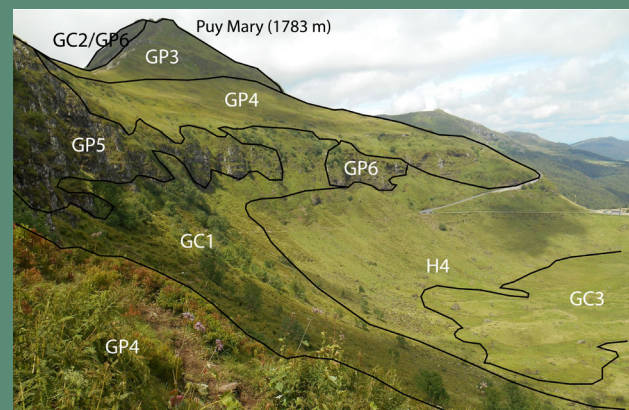
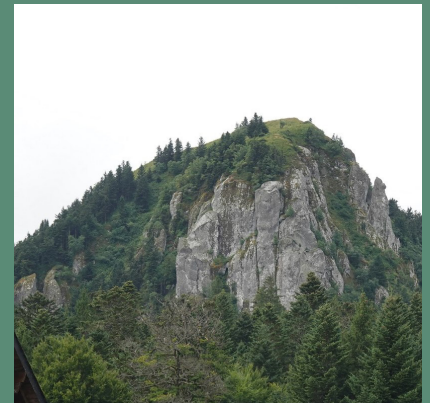


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du Massif central



European Vegetation Survey 34th conference 2026

07th - 11th (13th) September, Clermont-Ferrand

Excursion booklet

UniVegE collective / BIOM 7(1) (2026) : 105-146

UniVegE - Herbarium CLF, University of Clermont-Ferrand

UniVegE is a service of the University of Clermont-Ferrand, responsible for the conservation and management of herbarium collections, and conducting research and expertise in botany and phytosociology applied to knowledge of natural habitats.

The herbaria of the University of Clermont Ferrand constitute the 4th national collection and are referenced in the 100 largest herbaria in the world. They comprise a total of 660,000 specimens organized into 78 collections, including 47 of tracheophytes and 31 of cryptogams.

It is an international herbarium that includes plants from all continents, listed in the New York Botanical Garden's Index Herbariorum (acronym CLF).

It also constitutes a historical heritage, with acquisitions spanning the period from 1784 to the 21st century. The collections contain over 700 nomenclatural types, including reference specimens from the French Massif central.

It is an active scientific collection to which numerous specimens are added annually by various users and the UniVegE team.



A part of the herbarium CLF at 3 boulevard Lafayette 63000 Clermont-Ferrand.

Notable historical collections include the herbaria of Dutour de Salvert (early 19th century) and Martial Lamotte (second half of the 19th century). Major 20th-century collections include those of d'Alleizette (Mediterranean basin, Francophone Africa), Chassagne (Auvergne, etc.), Lassimonne, Le Grand, and Chouard. More recently, the herbaria of Deschâtres (Crete, etc.), Loiseau (Loire basin, sub-Saharan Africa), Brunel (Togo), and Chaffin have been deposited at CLF, alongside the Billy herbarium, whose publications serve as a key reference for the phytosociological understanding of the Auvergne region. Aimé Luquet's herbarium, part of the MPU herbarium, has been placed on deposit in Clermont-Ferrand for research purposes. A general tracheophyte herbarium comprising over 75,000 specimens brings together numerous collections.

Cryptogam herbaria include the Pierrot herbarium (European bryophytes, 23,000 specimens), the Skrzypczak herbarium (11,000 specimens), and a general herbarium of approximately 44,000 specimens. A general lichen herbarium, currently being assembled, contains around 14,000 specimens.

Details regarding the Clermont collections are available at: <https://herbiers.uca.fr/version-francaise/collections-dherbiers/presentation>

UniVegE has carried out extensive digitization (340,000 images) and data computerization (180,000 specimens) work as part of various programs (ReColnat, IMHAGES), making it the second most computerized botanical collection in France. This database supports historical data analyses conducted by UniVegE, notably within the framework of the IMHAGES program (2020–2022).

UniVegE currently consists of a two-person team: Dr. Camille Roux, curator and research engineer, and Léa Brocard, master's degree. Gilles Thébaud, Dr HDR, a retired curator, is a regular contributor. The team maintains connections with a network of correspondents and users.



The UniVegE team. From left to right: Camille Roux, Léa Brocard and Gilles Thébaud.

UniVegE conducts phytosociological research focusing on plant bio-indicators to understand changes in natural habitats, particularly regarding plant communities in the French Massif central. The SurVegE software, developed by Camille Roux and Gilles Thébaud, is a tool for the diachronic analysis of vegetation changes; it is used in assessments commissioned by local authorities (such as the département du Puy-de-Dôme, natural parks, and the Clermont-Ferrand metropolitan area); the monitoring plots associated with it are integrated into the ReSurveyEurope temporal database.

The UniVegE phytosociological database-hosted on Turboveg and adapted to French standards-compiles nearly 20,000 historical and current vegetation plots, mainly from the French Massif central.

UniVegE publishes *BIOM*, a scientific journal dedicated to the biodiversity of the French Massif central and mid-mountain regions (<https://revues.polen.uca.fr/index.php/BIOM>), and participates in the *Prodrome des végétations de France* (PVF2) project led by the French Phytosociological Society.

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Société Française de Phytosociologie (SFP)

Established in 2002, the French Phytosociological Society is a non-profit association dedicated to promoting and developing both fundamental and applied phytosociology. It fosters scientific exchange—notably by organizing symposia and field sessions—develops national or regional prodromus (overviews of plant communities) and disseminates knowledge through the production of books and scientific publications.

Our activities advancing cognitive research and scientific exchange in the field of phytosociology; preserving and showcasing bibliographic heritage, as well as gathering published and unpublished phytosociological documentation; developing synopsis or syntheses of regional, national, and international synsystems, and establishing their correspondence with other classification systems; applying phytosociology to: conducting inventories, expert assessments, and biological and coenotic mapping, evaluating natural and human-altered environments, managing and conserving phylogenetic, floristic, coenotic, and landscape heritage; writing phytosociological works and publications, whether scientific or educational; publishing phytosociological documents of all types and levels: scientific (journals, bulletins, etc.), educational, informational, etc.; organizing symposia, study days, field sessions, training courses, etc.



Part of the SFP team. From left to right: Erwan Glemarec, Corentin Chevrollier, Frédéric Bioret and Christian Gauberville.

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European Vegetation Survey 34th conference 2026

07th - 11th (13th) September, Clermont-Ferrand

Excursion booklet

UniVegE collective*

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Abstract

This article is the excursion booklet for the 34th conference of the European Vegetation Survey, the European group of the International Association of Vegetation Sciences, which is being held in Auvergne from September 7 to 13, 2026. Several excursions are being organized during this congress in honor of Josias Braun-Blanquet and Aimé Luquet as part of the centenary of phytosociological studies in Auvergne published in the Revue d'Auvergne in 1926. The conference is taking place in Clermont-Ferrand from September 7 to 11. The mid-conference excursion takes place on September 9th in the Dore mountains. An evening excursion is scheduled for September 10th to the summit of the puy de Dôme, coinciding with the social dinner. A post-conference excursion, from September 11th to 13th is being held in the Cantal mountains. The first part of the booklet presents the physical environment, human uses, and major vegetation types of the region. Each of the three mountain ranges visited is then the subject of a detailed description of its environment, the plant communities present, their dynamic relationships, its landscape compartments, and its typical flora. The excursion routes prioritize returning to sites surveyed a hundred years ago, some of which are *classici loci* of phytosociological alliances described for the first time in 2026 by Braun-Blanquet and/or Luquet as *Nardion*, *Genisto-Vaccinon*, *Adenostylion*, *Festucion variaae*, *Cardamino-Montion*, *Fagion*, *Calamagrostion*, *Caricion fuscae*, *Arrhenatherion*, *Piceion*. In the Dore mountains, the participants visited the Chaudefour valley, the cirque of Monneaux, The Pavin lake, and the Capucin. On the puy de Dôme, they observed the summit vegetation as well as the landscape of the Chaîne des puys. In the Cantal mountains, the subalpine areas of the northern part of the Chaîne of the Plomb du Cantal and the cirque of Impradine below the Puy Mary were explored, as well as the basaltic hill of the Chapelle Sainte Anne north of Murat. In total, 81 plant communities are mentioned and described in this booklet, resulting from the most recent and in-depth researches, integrated within the hierarchical system of the French (Prodrome des végétations de France, PVF2) and European (EuroVegChecklist) phytosociological classification.

