LIFE NATUR' ADAPT

Adapting to climate change in Protected Areas

A forest in free evolution

Forêt de la Massane National Nature Reserve, Pyrénées-Orientales

An interview with **Kenzo Héas**
by Olivier de Sadeleer, EUROPARC Federation

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La Massane, a freely evolving forest ecosystem

The Massane forest has not been exploited for over a century. It is an open-air laboratory on the functioning of forest ecosystems. The processes of life and death take place freely. This beech forest is one of the last 40 old forests in the Mediterranean.

The Forêt de la Massane National Nature Reserve (NNR) covers 336 hectares, between 600 and 1,150 metres in altitude. It is located in the eastern part of the Albères massif, in the Pyrénées-Orientales in France.

The reserve is known for its "old forest" of beech trees. It is located on the southern limit of the species' range. Several ambitious research programmes are under way in the reserve to monitor the evolution of this rare ecosystem. It also hosts a riparian forest and aquatic environments linked to the Massane coastal river, which flows into the Mediterranean at Argelès-sur-Mer. The reserve is home to extensive herds of cows that graze freely during the summer months. They help maintain semi-natural grassland habitats on the ridge. There is a high level of tourism. The famous long-distance hiking route (GR 10) passes along the border of the reserve. Seaside tourism on the nearby Côte Vermeille attracts many people in the summer.

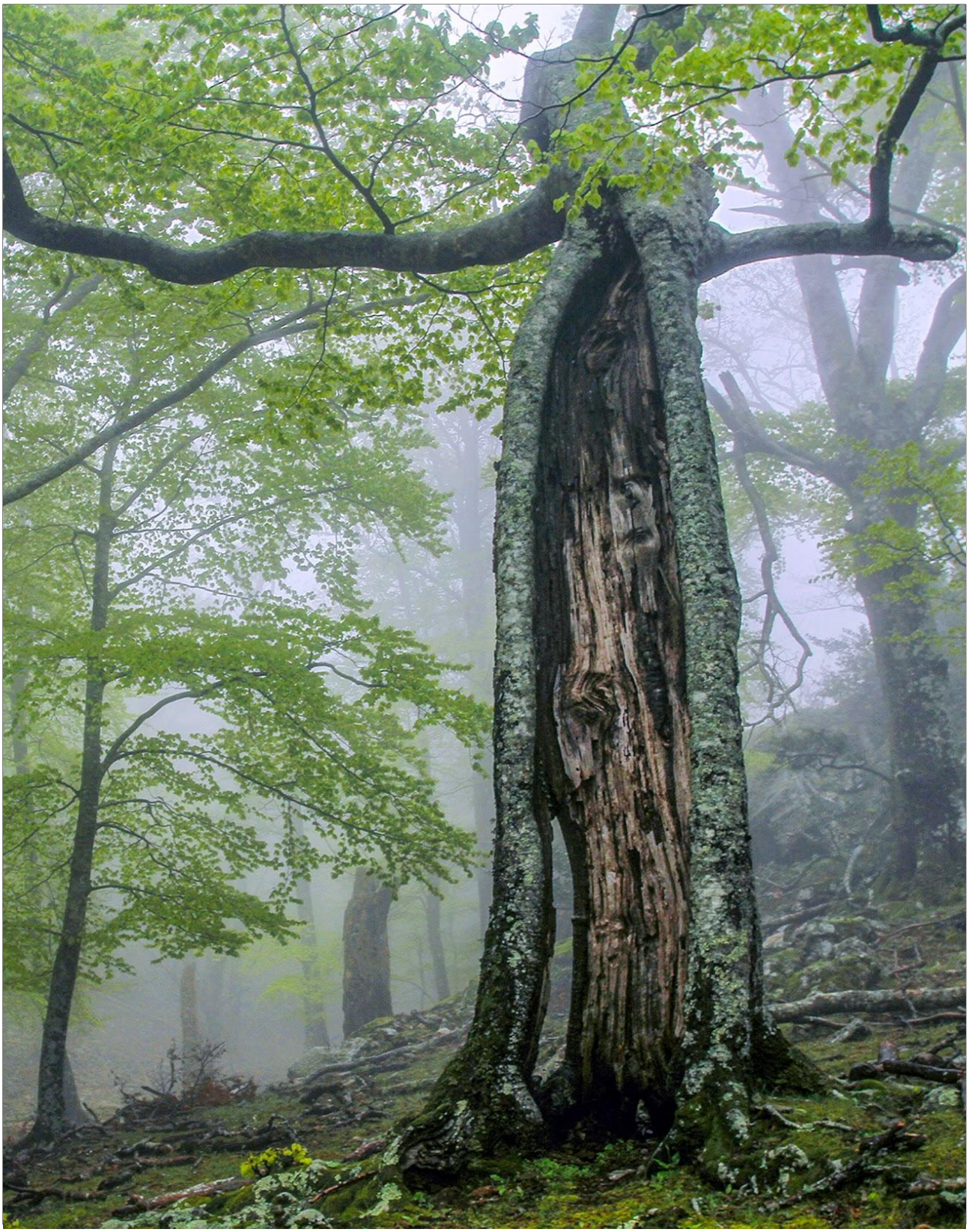
Kenzo Héas, tell us a little about yourself

