Support for Public Policy

RÉPUBLIQUE FRANÇAISE
*Liberté*
*Égalité*
*Fraternité*

INRAE

# INRAE and France's regional nature parks (PNR): a partnership for regional transition

June 2024

# Contents of this report

**Report written by Roxane Jupin and Marie-Pierre Arlot (DAPP), Christine Argillier, Pascal Carrère and Emmanuelle George (AQUA, ECODIV and ACT Divisions)**

**PAGE 4**
INRAE and France's PNR: a partnership between science and regions

**PAGE 6**
Research projects with, and within, regional nature parks (PNR)

- Research projects for the transition of agri-food systems, agroecology and the bioeconomy
- Research projects for the management of water and aquatic environments
- Research projects for forests in the face of climate change

**PAGE 14**
Cross-cutting forms of collaboration

## Acknowledgements

**Thank youto everyone who contributed to the publication of this report.**
Frédéric Bray, Arnaud Cosson, France Drugmant, Jean-Luc Langlois, Céline Le Pichon, Grégory Loucougaray, Sophie Madelrieux, François Mitteault, Philip Roche, Evelyne Tales.

Support for Public Policy collection
Publication Director: Marion Bardy
Editorial Director: Gisèle Parfait
Design and content:
Roxane Jupin, Marie-Pierre Arlot
Design and layout:
EliLoCom - www.elilocom.fr, Roxane Jupin
Printing: Biprint
June 2024

Cover photo: ©AdobeStock, Marina

Inside cover photo: ©AdobeStock, Tolo

Head shots: p7 ©FPNRF, p8 ©Nathan Daumergue, p9 ©Jean-Luc Langlois, p10 ©INRAE, p11 ©INRAE-Bertrand Nicolas, p12 ©Robin Cosson, p15 ©FPNRF

June 2024

INRAE and around forty regional nature parks work together to deliver transitions.

# INRAE and France's regional nature parks (PNR): a partnership for regional transition

*Established in 1967 and now numbering 58, regional nature parks (PNR) are key partners for INRAE. The partnership was further strengthened with the signing of a framework agreement with the Fédération des parcs naturels régionaux de France in 2021. INRAE scientists, whose work addresses sustainable regional development and transitions, contribute in a variety of ways—from collaborative research projects to providing expertise for scientific advisory bodies. This report illustrates the richness and diversity of that partnership for both sides, positioning PNRs as innovative laboratories for transitions and as field sites for research that supports public policy.*

PNRs describe themselves as regions "for experimentation and research". In doing so, they emphasise the important role of research in innovation and in reconciling nature conservation with human activity and development. They provide concrete field environments close to INRAE research units, facilitate access to local stakeholders—farmers and entrepreneurs, advisers and technical staff, as well as elected representatives— and they share data that can be used across the Institute's wide-ranging research. In return, research provides knowledge and tools that can be mobilised to support agro-ecological and food transitions in regions with highly varied ecological conditions and management contexts.

This report looks at the different ways INRAE is working with regional nature parks in France via a dozen projects in one of the three themes that are central to parks and at the heart of the framework agreement with INRAE:

❶ agroecology and the transition of food systems; ❷ the management of water and aquatic environments, ❸ and forest management in the context of climate change. Some of these projects also engage citizens through participatory science and consultation initiatives.

The aim here is to showcase the breadth of action carried out with PNRs and provide a (non-exhaustive) illustration of the partnership. The report also presents more cross-cutting forms of interaction and action between INRAE and the parks.

### A FRAMEWORK AGREEMENT AND FIVE THEMATIC PRIORITIES TO SUPPORT TRANSITIONS

1. Transition of agri-food systems and development of agroecology and the bioeconomy
2. Forests: green infrastructure and climate change; new management practices and their impacts on biodiversity and the functioning of regional ecosystems
3. Management of water and aquatic environments and the imperatives related to climate change and the ecological transition.
4. Citizen mobilisation and local initiatives in ecological and climate transition processes, in relation to resulting social conflict and inequalities
5. Transformation of rural areas and landscapes, including villages and the centres of small towns

