EXPERTiSE AT THE MUSÉUM

Answering
society's questions

MUSĒUM
NAL HIST
NATURELLE

THE MUSÉUM, CONVEYiNG THE VOiCE OF NATURE

Narcissus bulbocodium (Petticoat daffodil) © MNHN - F.-G. Grandin

Nature, the environment, biodiversity, cultures, societies, fauna, flora, fungi, geodiversity… These words are the heart of the Muséum national d'Histoire naturelle (French National Museum of Natural History), making it an essential player in the crisis that the planet is undergoing.

Today, biodiversity is undergoing an extremely rapid global decline. Something previously unseen in human history. Humans are the victims of this disaster for which they are in fact primarily responsible.

The Muséum, with its 2,500 employees, its collections and databases, its galleries, museums, botanical and zoological gardens, as well as a legitimacy built on nearly four centuries of Natural History, is dedicated to alerting, explaining and offering solutions to all those willing to grasp them. This mission is all the more important since people's faith in science has been on the wane in recent years, something worsened by an ever-accelerating flow of information. However, science is not a matter of belief or opinion, nor should it allow itself to be courted by partisan bias. It is based on fact.

Forest of skyscrapers © Manson Yim / Unsplash

This is the role and the richness of the Muséum. It mobilises the knowledge of the surrounding world to support society. At the crossroads of research, culture and society, it is in a position to make its relevant, recognised scientific voice heard, at a time when biological diversity more than ever demands everyone's unwavering attention.

Vulpes vulpes (Red fox) © MNHN/INPN - L. Jouve

THE EXPERTiSE MiSSiON AT THE MUSÉUM

Keys for action

The expert advice reviews the state of knowledge in response to the questions of the public or private decision-makers who are in charge of nature management and conservation.
To do this, it mobilises existing information on a topic. It analyses all the scientific studies conducted on a topic, identifying what is known but also what is not known and what must still be considered. It there is no available knowledge, the Muséum teams are then mobilised to produce it. This is how research and expertise interact on a daily basis.

A range of professions and skills

All the staff within the Museum, whatever their areas of expertise, may contribute to expert and scientific advice.
This feature enables a broad range of diverse profiles to be brought together, multiplying the professions and skills that can be mobilised. This means that the experts are researchers, engineers and technicians, as well as naturalistic collection or library managers, taxidermists, museologists, animal keepers, gardeners, etc.

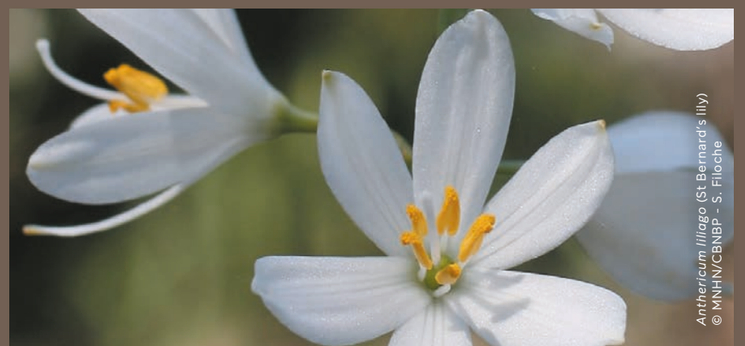
The strength of interdisciplinarity

Another major asset of expertise and advice at the Museum is its mixture of multiple speciality fields in the laboratories, especially in the context of joint research and service units. These are built in partnership with many other scientific institutions which provide complementary skills involving a richness of disciplinary fields. This diversity makes it possible to combine scientific and technical skills that are rarely found together.

The experts include specialists in various areas related, for example, to biodiversity (amphibians, birds, insects, flora, fungi, habitats, etc.) or to the humanities and social sciences. In each of these subjects, various scientific approaches can also complement each other (ecology, endocrinology, anthropology, geology and bioinformatics, as well as citizen science, etc.) in order to provide the most appropriate response to the issues being addressed.

The Muséum, within a network of experts

Beyond the multiple partnership structures to which the Muséum contributes (such as the joint scientific units), it coordinates and participates in many French and international expert networks. It works specifically with various scientific societies and so can mobilise even more widely to add to the skills available among its own employees.



Anthericum liliago (St Bernard's lily) © MNHN/CBNBP - S. Filoche

And tomorrow...