Keywords

Vegetation
Auvergne
Braun-Blanquet
Luquet
Dore mountains
Cantal mountains
Puy de Dôme
Phytosociological alliances
Excursion

Résumé

Cet article constitue le guide d'excursions de la 34^{ème} conférence de l'European Vegetation Survey, groupe européen de l'Association internationale des sciences de la végétation, qui se tient en Auvergne du 7 au 13 septembre 2026. Plusieurs excursions sont organisées durant ce congrès en hommage à Josias Braun-Blanquet et Aimé Luquet dans le cadre du centenaire des études phytosociologiques en Auvergne publiées dans la revue d'Auvergne en 1926. Le congrès a lieu à Clermont-Ferrand du 7 au 11 septembre. L'excursion de milieu de congrès a lieu le 9 septembre dans les monts Dore. Une excursion en soirée a lieu le 10 septembre au sommet du puy de Dôme, à l'occasion du social dinner. Une post-excursion, du 11 au 13 septembre est conduite dans les monts du Cantal. La première partie présente le milieu physique, les usages humains et les grands types de végétation de la région visitée. Chacun des trois massifs visités fait ensuite l'objet d'une description détaillée de leur environnement, des communautés végétales présentes, de leurs liens dynamiques, de leur compartimentation paysagère et de leur flore typique. Les itinéraires d'excursion priorisent le retour sur les lieux prospectés il y a cent ans, dont certains sont des *locus classici* d'alliances phytosociologiques décrites pour la première fois en 2026 par Braun-Blanquet et/ou Luquet comme le *Nardion*, *Genisto-Vaccinon*, *Adenostylion*, *Festucion variaae*, *Cardamino-Montion*, *Fagion*, *Calamagrostion*, *Caricion fuscae*, *Arrhenatherion*, *Piceion*. Dans les monts Dore les congressistes visitent la vallée de Chaudefour, le cirque de Monneaux, le lac Pavin et le Capucin. Sur le puy de Dôme ils observent la végétation du sommet ainsi que les paysages végétaux de la Chaîne des puys. Dans le Cantal les espaces subalpins de la partie nord de la Chaîne du Plomb du Cantal et du cirque de l'Impradine sous le puy Mary sont prospectés ainsi que la butte basaltique de la Chapelle Sainte Anne au nord de Murat. Au total 81 associations végétales sont mentionnées et décrites dans ce guide, issues des recherches les plus récentes et les plus approfondies concernant la végétation de ces sites, intégrées au sein du système hiérarchique de la classification phytosociologique française (Prodrome des végétations de France, PVF2) et européenne (EuroVegChecklist).

Mots-clés

Végétation
Auvergne
Braun-Blanquet
Luquet
Monts Dore
Monts du Cantal
Puy de Dôme
Alliances phytosociologiques
Excursion

Introduction - The centenary of phytosociological studies in Auvergne

The French Society of Phytosociology (SFP) and the International Association for Vegetation Science (IAVS) are organizing the 34th European Vegetation Survey (EVS) conference in Clermont-Ferrand (Auvergne, France) from September 7 to 11, 2026, in partnership with Clermont Auvergne University (UCA) and the University of Bretagne occidentale (UBO). Since 1992, when the EVS was created, this is only the second time that the annual conference has been held in France.

It brings together around two hundred European researchers specializing in vegetation science, who will speak and exchange views on topics such as historical vegetation data, vegetation dynamics and monitoring, conservation and restoration strategies, and the classification of vegetation and natural habitats.

This event is being held in honor of Josias Braun-Blanquet and Aimé Luquet as part of the centenary of phytosociological studies in Auvergne (1926, Fig. 1). It is enriched by various excursions allowing participants to discover the main volcanic massifs of Auvergne: mid-symposium excursion on September 9 to the Dore mountains, climb to the puy de Dôme, summit of the “Chaîne des puys”, on September 10 during the social dinner; post-symposium excursion to the Cantal mountains, from September 11 to 13.

In 1924, Braun-Blanquet and Luquet organized a phytosociological excursion in the Auvergne region, which resulted in several articles included in a collection of memoirs and documents concerning Auvergne region, under the title *Arvernia*

2, published in the *Revue d'Auvergne* in 1926. Among these was J. Braun-Blanquet's article, « le climax complexe des landes alpines (*Genisteto-Vaccinion* du Cantal) ». Simultaneously, in 1926, Luquet published his thesis under the editorship of Brulliard in Saint-Dizier, entitled « Essai sur le peuplement végétal de l'Auvergne. Les associations végétales du Massif des monts Dore ».

At that time, these authors collaborated closely, as Roux *et al.* (2026) point out. In his thesis, Luquet thanks Braun-Blanquet because, in the spring of 1920, when they were together in the Dore mountains, Braun-Blanquet asked him to undertake a study of their vegetation (Luquet 1926: p. 11). Traces of these joint excursions have been revealed by consulting the herbaria of Braun-Blanquet in Montpellier (MPU), of Luquet in Clermont-Ferrand (deposited at CLF), where it can be seen that they collected plants together on the puy de Sancy in May 1920, as well as during joint outings over the following three years.

In July 1923, Braun-Blanquet traveled alone to the Cantal mountains, and in August returned to the Dore mountains to see Luquet. We have indeed found herbarium sheets collected during this period in this mountain range on the same day by each of them. It was surely at this time that they decided to organize the phytosociological excursion to Auvergne in 1924, published in 1926 in the *Revue d'Auvergne*.

Braun-Blanquet and Luquet continued their collaboration for many years after this period, the former as director, the latter as treasurer of the office of the “Station internationale de géobotanique méditerranéenne et alpine” founded in Montpellier, which would play a major role in the rise and international influence of phytosociology.