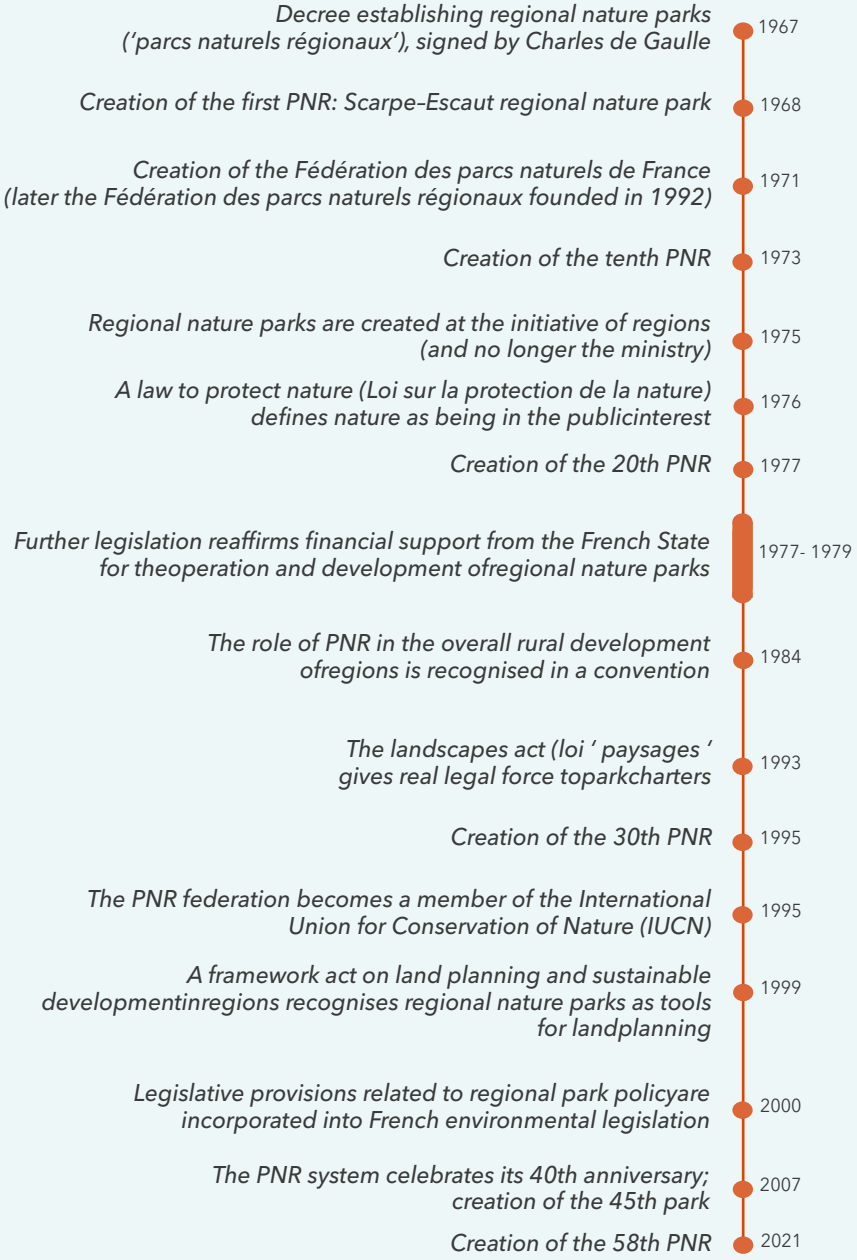
## INRAE AND PNR: A PARTNERSHIP BETWEEN SCIENCE AND REGIONS

INRAE's work with regional nature parks involves around forty of the 58 parks and 36 INRAE research units across five scientific departments (ACT, AGROECOSYSTEM, AQUA, ECODIV, ECOSOCIO). It spans a wide range of issues, locations and regional dynamics, reflecting the ecological diversity of terrestrial, forest and agricultural environments, as well as aquatic environments.

Partnerships take the form of joint research and field projects, and the strong presence of scientists within PNR governance structures: on park scientific advisory boards; on the research and foresight steering council (CORP) of the PNR federation; and on specialised national committees, where they provide expert input to support public action. Scientists generate and contribute knowledge and methods, conduct experiments, produce expert assessments and foresight work, support the drafting of park charters, and run campaigns to inform local authorities and citizens. In line with the aims and missions of PNRs, particular emphasis is placed on involving residents in park projects, on multidisciplinary approaches, and on the regional impacts of projects.

The scientific advisory boards of PNR, CORP and specialised national committees are key forums for exchange between research stakeholders and park staff. While each regional park is autonomous in its action and tailored strategy, the park federation coordinates the PNR network and acts as its spokesperson. The framework agreement signed between the regional nature park federation, INRAE, Institut Agro and AgroParisTech was developed under its impetus. Its purpose is to pool emerging research issues for parks and ensure that scientific responses are shared more effectively across the entire network.

**Regional nature parks: a few key milestones**



# Regional Nature parks: a public policy for the environment and sustainable development

## Regional nature parks: an organisation based on joint authorities

Created by decree in 1967, regional nature parks (PNRs) are inhabited areas recognised for their natural and cultural heritage. They are governed by a shared project set out in a charter drafted by local stakeholders in a region. PNRs are established at the initiative of local representatives and developed by a technical team led by a joint authority composed of local authorities.

PNRs contribute to a range of public policies and initiatives for the protection and management of natural, cultural and landscape heritage; environmental protection; land planning; economic and social development; welcoming visitors, education and information, as well as experimentation and innovation.

These last two missions focus on agricultural diversification and value creation, the restoration of aquatic environments, the promotion of 'short supply chains', as well as sustainable forest management and the creation of wood-sector value chains. These are supported by scientific partners, including INRAE.

Numbering 58 in total, including two overseas, regional nature parks encompass the ecological diversity of French territories.

This social, economic and environmental cooperation project at the regional level is based on a broad partnership that includes scientists.

## Seven foundational laws in the history of Regional Nature parks

The first eight parks created between 1968 and 1970 were considered small in size. On average they covered less than 150,000 hectares and brought together 36,000 inhabitants in approximately 40 municipalities.
From 1971 to 1975, PNRs were under the responsibility of the newly created ministry of the environment, before being transferred to the regions in 1975. Between 1972 and 1979, 13 PNRs were created. They covered a larger area than the initial parks, averaging 177,000 hectares and 90 municipalities. All of these parks spanned more than one region or county.
The period 1985–1991 was marked by decentralisation and an economic crisis. Projects to create seven parks during that period placed particular emphasis on economic development. They encompassed an average of 113 municipalities and nearly 100,000 inhabitants.
In 1993, the landscapes act defined the five main missions of PNRs. The decade that followed was particularly productive, with 17 parks designated, including the first ones located just outside urban areas. Four more laws were enacted to strengthen the balance between environmental protection and regional development: the Barnier and Pasqua laws of 1995, the Voynet law in 1999, and a 2005 act on the development of rural areas.
With these legislative advances, PNRs gained access to 'state–region plan' funding for land planning and partnerships with greater regions and regions.
Since 2004, the creation of new PNRs has slowed. The NOTRe law of 2015 strengthened the powers of inter-municipal authorities regarding economic development and support for rural municipalities—areas that are among the core missions of PNRs, which are also not eligible for certain local development policies. The 2016 law for the restoration of biodiversity instead assigns them a role in ensuring policy coherence across their regions *via* their charters.

Alain Feretti, 2018, L*es parcs naturels régionaux : apports à l'aménagement et au développement durable des territoires et perspectives* (CESE) online (in French) <https://www.lecese.fr/sites/default/files/pdf/Avis/2018/2018_24_pnr.pdf>

## Regional nature parks in figures (2021)

- There are 58 PNRs, including 2 overseas parks.
- There is at least one PNR, or part of a PNR, in 13 regions and 76 sub-regions.
- More than 4,900 municipalities are located within PNRs, representing 6,000 elected representatives.
- PNRs cover 19% of the country, i.e. 9.5 million hectares, including 4 million hectares of woodland.
- PNRs account for 43% of the surface area of nature reserves (INPN, 2019).
- They also account for 36% of land managed by the national coastal protection agency (Conservatoire du littoral, 2020).
- 21 of France's 51 Ramsar-listed sites (wetlands of international importance under the Ramsar Convention) are regional nature parks (2021)
- Nine of France's 14 biosphere reserves are PNRs.
- 26% of Natura 2000 listed sites in France are located inside PNRs (PatriNat joint service unit, 2020).
- Regional nature parks include 60,000 farms (2020).
- Around ten park projects are under study.

# Research projects with, and within, regional nature parks (PNR)

## RESEARCH PROJECTS FOR THE TRANSITION OF AGRI-FOOD SYSTEMS, AGROECOLOGY AND THE BIOECONOMY

Agriculture plays an essential role in regional nature parks, which include 58,000 farms, with 60% of their land made up of grassland and upland livestock areas. Agriculture is therefore often central to park charters, covering issues as varied as forage self-sufficiency in livestock systems and the management of grasslands—particularly semi-natural grasslands—and water resources. Scientific cooperation on food issues – a more recent focus for PNRs—has taken shape through 'PAT', a public policy instrument for regional food projects, implemented in the vast majority of parks.

This section sets out four examples of long-standing collaborations supporting the transition of agri-food systems and the development of agroecology and the bioeconomy.