In recent years, biodiversity and its study by experts have been thrust into the spotlight. New challenges are increasing the institution's principle to maintain its position as a national and international place of reference for its natural history knowledge.

One of the Muséum's missions is to anticipate emerging issues.
The issue of soil artificialisation is one of them. What does the national goal of achieving "zero net soil artificialisation" actually mean? Is it even possible to reverse soil artificialisation? Another is the link between health and biodiversity, which today is the focus of everyone's attention.

Ecological transition is another iconic example. Here, the human sciences, and in particular the behavioural sciences, will make it possible to support the changing practices brought about by the evolution of our societies.

Bombus pascuorum (Common carder bee) and *Cyclamen hederifolium* (Ivy-leaved cyclamen) © MNHN - A. Iatzoura

Expertise is one of the Muséum's five statutory activities. Since 2017, a dedicated department brings together three services which use scientific methods and data to provide support to public policies on the environment, at different geographical levels: the Conservatoire botanique national du bassin parisien (CBNBP - National Botanical Conservatory of the Paris Basin), the Unité mixte de service Patrimoine naturel (UMS Patrinat - Natural Heritage Joint Service Unit) and the European Topic Centre on Biological Diversity (ETC/BD). This department also ensures the facilitation, coordination and coherence of this mission in all the establishment's departments that make it up, in particular the research laboratories. Its work is conducted within a network of national and international partners.

ORGANiSATiON

The Natural Heritage Joint Service Unit (UMS PatriNat)

It is both the manager of the biodiversity and geodiversity inventory and monitoring data at national level and a centre of expertise that supports conservation policies. This unit, shared by the Muséum, the OFB (Office français de la biodiversité (French Biodiversity Agency)) and the CNRS (Centre national de la recherche scientifique (National Centre for Scientific Research)), comprises around 120 people. These employees with a wide variety of profiles from research or other scientific and technical backgrounds are involved in many projects, from designing methodologies to interpreting data: species and ecosystems inventory and monitoring, reference portal on nature (INPN), information system for research (PNDB) or public policies (SIB), strategy for protected areas, red lists of threatened species, citizen science (Vigie-Nature), CITES (International Trade in Endangered Species). UMS PatriNat also provides support to public and private partners to improve the way biodiversity is understood in their activities. It puts its experience at the service of a major objective: understanding nature more thoroughly to promote protecting it.

The Conservatoire botanique national du Bassin Parisien (CBNBP)

The National Botanical Conservatory of the Paris Basin is accredited by the Ministry of the Ecological Transition to cover the regions of Burgundy, Centre-Val de Loire, Champagne-Ardennes and Île-de-France. A staff of about fifty people maintain the inventory of the natural plant heritage of this vast territory and preserve threatened species in a seed bank. Its role is also to inform and educate the public. It focused in its early stage, about thirty years ago, on identifying and localising the fragile, iconic elements of the vascular plants (mainly ferns and seed or flowering plants), but the area of expertise has now been considerably expanded to take into account more taxonomic groups and themes (ecological belts, rewilding, indicators of biodiversity evolution etc.). The requests now come both from local authorities and the State and the private sector, in particular large infrastructure companies.

The European Thematic Centre on Biological Diversity (ETC/BD)

It is one of the seven European Thematic Centres of the Environmental Information and Observation Network managed by the European Environmental Agency. Since its creation 25 years ago, it has always been run by the Muséum, which has been an international reference in terms of biodiversity for some time. The ETC/BD is a consortium of eleven partners that specialise in biodiversity and data management, coordinated by a dedicated team of ten at the Muséum. It supports the implementation of the two EU Nature Directives: "Birds" and "Habitats-Fauna-Flora". In particular, it assists the European Environmental Agency in collecting and assessing data on nature in Europe, an enormous work of precision in ensuring that data from different countries are coherent and comparable.

The research-expertise cells

The point of these structures is to open up the frontiers between basic and applied research. They are unique in that they bring together scientists from several units, some dedicated to expertise and others to research, around a same subject. The aim here is to combine skills to support public policies more effectively.

These cells bring together different communities and professions (researchers, engineers, project managers etc.) to achieve common goals. So far, there are two of them: the first dealing with the geological heritage, is a cell that is jointly run by the UMS PatriNat and the Centre de recherche en paléontologie de Paris (CR2P - Centre for Research on Palaeontology - Paris), and the second, Vigie-Nature, brings together UMS PatriNat and the Centre d'Écologie et des Sciences de la Conservation (CESCO - Centre of Ecology and Conservation Sciences), and deals with citizen science in the field of biodiversity.