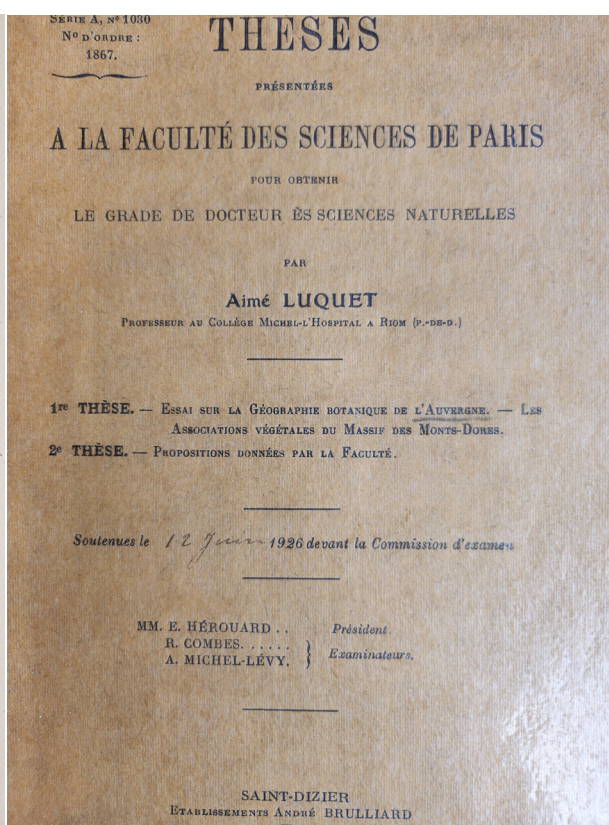
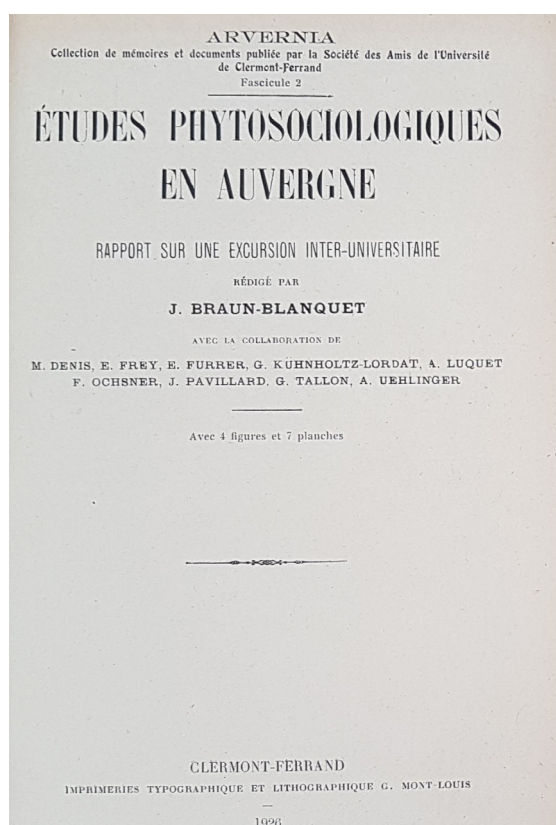


Figure 1 - Left, field trip report on phytosociological studies in Auvergne, *Arvernia* 2, published in the *Revue d'Auvergne*, volume 41 (4) 1926, Braun-Blanquet as editor; right, Aimé Luquet's thesis, defended on June 12, 1926.

The mountain ranges visited and the excursion sites

The three mountain ranges visited during the excursions form a biogeographical group of mountains located to the west parts of the Massif central and of the Auvergne (Fig. 2), which can be defined as an area with an oceanic climate on volcanic substrate (Fig. 3).

Relief and geology

The “Chaîne des puys”, the northernmost of the three mountain ranges, is a group of 80 volcanoes, aligned from north to south, formed between 95,000 and 8,000 BP. It consists mainly of Strombolian cones, some with craters, overlooking a layer of lapilli and long flows of fluid basaltic or trachyandesitic lava. There are also a few Pelean-type domes, made up of trachyte, a more viscous lava, such as the puy de Dôme, the highest peak in the chain at 1,465 m. There are also numerous “maars”, bowl-shaped, of phreato-magmatic origin.

The massif of the “monts Dore” is a result of an older volcanism whose formation began 3 Ma ago. It is a complex stratovolcano of 35 km from north to south and 16 km from east to west, made up of many imbricated edifices and various lava formations, such as basalts, trachyandesites, and rhyolites. It was the site of a collapsed caldera with debris avalanches. It peaks at 1,886 m at puy de Sancy, the summit of the Massif central.



Figure 2 - Location of the three main mountain ranges in Auvergne visited during the field trips of the 34th European Vegetation Survey conference in Clermont-Ferrand.

The Cantal massif is also a stratovolcano, even older, formed between 8.5 and 7 Ma ago, and twice as large as the Dore mountains. It is the largest volcano in Europe. It is thought to have reached an altitude of nearly 3,800 m before a gigantic caldera formed, with a central collapse, triggering debris avalanches that covered the trachyandesite lava. Phonolites and trachytes are less common. Around the stratovolcano, there are basalt formations known as “supra-cantalien,” which are between 7 and 2 Ma old.

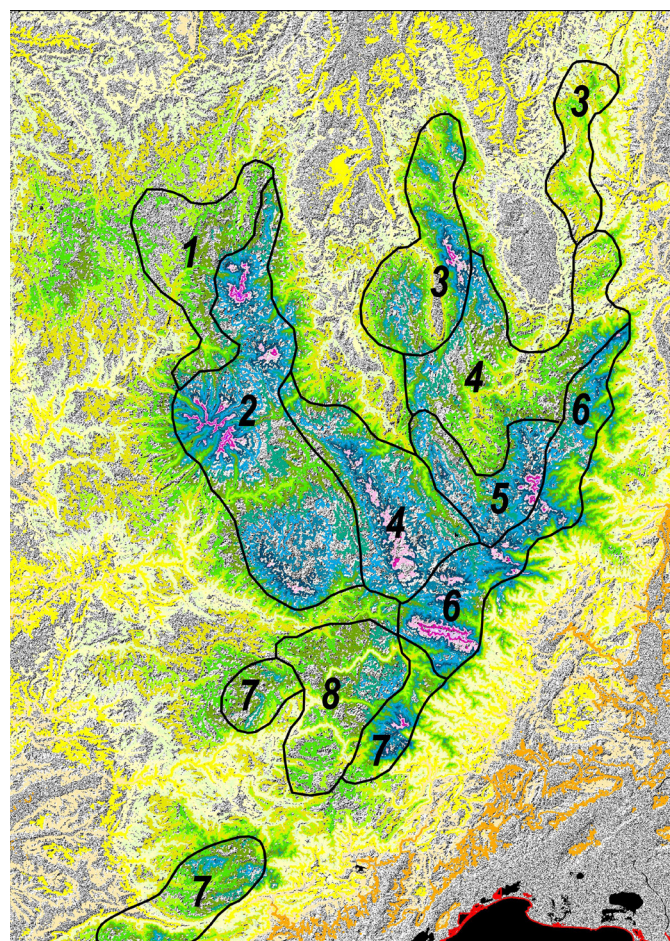


Figure 3 - Biogeographical zones of the Massif central according to Thébaud & Roux (2018). The EVS 2026 excursions cover the mountains of zone 2, an area influenced by the ocean on volcanic substrate, from north to south: the Chaîne des puys, the Dore mountains, the Céallier plateau, the Cantal mountains, and the Aubrac plateau. Map source: Earth Explorer.

These volcanic structures formed along basins and faults located to the east, including the Limagne basins, which constitute the southern part of the northwestern continental rift system (Limagnes, Bresse, Rhine) formed between the Eocene (60 million years ago) and the Oligocene (30 million years ago) during the Alpine orogeny.

Climate and recent trends

These mountain ranges are influenced by the oceanic climate. Weather stations in the Chaîne des puys, Dore mountains, and Cantal mountains show significant precipitation, averaging over 1,000 mm per year at an altitude of 1,000 m, and often much more, between 1,500 and 2,000 mm (1991–2020 period, [Météociel](#)) on the western slopes, such as at Lioran in the Cantal mountains (2,129 mm at 1,236 m) or at the town of Mont-Dore (1,783 mm at 1,050 m). This precipitation is evenly distributed throughout the year, as shown in the rainfall diagrams.

The average temperatures are low, generally below 8°C above 1,000 m and below 5°C above 1,600 m, and remain cool in summer. The westerly winds, snow and late frosts, strong cloudiness, and periods of milder temperatures in the middle of winter are other characteristics of this climate. Only the parts of

the mountains sheltered from western influences show a drier, warmer, and more contrasting climate, with a semi-continental sheltering character in the basins, where annual precipitation can fall below 600 mm, as is the case of the Limagnes.

