis and the adaptation plan when they are ready.

Lagoons on Lilleau des Niges NNR ©David PACAUD

Adaptation plan

Anticipating maritimisation and relocating the reserve

The key measure is to work from now on to relocate the terrestrial part of the nature reserve so that its main functions are ensured in the future. This is important for a site like Lilleau des Niges, because it promotes the conservation and adaptation of many species.

What are the main adaptation measures that you have chosen?

The main strategic axis for conservation is to adapt in order to maintain the biological diversity and functions of the reserve in the future.

Since the site is vulnerable to flooding, it will not be possible to do this within the current boundaries so our flagship measure is to look for a site to relocate the reserve. We are working with the local authorities to select a new site. We have presented them with the results of our climate change adaptation plan and described the qualities of the ideal site.

For the part related to biological issues, we will document maritimisation in due course and establish a monitoring protocol.

Finally, it is important to anticipate the effect of maritimisation on our own tools and infrastructure. We decided to stop grazing on the site and to dismantle related infrastructure. This process was done slowly at first, but it was accelerated by the climate projections.

How will you measure the effects of these measures?

These actions will be integrated into the management plan and will be monitored in the same way as other conservation actions. Precise indicators have not yet been defined at this stage.

Black-tailed godwit roost - ©RLilleau des Niges NNR

A little advice for the road?

Don't hesitate to get started. In any case, it is interesting and beneficial. It is an opportunity to step back and take stock of the conservation of the site and its management, now and in the future. This approach allowed us to question ourselves, to change certain aspects of our current approach and to strengthen others. At Lilleau des Niges, the results made it possible to formalise and argue for the idea of relocating the terrestrial part of the reserve. These results strengthen the conservator's position, and offer him new opportunities to work with stakeholders.

The marshes of the Lilleau des Niges NNR at dusk ©David PACAUD

To go further:

1. [English] Summary - Vulnerability assessment and adaptation plan >>
2. [French] Lilleau des Niges Nature Reserve website >>
3. [French] Diagnosis of the vulnerability of the Lilleau des Niges National Nature Reserve. BASTIAN E. et al., 2020. LIFE Natur'Adapt - LPO reports. 85p. >>
4. [French] Adaptation plan for the Lilleau des Niges National Nature Reserve. BASTIAN E. et al., 2020. LIFE Natur'Adapt - LPO reports. 31p.>>
5. [French] The Lilleau des Niges Nature Reserve facing climate change. LPO - 2021. Video - 1min40 >>

LIFE NATUR'ADAPT

A collective learning process on climate change adaptation in Protected Areas.

In Europe, Réserves Naturelles de France, EUROPARC and eight partners have come together in this LIFE Climate Action project to transform this challenge into an opportunity to innovate. Natur'Adapt aims at triggering a transition towards the adaptive management of protected areas while laying the foundations of a dynamic collective learning process.

www.naturadapt.com

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