Taurulus bubalis (Longspined bullhead) © MNHN - A. Iatzoura

The state of European nature, **a colossal task**

It is a difficult task to assess the conservation status of the fauna and flora in a country, what is threatening them, what means are needed to protect them. So, it is a huge challenge to carry out this kind of work for twenty-seven European States with resources, nomenclatures and methodologies that are often very different!
An example? The bullhead, a common freshwater fish very widespread in European rivers and protected by the Habitats-Fauna-Flora Directive.
In fact, this name includes several species which are not always easy to distinguish in the field.
This is where all the knowledge and expertise of the European Topic Centre on Biological Diversity, led by the Muséum, come in.

Specialists who know how to harmonise the data, ensure their consistency and compare them in order to review the actual status of biodiversity.
Every six years, this colossal task results in an extensive report on the state of nature in the EU published by the European Environmental Agency.
A collection of harmonised data and assessments which is unique on the continent and finalised to a large extent at the Muséum.

Assessing the current status of biodiversity

Seven million data entries resulting from field observations

First of all, inventories of the wild flora and natural and semi-natural habitats needed to be produced. This is the task undertaken by the Conservatoire botanique national du Bassin parisien in the 1990s by mobilising experts in the four regions for which it is responsible (Centre, Champagne-Ardennes, Burgundy and Île-de-France). Now, with some seven million data entries resulting from field observations - and this amount is steadily increasing - the expertise of the CBNBP has become indispensable to local and national authorities, and to some large businesses:

reviewing an impact study, restoring when conservation is not possible, enhancing a vulnerable natural area (ENS), etc. The CBNBP's expertise is also essential in legal disputes and even in criminal cases. This is how it came to be called upon to identify a twig on a crime scene.


Anemone ranunculoides (Yellow anemone) © MNHN/CBNBP - S. Filoche

A plant can hide **thousands** of others


Intra-torrent source and Palustriella (bryophytes) source at Gevrey-Chambertin (Côte-d'Or) © MNHN/CBNBP - O. Bardet

Canis lupus lupus (Eurasian wolf) © MNHN - A. Iatzoura

The wolf: **a multi-faceted** subject

How many animals are needed for a wolf population to be viable? To answer this question which is a source of controversy in our society, the French ministry of Environment approached organisations whose reliability was recognised: the Muséum and the Office National de la Chasse et de la Faune Sauvage (now integrated into the Office français de la biodiversité). They coordinated the expert study on the ecological and biological aspects of the French wolf population.

This work was based on a thorough scientific approach, bringing to the table a group of experts from different countries, institutions and disciplines - conservation biology, biostatistics and genetics. In this case, there were seven of them, but in the end only one opinion was voiced.
Is it possible to consider the return of wolves to France without questioning the sociological, cultural and ethnological aspects of their presence? The French authorities were able to rely this time on the Muséum's "Man and Environment" Scientific Department. This expert study relied on eight researchers from diverse institutions, covering a large variety of approaches (sociology, anthropology, ethnoecology, geography and philosophy), and called for collegiality and interdisciplinary work. The report was well received by all the stakeholders, reflecting its scientific rigour and its objectivity in dealing with a complex, impassioned subject. At the end of the assessment no fewer than 31 recommendations were proposed to assist the State in its decision.

International trade in endangered species: **constant surveillance**

On that particular day, looking at the objects offered in the auction room, the customs officials did not hesitate and called the Muséum. It had to urgently send an expert to determine if one of the batches was indeed ivory, which is strictly regulated within the framework of international trade.
The expert confirmed, the lot weighing 150 kg was confiscated. Via UMS PatriNat, the Muséum is the French scientific authority for the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). Its responsibility is to ensure that the species protected by the CITES can move in and out of France without compromising their conservation. The representatives of the scientific body do not directly carry out the expert study. However, they must find the best specialist in each field.

The stakes are enormous. The trade in endangered species, which is constantly growing, is often considered as the most lucrative illegal trade after drugs, counterfeiting and human beings.