According to the classification by Rivas-Martínez (2007), the whole area corresponds to an oceanic temperate bioclimate. The calculation of simple continentality indices yields a temperate oceanic bioclimate that varies from the eu-oceanic subtype to the semi-continental subtype.

Recent climate trends are manifested by a marked increase in temperatures in the recent period, for example in the Monts Dore: a rise of 0.91 °C between the periods 1951-1980 and 1981-2010, particularly noticeable at higher altitudes and during the growing season (Serre 2015). A decrease in snow cover is also observed during this same period 1980-2010 in the Massif central, where the number of days with snow on the ground decreased by 16% (Serre 2010) compared to the period 1950-1980.

Soils

The decomposition of volcanic rocks in a cold and humid climate without significant drought forms particular soils called Andosols, very rich in organic matter, which gives them a black color. They contain characteristic amorphous compounds called "allophanes", and complexes of aluminium/organic matter (Hétier 1975). Among the volcanic soils of the region, one distinguishes Brunisols at low altitudes and in a climatic shelters, Silandosols, moderately or slightly acidic, forming under precipitation less than 1,100 mm, and Aluandosols, the most acidic, developed under significant rainfall, and very rich in aluminium (Coquillard 1994). They are dominant in the mountain foothills. On the highest peaks, due to the short vegetation period, organic matter accumulates in the soils, forming Rankoaluandosols.

Grazing use

In the montane belt, extensive cattle grazing is widespread. Two-thirds of livestock are for meat production, and the remaining third is for dairy and cheese production. The main local cattle breeds are "Salers", "Limousine", "Aubrac", and "Charolaise", more rarely "Ferrandaise". Sheep herds are only in the Chaîne des puys, with light filtering soils. This cattle-based economy, which constitutes a very lively sector, maintains the open landscapes in the montane belt where mowed meadows and extensively grazed pastures dominate. The transhumance takes place in summer pastures, large expanses of grassland, which receive the herds from June to October, and where we find traditional buildings located above the permanent habitat, the "burons".

Vegetation

Auvergne is in the Eurosiberian biogeographical region, Alpine-Caucasian subregion, Pyrenean-Cévennian province, Arverno-Cévennian subprovince (Rivas-Martínez 2007). The vegetation is arranged according to altitude, following the pattern of vegetation belts defined for the Alps and peripheral massifs by Ozenda (1985; 2002).

The hilly (or colline) belt is divided into an Atlantic-type hilly belt with *Quercus robur*, between 200 m and 500 m at the western limit, a warm hilly belt dominated by *Quercus pubescens*, present in the sheltered climate of the Limagne basins between 300 and 700 m, and a medio-European belt, with *Quercus petraea*, found further east, between 500 and 900 m. Above this is a temperate montane belt that is omnipresent in the Massif central. This is divided into a lower montane (submontane) belt, with oak-beech forests, a middle montane (mesomontane) belt, dominated by *Fagus sylvatica*, *Abies alba*, and *Pinus sylvestris*, and an upper montane (altimontane) belt, which reaches 1,450/1,550 m. Above this, in the highest mountain ranges, particularly in the Cantal and Dore mountains, there is a subalpine belt (Thébaud et al. 2014).

In the Massif central, given the oceanic climate, we note the absence of trees such as *Picea abies*, *Pinus cembra*, and *Larix decidua*, and the rarity of indigenous stands of *Pinus mugo* subsp. *uncinata*, confined to a few peat bogs. The subalpine area is mainly treeless, as neither beech nor fir trees grow there. However, we can distinguish a lower subalpine belt consisting of heathland and grassland where thickets, tall grasses, and shrub species are abundant, such as *Sorbus aucuparia*, *Aria edulis*, *Sorbus* sp., *Betula pubescens*, *Salix* sp., and an upper subalpine belt above 1,600 m, in the form of low heathland and grassland without trees or shrubs, and where several species of alpine belt (*Juncetea trifidi*) are regularly found (Thébaud et al. 1992; Michalet & Philippe 1994; Coquillard et al. 1994).

Description of the excursion sites, sources, and tools

The excursions take participants to the Dore mountains (September 9), the puy de Dôme (September 10), and the Cantal mountain (September 11 to 13).

This excursion booklet presents the physical characteristics of the sites visited and the different types of vegetation encountered, generally up to the level of plant association as defined in the sigmatist phytosociological approach (Braun-Blanquet 1932; 1964; Guinocet 1973; Géhu 2006). A hierarchical classification system for the vegetation encountered is presented at the end of the article, based on Mucina et al. (2016) or on the PVF2 (Roux et al. 2024). The nomenclature of taxa refers to TAXREF (v. 16, INPN).

Numerous phytosociological studies have been conducted in the mountain ranges and sites visited. They are cited in the bibliography section. Similarly, numerous recent plots (relevés), carried out by various researchers, mainly from Clermont Auvergne University, in the Chaîne des puys, the Dore mountains and the Cantal mountains, have supplemented these data and have also been used to characterize communities and vegetation dynamics.

Here, we have adopted the principles and definitions of landscape or dynamic-catenal phytosociology, as explained by numerous authors, in particular Biondi (1994), Lazare (2009) and Bioret et al. (2019), as a way of presenting the dynamic and ecological links between the different communities. Among the various units identified by these authors, we have selected those most relevant to the region visited, as listed below.

According to Bioret *et al.* (2019), the vegetation series is a conceptual dynamic unit gathering plant communities with the same potential vegetation the final stage of which is called “series head”. Vegetation series is linked to an ecologically homogeneous spatial unit, or “tessela”. There is climatophilous series, related to the mesoclimate and edaphophilous series mainly influenced by edaphic constraints. Among the latter, several can be distinguished, including edaphoxerophilous series or the edaphohygrophilous ones.

The “holoserries” is a complete series, whose mature stage is the forest.

The “curtaserries” is a truncated series, whose mature stage, due to ecological constraints, is not forest but often shrubby.

The “permaseries” consists of a single permanent stage within a tessella characterized by severe ecological constraints. It may, however, include vegetal stages of anthropogenic degradation.

The “geoserries” is a conceptual unit that includes different series within a “catena”. Catena is forming a homogeneous geomorphological and bioclimatic spatial entity of variable size, made up of several tessellas. There are also “geopermaseries”, comprising several permaseries, and “geocurtaserries”, comprising at least one curtaserries.

Only the Chaîne des puys has been the subject of an in-depth study in landscape phytosociology (Roux 2017), unlike the Cantal mountains and the Dore mountains, where the units described are only a rough outline.

The Dore mountains (mid-symposium excursion 9th September)

Chaufour valley-Monneaux-Sarreville (groups 1 and 2, morning)

The first group's excursion takes place in the lower Chaudefour valley, from the Sainte-Anne chalet at the entrance to the national nature reserve to the beech forests below the Crête du Coq (4 km round trip, 100 m elevation gain) (Fig. 4).

The second group's excursion takes place in the Monneaux cirque, starting from the car park of the restaurant Les Cinq Cents Diabes to the ridge south of puy Jumel at 1,430m (4km round trip, elevation gain 280m), where there is a panoramic view of the upper Chaudefour valley (Fig. 4).

