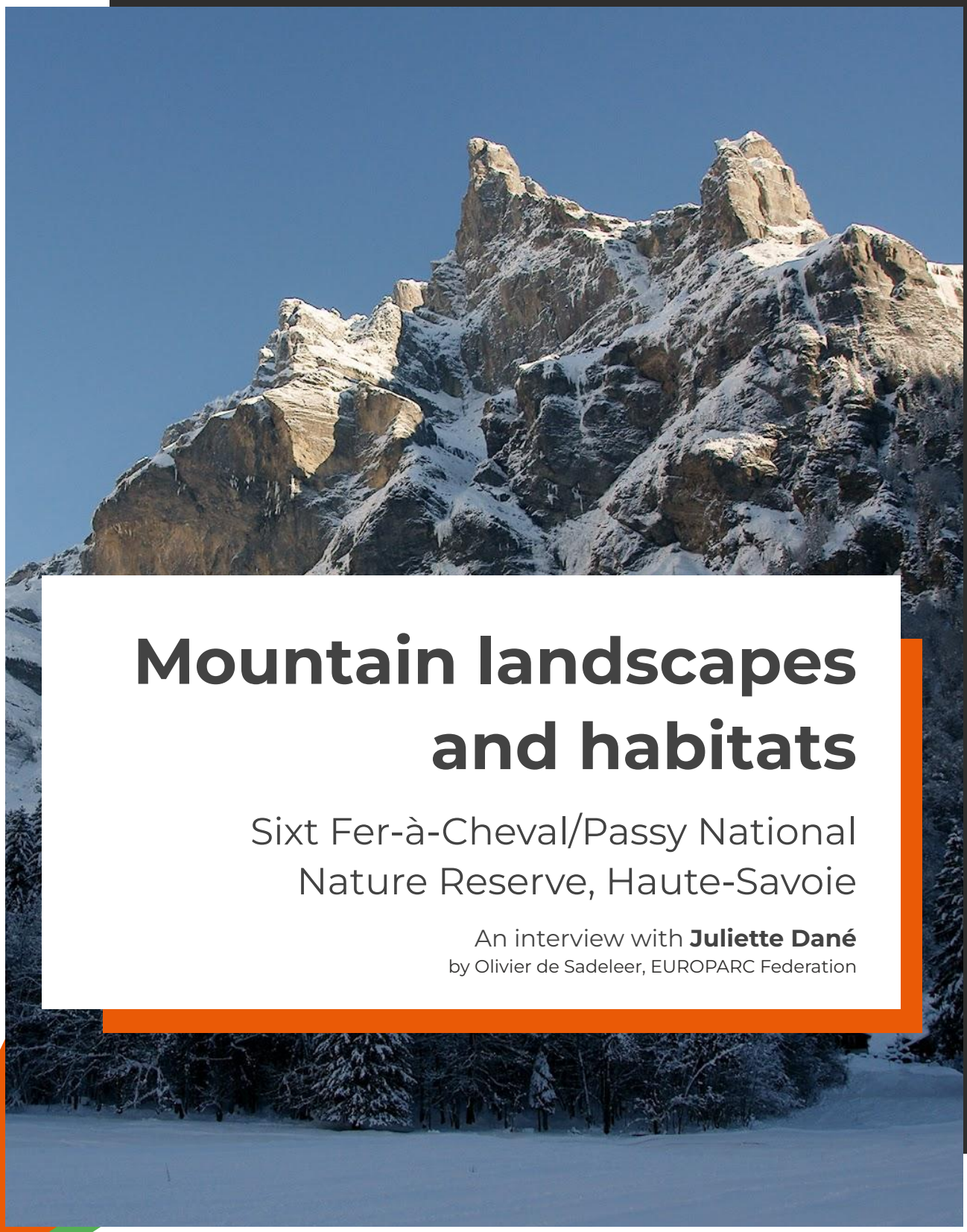
LIFE NATUR' ADAPT

Adapting to climate change in Protected Areas



Mountain landscapes and habitats

Sixt Fer-à-Cheval/Passy National Nature Reserve, Haute-Savoie

An interview with **Juliette Dané**
by Olivier de Sadeleer, EUROPARC Federation

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Sixt-Fer-à-Cheval Passy NNR in winter © Julien Heuret

Sixt Fer-à-Cheval-Passy, mountains in all their states

The Sixt Fer-à-Cheval Passy Nature Reserve in Haute-Savoie is incredible in its diversity. It covers more than 9,000 hectares over an altitudinal gradient of over 2,000 metres. All mountain vegetation levels can be found there, together with the associated ecological processes and human activities.