Hello, I am a project manager at the Federation of Catalan Nature Reserves (FRNC). I am 24 years old. I have a university degree in geography. I am passionate about climbing and particularly demanding routes such as the Cima della Madonna in the Dolomites. While contributing to the adaptation process of La Massane, I was very interested in developing a systemic understanding of nature and its management. Considering the functionality of ecosystems and the interactions between different biotopes is exciting.

Who did you work with on carrying out this adaptation planning?

I worked with the FRNC team and in particular scientific coordinator Céline Quélennec, and Joseph Garrigue, conservator of the La Massane NNR. In order to understand climate change and prospective models, I cooperated with the Observatoire Pyrénéen du Changement Climatique (OPCC) and the Réseau d'Expertise du Changement Climatique en Occitanie (RECO). To define the strategic axes of the adaptation plan, we worked with the municipality of Argelès-sur-Mer. The next step will be to cooperate with farmers to implement adaptation measures.

Kenzo Héas, Project Manager
Federation of Catalan Nature Reserves



© Diane Sorel, La Massane NNR

A warmer, drier and more extreme climate

Climate monitoring has been in place for more than forty years. It shows that annual average temperatures have been increasing, and average precipitation has been decreasing. Projections show that this trend will intensify. It is also likely that weather patterns will change and the number of extreme weather events will increase. But this is difficult to predict.

What is the current climate like?

Currently, La Massane has a Mediterranean climate characterised in the region by intense summer droughts, strong winds and episodes of intense rainfall in the autumn.

And in the future?

To understand the climate of the reserve, we are fortunate to have data collected over decades by a weather station located in La Massane. It has been recording rainfall since 1961 and temperatures since 1976. It is striking that we can already observe climate change over this period. Average annual rainfall has decreased by 150 mm in 60 years. The average annual temperature has increased by 1.5°C in 45 years. The river's flow has also decreased.

Climate projections for 2100:

+ 5°C

- 100 to 200mm

+ extreme

The IPCC offers interesting global scenarios to foresee possible future climates. On the reserve, I especially needed to understand the average temperature and precipitation evolution, but also the evolution of extreme events. To do this, I mainly used climate data and services provided by Météo France.

The climate projections that we used as a basis for our prospective work are that by 2100:

- the average annual temperature is likely to increase by 5°C;
- the average annual rainfall will decrease by another 100 to 200 mm.

In parallel with these changes, a **sharp increase in extreme weather events** is expected. Specifically, we expect an increase in the number of heat waves and the number of hot days on the one hand, and an increase in the number and violence of storms on the other. Unfortunately, it is very difficult to predict these extreme one-off events. To my knowledge, we are not able to model them today.

Photo: Diane Sorel, RNN La Massane

Droughts, floods: towards an erosion of life

Changing climate conditions will reinforce the existing fragility of ecosystems, and reduce their capacity for regeneration. Preserving the water cycle and soil quality will be central to sustaining the resilience of the biosphere. Developing an integrated approach is therefore crucial.

Our analysis showed that the most vulnerable elements are: the beech forest ecosystem, water-related species and habitats, and pastoralism. In short, future climate conditions will further exacerbate ecosystems' current fragility. In addition to natural pressures, there are strong local anthropic pressures, such as tourism and extensive pastoralism. It is therefore crucial to anticipate and adapt where possible. The most likely scenario is that we will see an increase of prolonged drought events followed by violent storms. These Mediterranean rainfall episodes are already known locally. It is their frequency and violence that is likely to increase. The consequences of this phenomenon are accentuated by the steep terrain of this mountainous area. In concrete terms, the capacity of the soil to absorb and store water is reduced by drought, over-frequentation and over-grazing. During heavy rainfall, water run-offs onto hardened and poorly vegetated soils cause severe erosion and mudflows. The river and associated environments are faced with very intense flows and a sediment overload. If these episodes are repeated too often and/or are too violent, the natural systems will not have time to regenerate and may be destroyed. Last but not least, as the lower part of the river is very artificial, the risk of flooding downstream increases.