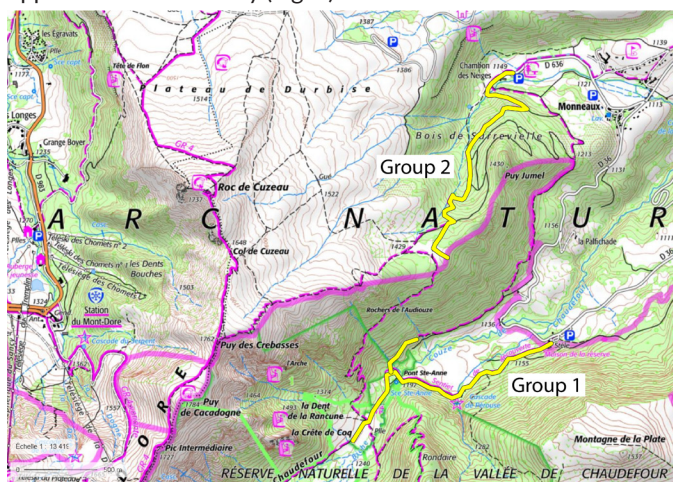


Figure 4 - Itineraries of the two groups (in yellow) in the Chaudesfour valley and the Monneaux cirque. Map source: French national geographic institute (IGN).

The Monneaux cirque is a small ancient glacial cirque attached to the larger Chaudefour cirque. It is characterized by its U-shaped profile with steep slopes, abrupt cliffs, and a flat bottom. The

north-facing slope and the plateaus overlooking the valley are composed of trachyandesite. The puy Jumel and the ridges to the south are formed of basaltic lava corresponding to the third phase of the formation of the Dore stratovolcano. The valley floor consists of fluvial-glacial deposits and recent alluvial deposits.

The Chaudefour valley is the second largest valley in the Dore mountains after the vallée des Bains. It forms a cirque, upstream culminating in the puy Ferrand peak at 1,856m. It was formed by a powerful and thick glacier, several hundred meters deep, which flowed downstream to lake Chambon, more than 10km away. The steep slopes are composed of trachyandesites and trachyandesitic screes, topped by dikes-volcanic veins injected into the surrounding rock and brought to the fore by erosion: Crête du Coq, Dent de la Rancune, and Arche. These light gray lavas are richer in silica than basalts and are remarkable for their abundance of phenocrysts. The valley floor upstream is filled with scree and coarse volcanic deposits, obscuring the underlying formations.

Vegetation series and plant communities visited:

Several vegetation series are expressed across different ecological compartments (tesselas), mainly depending on altitude, aspect, and soil moisture. These have not been studied in detail, but an outline can be drawn given the good state of knowledge of the area's plant communities, which have been extensively surveyed for nearly a century and mapped (Bock & Prelli 1975; Combe & Rameau 1994).

Only the series and communities present along the routes followed by the participants, from the mesomontane belt to the base of the subalpine belt, will be presented here (Fig. 5).

The subalpine plant formations of the Chaudefour valley, which are very rich and diverse, will not be described in this booklet. Readers are referred to the bibliography listed at the end.

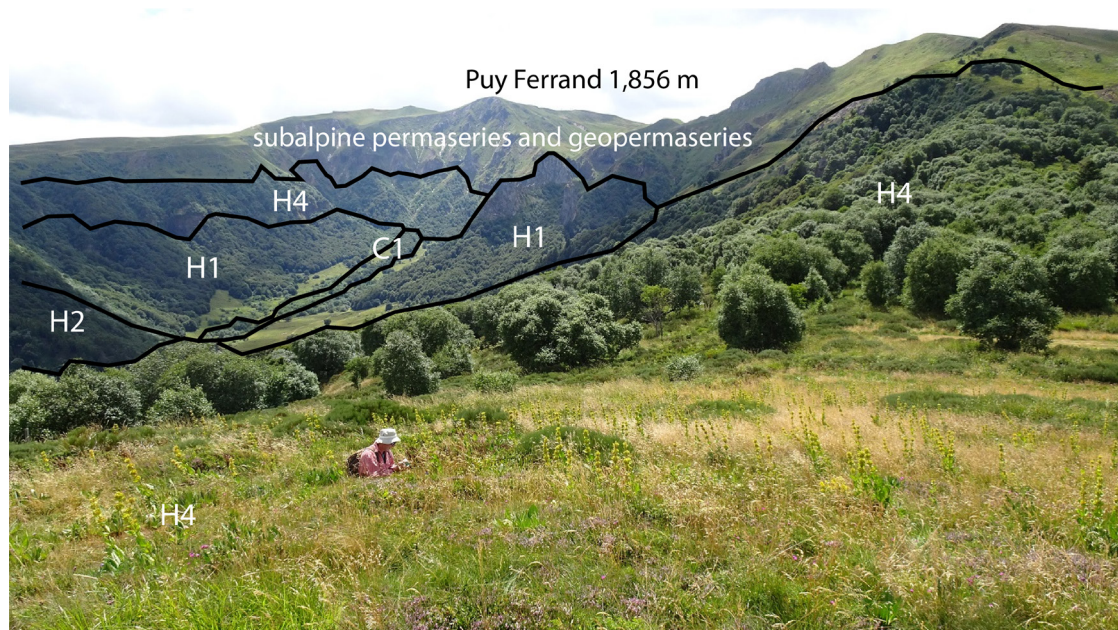


Figure 5 - Sketch of the vegetation series of the Chaudefour Valley as seen from the Sarrevielle woods. H1: mesomontane holoserries of the neutrophilous beech forest *Adoxo-Fagetum*. H2: mesomontane holoserries of the acidiphilous beech forest *Luzulo sylvaticae-Fagetum*. H4: uppermontane holoserries of the chionophilous beech forest *Doronici austriaci-Fagetum*. C1: edaphic-hygrophilous curtaserries of the willow scrub *Salicetum pentandro-atrocinereae*.

The landscapes have changed in the Chaudefour valley since the 19th century, as in all the mountains of Auvergne, as shown in the drawings of Delécluze (Photo 1, Fig. 6). The mowed meadows at the bottom of the valley have become pastures, and the forests have progressed on the slopes.



Photo 1 and Figure 6 - Chaudefour valley according Étienne-Jean Delécluze (1821, MARQ Art Museum). In 2025, it can be observed that the hay meadows (*Agrostietum capillaris* Luquet 1926, *Trisetum-Polygonion*) have given way to extensive pastures (*Nardo-Agrostion tenuis*) and the forest is more widespread. In the foreground on the left: the rock crête de Coq (cockscorn) and on the right the rock "dent de la Rancune" (tooth of rancor).

In the riverine habitats and wet flats on hydromorphic soils at the bottom of the valley, with river or groundwater flooding, a mesomontane eutrophic edaphohygrophilous curtaserie develops, which leads to the willow grove with *Salix pentandra* and *S. atrocinerea* (C1).

Following the abandonment of the maintenance of the drainage ditches of the wettest meadows, the pastures of these areas are transformed into mesotrophic hygrophilic meadows (*Calthion palustris*), then after total abandonment, into tall-forb communities (*Ranunculo aconitifolii-Filipenduletum ulmariae*) with *Filipendula ulmaria*, *Angelica sylvestris*, *Cirsium palustre*, *Veratrum album*, *Chaerophyllum hirsutum*, *Ranunculus aconitifolius*, and *Equisetum fluviatile*. The *Salix atrocinerea* and *S. pentandra* willow grove (*Salicetum pentandro-atrocinereae*), eutrophic to meso-eutrophic, establishes itself at the expense of these formations and constitutes the series head.

On the lower slopes, colluvial flats, in particular in concave landforms, on deep, well-drained volcanic andosol, we find the climatophilous neutrophilous mesomontane Atlantic beech forest holoserries with *Adoxa moschatellina*, well represented upstream of the Chaudefour cirque (H1, Photo 2). It includes hay meadows (*Viola luteae-Trisetum* = *Agrostietum capillaris* Luquet 1926). *Trisetum flavescens*, *Avenula pubescens*, *Knautia arvensis*, *Agrostis capillaris*, *Poa chaixii*, *Centaurea nigra*, *Phyteuma spicatum*, *Geranium sylvaticum*, *Lathyrus pratensis*, etc., are found there in abundance. Mowing is limited to the flattest areas (Photo 3), the others being mainly used for cattle or horse grazing (*Cynosurion cristati*) with resting areas that are sometimes very eutrophic (*Rumicion alpini*), where *Rumex alpinus*, *Veratrum album*, *Chenopodium bonus-henricus*, *Dactylis glomerata*, etc., predominate.