The Sixt Fer-à-Cheval-Passy National Nature Reserve was created in 1977. It is located on the Swiss border, in the Haut-Giffre massif in the northern Alps. Over an area of 9,000 hectares, the reserve covers a wide altitudinal gradient, from 900 to 3,000 metres above sea level. It therefore contains representative habitats of all mountain levels. The entire range of mountain ecological processes can be observed on one site. There is also a great variety of species and a remarkable habitat mosaic, including 17 of community interest. The site hosts, among others, emblematic species of the Alps such as the Bearded Vulture (*Gypaetus barbatus*) and the Ptarmigan (*Lagopus muta*), for example. The Grey Wolf (*Canis lupus lupus*) is slowly recolonising the Alpine range, and it has been seen in the reserve since 2019. It is also possible to observe more common species such as the Golden Eagle (*Aquila chrysaetos*), the Chamois (*Rupicapra rupicapra*) and several rare or endangered species such as the Parnassius Apollo and the Black Salamander (*Salamandra atra*). The reserve is managed by ASTERS, the *Conservatoire des Espaces Naturels* (CEN) of Haute-Savoie. The main objective is to find a balance between the preservation of this rich and vulnerable natural heritage and human activities (pastoralism, tourism, etc.). Forestry and farming still take place in the reserve. The beech and spruce forests are exploited, and sheep, cattle and goat herds graze in the summer. People may also hunt or take part in sports set in nature such as mountain biking, canyoning, hiking, skiing, climbing, etc.

Juliette, please say a few words about yourself.

Hello, my name is Juliette Dané. I am 28 years old. I grew up on the edge of the Port-Royal Forest, in the Paris region. I lived my everyday life in an urban environment. When I was young, my parents took me on several trips to the Queyras massif in the Hautes-Alpes. It was there that I fell in love with the mountains. It remains my *madeleine de Proust*. I studied Political Science in Toulouse, with a focus on "Risks, science, health and the environment". When I'm not busy trying to "save the world", I like to take time to roam. I love backpacking and discovering the world.

Juliette Dané, Project Manager, ASTERS, CEN Haute-Savoie

Massif des Fiz and Lake Anterne
© Julen Heuret

Climate projections

Towards a climate similar to that of the Southern Alps?

In 2100, the average summer and winter temperatures are projected to be the same as those observed in the Southern Alps today. The development of precipitation is uncertain. Snow cover and glaciers will be affected. It is likely that the current snow glacier hydrological regime will become a pluvio-nival regime.

How will the climate change?

