Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
ET SOLIDAIRE

BIODIVERSITÉ

T H É M A — Essentiel

Commissariat général au développement durable

EFESE
L'évaluation française des écosystèmes et des services écosystémiques

Rocky and mountain ecosystems in France

Key messages for decision makers

APRIL 2019

In the absence of a unified definition, high mountain ecosystems were delineated according to bioclimatic and altitude, snow cover and soil cover type criteria for EFESE. They cover the non-forest terrestrial natural environments of the subalpine, alpine and nival levels in the Alps, the Pyrenees and Corsica, and represent 2% of the surface of metropolitan France. Overseas, the altimontane formations have particularities related in particular to their insularity and volcanic character. The national territory also includes a great diversity of rocky environments of anthropic (heaps, quarries, etc.) and natural (screes, rock walls, etc.) origins .

This evaluation was conducted for the EFESE program by a team from the Laboratory of Alpine Ecology (Leca) with the support of a working group. It has been reviewed by the EFESE Scientific and technical advisory board and the key messages for decision-makers that emerged were discussed and approved on 11 April 2018 by the EFESE National stakeholders committee. The level of consensus observed and cross-references to the detailed sections of the report are presented in the margins of the messages.

To access the full report (in French): https://www.ecologique-solidaire.gouv.fr/EFESE

Ecological condition, drivers and trends

1. High mountain ecosystems host an exceptional biodiversity because of their topographic and geological complexity, climatic constraints, their historical trajectories, and in particular the effects of glaciations and past and present land uses. Across the European continent, high mountain environments cover 3% of the area and yet they shelter about 20% of its plant diversity[1]. High mountains host four mammal species, 28 bird species and 12 species of reptiles and amphibians[2] among the nation's most endangered species. The four national parks covering the high mountain (Vanoise, Ecrins, Mercantour, Pyrenees) include 186 flora species listed on the IUCN Red List of Threatened Species as Critically Endangered, Endangered, Vulnerable or Near Threatened[3].

[1] Well-established and accepted (§3.1)
[2,3] Well-established and accepted (§ 11.1)

2. Today, globally in a favorable state of conservation, the high mountain ecosystems are nevertheless threatened[1]. Some habitats are currently in an unfavorable state[2]:

i. glaciers reduced by climate change,
ii. certain wetlands, especially peatlands, destroyed, fragmented and polluted by urbanization and ski area infrastructure,
iii. some dry herbaceous formations experiencing shrub encroachment due to agricultural abandonment and
iv. meadow-woods with larches or cembro pines depending on traditional practices.

High mountain ecosystems are threatened by local pressures such as the abandonment or modification of pastoral practices (localized overgrazing, etc.)[3] and tourism development[4], or diffuse pressures such as climate change[5] and pollution including the deposition of atmospheric nitrogen[6].

[1,2] Well-established and accepted (§5.1 et 5.2)
[3] Well-established and accepted (§ 6.5)
[4] Well-established and accepted (§ 6.5)
[5] Well-established and accepted (§ 6.5)
[6] Well-established and accepted (§ 6.5)

3. Overseas, the altimontane environments are home to an exceptional biodiversity, especially floristic: out of 206 plant taxa listed on the altimontane flora of La Réunion, more than 30% are strict endemics in La Réunion and 47% are found only in the archipelago of Mascareignes[1]. As in metropolitan France, climate change and the pressures associated with tourism threaten ultramarine habitats and high altitude species. The impacts of animal and plant invasive species are also significant in the islands and pose a major threat to the maintenance of habitats, as are increases in fires resulting from increased droughts[2].

[1] Well-established and accepted (Appendix on overseas, § 1.4)
[2] Well-established and accepted (Appendix on overseas, § 2.2 et 3.5)

Ecosystem goods and services, natural heritage

4. The goods and services of high mountain ecosystems offer advantages to a multiplicity of beneficiaries, local and distant[1]. These are highly multi-functional environments on a regional scale and at a very local scale that provide the community with high levels of services despite their reduced surface area[2].