### › MOUVE (2008-2011): grasslands for the ecological intensification of livestock farming

**Partner PNRs:**
**Livradois-Forez, Vercors**
**INRAE divisions and units:**
**ACT, ECODIV and PHASE for the Lessem, SADAPT, Dynafor and Selmet units**

The MOUVE project set out to examine the conditions, examples and implications of the ecological intensification of ruminant livestock farming, particularly in mountain areas like the Livradois-Forez and Vercors parks, which faced a twofold challenge: maintaining profitability for farmers while conserving biodiversity. The goal was to help livestock systems perform at a high level while reducing environmental impacts and ensuring the sustainable management of ecosystems.

MOUVE highlighted the importance of permanent grasslands – not only for forage self-sufficiency and the resilience of livestock systems to contingencies, but also for operational flexibility. On the Vercors Plateau, livestock intensification and grassland practices were sometimes controversial, at times due to farmers' limited knowledge of the role of these grasslands in forage production. One outcome of the project was the launch of training for farmers based on plot visits. The value of permanent grasslands – their diversity and composition, how they function, and their benefits for livestock farming – was shared more widely, helping to shift perceptions of these systems.

This applied research also enriched local approaches and perspectives during 'Prairies fleuries' competitions, now known as 'agroecological practices' competitions. The competition has become a tool to help highlight the importance of permanent grasslands in livestock farming.

Polices for regional food projects, called PATs, are central to coordinating agricultural initiatives in certain PNRs. INRAE scientists support them from design through to assessment.

©INRAE

### Regional food projects (PAT): a tool for the agri-food transition in PNRs

Since the 1960s, the places where food is produced, processed and consumed have gradually moved further apart. In response, regions have increasingly called for the relocalisation of their agri-food systems. Regional food projects — both a tool for this relocalisation and a public policy instrument — were launched in 2014. PNRs, which have committed to being 'regions for responsible and sustainable food' that promote local, good quality food, are therefore well-suited settings for rolling out PATs. PATs are central to coordinating agricultural initiatives in certain parks. A survey published in 2020 and conducted among 48 PNRs by the federation highlighted the different relationships between these two regional public policy instruments.

INRAE scientists have supported the development, implementation and assessment of regional food projects since their launch in 2014.

More information about regional food projects and INRAE is available in this report: https://hal.inrae.fr/hal-04482463v1

### SIDDT: an INRAE designed information system for regional diagnostics

Developed from 2005 onwards at INRAE, the regional information system portal (SIDDT) produces regional diagnostics in mainland France and the overseas territories. SIDDT provides regional managers consolidated datasets on agriculture, demographics, forests, pollution, employment and more at the municipal level. A range of dynamic analysis features can be used to combine these datasets and present the results in the form of maps, figures, charts, and so on. The system can incorporate additional datasets to enrich analysis. Biodiversity indicators developed in collaboration with the Institut national de l'information géographique et forestière (IGN) will enrich SIDDT data and diagnostics used to develop regional transition strategies. SIDDT includes a special module for the analysis of PNR regions. Staff from several PNR geographical information services have already received training on this tool, which is available free of charge online: https://siddt.inrae.fr/

## › The agroecological practices competition a dialogue between agriculture and biodiversity

**Partner PNRs: Haut-Jura, Massif des Bauges, Vercors**
**INRAE division and unit: ACT-Lessem**

The 'Prairies fleuries' scheme was developed via a joint research programme involving INRAE and the Massif des Bauges regional park. When the park's charter was updated, sociologists were consulted so that the new charter reflected the interests of livestock farmers who make Tome des Bauges – an AOP cheese emblematic of grass-based livestock farming. The challenge was to reconcile the environmental measures of the Habitats Directive with the economics of livestock farming.
Interdisciplinary research was carried out with park stakeholders, and in 2005 the 'Prairies fleuries' agri-environment scheme was tested. Initially developed by German researchers, it assesses the ecological qualities of farmed grasslands using a small number of indicator plant species. One year later, the measure was included in France's national rural development plan. The ecological and agricultural relevance of the scheme was tested in the Massif des Bauges, Haut-Jura and Vercors regional parks as part of the result-based agri-environment measure (MAE-R) research project.

At the same time, the Massif des Bauges and Haut-Jura parks launched the local 'Prairies fleuries' competition, later renamed the 'Agroecological practices competition'. In 2010, the PNR federation extended the highly popular competition to the whole country. It became a part of the General Agriculture Competition (CGA) in 2014. The move to national scale was led by SCOPELA, a company created jointly by the agriculture project officer for the Bauges PNR and INRAE researchers, who designed the competition's assessment criteria and the rules for local juries.

More information is available in the ASIRPA study, which traces the history of the competition and illustrates its environmental, social, economic and political impacts.

**France Drugmant**
Agriculture and food Project Officer at the PNR federation and Coordinator of the research and foresight steering council (CORP)

I trained as an agricultural engineer and joined the PNR federation in 1994, where I spent five years coordinating a network of protected areas working to conserve biodiversity through upland livestock farming. Over twenty people work at the PNR federation. Following the launch of regional food projects (PAT) in 2016, our approach to agroecology expanded to include food, which helped bring agricultural and food-system stakeholders closer together. As the research and foresight steering council (CORP) coordinator, my role is to connect the scientific advisory boards and facilitate cooperation between scientists and park stakeholders. The Charme project, led by INRAE with our collaboration, has already identified 83 ongoing projects with researchers on agricultural and food transition alone. CORP brings an interdisciplinary perspective to our work. It plays a role in the biennial PNR conference and organises *'debates and contentious issues'* sessions.

Species-rich, unsown grasslands help strike a balance between the agricultural and ecological value of farm and are consistent with agroecological public policies.

©INRAE, Grégory Loucougaray /

**Grégory Loucougaray**
Research fellow, Community ecologist at INRAE and member of two PNR scientific advisory boards.

I study the synergies possible between the environmental and agronomic properties of semi-natural mountain grasslands.

For nearly twenty years, we have worked with the Vercors PNR to lead agroecology projects that highlight the importance of diversity in ensuring forage self-sufficiency and helping livestock systems adapt to climate change. We raise awareness among stakeholders via the agroecological practices competition and visits to farms, bringing together the viewpoints and expertise of livestock farmers, technical advisers from French chambers of agriculture, park staff and researchers, and focusing on the role of diversity in supporting forage production. Improving our understanding the resilience of grasslands and grazing environments to drought and other climate risks is a major challenge that we are trying to address with the help of observatories such as Alpages Sentinelles, which covers the Alpine region (a network of nearly 200 vegetation plots). I sit on the scientific advisory board of the Baronnies provençales regional nature park and chair the scientific advisory board of the Vercors park. These boards handle issues as varied as applications to open quarries, tourism development, the coexistence of humans and nature, and challenges linked to renewing regional charters.