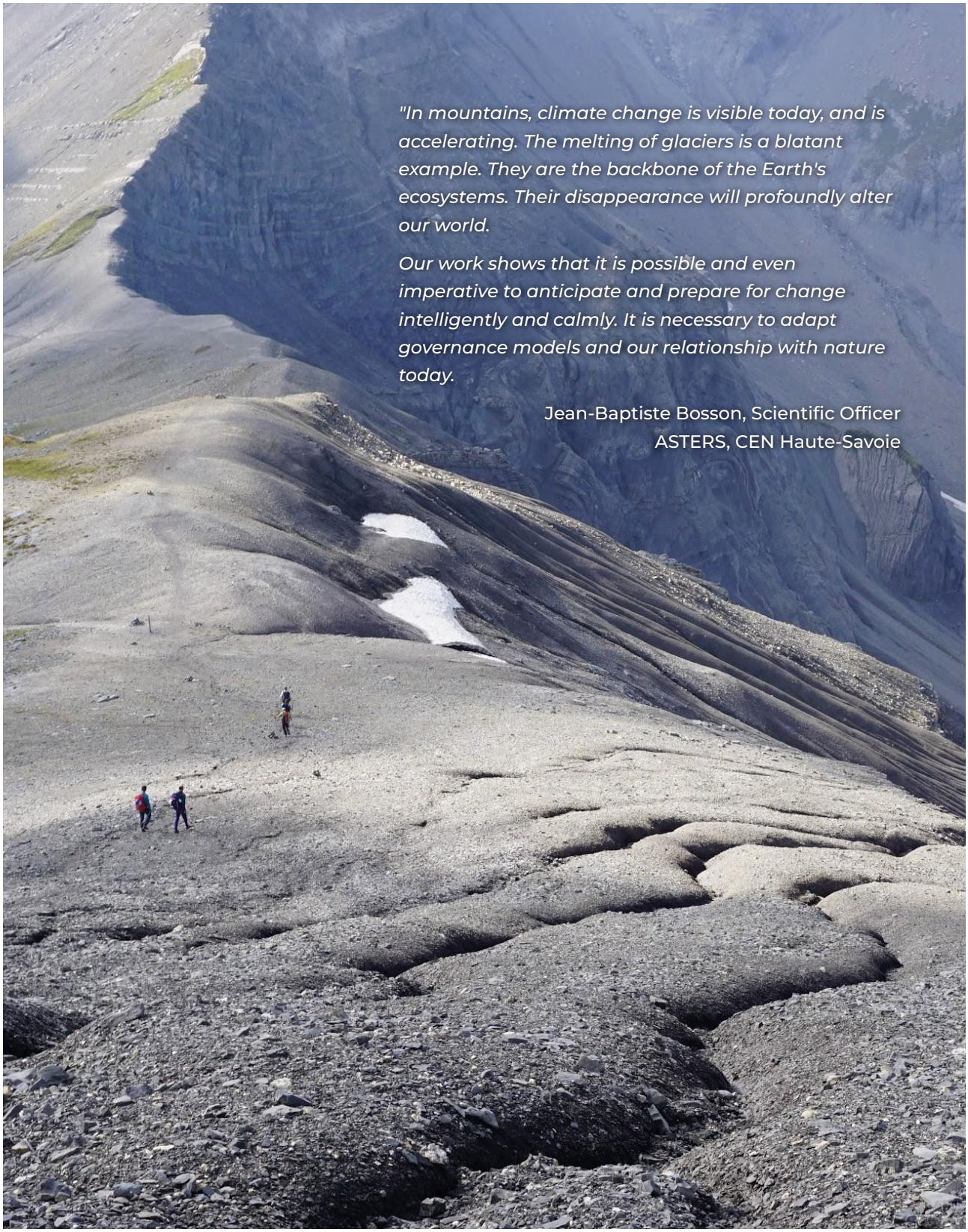
We worked with two scenarios (RCP 4.5 and 8.5). This makes it possible to highlight various possibilities, and is a useful way to mobilise colleagues, elected representatives and economic players in the protected natural area.

Temperatures will rise. Projections under the medium emission scenario (RCP 4.5) predict average summer and winter temperatures in 2100 identical to those observed in the Southern Alps today. By way of analogy, these temperatures are observed in the Ubaye massifs, near Gap, 170 km to the south as the crow flies. In the case of the RCP 8.5 scenario, we would find in the Sixt area at an altitude of 1,800 metres, the temperatures that we observe today at 900 metres or at the highest points of the Verdon region located 250 km further south. **Snow cover will decrease in depth and duration**. In the high-emission scenario (RCP 8.5), snow would only remain throughout the winter between 2,000 and 2,400 metres in altitude, whereas today this is the case from 1,000 metres up. **The evolution of precipitation and winds is uncertain.** Forward-looking models cannot predict the evolution of precipitation. It is not expected to decrease on average between now and 2100. Nevertheless, extreme events (droughts, rains) are bound to intensify. The evolution of winds is unknown too.

Locals have the impression that winds are changing, but there is no evidence for this at this stage.

What are the expected effects?

Although it is difficult to make precise predictions, changes in ecosystem structures and functioning can be expected. In the context of warming, it is certain that the amount of snow and the size of glaciers will decrease. The trend is therefore likely to be a move from a snow-glacier hydrological regime to a pluvio-nival one. This will have a structuring effect on habitats and the geomorphology of the landscape. There is a risk we will see a reduction in the number of habitats dependent on the continuous conditions of humidity and coolness. Furthermore, the massif is essentially made out of limestone and therefore not suited for storing water on the surface. If precipitation falls more as rain than snow, run-offs may accelerate the sedimentary cascade. This effect could be reinforced by the degradation of the permafrost that would allow rocks it was sealing to break away. Finally, effects on avalanches are difficult to establish with certainty.



"In mountains, climate change is visible today, and is accelerating. The melting of glaciers is a blatant example. They are the backbone of the Earth's ecosystems. Their disappearance will profoundly alter our world.

Our work shows that it is possible and even imperative to anticipate and prepare for change intelligently and calmly. It is necessary to adapt governance models and our relationship with nature today.

Jean-Baptiste Bosson, Scientific Officer
ASTERS, CEN Haute-Savoie

The Ottans © Juliette Dané

Many changes, few functional losses?

