



European Speleological Federation (FSE)  
European Cave Protection Commission (ECPC)  
Fédération Française de Spéléologie (FFS)

## Environmental Outlook Status of Caves in France

### Detailed version

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### Geological Diversity and Caves

#### Karst regions

France's geological landscape is rich with extensive karstic regions, covering approximately 40% of its total land area. Notable regional disparities include the number, size, and types of caves across different regions.

Over a century of exploration has led to the discovery and documentation of more than 50,000 caves, primarily in carbonate rocks such as limestone and dolomite. Caves in gypsum, sandstone, and volcanic rocks add to France's geological diversity. The lithological framework, tectonic, and geomorphological evolution have resulted in a variety of karsts, including the classic Grands Causses, semi-karst plateaux in sedimentary basins, high mountain karsts, peri-Mediterranean karsts, and various scattered karsts.

#### Types of caves

Caves in France can be categorized based on human access, uses, and resources. These include:

- Decorated or with archaeological deposits caves: prehistoric caves, troglodytic caves, burial caves;
- Underground mines and quarries;
- Show caves: after the United States and China, France is the third country in the world in terms of numbers of caves open to public visits;
- Caves as components of groundwater aquifers;
- Caves as habitats for animals (subterranean fauna): some are accessible to humans, but fauna also lives in tiny interstices;
- Caves as places for exploration and scientific studies;
- Caves as places for recreational and sportive caving : horizontal caves; vertical caves ; cave systems with many different features.

The same cave can have different resources and uses. While the majority of caves are natural, others may be artificial, built or dug by man. This typology is not exhaustive and is not specific to France.

### Cave Protection Status

#### Cave register

The Fédération Française de Speleology (FFS, French Speleological Federation) is developing a national caves database to better manage and protect them: <https://www.karsteau.org/karsteau/>

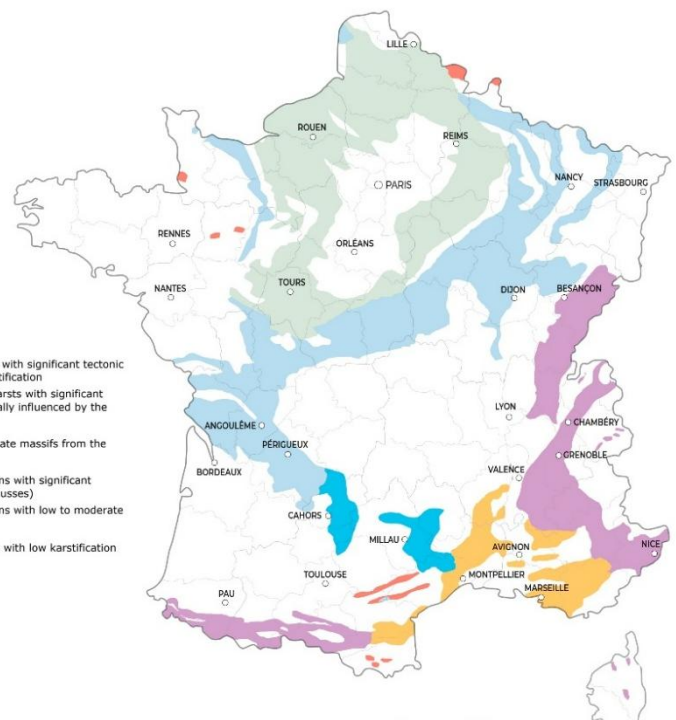


Figure 1: karst areas in France. Crochet Ph., 2022.



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Event de Peyrejal (Ardèche). Photo : Labat M.



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### *Laws for cave protection and autonomous protection*

There are no law specific for cave protection. French caves benefit from legal protection under various regulations, including those for historical monuments, archaeological excavations, natural monuments, biodiversity preservation, and water protection. Nature protection associations and speleologists' organizations also undertake protection actions, usually in agreement with landowners.

The history of caves preservation in France dates back to the early 20th century, with significant milestones:

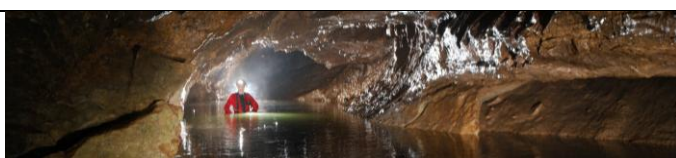
- **1902: law relating to the protection of public health. Article 28:** *“the abandonment of animal cadavers, butchery wastes, manure, faecal matter and in general, putrescible animal wastes in faults, pits, sinkholes and excavations ... is forbidden”*. Edouard Alfred Martel, the famous French speleologist was very committed to this law, so strongly that it is still sometimes called “Martel law” ;
- **1902: classification as historical monuments** of the caves des Combarelles and Fond de Gaume (laws of 1887 and 1913);
- **Law of 1906 (improved by law of 1930)** allowing the classification (and the inscription) for protection of natural sites and monuments. The sites policy aims to protect the most outstanding landscapes;
- **In 1913** Martel published a paper proposing a list of several hundred sites to be protected which he called “*National parks*”. His objective was to highlight the limits of the law of 1906;
- **In the years following their promulgation, the 1906 and 1930 laws** were used quite extensively for caves. This dynamic then slowed down considerably. The classification of cavities as historical monuments (archaeological and prehistoric sites) has a much more stable dynamic;
- **1969: creation of a "cave protection" commission** by FFS (2 years in advance of the French State which established its first environment ministry in 1971). This commission had great success in fighting the looting of and trade in concretions. Until the end of the 90s, FFS had important institutional recognition for its protection activities;
- **1976: law of nature protection** who enabled the relaunch a cave protection activity;
- **1992 : start of Natura 2000**, a network of protected areas covering Europe's most valuable and threatened species and habitats. In France numerous caves are included in Natura 2000 sites;
- **1996: creation of the conservatoire du milieu souterrain (Conservatory of underground milieu)** by FFS. Its objectives are: 1) to protect vulnerable sites through land management (purchase, agreements); 2) to promote the richness of the underground heritage; 3) to raise public awareness of the vulnerability of the environment; 4) to facilitate the development of knowledge. The conservatory had little activity since 2008 due to a lack of political will and resources. Since 2024 a new strategy has been designed and implemented;
- **Since the years 2000 environmental NGOs** have shown an increasing interest in caves mainly as bat sites : for example, in 2020, the conservatoires d'espaces naturels (which cover the whole of France) have land control (ownership, lease, agreement) over 95 caves. 55% have physical protection (gates);
- **January 2021: new French national strategy for protected areas** encourages a new dynamic of creation of protected areas. This has led to a new dynamic of protection including caves.

Assessing the number of protected caves is challenging due to two main reasons:

- Some caves are specifically protected, but many others are included in largest protected areas. For example, in the Gorges de l'Ardèche national natural reserve there are specific regulations governing caving. Another example, in the regional natural reserve of the Pibeste-Aoulhete massif in the Hautes-Pyrénées, nearly 1,000 caves have been identified and the management plan of this reserve includes actions to improve knowledge and reduce the impact of caving on the whole area;
- There is a wide range of protection tools used: numerous public policies, but also various initiatives by cavers and nature protection NGOs. Moreover, each protected cave is subject to specific management rules, from the strictest (no access) to the lightest (information and awareness-raising for visitors).

### *Ratification of relevant international treaties*

France has ratified several treaties on environmental protection, but none specifically devoted to caves.



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## Underground Geological Heritage Status

### *Importance and localisation*

France's underground geological heritage is particularly important. A national inventory of geological heritage was launched in 2007, initially focusing on surface geological heritage, while underground remains largely unknown. Local and regional studies by geologists who are also speleologists provide valuable knowledge on underground heritage, but a comprehensive national synthesis is needed.

### *Relevant Actions Implemented*

Different policy tools are mobilised:

#### **National natural reserves:**

- Grotte du TM 71 (Aude), created in 1987;
- National natural reserve of geological interest in the Lot department (RNN180), created in 2015. 65 of the 85 protected sites are "phosphatières";

**Classified sites (sites classés)** for protection of landscapes and natural monuments (law of 1930). Classified sites are places whose exceptional character justifies protection at national level.

- grotte du Cirque (Lot), grotte de Clamouse (Hérault), grotte de la Cigalère (Ariège), ...

#### **Citizens' initiatives :**

- Mont Marcou' association, set up by speleologists to study and protect the Mont Marcou cave, in particular its crystallisations, and the karstic system as a whole;
- Malaval cave association (Lozère);
- Grotte des Petites Dales (Seine Maritime) part of the FFS conservatory of the underground milieu.

### *Efficiency and Limits*

Some caves are protected for their geological heritage but the dynamics is not sufficient because of a lack of knowledge and also because priority is often given to the biological heritage. For example, the arrêté préfectoral de protection de géotope (APPG, prefectural geotope protection order) is a regulatory tool to protect sites on the departmental list of sites of geological interest through appropriate measures. Created in 2015, it is the first nature protection tool specifically applicable to geology. To date, there is no APPG for underground geological heritage.