Photo 2 - *Tractema lilio-hyacinthus* in the Atlantic beech forest (*Adoxo-Fagetum* = *Fagetum sylvaticae* Luquet 1926), Chaudefour valley.



Photo 3 - Hay meadows downstream of the Chaudefour valley: *Agrostietum capillaris* Luquet 1926 (*Viola luteae-Trisetum flavescens*, *Trisetum-Polygonion*).

Grazed woodlands with *Salix caprea*, *Betula pubescens*, *Sorbus aucuparia*, and *Corylus avellana* were established, preparing the way for the arrival of the neutrophilous beech forest (*Adoxo moschatellinae-Fagetum sylvaticae* = *Fagetum sylvaticae* Luquet 1926, *Fagion sylvaticae* Luquet 1926), which constitutes the series head, on deep, well-mineralized mull andosol. There is a group of neutromesophilous species, including *Lilium martagon*, *Paris quadrifolia*, *Milium effusum*, and *Galium odoratum*, species of Atlantic distribution, such as *Euphorbia hyberna* and *Tractema lilio-hyacinthus*, vernal geophytes such as *Adoxa moschatellina*, as well as some tall mesotrophic grasses, including *Lactuca plumieri*, *Doronicum austriacum*, and *Senecio ovatus*.

On the steep valley slopes, mainly facing north, lies a subatlantic, mesomontane, meso-acidiphilous climatophilous holoseris that leads to beech forest dominated by *Luzula sylvatica* (H2). It mainly occupies the steep north-facing slopes on trachyandesitic lava.

A few dynamic stages of meadows and grasslands within this series are visible in the area visited: one can observe shrubby thickets of *Salix caprea*, *Betula pendula*, *B. pubescens*, *Sorbus* (*Betula pendulae*-*Salicetum capreae sorbetosum ariae*, *Sambuco-Salicion capreae*), and a few patches of montane heathland (*Galio saxatilis*-*Vaccinietum myrtilli*, *Diantho hyssopifolii*-*Vaccinion myrtilli*), tall grasses of clearings or windthrow areas (*Lactuco plumieri*-*Epilobietum angustifolii* or *Senecioni fuchsii*-*Digitalietum purpureae*, *Epilobion angustifolii*) and shaded edges of *Melampyro sylvatici*-*Poion chaixii*, mesophilous (*Prenantho purpureae*-*Avenelletum flexuosae*), or on water soils (*Agrostio capillaris*-*Lactucetum plumieri*). A similar series was described in detail in the Chaîne des puys by Roux (2017).

We especially observe the predominance of the series head, the *Luzula sylvatica* beech forest (*Luzulo sylvaticae*-*Fagetum*, *Fagion sylvaticae* Luquet 1926). It is a forest which is dominated by acidiphilous species, *Vaccinium myrtillus*, *Avenella flexuosa*, *Prenanthes purpurea*, *Luzula sylvatica*, and *L. nivea*, and includes a group of neutromesophilous species, *Galium odoratum* and *Phyteuma spicatum*, as well as mesotrophilous, such as *Poa chaixii*, *Senecio cacaliaster*, and *Festuca altissima*.

On sunny and convex slopes with drier soils, and more sporadically, a mesomontane, acidiphilous, climatophilous holoseris is found, leading to a species-poor beech forest with *Solidago virgaurea* (H3). This series includes acidiphilous montane heaths (*Galio saxatilis*-*Vaccinietum*, *Diantho hyssopifolii*-*Vaccinion myrtilli*) and grasslands (*Nardo*-*Agrostion tenuis*). *Avenella flexuosa*, *Vaccinium myrtillus*, *Teucrium scorodonia*, *Luzula nivea*, *L. sylvatica*, *Hieracium murorum*, *Melampyrum pratense*, and *Maianthemum bifolium* are abundant.

The beech forest (*Solidago virgaureae*-*Fagetum*, *Luzulo*-*Fagion*) constitutes the most represented community.

Above 1,400m altitude, the uppermontane neutrophilous and chionophilous climatophilous holoseris of the beech forest with *Doronicum austriacum* (H4, Photos 4 and 5) is observed, forming a regular belt at the upper edge of the beech forest with several communities in dynamic contact.

The grazed grassland *Diantho pseudocollini*-*Scorzoneroideum pyrenaicae* (*Nardo*-*Agrostion tenuis*, Photo 6) is a widespread community in the Auvergne mountains, acidiphilous, on oligotrophic soils, species-rich (>30 per 20m²). It is maintained by extensive cattle grazing. It includes numerous species of the class *Nardetea*, including *Arnica montana*, *Galium saxatile*, *Gentiana lutea*, *Viola lutea* subsp. *lutea*, *Meum athamanticum*, and *Nardus stricta*, as well as a small group of subalpine species (*Nardion*), such as *Epikeros pyrenaicus*, *Potentilla aurea*, and *Scorzoneroideum pyrenaica*.

The low cranberry heath *Allio victorialis*-*Vaccinietum myrtilli* *vaccinietosum uliginosi* (*Genisto pilosae*-*Vaccinion*) is acidiphilous,



Photo 4 and 5 - *Doronicum austriacum* and chionophilous uppermontane beech forest on the upper slope of Chaudefour (*Doronicum austriaci*-*Fagetum*, *Aceri*-*Fagion*).



Photo 6 - In the foreground, pastures with *Nardus* (*Diantho pseudocollini*-*Scorzoneroideum pyrenaicae*, *Nardo*-*Agrostion tenuis*) in series H4 in the uppermontane belt above the Sarrevielle wood.

typical of the upper edge of the beech forest, enriched in mesotrophic species such as *Stellaria holostea*, *Polygonatum verticillatum*, and *Calamagrostis arundinacea*. It is dominated by cranberries, *Vaccinium gaultherioides*, *V. uliginosum*, *V. myrtillus*, and includes *Calluna vulgaris* and *Genista pilosa*.

This series also includes a tall heath with “purging broom” (*Cytisium oromediterranei*), which corresponds to dynamic stages after abandonment of grazing (*Silene vulgaris*-*Cytisetum purgantis*) or occupies either rocky, dry and warm sites, where it constitutes a permaseris (*Teucrio scorodoniae*-*Cytisetum purgantis*).

Shrubby thickets of *Betula pubescens*, *Sorbus aucuparia*, and *Aria edulis* occupy extensive areas between the uppermontane and lower subalpine belts. In the area visited, they form grazed woodlands where herds find shelter. *Calamagrostis arundinacea*, a thermophilous subalpine species, forms significant populations at forest edges (cf. *Doronico austriaci-Calamagrostietum arundinaceae*), in these undergrowth and clearings where it is sheltered from the wind. These shrub communities interact with the beech forest or form patches above the upper edge of the forest (*Pruno petraeae-Sorbus aucupariae*).

The series head is the beech forest *Doronico austriaci-Fagetum* (*Aceri-Fagion*, Photo 5). This plant community, with *Acer platanoides* instead of *A. pseudoplatanus*, is in its typical aspects with trunks and shoots bent by the snow. It is species-rich with a group of neutromesophilous forest species, *Paris quadrifolia*, *Lamium galeobdolon*, *Galium odoratum*, *Phyteuma spicatum*, acidiphilous, *Prenanthes purpurea*, *Luzula sylvatica*, *Poa chaixii*, a group of tall mesotrophilous and chionophilous subalpine herbs, *Ranunculus plataniifolius*, *Doronicum austriacum*, *Imperatoria ostruthium*, *Adenostyles alliariae*, *Lactuca plumieri*, *Allium victorialis*, and also has an Atlantic character with *Tractema lilio-hyacinthus* and *Euphorbia hyberna*.