Vulnerability is an interesting concept. It is directly linked to conservation objectives and uses of the land. The analysis shows that on the scale of the Protected Area, vulnerability is high if the diversity of habitats, species and landscape forms is considered important. If you look at “naturality”, we don’t expect major losses.

Today, all the landscape features of the Northern Pre-Alps are present in the Reserve. The expected climate changes will probably modify ecosystems’ structural conditions. The period of snow cover will become shorter. Soil moisture will no longer be guaranteed for much of the year, about 8 months. A certain number of habitats, such as snowbed, calcareous grasslands, subalpine beech forests, wetlands, etc., will change or disappear. On the other hand, no "nature" will be lost because the reserve will continue to protect the land from urbanisation. Some species will probably replace others. Yet, it is still difficult to formulate scenarios for the establishment of species. However, we know that the potential for adaptation is there. Some areas of the reserve are already drier today. The same goes for the neighbouring region of Valais in Switzerland. These habitats host cohorts of thermophilic species. Natural colonisation should allow the habitats to adapt and evolve into new functional forms.

While the Reserve's role as a refuge for biodiversity and as a carbon storage site is not very vulnerable, its regional influence as a freshwater reservoir is at risk. Its capacity to play a role in water supply throughout the summer and as a source of coolness will be greatly reduced, with cascading consequences outside the protected area.

We also analysed the **various habitat types**. Alpine and sub-alpine **grasslands** will evolve but appear to be resilient. The big winners will be those adapted to a water deficit, such as alpine blue moorgrass or dry grasslands in valley bottoms. On the other hand, grasslands of the caricion ferrugineae and snowbeds that depend on the duration of snow cover will decrease in surface and face increased competition. The pressure on these areas could increase, depending on the adaptation strategies of **pastoralism** to drought. Analysis of the vulnerability of this practice must be conducted on a farm-by-farm basis. The most structuring condition is their access to water and the presence or absence of a shepherd to lead the flocks. The vulnerability of livestock farming is therefore linked to drought and to the capacity to adapt practices. The decisions that will be taken could have a great impact on the vulnerability of the grasslands. The *Alpage Sentinelle* research programme is already very active on this issue.

A more dramatic change could take place in the evolution of the **forest**. Depending on the scenario, forest health is moderately to highly vulnerable. Spruce is vulnerable and risks "disappearing" or being drastically reduced due to repeated droughts that weaken individuals and open the door to parasites such as the bark beetle. Beech forests are also vulnerable, as it is sensitive to sunburn and spring drought.

We also analysed the vulnerability of **emblematic species** such as the bearded vulture, golden eagle, Tengmalm's owl and little owl, ptarmigan, black grouse and ibex. The eagle and the bearded vulture do not seem to be very sensitive to the climate, and their habitats will not change much. The ptarmigan is much more vulnerable. It is at the limit of its distribution range. Tengmalm's owls and black grouse are more specialised in terms of habitat and food, and will probably be more affected. Ptarmigan are likely to suffer from increased rainfall during spring hatching. Summer heatwaves are also likely to be harmful, as ptarmigan cannot thermoregulate early in their lives. Tengmalm's owls will see their habitat shrink as old beech and spruce forests are likely to die out. The future of the black grouse depends more on the evolution of grazing practices than on climate change as such.

Tourism is likely to change, and in some cases intensify. Rising temperatures could support the spread of summer activities such as hiking and camping. It is likely that the increase of visitors on traditional routes will push advanced hikers to go further off the beaten track. They may want to explore areas of the reserve that have been preserved until now. In general, the increase of visitors in spring and early autumn could cause more disturbance during the breeding/nesting season. Risks to winter activities such as ski touring and ice climbing are likely to increase due to more frequent temperature changes and less stable frost conditions.

Sauffaz waterfall © Julien Heuret

Boosting natural adaptive capacity and awareness

In general, the adaptation measures chosen aim to develop management that favours natural adaptive dynamics, species mobility and connectivity. To adapt, resources will be invested in efforts to raise awareness, develop participatory governance and increase staff presence in the field.

The reserve management plan for the next ten years is currently being prepared. The results of the vulnerability and opportunity assessment will hence be integrated directly into the selection of priorities and long-term objectives. New priorities have emerged. For example, we would like to highlight the Reserve's geological heritage. On the whole, it is not so vulnerable to climate change. But it is an effective means of raising public awareness of the effects of past and present changes in the climate.