## › Alpages sentinelles (2007): anticipating changes in upland pastures to adapt grazing systems

**Partner PNRs: Luberon, Mont-Ventoux, Vercors**
**INRAE division and unit: ACT-Lessem**

The ' Alpages sentinelles ' research-action network was created in 2007 for the Écrins national park following a series of severe droughts. It aims to anticipate the impacts of climate change on subalpine upland pastures. This goal provides a basis for collaboration between INRAE and the three PNRs bordering the French Alps.

The network operates with the help of:

- an observatory that monitors changes in vegetation, upland grazing practices and weather conditions;
- interdisciplinary working groups which produce knowledge for livestock farmers;
- forums for debate designed to share a culture of grazing management in upland pastures.

These mechanisms have generated a number of results that have been shared with and taken up by technical stakeholders. Ecologists, for example, have shown that vegetation height is an indicator of grassland sensitivity to climate variations, and that temperature is the main driver of growth peaks. Sociologists, for their part, have highlighted the importance of better monitoring the fatigue and hopes of the professionals involved in the network, in order to sustain their long-term engagement. Data from the national weather service, Météo-France, has enabled the development of agroclimatic profiles that estimate the impacts of weather conditions on vegetation growth. Another development has been a diagnostics approach to assess the vulnerability of upland pastures to climate change.

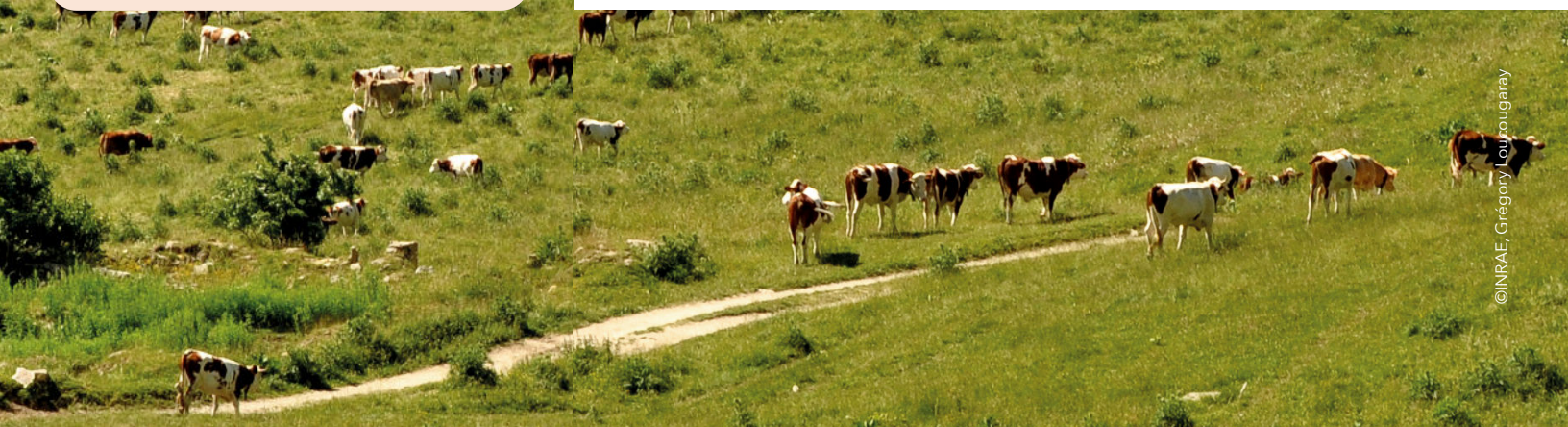
For more information: https://www.alpages-sentinelles.fr/

## › OENOMED (2021-2023): promoting Mediterranean winegrowing and winemaking in protected areas

**Partner PNRs: Haut-Languedoc**
**INRAE divisions and units: ACT-Innovation; AQUA-G-eau**

This cross-border cooperation project between Tunisia, Lebanon, Italy and France aims to support, enhance and promote best practices in sustainable viticulture that respect the Mediterranean's natural and cultural heritage.
In France, the project involves the Thau basin and Minerve, a site located within the Haut-Languedoc regional park -- a mixed-farming area of alternating zones of grazed dry grasslands, vineyards and gorges. Also active in wine tourism, this area includes

The "Alpages sentinelles" research-action network works to anticipate the impacts of climate change on subalpine upland pastures. These projections are useful for adapting upland livestock systems.

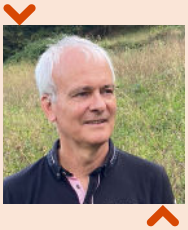



The Minerve site, located within the Haut-Languedoc regional park, is home to several winegrowers' cooperatives. It was selected for the development of a certification programme and charters to encourage the adoption of best practice for sustainable viticulture.

numerous wine cooperatives and winegrowers facing water shortages exacerbated by climate change. Irrigation projects are in development, which raises regional, ecological and socio-economic questions in relation to water efficiency. OENOMED worked with action groups of public and private stakeholders, citizens and elected officials to co-design a certification programme and charters encouraging the adoption of green technologies, responsible water-use practices and sustainable commercial practices. INRAE's AQUA-G-eau and Innovation joint research units helped design these charters and identified several ways to enhance the sustainability of viticulture, such as the use of resistant grape varieties, targeted irrigation, a reduction in the use of crop protection products, and the adoption of high-value environmental approaches.

***

These four projects, which tackle transitions in agri-food systems, illustrate the different roles scientists play in their work with PNRs. They produce knowledge through the implementation of environmental and agricultural public policies (e.g. MOUVE and Alpages sentinelles); they raise awareness around research findings (via an agricultural competition that showcases research on grasslands); and, lastly, they support local stakeholders as they adopt new approaches, by drafting best practice charters –– for the OENOMED project, for example.



**Jean-Luc Langlois**

Agroecology project officer at the Vercors PNR

I began my career as a technical and economic adviser at the Chamber of Agriculture in the Cantal region. I later headed the Vercors PNR farmers' association. Created in 1970 — the same year as the park — it represented farmers at park organizations and promoted their work while also striving to preserve the region. They held an active role in co-designing a joint project for a charter. In 2006, I joined the park as an agriculture project officer — an opportunity to work even more closely with research. The Vercors region is of interest to scientists, notably for its Hauts-Plateaux national nature reserve. Our collaboration was launched following the support they provided with the results on the agri-environment measures introduced in the 1990s. Today, we are working on developing agriculture in an environmentally friendly way that respects biodiversity. The 'Prairies fleuries' competition contributes by demonstrating the agroecological benefits of grasslands. The important thing is that scientists take an interest in our work and our region and make their findings understandable.