It appears that the current altitudinal range of this series is shifting due to climate change. The active expansion of *Betula* and *Sorbus* shrubby thickets is noteworthy.

Several tall-herb permaseres can be observed in the visited area.

Along the streams on the forested slope of Sarrevielle, in the mesomontane belt, we observe an edaphohygrophilous permaseres of sylvatic tall forbs, (*Crepido paludosae-Adenostyletum alliariae*, *Adenostylion alliariae*) (P1). It includes a group of sciophilous species *Lamium galeobdolon*, *Chrysosplenium alternifolium*, *Epilobium montanum*, a group of rheophilous species, *Chaerophyllum hirsutum*, *Ranunculus aconitifolius*, *Geum rivale*, *Chrysosplenium oppositifolium*, and tall herbs descended from the subalpine belt, *Lactuca alpina*, *Rumex arifolius*, *R. alpinus*, *Adenostyles alliariae*. This tall forb riparian community of the montane belt exists throughout the north of the Massif central where it replaces the southern *Arabidopsis cebennensis-Adenostyletum* Braun-Blanq. 1950.

An edapho-aerohygrophilous permaseres of tall-forb forest, non-riparian, on eutrophic soils, the *Doronico austriaci-Campanuletum latifoliae* (*Adenostylion alliariae*) (P2), exists in a few rare locations (Chaufeufour only), notably near the Pérouse waterfall. This community is primarily known in the Cantal mountains where it also occupies bottoms of glacial valleys.

The climatophilous thermomesophilous, on mesotrophic soils, subalpine tall-herb meadow *Calamagrostietum arundinaceae* Luquet 1926 (*Calamagrostion arundinaceae*) (P3, Photo 7) constitutes subalpine enclaves in the uppermontane belt, benefiting from snowy, sheltered climates. It occupies steep east-facing slopes, sheltered from the prevailing winds, where snow accumulates and supplies the soil with water in spring. It is very species-rich community with *Cirsium erisithales* (Photo 8),

Laserpitium latifolium, *Crepis conyzifolia*, *Campanula scheuchzeri*, *Lactuca plumieri*, *Patzkea paniculata*, *Rosa spinosissima*, *Gentiana lutea*, and *Serratula tinctoria* subsp. *macrocephala*. This is an impoverished grouping compared to the *Calamagrostis* communities located and widespread higher up in the subalpine belt, where we also find *Bupleurum longifolium*, *Cyanus montanus*, *Allium victorialis*, *Pedicularis foliosa*, *Chaerophyllum villarsii*, *Vicia orobus* (Photo 9) and *Sorbus chamaemespilus*.

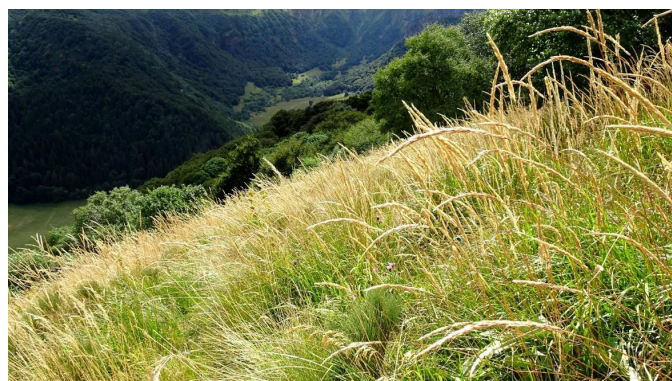


Photo 7 - Enclave of subalpine vegetation on the upper slopes of Chaufeu four valley, upstream from the Sarrevielle woods: *Calamagrostietum arundinaceae* Luquet 1926.



Photo 8 - *Cirsium erisithales*.

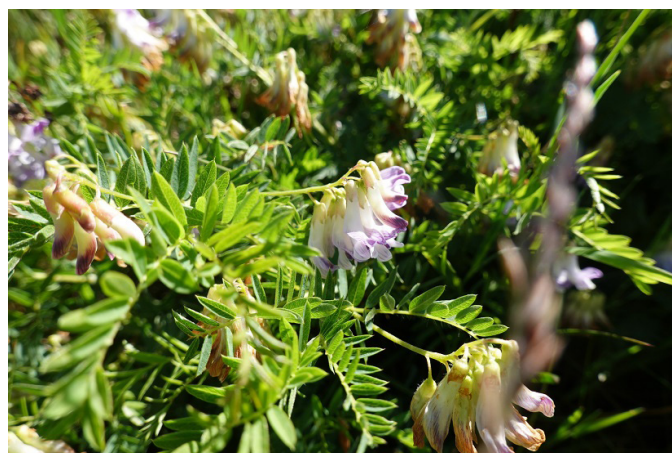


Photo 9 - *Vicia orobus*, Atlantic-montane common species in *Calamagrostietum arundinaceae* Luquet 1926.

Pavin lake (group 1, afternoon)

The first group will hike around lake Pavin (2.5 km), ascend to the viewpoint (70 m elevation gain). We will then make our way across the *Nardus* mountain pastures located above, heading to the small, natural Estivadoux lake, which is subject to temporary flooding (Fig. 7).

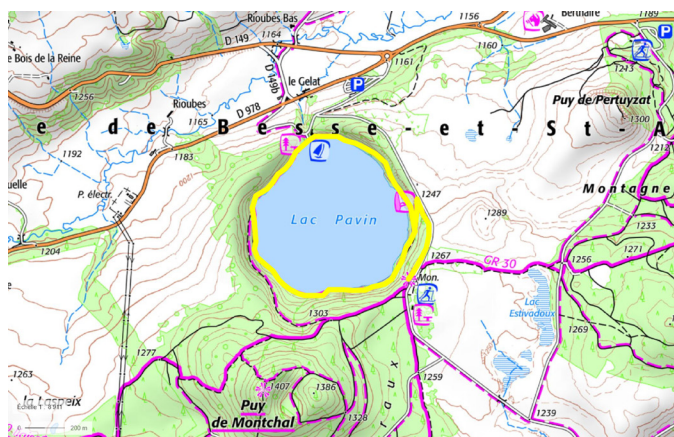


Figure 7 - Itinerary of group 1 around lake Pavin. Map source: IGN.

Pavin lake (Photo 10) lies in a maar crater created due to phreatomagmatic explosions. It is an oligotrophic lake with a depth of 91.8 m and a surface area of 0.44 km². It is overlooked by the puy de Montchal at 1,407 m, a Strombolian cinder cone. The age of this volcanism, estimated between 6,700 and 3,450 BP, makes it the youngest in the Auvergne region. The emerged slopes of the Pavin crater are covered with pyroclastic rocks ejected from the maar. It is surrounded by trachyandesite lava (Renault et al., 2009).



Photo 10 - Pavin lake with the snow-capped Dore mountains in the background.

Due to its great depth, Pavin lake is a meromictic lake, whose waters from a depth of 60 m are not mixed and are therefore anoxic and rich in toxic gases (CH₄, H₂S and CO₂).

Vegetation series and plant communities visited:

The lake's flora is very poor, due to its great depth and steep banks. The aquatic flora includes two oligotrophic freshwater

pondweeds: *Potamogeton alpinus* and *P. praelongus*; the latter species, found in the Jura and the Alps, is very rare in France and is specific to deep waters.