[1] Well-established and accepted (§ 14 et 8 à 11)
[2] Well-established and accepted (§ 14 et 8 à 11)

5. Forage production is a structuring activity of high mountain ecosystems and associated biodiversity[1]. The interactions between abiotic constraints, landscape structure and management shape a great diversity of grassland types, in terms of fodder quality and yields (from just 1 tonne for the nival formations to more than 6 tonnes of dry matter per hectare for some fertilized meadows)[2]. In addition to its economic benefits, it contributes to human health through diet, recreational activities of nature, psychological well-being and the support of social relationships[3]. Alpine pastures create links with lowland farmers, particularly

[1,2,3] Well-established and accepted (§8.1)
[4] Well-established and accepted (§10.2 et 13.1)
[5,6] Well-established and accepted

through the practice of transhumance. Climate change is increasing the demand for these alpine pastures and thus the pressures on their biodiversity[4]. High mountain meadows and lawns have a strong heritage value[5]. They are home to many heritage species such as the *Erygium alpinum*, various orchids, Chamois, Mouflon in Corsica, or butterflies such as *Parnassius apollo*[6]. Forage production has close direct and indirect links with hydrological regulation, control of erosion and natural hazards, recreation and tourism, gathering of wild plants and landscape amenities[7]. In addition to climate change, these values are threatened by agricultural abandonment or localized overgrazing[8]. Current farming practices conflict with the presence of large predators, which requires conciliation or arbitration[9]. Livestock sustainability depends on changes in agricultural and biodiversity public policies, the maintenance and improvement of mountain employment conditions, and the development of pluriactivity, innovation and infrastructures[10].

(§15.2)
[7] Well-established and accepted (§12)
[8] Well-established and accepted (§6 et 5)
[9] Well-established and accepted (§6.4)
[10] Well-established and accepted (§15.3)

Presence of ibex on the mountains near Champagny en Vanoise *(Auvergne-Rhône-Alpes).*
© Arnaud Bouissou - Terra

6. Soils of high mountain ecosystems and high mountain wetlands contain significant but poorly understood carbon stocks[1]. These stocks are highly vulnerable to climate change, agricultural uses, and the impacts of tourism and infrastructure[2]. They have low resilience once destroyed due to their slow ecological dynamics[3]. Due to the combined influences of climate change and land use, carbon fluxes also remain poorly known despite their importance[4].

[1,2,3,4] Well-established and accepted (§ 9.1)

7. At the catchments of watersheds, high mountain ecosystems participate in hydrological regulation, which determines the production of hydroelectric power, flood regulation, and the preservation of wetland habitats[1]. Although their contribution is marginal compared to forests and glaciers and snow masses, their vegetation cover significantly regulates the flows and the quality of the water resource[2]. Wetlands play a critical role in filtering and dissipating erosive forces. However, quantitative knowledge is limited, particularly with respect to the contribution of different types of herbaceous vegetation[3]. Hydrological regulation depends on high mountain ecosystems that are very vulnerable to climate change, the impacts of tourism activities and, to a lesser extent, nitrogen deposition and the multiplication of micropower stations[4].

[1,2] Well-established and accepted (§ 9.2)
[3,4] Well-established and accepted (§ 16.3)

8. High mountain ecosystems at the top of slopes contribute to the control of erosion[1] and natural risks[2]. They are thus guarantors of other activities (agriculture, tourism) and the safety of people and infrastructures[3]. The vegetation cover plays a significant role, but knowledge is very limited on the respective effects of different types of vegetation[4]. By degrading vegetation and soils, tourism and infrastructure reduce the control of erosion and natural hazards by high mountain ecosystems[5], but revegetation, particularly with local seeds, mitigates these impacts[6]. The progression of woody species in response to pastoral abandonment and global warming is unlikely to offset the increase in demand for regulation due to the resurgence of climate extremes[7].