## RESEARCH PROJECTS FOR THE MANAGEMENT OF WATER AND AQUATIC ENVIRONMENTS

Regional nature parks are home to an exceptionally rich biodiversity, and water is an essential habitat for many animal and plant species. As a particular form of local authority, PNRs are responsible for addressing the ecological quality objectives for water bodies set out in the EU Water Directive, for meeting the species-protection requirements of the Habitats Directive on the conservation of natural habitats, and for responding to flood-prevention objectives in French legislation on aquatic environment management and flood prevention (GEMAPI). INRAE carries out extensive work on aquatic biodiversity. This report presents four examples of work carried out in, and with, parks where water accounts for a significant share of the region, in the form of wetlands, rivers and streams. These projects illustrate the partnership between INRAE and regional natural parks for the management of water and aquatic environments. Themes range from ecological continuity and the preservation of spaces and species, to the management of invasive species.

### › Enhancing the value of wetland ecosystem services (2017–2019)

**Partner PNRs: Scarpe-Escaut**
**INRAE division and unit: AQUA-Recover**

The Scarpe-Escaut regional nature park is primarily peri-urban. Its natural habitats largely consist of wetlands

designated as being of national interest, as well as grasslands and forests. The Biodiversa-Imagine project, together with PhD research on the assessment of ecosystem services using the capacity matrix method, made it possible to evaluate the ecosystem services delivered by these wetlands, their sustainability, and their use by people.
Drawing on the innovative approach of ecosystem capacity matrices – a graphic representation that cross-references ecosystem services and ecosystem typologies – the PhD work made it possible to represent wetland ecosystem services in several different formats. The matrices were later used in a range of plans and programmes, including SCoT, SAGE, the application process to become a Ramsar site, as well as the national nature reserve application for the Marchiennes Peat Bog, and helped to develop awareness-raising tools such as the park's website. This work brought together local authorities, nature conservation associations and site managers around wetland preservation and the restoration of the ecological network. The Biodiversa-Imagine project delivered further innovation by integrating ecosystem services into park management. The park's foresters, river managers and other stakeholders were able to meet and gain a clearer picture of each other's respective challenges, thereby fostering collaboration.
Developed with stakeholders, these two projects produced a representation of wetland ecosystem services that can be used by park managers. The results are already of interest to the Baie de Somme and Brière parks, as well as the Hauts-de-France regional environmental, planning and housing authority (DREAL).

**Philip Roche**
Research Director, Landscape ecology at INRAE and Chair of the Alpilles PNR scientific committee

The Scarpe–Escaut PNR is a peri-urban zone where water is ever-present, making it particularly interesting for our Recover unit, which carries out research on wetlands. Park managers — who need science to guide their work in these environments — welcomed us in the framework of a PhD study on the assessment of wetland ecosystem services. The PhD was original in two ways: it used the capacity matrix method to evaluate these services, and it included a collaborative angle involving local stakeholders in the process of building the results — one way for the park to build a bridge between those stakeholders in the form of a project. This work sparked interest from the Baie de Somme and Brière PNRs to transfer the approach to their own parks. During this time, I led a three-year project on how wetlands are perceived within the park. A limited understanding of these environments, and the sometimes negative impressions of managers — could be countered by demonstrating the ecosystem services they provide, compared with those delivered by grey and brown networks.

### › SPABIO (2022-2025): managing water primrose in the Brière PNR

**Partner PNRs: Brière**
**INRAE Research Unit: The Center for Environmental Economics of Montpellier (CEE-M)**

Developed with the Brière PNR, this project brings together economists and ecologists from INRAE, CNRS and Université Aix-Marseille, along with two park managers. It meets a clear operational need: to know where, when and how to manage invasive alien species.
Using the example of water primrose (*Ludwigia peploides*) – an invasive plant found along riverbanks and in lakes and ponds, that weakens biodiversity and is costly to manage – the project aims to build 'field-ready' bioeconomic models for invasive alien species.

These models combine an ecological population-dynamics module with an economic module, co-designed with local stakeholders so that real-world priorities, objectives and constraints are built in. They will be used to develop decision-making tools for the management of biological invasions. The first model will analyse

©AdobeStock, Philippe Paternolli

The Ramsar Convention provides international recognition for sustainable management measures. The results of the Biodiversa-Imagine research project on wetland preservation were used to support the Ramsar application submitted by the Scarpe–Escaut PNR.

©Fédération des PNR, Florence Coste

The national action plan to conserve the Rhône apron enabled the launch of unprecedented research to improve understanding of how the species interacts with its environment and what conditions it needs to live and reproduce.

management strategies for water primrose spread in the Brière PNR. Globally, the project aims to more clearly identify the issues linked to biological invasions in PNRs, the management plans put in place, and the data collected. Plans exist to implement the project in all fifty-eight parks, with support from the PNR federation.

### › National action plan for the *Zingel asper* (2012-2030): apron fish – a standard-bearer for the quality of French rivers

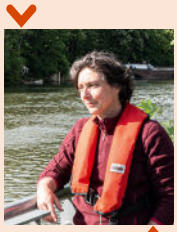
**Partner PNRs: Baronnies provençales, Doubs, Verdon**
**INRAE division and units: AQUA-Recover, Ecobiop**

Endemic to the Rhône basin, the apron fish (or 'Rhône streber') is an indicator of ecosystem quality. Since the 1980s, the species has declined in numbers, to the point of near extinction in the early 1990s. In response, several European research and action programmes were launched from 1992 onwards, followed in 2008 by pilot operations designed to pave the way for a national action plan (NAP) to protect the species. INRAE, together with the Verdon, Doubs and Baronnies provençales parks, took action by working together on a series of management, protection and awareness-raising measures.
Strongly supported by research, the NAP1 plan (2012–2016) enabled the launch of unprecedented research to improve understanding of the apron's interaction with its environment and the conditions needed for it to survive and reproduce. This included 'dietary metabarcoding': a technique implemented by INRAE and Université Aix-Marseille to identify the apron's diet by analysing the DNA contained in its faeces. Genetic studies also identified the most robust and the most vulnerable populations. The plan also supported efforts to rebuild populations. More than 100 kilometres of watercourses were regained between 2009 and 2018, and three new populations were discovered thanks to the installation of fish ladders, the restoration of ecological continuity, reintroduction operations and genetic monitoring carried out by INRAE.
The NAP2 plan (2020–2030) will stabilise the apron fish's presence on a lasting basis while expanding its habitat. INRAE's Recover and Ecobiop joint research units lead several monitoring and restoration programmes.
Two of the fourteen members of NAP2's scientific and technical council are from INRAE.