Have you assessed the vulnerability of protected species?

Yes, indirectly. We have chosen to work at the scale of the habitat (the forest, the grassland, the riparian biotopes); groups of species (saproxylic species, aquatic species, etc.); and processes (the water cycle, plant succession, pastoralism, etc.).

The **beech forest** is vulnerable because it is very sensitive to water stress. Trampling and grazing of the undergrowth reduces its regeneration capacity and the ability of the soil to absorb and store water. Furthermore, in a warmer and drier climate, holm oak and cork oak are likely to move up in altitude and compete with beech.

Although dependent on pastoralism, the **semi-natural grasslands** on the ridge are threatened by drought, soil erosion and overgrazing by large numbers of extensive livestock. Changing climate conditions will further exacerbate this fragility by reducing the ability of the grasslands to regenerate from one season to the next.

The impacts on **aquatic environments** are numerous. The decrease in flow may lead to asphyxia of the environment. The increase in water temperature will disrupt the physico-chemical conditions of the water, which may no longer be suitable for many aquatic species.

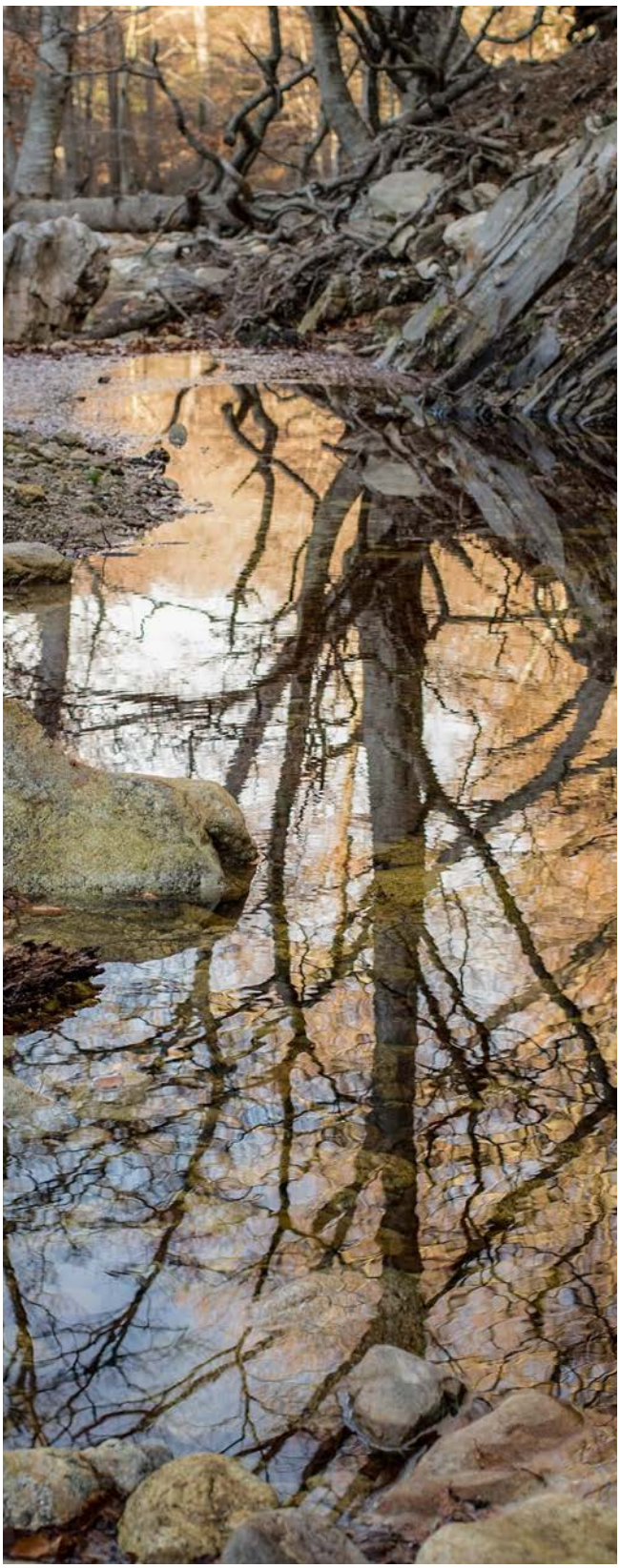
Entire species groups are at risk of disappearing. Flash floods and mudslides will destroy aquatic habitats, forcing an ecological reset. If their frequency increases, regeneration capacity is likely to be weakened.