[1] Well-established and accepted (§9.3)
[2] Partially established but accepted (§9.4)
[3,4,5] Well-established and accepted (§9.3 and 9.4)
[6] Well-established and accepted (§ 6.6)
[7] Partially established but accepted (§9.3 and 9.4)

9. High mountain ecosystems support a variety of recreational and outdoor tourism practices. These major economic and structuring activities place the regions concerned among those offering the most per capita tourist beds nationwide and the most jobs of nature sports professionals per bed[1]. They host a diverse audience of local, national and international practitioners. However, activities are highly concentrated in the highest mountains and iconic peaks with glaciers and eternal snow[2]. The attractiveness of outdoor recreational activities depends on the quality of the environment, including landscape amenities, some elements of iconic biodiversity, and agriculture[3]. It is reduced by localized (alteration or destruction of habitats, disturbance, water pollution) or diffuse (hydrological, sedimentary flows, air and water pollution) changes[4]. The pattern of summer attendance (summer / winter) has varied over recent history, and climate change is strengthening summer activities[5]. Recreational activities can affect emblematic and heritage biodiversity. These interactions mainly concern the subalpine stage, but also the alpine stage for the Pyrenees, where areas of tranquility with low recreational attractiveness and high habitat value for wildlife are smaller than in the Alps[6]. These interactions are regulated by the regulatory framework of practices, the training of professionals and education, but also require a consolidation of the dialogue between actors[7].

[1,2,3,4,5] Well-established and accepted (§10.1)
[6] Partially established but accepted (§ 13.2)
[7] Partially established but accepted (§ 15.2)

10. High mountain ecosystems are home to emblematic species and are landscapes with high heritage value, recognized through site rankings and labels[1]. 93% of the surface of the high mountain ecosystems are recognized as of interest for the biodiversity (ZNIEFF, ZICO), and 57% of the surface is covered by a protected status, testifying to the importance granted by the community to this cultural value[2]. Their national cultural importance is also visible through popular and artistic culture[3]. However, the protection or

[1] Well-established and accepted (§11.2 and 11.3)
[2] Well-established and accepted (§2.3)
[3] Partially established but accepted (§11.4)

designation in protected areas do not always guarantee good ecological status, and do not protect from the threats by climate change, tourism and changes in agriculture[4].

[1] Well-established and accepted (§2.3 and 7.2)

Levels of vegetation on the northern aspect (shady side) near the Col de Lautaret – Hautes-Alpes. © *Leca*

Options for integrated and sustainable management

11. Because of the remoteness of populations, the notion of solidarity is at the heart of the sustainable development of high mountain ecosystems, their ecosystem goods and services and their natural heritage[1]. At the local level, the aim is to maintain spatial, landscape and economic complementarities within these territories, whose high heterogeneity is a guarantee of biodiversity, livestock, tourism and pluriactivity[2]. At the regional and national level, interactions with valleys and distant regions are to be considered, as urban populations are beneficiaries of ecosystem services and have cultural and aesthetic attachment to high mountains[3]. The cross-sectoral integration of public policies is also a critical issue for the sustainable and coherent use of high mountain ecosystems[4]. Relying for example on existing planning documents (*ScoT, PLUi* and *SDAGE)*, mountain committees, the Alpine Convention, and public dialogue, such integration would facilitate the integration of the cumulative impacts between activities, the planning of social and economic development at the regional level, and biodiversity recovery[5].

[1,2,3,4,5] Partially established but accepted (§15.2)

12. For overseas altimontane environments, bundles of ecosystem services are dominated by the cultural and heritage dimensions[1], but also include regulatory

[1,2,3] Partially established but accepted (

services, particularly the stabilization of volcanic soils by vegetation in La Réunion or hydrological regulation in Guadeloupe and goods related to pastoral activities and the gathering wild plants[2]. A better knowledge of these ecosystems, communicated to the populations and the scientists, would support their preservation[3]. The operational development of adapted management measures requires the participation of a large number of stakeholders, including local populations, and constitutes a major lever of sustainable governance[4].

Appendix on overseas, §3)
[4] Well-established and accepted (§16.5 and Appendix on overseas, §4)

13. Rocky environments provide a limited number of ecosystem goods and services. The gathering of wild cliff plants[1], like the *Artemisia genipi* or *Hypericum nummularium*, is a first example; their habitat quality for certain remarkable species, such as birds of prey and chiroptera, is a second[2]. Despite their dominant abiotic character essential for recreational activities and landscape aesthetic[3], they are sensitive ecosystems which are not spared from human pressures[4]: tourism, sports activities, amenities, etc. These original environments contribute to the biological richness of the continental areas. Awareness of the natural heritage and ecosystem services of the rock communities by practitioners and professionals contributes to the consideration of their conservation issues and is still a lever of action[5].