### › Restoring ecological continuity on the Mérantaise and the Aulne rivers (2021-2025)

**Partner PNRs: Haute Vallée de Chevreuse**
**INRAE division and unit: AQUA-Hycar**

Biodiversity in the Haute Vallée de Chevreuse regional nature park owes a great deal to its valley-bottom wetlands. However the 330 kilometres of watercourses that drain the region are obstructed by more than 200 barriers – artificial dams or natural weirs – breaking their ecological continuity. The park and INRAE are working together to restore this continuity and facilitate the movement of brown trout, a migratory species valued for its ecological heritage and



**Céline Le Pichon**
Research engineer in hydroecology at INRAE.

My research focuses on how the structure of aquatic habitats influences the spatial distribution of fish populations in watercourses. The partnership with the Haute Vallée de Chevreuse PNR began in 2012, following a request from the park's 'aquatic environments' project officer, who wanted expertise in identifying which watercourses would be suitable candidates for ecological restoration. Water is a major issue for this PNR, as the park is dotted with springs. A joint project therefore took shape around restoring ecological continuity. We supported the park in developing its strategy for monitoring restoration operations. Drawing on data on the condition of watercourses collected by the park under the previous charter, along with additional measurements gathered by our team of hydroecologists, we helped it prioritise three watercourses for restoration, with the aim of conserving *brown trout*. Over the same period, we contributed to raising awareness among the park's elected representatives about ecological restoration through field visits and 'water classes'. This project was scientifically rich. It also taught us how to engage in dialogue with a range of stakeholders and helped us build a trusting relationship with the project officer.

angling interest. The study focused on restoring ecological continuity at two mills: one on the Mérantaise river (Ors Mill) and the other on the Aulne (Béchereau Mill), selected from among the 31 structures prioritised by the PNR. Hydroecologists committed to a ten-year monitoring programme, before and after the restoration efforts. Between 2011 and 2022, prior to the project, they tracked changes in the hydromorphology of the two watercourses, as well as the presence of invertebrates and fish upstream and downstream of the mills. INRAE also recorded the passage of brown trout fitted with electronic tags, using stationary antennas installed at the mills. Observations showed that the presence of the mills reduces trout movements and limits their access to potential spawning grounds. As a result, work was carried out on the riverbeds of the Mérantaise and the Aulne in 2022 and 2023. These involved creating a new riverbed on the valley floor at the Béchereau Mill site, and a bypass at the Ors Mill weir. Monitoring continues to assess the effectiveness of these efforts.

***

These four projects, on the management of water and aquatic environments, provide three examples of the continuum between research and decision support. Projects on the Mérantaise, Aulne and Rhône rivers illustrate how research can support policies for restoring ecological continuity and the conservation of two species: brown trout and the Rhône streber. The Biodiversa project, and PhD research on ecosystem service assessment, are an example of the research–awareness continuum—here focused on the ecosystem services delivered by wetlands.

## RESEARCH PROJECTS FOR FORESTS IN THE FACE OF CLIMATE CHANGE

France's regional nature parks are heavily wooded in general, with forests covering 40% of their land, compared with an average of 27% across mainland France. A large proportion of PNR forests are publicly owned.

Parks are therefore on the front line when it comes to helping implement public policies that support healthy forest ecosystems. They are heavily involved in delivering local forest policies, with most adopting multifunctional, regional approaches to forest management and others taking a biodiversity-led approach or focusing on developing the forest-wood value chain.
To support them, the parks draw on research and INRAE in particular, which conducts research focused on shared challenges with the PNRs, such as socio-economic development and the sustainable management of common goods linked to forests.
Using three examples, this section illustrates the kind of collaboration that INRAE and regional nature parks can build around forest management in a context of climate change.

### › TRAMES (2021-2023): strengthening the biodiversity of ancient forests

**Partner PNRs: Baronies provençales, Chartreuse, massif des Bauges, Vercors, Verdon**
**INRAE division and unit: ACT-Lessem**

The TRAMES project aims to improve knowledge of biodiversity in grazing areas and ancient forests, and to study these ecosystems over time to track how they evolve and to develop a programme of measures for their restoration or maintenance.

Five parks located in the 'pre-Alps' – Baronnies provençales, Bauges, Chartreuse, Vercors and Verdon – have joined forces to describe these two biotopes and how they are used. These ecosystems are closely linked to activities that are fundamental and strategic in rural areas: upland livestock farming and forestry.
The mature forest network – which INRAE scientists from the Institute's Ecology and Biodiversity division are helping to characterise – supports the essential genetic exchanges between populations of species (fauna and flora), their migration, and their resilience in a context where biodiversity is adapting to climate change. Scientists support the project in a number of

Safeguarding *brown trout* is a priority for biodiversity in the Haute Vallée de Chevreuse PNR. To facilitate their movement along the Mérantaise, work was carried out toreduce the height of a weir.

©AdobeStock, AlcelVision

ways: by helping the parks define what makes a Mediterranean forest mature; by identifying indicator fauna species, and by testing LiDAR remote sensing and photogrammetry as well as other methods in order to model the network.

### › Saving Chantilly forest (Since 2020): adapting forests to climate change

**Partner PNRs: Oise**
**INRAE division and units: ECODIV-UR BEF, IAM, BIOGECO, EFNO, USC P2E,URZF**

Forty per cent of Chantilly forest is affected by dieback due in part to climate change.
With its sandy, free-draining soils and dry microclimate, the area is seen as an avant-garde natural laboratory and example of the potential impacts of future climate change on French forests. Rising temperatures are having a major impact on the common oak, a keystone species in this ecosystem that is highly vulnerable and poorly adapted to drying climatic conditions.
An interdisciplinary research-action programme involving twelve laboratories and more than forty researchers was launched in 2020. It is led by INRAE via the ARBRE laboratory of excellence (LabEx). The project's 300 volunteers help map the 6,300 hectares of forest and help collect 13,000 soil samples across several hundred plots. The samples will be used to study the trees' genetic heritage and identify those that are most resilient on these soils. In addition, a selection of species known to be more resistant to water stress are being planted on an experimental basis to determine which are best suited to the climate ahead.
Owners, managers, elected representatives, scientists and non-profits jointly developed an action plan and management scenarios base on projected changes in vegetation and climate. This innovative participatory foresight approach has been implemented in the field by testing new regeneration methods and laying the foundations for the assisted migration of European tree species. A long-term roadmap has been established to monitor how the forest evolves.

### › S'EnTET (2019-2022): supporting the transition towards sustainable forest management

**Partner PNRs: Haut-Languedoc, Pays d'Epinal**
**INRAE division and unit: ECODIV-Silva joint research unit**

The S'EnTET project mobilised several disciplines from the social sciences and humanities to analyse and support transition processes towards sustainable forest management in regions. Solutions for sustainable management need to be tailored to the specificities of each region, such as its history, governance and human resources. Stakeholders – policy-makers, elected representatives of forest municipalities and managers – do not all provide the same answers, so transitions must be flexible and adaptable.
The project tested flexible and adaptable transition processes in three forest areas: the Haut-Languedoc PNR, the Pays d'Épinal and Forêts national park.
The study looked at qualitative geographical and ethnographic surveys and participatory workshops to address three criteria: the profile of individuals and organisations that commit to the process; the effect of a region's governance on stakeholder engagement; and making knowledge and innovation tools available to regional stakeholders to guide their public policy choices.
The study will disseminate its findings in a range of formats aimed at public decision-makers (*policy briefs*), the scientific community and the general public.