Generally speaking, adaptation measures aim to increase acceptance of management practices that favour natural adaptive dynamics, e.g. free evolution. This also requires educational actions. The challenge for local actors and inhabitants is to accept landscape transformations such as greening of the mountain and regrowth of the forest... the landscape they inherited from their forebears was indeed a deforested and grazed mountain. Thus, we do not wish to fight against the rise of the beech, fir and spruce forests, even though these will reduce the surface area of alpine grasslands. We want to go down the governance road. Rather than putting all the reserve's human and financial resources into conserving an emblematic species such as the ptarmigan or the ibex *in situ*, the strategy adopted is to facilitate the mobility of all species towards more favourable habitats in the new climate conditions. Thus, many of the adaptation measures concern land-use planning. We will protect the corridors between the Reserve and areas of higher altitude such as Mont Blanc; with a more southerly climate as in the Swiss Valais, or with the same limestone soils as in the Bornes Aravis.

We are considering proposing the relocation of some pastoral activities to the valley floor. This would give mountain forests a chance to grow, limit the degradation of grasslands by domestic herds in the event of drought, and encourage the slow conquest of grasslands on the mineral environments at higher altitude.

Finally, the expected evolution of visitor numbers and land uses will require the team's increased presence. Consequently, to be able to continue to carry out the mission of protecting the natural heritage as delegated by the State, part of the adaptation measures are directed towards advocacy at ministerial level to increase staff numbers, whether for policing, management or awareness-raising missions.

"Bout du monde" in autumn © Julien Heuret

Who did you work with?

Cooperation was central. Given the potential complexity of the analysis and the diversity of the subjects to be dealt with, I did not always feel legitimate. At the beginning, I worked a lot with Jean-Baptiste Bosson, who is a specialist in high mountain ecosystems. He is also directly involved in the LIFE Natur'Adapt project. We sought to understand the changes in the climate and to frame our analysis.

Then I worked with experts to gather knowledge and understand the sensitivity and adaptability of species and habitats based on the precise climate analyses that I had conducted for various zones and altitudes within the site. This did not always prove conclusive. Climate change is not linear. Experts have difficulty assessing threshold effects in the evolution of certain parameters.

To carry out the prospective analysis and understand the site's vulnerability, experts who know the site were needed. I mainly worked with my colleagues who manage the Reserve on the ground. I also worked with the *Office National des Forêts* (National Forests Office) for questions about the beech forest; the *Ligue de Protection des Oiseaux* (Birdlife France) for questions about mountain owls; the *Observatoire des Galliformes de Montagne* (Mountain Galliform Observatory) and local naturalist association GRIFEM for the study of the ptarmigan.

We did not work as much with the users of the Reserve as we had hoped because of the Covid-19 pandemic. I did meet a shepherd and a couple of mountain hut keepers. For the people who live off of the reserve on a daily basis like them, climate change is far from their concerns. They have other more pressing concerns such as the sanitation system in their refuge, adapting to the return of the wolf, the grazing plan, etc. They do not have the same time frame. Meetings with actors working further away from the field, such as the *Société d'Économie Alpestre* (Alpine Economy Society) for example, were very interesting. Climate change is a new anchor point for collaboration.

Finally, I had regularly exchanges with the other project leaders and partners of the LIFE Natur'Adapt project. This has helped me a lot in my own reflections and in running the adaptation planning process within the reserve team.

Ecovolunteer training © F. Jeanparis

A little advice for the road?

With hindsight, I would listen to my initial intuition. Rather than developing a pure research approach, with exhaustive aims, I would take a more pragmatic one. I would start by working to understand the changes in the climate that are structuring the reserve's socio-ecosystems. Then I would critically analyse the existing action or management plan against these projections. This would focus our attention on understanding the future climate(s) and put it on the agenda for strategic decision-making. Here, this was difficult, as the reserve previously had no management plan and objectives.

Measuring the surface of the Ruan glacier

To go further):

1. [English] Summary - Vulnerability assessment and adaptation plan >>
2. [French] About the Sixt Fer-à-Cheval/Passy National Nature Reserve:
   On RNF website >> On ASTERS website >> Facebook >>
3. [French] Diagnosis of the vulnerability of the Sixt-Fer-à-Cheval/Passy National Nature Reserve. DANE J., 2021. LIFE Natur'Adapt - Asters Report. 79p. >>
4. [French] Appendixes to the vulnerability assessment of the Sixt-Fer-à-Cheval/Passy National Nature Reserve. DANE J., 2021. LIFE Natur'Adapt - Asters Report. 79p. >>
5. [French] Adaptation plan for the Sixt-Fer-à-Cheval/Passy National Nature Reserve. DANE J., 2021. LIFE Natur'Adapt - Asters Report. 50p. >>

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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