### *Ongoing monitoring or research*

Speleological geologists are still active in studies and research, but the systematic implementation of an inventory of underground geological heritage remains a priority.

## Over Visitation Concerns

Over-frequented caves or inadequate caving can significantly impact the geological, archaeological, and biological components of the heritage. The stakes are different depending on the extent and type of use: exploration caving; sport caving; caving for public under professional supervision; visits by non-cavers.

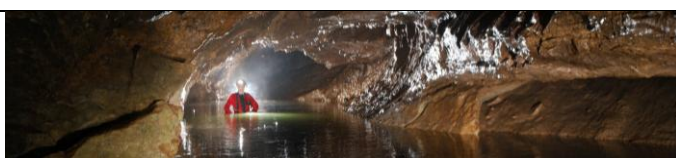
Management plans for protection address these concerns through measures depending on the heritage at stake:

- Total closure to the public;
- Period during which visits are prohibited;
- Guided tours and visitor quotas;
- path markings to be respected;
- Special rules for exploration and removal of obstruction. For example, in Natura 2000 network (which covers 13.2% of metropolitan France), it is necessary to perform an assessment of the incidences of the removal of obstructions in order to obtain a permit.

At national level, the FFS has published two charters of good practices (their respect is based on a voluntary commitment :

- Charter for practicing caving and canyoning;
- Charter of good practices for cavers in the presence of bats.

Rules prohibiting or limiting frequentation or certain practices may be difficult to accept socially. The extent of the necessary changes is often a conflictual issue



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## Archaeological Heritage Status

### *Legal protection of archeological sites*

The protection of archeological caves is included in national laws related to the preservation of historical monuments. Archaeological heritage can be protected under the legislation on historical monuments, whether in the form of archaeological deposits, built remains or archaeological objects (articles L. 621-1 et seq. of the French code du patrimoine (Heritage Code)). The aim of this protection is to ensure the conservation of the immovable and movable heritage. A distinction is made between classification as an historic monument and inclusion in the supplementary inventory of historic monuments. Listing is the first level of protection and classification the highest.

On January 2022, there were 139 ornate Palaeolithic sites in France protected as historic monuments: 116 ornate caves and 22 rock shelters, and 1 ornate rock. 92 sites (66%) are protected and 47 (34%) are simply listed (<https://www.culture.gouv.fr/Aides-demarches/Protections-labels-et-appellations/Protection-au-titre-des-Monuments-historiques>). Other forms of archaeological heritage may also be protected: cave fortresses, troglodytic dwellings, mines, etc.

Caves protected as historic monuments are frequently closed to the public or subject to guided tours. Access is often protected by a gate.

### *Importance and localisation*

France is very rich in archaeological sites. Palaeolithic caves and painted shelters are mainly located in south-west (Périgord, Quercy, Nord-Pyrénées) and south-east France (Causse, Gard, Ardèche). Many discoveries have already been studied and protected. Sometimes some problems still appear, especially in the exploration phase of new caves.

### *Relevant Actions Implemented:*

Precautions must be taken in the event of an archaeological discovery. The Ministry of Culture published a handbook of good practice for ornate sites in underground environments in 2021 (Ministère de la culture, 2021). This manual sets out what to do in the event of speleological exploration and/or discovery.

## Biodiversity Conservation Status

### *Importance and localisation*

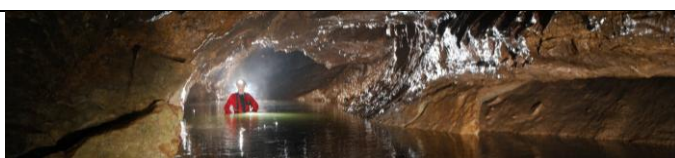
France's caves are vital habitats for a diverse range of species, with over 50,000 caves accommodating various flora and fauna. The cave fauna in France is well-studied, with ongoing research leading to continuous discoveries. In France at least 421 species are considered as troglobites (terrestrial species exclusively living underground) and the stygofauna (aquatic species exclusively living underground) consists of 381 species and subspecies. Well-known zoological orders found in French caves include: Chiroptera, Araneae, Palpigrada, Trichoptera, Amphipoda, Coleoptera, Orthoptera, and Lepidoptera. However, some groups such as Diplopoda, Chilopoda, Opiliones, Isopoda, and Oligochaeta are still undergoing revision. Additional specialists are needed for groups like Pseudoscorpiones, Diptera, and Cyclopida.