***

These three forest-related projects illustrate scientific support for climate change adaptation policies through biodiversity, and for the transition towards sustainable forest management.
They are based on collaboration with public-sector partners, citizen participation and field experimentation.

©AdobeStock, Aterrom

**Chantilly forest, part of the Oise Regional Nature park,is regarded as an example of the future state of French forests due to climate change. Experimental work there will identify which tree species are best adapted to tomorrow's climate.**

**Arnaud Cosson**
Sociologist at INRAE and member of the research and foresight steering council (CORP) of the regional nature park (PNR) federation

I have been working on protected natural areas since 2008: national parks, regional parks and nature reserves. These public policies look at regions from every angle: heritage, society, the economy and the environment. A forum for regional dialogue, parks act on the basis of their charter. After serving as deputy head of Cévennes national park from 2000 to 2007, I went on to complete a PhD in sociology on the 2006 reform of national parks. That reform established park charters as well as the national French parks network. I also studied the interface between research and public policy — scientific advisory boards of protected areas in particular. Working in a research support role, I collaborate with protected-area managers and the Office français de la biodiversité to help them reflect on and critically review practices. I conduct surveys and then run group problem-solving sessions. That is the added value expected: asking the right questions and enabling learning by studying action 'as it unfolds'.

# Cross-cutting forms of collaboration

## SCIENTIFIC SUPPORT IN THE GOVERNANCE BODIES OF THE REGIONAL NATURE PARK NETWORK AND FEDERATION

While the partnership between the parks and INRAE scientists consists mainly in conducting scientific projects inside the parks, INRAE scientists also provide expertise to park bodies and, at the national level, to the PNR federation.
Two administrative bodies support this interface between parks and scientists: the scientific advisory boards (CS), which support most PNRs, and the federation's research and foresight steering council (CORP).

### INRAE scientists on PNR scientific advisory boards

PNR scientific advisory boards (SC) are tasked with proposing and discussing ideas to inform decisions requiring technical and scientific expertise.
They are consultative bodies called upon by park management teams to provide technical and scientific guidance. They work closely with CORP and help to map scientific activities within their regions. SCs play a central role in the drafting of park charters, for which they indicate what research should be conducted.
They are composed of scientists from different disciplines across the biotechnical sciences, and since the 2010s have been joined by the social sciences and humanities, to strengthen interdisciplinary approaches.
Establishing a scientific advisory board is not a regulatory requirement. To date, however, 81% of parks have one. INRAE scientists are involved on an individual, as-needed basis, both as members – sometimes of several SCs, thereby helping circulate the scientific issues – or as chairs or co-chairs. Each SC designates an elected representative and a technical officer to support the expert assessments it carries out. While certain knowledge can be transferred from one PNR to another, the presence of an SC helps park managers tackle issues and find solutions that are specific to their own park.

### CORP: a forum of the PNR federation for pooling research needs

The federation's research and foresight steering council (CORP) is tasked with supporting innovation and research activities across the parks network. It has no authority to steer research, but it informs the federation's deliberations, drawing on its knowledge of

**Charme: a project on 'Collaboration between researchers, project officers and elected representatives in regional nature parks for the agricultural and food transition' (2021–2024).**
**INRAE division and unit: ACT-Lessem, SADAPT**

The Charme project, coordinated by Sophie Madelrieux, operates as part of the framework agreement between INRAE, the PNR federation, AgroParisTech and Institut Agro. Charme looks at joint projects between researchers, project officers and elected representatives, and how this collaboration can foster the agricultural and food transition in PNRs, in which the parks present themselves as key stakeholders. The first phase of the project was a quantitative survey conducted via an online questionnaire with all fifty-eight parks to produce an initial overview of these joint projects. The second phase provided more in-depth analysis in the form of a qualitative interview survey with the different types of stakeholders in four PNRs (Livradois-Forez, Monts d'Ardèche, Gâtinais français, Pyrénées Ariégeoises). The final phase of the project will focus on piloting a network that lets researchers, project officers and elected representatives share experience, with a focus on the roles and added value of each in advancing the agricultural and food transition. Results obtained so far show that agricultural and food issues are viewed differently from one park to another. Many research projects are being carried out on these issues (83 have been identified over the past five years). However, there is little effort to capture and consolidate the knowledge produced. Researchers have little contact with elected representatives, and PNR scientific advisory bodies take little action on agricultural and food transition issues. PNR project officers play a key intermediary and 'translator' role. The agricultural and food transition can become a driver of recognition within PNRs and for the PNRs themselves, and that research can help—provided the challenges, roles, commitments and added value of each party are clearly articulated.

the research carried out in the parks and on input from its various experts. Based on an inventory of these initiatives and the discussions around them, it shares them across the network of regional nature parks, supporting the transfer of initiatives from one region to another on common issues such as the future of small-scale farming in the parks, forest regeneration in a changing climate, and the impact of regulatory protection on biodiversity. Its aim is to bring together input from scientific advisory boards and research projects, and give it greater visibility across the parks. CORP is also responsible for sharing scientific knowledge across the parks network, helping to put research findings to use in forward planning, and supporting the work of park scientific advisory boards. In 2022, two of CORP's twenty-two members were from INRAE.

### Supporting strategic thinking and charter revisions: the example of the Vercors regional nature park

Revising a park charter is an opportunity for consultation among all the stakeholders across a regional nature park. INRAE researchers contribute through their involvement in park SCs and by taking part in foresight studies on cross-cutting issues such as climate change adaptation. Charters also incorporate concrete measures that emerge from research projects carried out in the parks. One example is the eco-climatic observatory set up in 2005 in the Vercors regional nature park, which provides data and analysis on local climate trends. These data are used to update charter proposals every 15 years. In addition, a dedicated module in the regional information system portal (SIDDT) developed by INRAE can generate an automated diagnostic across multiple areas and themes, offering detailed knowledge of the region. This overall picture also informs the discussions held as part of charter revisions. The first multi-area diagnostic is intended to be rolled out to other regional nature parks. The first multi-area diagnostic is intended to be rolled out to other PNRs. See: Feedback – the AdaMont project, a catalyst for climate-change awareness in the Vercors (in French)

©AdobeStock, BPiccoli

INRAE and PNRs have made the wider uptake of agroecology across regions central to their collaboration.