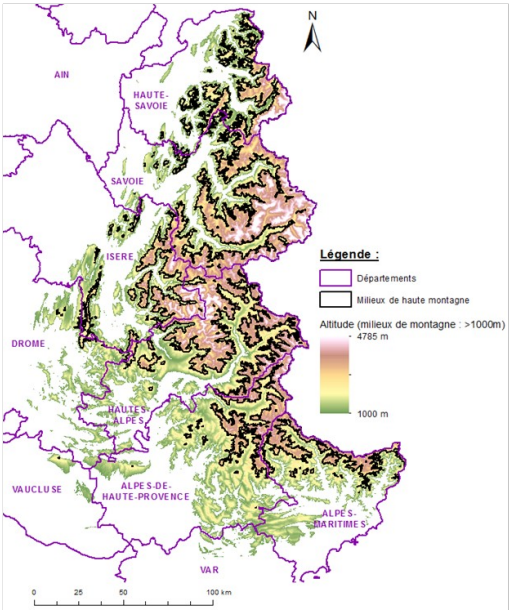
[1] Partially established but accepted (Dedicated appendix, § 3.1)
[2,3] Partially established but accepted (Dedicated appendix, § 3.4)
[4,5] Well-established and accepted (Dedicated appendix, § 2)

Knowledge and data gaps and needs for further studies

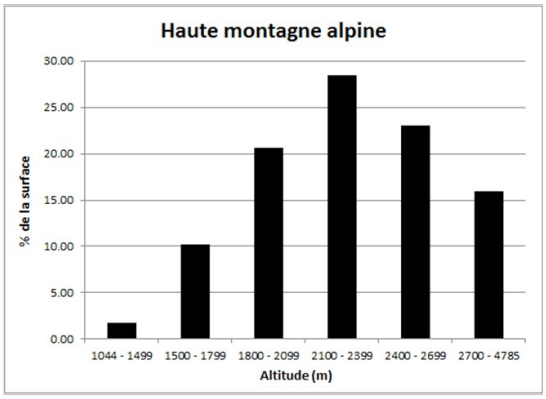
14. There are significant gaps in data, especially on the fine-scale distribution of habitats and species, abiotic factors such as soil or climate, or socio-economic variables (eg. livestock, tourism)[1]. The lack of detailed knowledge and data on the effects of different types of vegetation cover limits the ability to quantify regulatory services[2]. The evaluation of cultural services and natural heritage whose values are central to high mountain ecosystems calls for the strengthening of interdisciplinary research[3]. The complexity of the dynamics of species, ecosystems and their resilience in response to combined and cumulative drivers of change underscores the need for integrated assessments, including through scenarios that also incorporate economic and social dimensions, public policies and governance[4] .

[1,2,3,4] Well-established and accepted (§ 16.1 to 16.4)

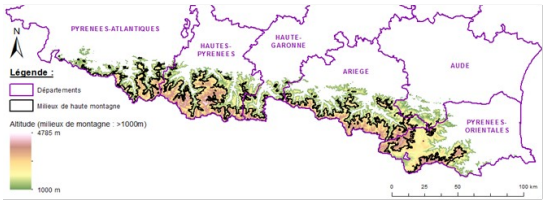
A.



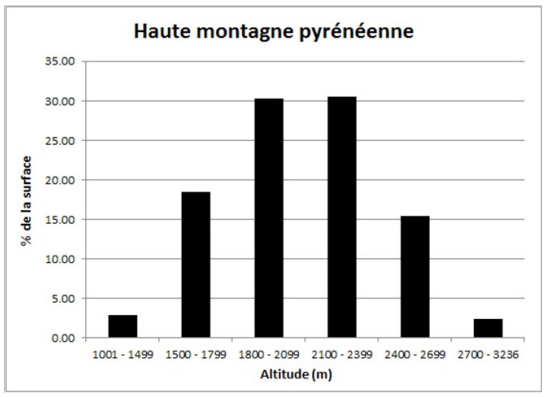
B.