Negative chain effects and erosion of **local biodiversity** are expected. As the main habitats of the reserve are vulnerable, so are many native species, such as green and black woodpeckers and amphibians.

And what about the territory in which La Massane is located?

We also looked at the socio-ecosystem around the reserve. We did not carry out a specific vulnerability analysis. In addition to tourist and pastoral activities, the reserve is connected to the urban agglomeration of Argelès-sur-Mer on the coast. Being located at the head of the catchment area, we assessed the consequences of the health of the reserve's environments downstream. The climate projections highlight strong and repeated risks of flooding. The village of Lavail and entire districts of Argelès-sur-Mer are at risk of being flooded by mudslides. This phenomenon is reinforced by the strong artificial development of the banks in the lower part of the river and the estuary.

In the future, it could also be interesting to work with the marine reserves to understand the impact of the increased sediment load at sea.



High-quality soils for greater resilience

Our strategy is to improve the resilience of forest, riparian, aquatic and grassland ecosystems. By better managing human pressures, we aim to improve the ecological richness and therefore the water absorption and storage capacity of the reserve's soils and habitats. This should help slow run-offs down.

This adaptation strategy is close to our current management plan. We will maintain free-evolution management for the forest. We want it to be as ecologically rich as possible to improve its resilience. The main challenge is to maintain its ecological functionality. By better managing anthropic pressures, hence reducing erosion, we can increase soil permeability and increase the vegetation of the undergrowth. We hope to increase the amount of water in the reserve to cope with periods of drought and to act as a buffer to protect the downstream area in the event of storms and flash floods. We also want to encourage the development of seedlings and young trees to rebalance the age pyramid of the forest stand.

In concrete terms, we will work with users and the municipality to reduce existing anthropogenic pressures. Free-range grazing increases the vulnerability and risks of flooding of the inhabited areas downstream. Sound herd management is central. After presenting the different scenarios to the municipal councillors, they opted for improved management of pastoralism in the interest of the reserve and the municipality. We are currently looking for solutions to hire a shepherd who would keep the herd, prevent it from entering the beech forest and respect the defined grazing areas for the ascent to the summer pastures on the ridge.

Other options that we need to consider with the farmers are to reduce the number of animals or the duration of the summer pasture, to multiply water points and to actively repress illegal grazing by "free" herds coming from neighbouring valleys. Tourist activities will be channelled around the reserve to avoid mechanical erosion and trampling. It has been confirmed that the reserve is not intended for tourism. In order to protect the forest floor, these recreational activities will be concentrated on the Massane Tower path and the GR10 on the edge of the reserve.

How will you measure climate change and the effects of these adaptation measures?

The reserve's role as a centre for applied research and forest observatory will be maintained and strengthened. The climate change component will be integrated at all levels. In concrete terms, we will continue to monitor indicators of the effects of climate change on the reserve's conservation issues. Our adaptation process has shown that the issue of water and the soil’s absorption and retention capacity are central. We plan to install piezometric measuring instruments to monitor the state of the water table.

A little advice for the road?

In a prospective approach and vulnerability assessment, it is not necessarily easy to work at species level. They are too numerous and sometimes hide the importance of the processes that link them. Hence, **we have chosen to work at the scale of groups of species, habitats or processes.** The priority now is to promote the adaptability and resilience of living environments. I am particularly proud of this work, because this adaptation process has made it possible to imagine the future and to initiate, at La Massane NNR, the development of a more integrated approach to nature conservation and regeneration.

Further Reading

1. [English] Summary - Vulnerability assessment and adaptation plan >>
2. [French] Website of Forêt de la Massane NNR >>
3. [French] Website of Fédération des Réserves Naturelles Catalanes (FRNC)>>
4. [French] Complete assessment and adaptation plan of La Massane NNR >>
5. [French] Climate services of Météo France >>
6. [French] “Une forêt, le climat : services et changement”. Film by Camille Binda, La forêt de la Massane NNR >>

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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