**François Mitteault**

Chair of the research and foresight steering council (CORP) of the PNR federation

As Chair of CORP, I bring together a wide-ranging group of around twenty experts—scientists, agronomists, naturalists, sociologists, economists, urban planners and architects, as well as specialists in culture and heritage. That cross-disciplinary mix is what defines us, and it is essential if we are to support the regional nature parks network, whose work spans all of these fields. CORP also works to connect the wider community of some 1,000 experts and scientists who sit on park scientific advisory boards, with the aim of mobilising them collectively around all transition-related challenges. Sharing what is being tried in different places creates a synergy that benefits the whole network. Our work on the shift towards agroecology — central to the partnership with INRAE — illustrates this approach. We have launched a number of initiatives (webinars, an opinion piece on agroecology and more), but there is still plenty of scope to do better: scaling up agroecology across PNRs is urgent, and we need research to better understand the processes involved. Having a scientific advisory board (SC) in every park is also a real strength, because each region experiences these transitions in its own way and needs support tailored to its situation. One example is the local seminar organised by the SC of Queyras regional nature park on the area's future in the face of climate change. It made it possible to open a very practical — and no doubt non-transferable — dialogue with local stakeholders. The link between research and action within the parks has enormous potential, and it can open up new, unexplored pathways for transition — though it may in some cases unsettle established ways of doing things.

## FIELDWORK AND NATIONAL-LEVEL ACTION: HOW THE PARKS AND RESEARCH SUPPORT ONE ANOTHER

The examples and testimonies presented throughout this dossier illustrate the wide range of topics and formats that collaboration between INRAE researchers and PNR staff can take.

These partnerships help both generate knowledge and make it operational, thereby supporting regional management.

In their day-to-day work, park teams deal with complex issues that call for multidisciplinary action. They therefore need research on their priority themes in order to address these issues in all their dimensions. As reflected in the framework agreement between the PNR federation, INRAE, Institut Agro and AgroParisTech – which gives equal weight to both the biotechnical sciences and the social sciences and humanities – the parks are seeking multidisciplinary, and sometimes genuinely interdisciplinary, research–action. The aim is to meet the needs of both elected representatives and technical staff as they implement environmental and regional public policies, while also maintaining a strong link with communities.

Positioned at the junction between local and national scales, notably through their elected representatives, regional nature parks are at the heart of an action-oriented network in which scientists have a role to play. Thematic project officers are key to bringing this network to life and are close partners for researchers working in the field.

The parks are also distinctive objects of study, not least because they deliver public action through partnerships rather than regulation. While this approach makes them institutionally more fragile, it is also one of their greatest strengths. Thanks to an organisational model that encourages dialogue and innovation – and at a time when inter-municipal and metropolitan authorities are becoming ever more influential – the parks are continuing to rethink how they contribute to transitions. In doing so, they reaffirm their role as "transition laboratory territories", which are particularly valuable for research.

In return, research supports them in their innovations and in their role as actors in public action at both local and national level.

Alongside CORP, the federation's national body, park scientific advisory bodies make a major contribution to this interface, further strengthened by the close pairing of park project officers and researchers on the ground.

The inter-institutional coordination put in place through the four-party framework agreement helps to improve visibility of these different initiatives and actions and to showcase them more effectively, while also steering shared incentive measures that now simply need to be developed further through sustained, medium-term action. ■

**Consult Sciences Eaux & Territoires for more information on the projects presented in this report.**

J. HAURY, J.P. DAMIEN, 2012, *Les invasions biologiques dans le Parc naturel régional de Brière: présentation d'une recherche-action*, sur le site Revue SET (in French), <https://revue-set.fr/article/view/6457>

B. NETTIER, L. DOBREMEZ, P. FLEURY, 2012, L'obligation de résultat pour les mesures agri-environnementales "prairies fleuries" et "gestion pastorale", sur le site Revue SET (in French), <https://revue-set.fr/article/view/6521>

C.S. CAMPAGNE, L. TSCHANZ, T. TATONI, 2016, *Outil d'évaluation et de concertation sur les services écosystémiques: la matrice des capacités*, sur le site Revue SET (in French), <https://revue-set.fr/article/view/6704>

C. LE PICHON, E. TALES, *Évaluer la fonctionnalité de la Trame bleue pour les poissons (2018), article centré sur le PNR de la haute vallée de Chevreuse*, sur le site Revue SET (in French), <https://revue-set.fr/article/view/6777>

T. SPIEGELBERGER, V. GIRARD, P. CHOLER, 2019, *Le dispositif « Sentinelles des Alpes », un outil et une démarche pour réussir l'adaptation*, sur le site Revue SET (in French), <https://revue-set.fr/article/view/6839>

*Histoire d'une sauvegarde: l'apron du Rhône*, 2019, sur le site Revue SET (in French), <https://revue-set.fr/issue/view/692>

**References from the regional nature park (PNR) federation website**

Parcs naturels régionaux de France, 2007, *Les parcs naturels régionaux, 40 ans d'histoire...*, on line (in French), <https://www.parcs-naturels-regionaux.fr/sites/federationpnr/files/document/centre_de_ressources/histoire-40_ans.pdf

Parcs naturels régionaux de France, 2008, *Textes législatifs et règlementaires sur les parcs naturels régionaux*, on line (in French), <https://www.parcs-naturels-regionaux.fr/sites/federationpnr/files/document/centre_de_ressources/archive_avant_2016/Textes%20l%C3%A9gislatifs%20et%20r%C3%A9glementaires%20sur%20les%20Parcs%20naturels%20r%C3%A9gionaux.pdf>

Parcs naturels régionaux de France, 2019, *La Recherche, levier d'innovations dans les Parcs Naturels Régionaux*, on line (in French), <https://www.parcs-naturels-regionaux.fr/sites/federationpnr/files/document/centre_de_ressources/synthese_de_la_rencontre_du_011019.pdf>

Parcs naturels régionaux de France, 2021, *Agriculture et alimentation*, on line (in French), <https://www.parcs-naturels-regionaux.fr/les-enjeux/agriculture-et-alimentation/lagriculture-un-enjeu-majeur-pour-les-parcs>

Parcs naturels régionaux de France, 2021, *La forêt et la filière bois dans les Parcs naturels régionaux de France*, on line (in French), <https://www.parcs-naturels-regionaux.fr/les-enjeux/foret/la-foret-et-la-filiere-bois-dans-les-parcs-naturels-regionaux-de-france>

Parcs naturels régionaux de France, 2021, *Les parcs en chiffres*, on line (in French), <https://www.parcs-naturels-regionaux.fr/les-parcs/comprendre-les-parcs/les-parcs-en-chiffres>

Direction de l'Appui aux Politiques publiques

Centre siège d'Antony

1, rue Pierre Gilles-de-Gennes
92160 Antony

Find us at:

https://www.inrae.fr/

**The National Research Institute for Agriculture, Food and Environment**

RÉPUBLIQUE FRANÇAISE
*Liberté*
*Égalité*
*Fraternité*

INRAE