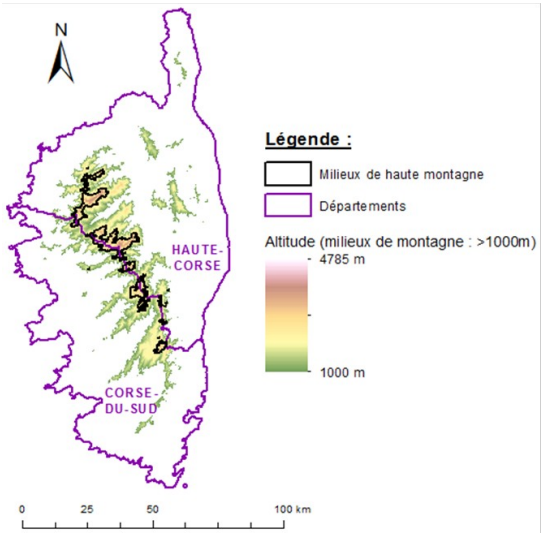
C.



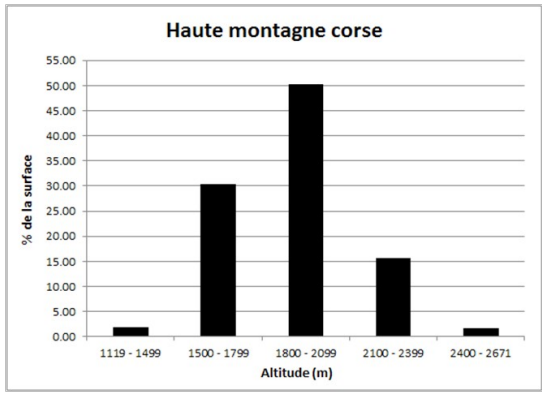
D.



E.



F.



Location high mountain areas in metropolitan France per massif (A., C., E.) **and distribution of the occupied surface according to altitude** (B., D., F.).

The EFESE is a program and a science-policy-society platform led by the Ministry for an Ecological and solidarity transition. It aims at revealing the multiple values of biodiversity in order to facilitate their integration in public policies and private decisions in France. The program builds on a shared conceptual framework and a national governance that brings together experts, policy makers and stakeholders. After a first phase ending with the publication of six broad assessments covering French ecosystems, EFESE is starting a second phase whose operational and strategic character will be reinforced in order to develop the tools required to foster the ecological transition of the French society.

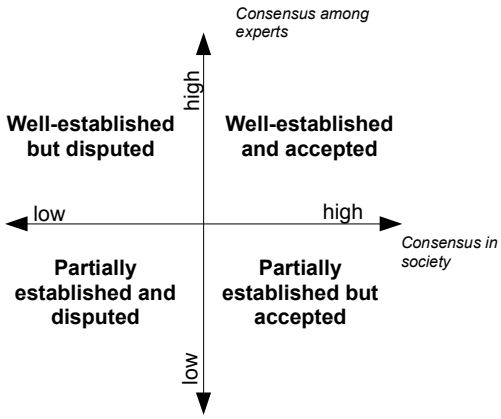
To **know more** and access the reports:
https://www.ecologique-solidaire.gouv.fr/EFESE

To **join** the EFESE community (free subscription):
http://plateforme-efese.developpement-durable.gouv.fr

The key messages for decision makers

The key messages for decision-makers are co-written by the EFESE project team of the Ministry for an Ecological and solidarity transition and by the authors of the studies. In order to enhance their scientific credibility and their legitimacy in the eyes of decision-makers, they are subject to scientific advice and stakeholder approval.

Every assertion composing these messages is qualified on two dimensions. The **scientific consensus**, first, is informed on two levels. It is proposed by the authors of the study and submitted to an arbitration by the EFESE Scientific and technical advisory board. The **societal consensus**, on the other hand, is informed on two levels. Unless opposition is expressed, the level of consensus is considered high. It is degraded as soon as a stakeholder disputes the assertion and makes the reasons for its disagreement explicit. This gives rise to the four qualifications which are presented opposite and indicated in the margin of the messages.



Directrice de la publication : Laurence Monnoyer-Smith, Commissaire générale au développement durable
Dépôt légal : avril 2019
ISSN : 2555-7564

Commissariat général au développement durable
Direction de l'eau et de la biodiversité

Tour Séquoia, 92055 La Défense cedex
Contact : efese@developpement-durable.gouv.fr

www.ecologique-solidaire.gouv.fr

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
ET SOLIDAIRE