### *Relevant Actions Implemented*

**The first regulation concerns protected species.** Article L411-1 of the Environment Code provides for a system of strict protection for species of wild fauna and flora, the lists of which are set by ministerial decree. All species of bats, amphibians, reptiles and certain coleopteran insects (Aphaenops, Hydraphaenops and Trichaphaenops) are protected in the underground environment. The protection covers individuals: it is forbidden to destroy, capture, transport, intentionally disturb or commercialise them; but also their habitats: it is forbidden to destroy, degrade or alter them. A derogation is required when a project impacts specimens of protected species or habitats necessary for the proper completion of their life cycle.

**The others concern the protection of areas.** As mentioned there are several tools. Two are specially dedicated to protected species and habitats:

- **Les arrêtés préfectoraux de protection de biotope (APPB)** (Prefectoral biotope protection decrees) allow to protect the habitats of protected species. Around a hundred caves, old mines or quarries are covered by an APPB. The objective of these APPBs is to protect bats. This is achieved by restricting underground visits,



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either at all times or during periods when bats are particularly sensitive. Exceptions are made for site owners and for naturalists responsible for scientific monitoring. The creation of new entrances and any work likely to damage the walls, floors or ceilings of underground areas are frequently prohibited.

- **Natura 2000 network and EU habitat's directive.** In the habitat's directive the caves are included in Habitat Type 8310 (Caves not open to the public) (excepted marine caves (Habitat 8330) and glaciers (Habitat 8340). A recent study assesses the interests and limits for cave conservation of the implementation in France of the Habitat's directive (Lankester 2021). It shows that there is a large amount of work to do to improve the way underground milieu is taken into account and managed:
  - During the inventories carried for the objective documents of Natura 2000 sites, the large majority of inventoried caves were habitats for bats. As a result, the database is not exhaustive and the representation of 8310 and 8330 habitats is very limited;
  - Since the directive was implemented, the conservation status of habitat 8310 seems to have deteriorated for all biogeographical regions, except for the Atlantic region. Explaining this regional improvement is difficult, as the definition of habitat trends by region relies heavily on expert opinion;
  - The sites selected and their management guidelines mainly concern bats: closing off of the sites to limit their disturbance, limiting visitor numbers to certain periods, information panels. In 12 years, fewer than 30 contracts relating to habitat 8310 have been identified. For all of them, their objective is not to restore or protect the habitat itself, but to target bat species;
  - Monitoring of the effectiveness of site management measures is based solely on changes in bats populations. It rarely takes into account the monitoring of changes in geo-climatic conditions brought for example by site closure and/or climate changes, which can have direct repercussions on the animal communities.

### *Efficiency and Limits*

Despite concerted efforts to protect and preserve these valuable habitats through various legal frameworks and conservation initiatives, several challenges persist in France's cave ecosystems. Ongoing threats such as habitat destruction, pollution, inadequate caving and invasive species pose significant risks to cave-dwelling fauna. Comprehensive conservation strategies, including habitat restoration and species management programs, are essential to safeguard France's cave biodiversity.

### *Ongoing monitoring or research*

Continuous monitoring and research efforts are critical to understand the dynamics of cave ecosystems and assessing the effectiveness of conservation measures. Long-term data collection, coupled with interdisciplinary research, can provide valuable insights into the resilience of cave ecosystems and inform adaptive management strategies.

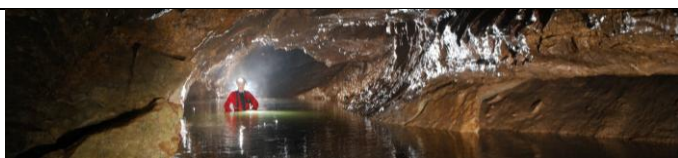
### **Mineral Resources Management Status**

Karst areas and caves offer considerable mineral resources. The implementation and management of mines and quarries are subject to specific policies and authorisation requirements. It is very difficult to prevent such projects from being implemented. To take the environment into account, measures to reduce or compensate for the impacts are most often put in place, based on the 'avoid, reduce, compensate' sequence (ERC, éviter, réduire, compenser). Nevertheless achieving a balance between economic and preservation stakes is challenging. With the objective of achieving greater national self-sufficiency in mineral and energy resources, new mining and quarrying projects are emerging in France.

### **Water Status**

#### *Importance and localisation*

In karstic areas, underground aquifers are subject to pressures from surface human activities such as agriculture, industry and human settlements. The quality of groundwater is directly related to the impact of these activities and the actions taken to limit or remediate pollution. Diffuse pollution from agriculture is a major concern. In karstic areas agriculture is mainly livestock farming, but there is also some crop production. There are many types of pollution: organic pollution from livestock, nitrates and pesticides from crops. These pressures on water quality are increasing with methanisation, agricultural intensification, installation of large pig farms, etc.