Elephants and their tusks © Bisakha Datta / Unsplash

Studying fisheries, **a matter of survival**

Toothfish and lobster. Two species from the southern seas greatly appreciated at the dining table, at the risk of being over-fished. This is why the Muséum's experts have an essential role in assessing fish stocks, recommending fishing quotas, and directly monitoring the catches of fishing vessels in order to preserve the resources. This would still require killer whales and sperm whales not to cause mischief!

They follow in the wake of the boats, effortlessly eating fish caught in the fishing lines. A maritime fast-food takeaway that is concerning to researchers. Might these large mammals, in addition to the competition they create, forget their "natural behaviour"? One expert study often calls for another...

Palinurus elephas (European spiny lobster) © MNHN - A. Iatzoura

A grass snake... **but which one?**

As is often the case, firefighters were called to the rescue: a snake about one metre long was in a garden in the Paris region. Impressive? Not really to the rescuers though, who believed it to be a common French grass snake, but they preferred to check before releasing it. In a few clicks, a photo was sent to the specialist from the Parc Zoologique de Paris (one of the Museum's zoos). It was indeed a grass snake, but one from North America.

Although it is harmless to humans, introducing this kind of exotic fauna to our countries may pose multiple risks to the environment. So this snake could not be released.

Protecting the geological heritage, **between research and expertise**

How can exceptional geological sites be preserved? The knowledge generated in geodiversity makes it possible to identify the most remarkable sites that can be subject to geotope protection orders. This process which can be applied in all the mainland and overseas regions, was used for the first time in 2018 to protect two sites in the Île-de-France area, following a request from the State authorities in the region.

To facilitate these kinds of measures, the Expertise-Research Cell on Geological Heritage coordinates the updating and dissemination of the National Inventory of Geological Heritage and the facilitation of the citizen monitoring network "Vigie-Terre". Knowledge of geoheritage gathered in this way opens up innovative prospects of integrating the conservation of geodiversity into the national strategy for protected areas.

The knowledge generated on geodiversity means that the most remarkable sites can be identified and protected

One Health: **at the service of an integrated health approach**

World events keep reminding us that understanding human-animal-ecosystem interactions has a fundamental impact on the control of newly emerging health threats. This concept of *One Health* is not something new at the Muséum, it is right at the heart of the institution's concerns. This is an example that has had a considerable impact. The study of endocrine disrupters, and in particular substances disrupting thyroid hormones, which are crucial to the development of the mammalian brain and to the metamorphosis of amphibians, has led to the discovery of effects of these molecules on our daily lives. These studies have made a contribution to greater scientific understanding of the problem, not only making it possible to acquire leading expertise on these public and environmental health issues but also for this major subject to be brought to the attention of citizens and elected representatives.

Collections to preserve **foreign plants**

And what if plants conserved in herbariums could help to protect species *in situ* ? This is the starting point for a project which has mobilised many botanists around collections of the Muséum and those of overseas partners. What is the aim here? To produce the most comprehensive inventory yet of endemic plant species of the Overseas regions of France. A huge expert study to assess the conservation status of these species found nowhere else, and the threats they face. These studies, compiled together with other previously-collected data, will help develop new chapters of the national IUCN Red List of threatened species, a tool for supporting political and field action. A step forward in the preservation of the natural heritage made possible thanks to the invaluable contribution of the collections.

Heterochaenia fragrans, endemic species of Réunion; Herbarium sheet of the holotype
© MNHN / S. Muller

Assessing the conservation status of these endemic species

A growing demand from private stakeholders

Developers, insurers, manufacturers, managers of natural areas on their land... Private businesses may also need expert studies and scientific advice, depending on their projects. Thus the Muséum specialists are regularly called upon to identify species, whether it is mould that needs to be removed or the remains of birds found in aircraft engines. Landowning companies such as golf resorts, quarries, airports and gas pipeline sites also require scientific support in the context of issues relating to ecological connectivity, the preservation of heritage and protected species, etc.
Biodiversity is now becoming a central subject in the development strategies of many companies. Yet another way the Muséum and its network of experts are able to participate in civil society.

Cover: © Lucie Capkova / Unsplash - Back cover: *Sabella spallanzanii* (European fan worm) © MNHN - A. Iatzoura

NATIONAL MUSEUM OF NATURAL HISTORY

57, rue Cuvier - 75005 Paris
+33 (0)1 40 79 30 00
direction.expertise@mnhn.fr
mnhn.fr