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Moreover, in a context of climate change, quantitative problems are appearing: karstic aquifer reserves are tending to decline and water availability is decreasing.

#### *Relevant Actions Implemented:*

To address water pollution issues numerous policies are implemented in the following fields: water policy, agri-environmental measures and CAP (common agricultural policy). The first policy dates from 1902. Agri-environmental measures linked to the CAP have been developed since 1992. The effectiveness of these actions on water quality is often limited and requires a great deal of time.

#### *Efficiency and limits*

The management of such problems could require important changes for agriculture. A good balance between economic and preservation stakes is often difficult to reach. Changes are often limited: manure spreading plans, little reduction in fertilisation, little or no reduction in the use of pesticides in France. Water pollution from agriculture remains a problem, but water quality is improving in some areas.

French speleologists are very aware to preserve water in karstic areas. They are involved in pollution and wastes monitoring (<https://pok-speleo.fr/>). They care also to the risks linked to new practices such as the spreading of digestates from methanisation. They are often involved in local actions to solve problems of pollution and sometimes come into conflict with polluters such as farmers.

#### **Environmental Contaminants Status**

Cave cleaning is an integral part of the FFS's cave preservation and restoration strategy. Volunteers clean a number of caves throughout France each year, addressing issues such as waste removal, graffiti, and speleothem alterations. New contaminants, such as microplastics, are emerging in water and underground sediments, and their analysis is still at the research stage.

#### **Monitoring and Research Status**

There are many thematic and localized research programs on underground environmental issues. However, there is a lack of national, multi-disciplinary synthesis studies on changes in the environmental quality of underground environments and the effectiveness of conservation and restoration measures.

#### **Public Awareness and Education Status**

Various initiatives inform and educate the general public and cavers about the importance of caves conservation:

- Nature protection associations communicate mainly on issues related to bats: threats, precautions to take, public fund-raising to protect bats, et;
- Many show caves, in particular those belonging to the Fédération française du tourisme et patrimoine souterrain (<https://www.grottesdefrance.org/>; French federation of underground tourism and heritage), take care to raise awareness of the fragility of the underground world and the need to protect it;
- Since the early 2000s, the FFS has also carried out educational initiatives to raise awareness of the richness and fragility of the underground environment:
  - Since 1999, the FSF proposes a scientific training course of one week (stage “équiper l’environnement”) for its trainers. It is based on the *in situ* study of a cavity. The hydrogeological, karstological and biological topics are studied with as well as the issues and policies for caves preservation;
  - The training of the new cavers from discovery to autonomy (French Speleology School) is based on the simultaneous acquisition of 4 types of skills: 1) Techniques of progression; 2) Environment (knowing and respecting); 3) Management of emotions; 4) Prevention of risks;
  - Information and awareness-raising campaigns for the general public, in particular during national spelunking and canyoning days.



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## Conclusion

Continued efforts are required to address emerging threats and ensure the long-term sustainability of French karstic areas and caves. Collaborative partnerships between government agencies, scientific institutions, local communities, and civil society organizations are essential for effective cave conservation. Key issues include:

- The need for a comprehensive approach to heritage conservation, combining biological, geological, hydrogeological and cultural issues;
- Addressing new problems, such as climate change and microplastic contamination;
- Improving knowledge about the underground environment;
- Developing holistic protection strategies, the current are too often sector-specific (protection of bats, archaeological or geological heritage);
- Fostering cooperation among stakeholders who know little about each other and have difficulty in working together (environmental NGOs, cavers' organisations, public institutions).

## Basic Data

- Total Number of Caves: 50,000
- Karst Area Coverage: approximately 40% of total land area
- Stygofauna: 381 species and subspecies
- Troglifauna: at least 421 species
- Main Zoological Orders: Chiroptera, Araneae, Palpigrada, Trichoptera, Amphipoda, Coleoptera, Orthoptera, Lepidoptera
- Number of Speleologists: Approximately 15,000
- Number of Speleological Groups and Organizations: 388
- National Caving Organization: Fédération Française de Spéléologie (since 1963)
- Main Speleological Publications: Spelunca, Karstologia, and various federal publications

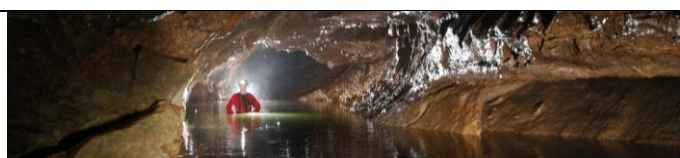
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