The crater slopes are entirely forested, covered by a beech forest (Photo 11) or a beech-fir forest, an ancient part of which already existed at the beginning of the 19th century on the slopes exposed to the north, as shown in Delécluze's drawing of 1821 (Fig. 8). The majority of these forests are meso-acidophilous and fall within the holoserries of *Luzulo sylvaticae-Fagetum* (H2). They include an inner shaded fringe belonging to mesophilic *Melampyro sylvatici-Poion chaixii* (*Prenanthes purpureae-Avenelletum flexuosae*).



Photo 11 - Beech forest with *Luzula sylvatica* on the slopes of Pavin Lake (*Luzulo-Fagetum*).

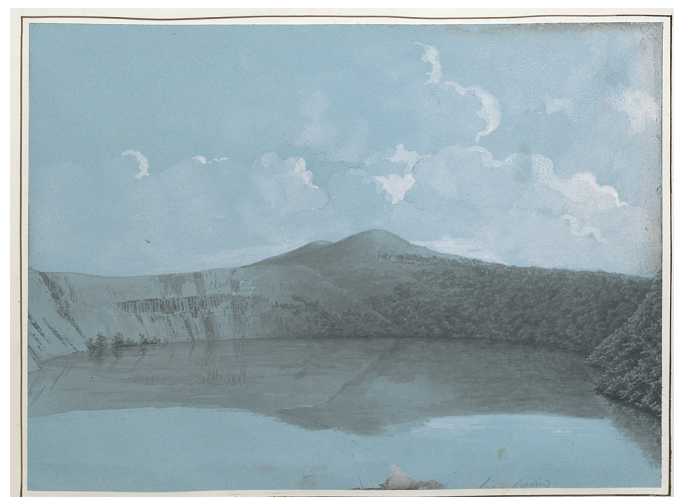


Figure 7 - Drawing of Pavin lake by Étienne-Jean Delécluze (1821, MARQ Art Museum). Only half of the slopes were wooded at that time, unlike in 2026 when they were all wooded.

There is also a more neutrophilous holoserries (H5), reflecting an Atlantic influence, particularly well expressed south of the lake on the steep north-facing slopes which includes as a head series the beech forest with *Euphorbia hyberna* (*Euphorbio hybernae-Fagetum*, *Fagion*, *Eu-Fagenion*) (Photo 12): it shelters *Cardamine heptaphylla*, *Actaea spicata*, *Festuca altissima*, *Lilium martagon*, and *Galium odoratum*, while the acidophilous species disappear. The ravines of this sector shelter a cold shrub group from the uppermontane belt, coming from avalanche flows from the northern slope of the puy de Montchal, with *Ribes petraeum*, *Lonicera nigra*, *Sambucus racemosa*, *Sorbus aucuparia*, *Aria edulis*, and *Rosa pendulina* (*Sorbo aucupariae-Loniceretum nigrae*, *Pruno petraeae-Sorbion*).



Photo 12 - *Euphorbia hyberna*.

On this wetter slope, around small rivulets, we can see *Chrysosplenium oppositifolium*, *C. alternifolium*, *Cardamine amara*, *Impatiens noli-tangere* (cf. *Cardamine amarae*-*Chrysosplenium alternifolii*, *Caricion remotae*) as well as tall grass (*Saxifraga rotundifolia*-*Petasitetum albi*, *Arunco*-*Petasition*).

Higher on the plateau, around 1,270m, we find large areas of *Nardus* grassland, rich in species, mesomontane, in the context of extensive cattle grazing (*Dianthus pseudocollini*-*Scorzoneroideum pyrenaicae galietosum veri*, *Nardo-Agrostion tenuis*) (Photo 13).

There are abundant species of *Nardetea*, *Festuca nigrescens*, *Arnica montana*, *Nardus stricta*, *Meum athamanticum*, *Hypericum maculatum*, *Rhinanthus minor*, *Gentiana lutea*, *Scorzoneroideus pyrenaica*, *Viola lutea* subsp. *lutea*, as well as *Platanthera chlorantha* (Photo 14), *Narcissus poeticus*, and *Dianthus seguieri* subsp. *pseudocollinus* (Photo 15). A more thermophilous group with *Genista sagittalis*, *G. tinctoria* subsp. *delarbrei* (Photo 16), *Galium verum*, and *Jacobea adonidifolia* completes this flora.

These pastures coexist with hay meadows (*Viola luteae*-*Trisetetum* = *Agrostietum capillaris* Luquet 1926, *Trisetum-Polygonion*) with more mesotrophic species, *Trisetum flavescens*, *Dactylis glomerata*, *Geranium sylvaticum*, *Festuca nigrescens*, *Achillea millefolium*, *Narcissus poeticus*, *Phyteuma spicatum*, *Lotus corniculatus*, *Ranunculus acris*, and *Poa chaixii*.

All sorts of intermediate forms exist between these communities, depending on pastoral practices. In the case of liquid manure spreading, one also find particularly eutrophic and species-poor meadows, dominated by *Dactylis glomerata*, *Rumex longifolius*, *Taraxacum officinale*, etc. These highly productive meadows increase forage quantities, but are not very favorable to biodiversity, and unfortunately, are compatible with the protected geographical designation (IGP) of Saint-Nectaire cheese.



Photo 13 - *Nardetea* pastures around Pavin lake in the territory of the protected geographical designation of origin of Saint-Nectaire cheese.



Photos 14, 15 and 16 - *Platanthera chlorantha*, *Dianthus seguieri* subsp. *pseudocollinus* (P.Fourn.) Jauzein, *Genista tinctoria* subsp. *delarbrei* (Lecoq et Lamotte) Nyman, species of *Dianthus-Scorzoneroideum pyrenaicae*, the latter two endemic to the Massif central.

Capucin – vallée des Bains (group 2, afternoon)

The participants in group 2 will follow the route from the Salon du Capucin on the basalt plateau to the northeast slope of the Capucin (round trip distance 1.5km, Fig. 9, Photo 17). Not far from the starting point, there is an old funicular built nearly 130 years ago, which was used to transport walkers from the town of Mont-Dore. The vallée des Bains is the largest and longest valley in the Dore mountains. It has numerous mineral springs captured in thermal establishments. Upstream, it ends in a very large glacial cirque overlooked by the highest peak of the Massif central, the puy de Sancy, which rises to 1,885m (Photo 18). Downstream, after the town of Mont-Dore, the valley curves westward to La Bourboule, thus fully exposed to oceanic influences.

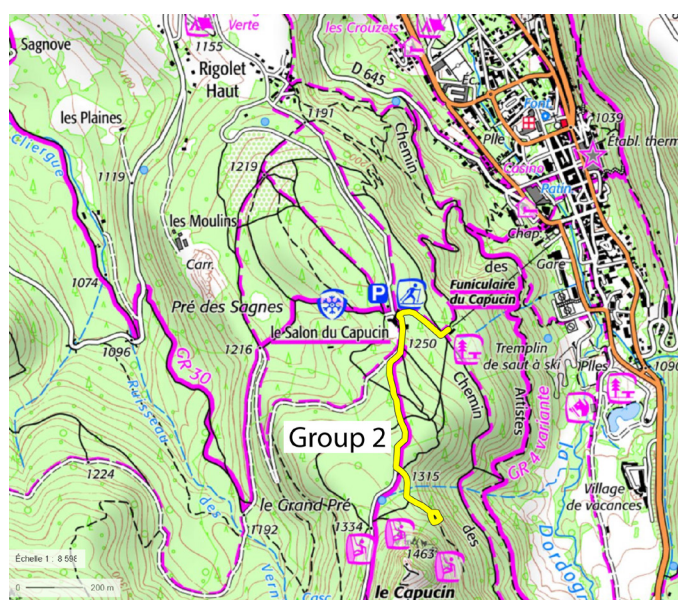


Figure 9 - Itinerary for group 2 north of the Capucin above the town of Mont-Dore. Map source IGN.



Photo 18 - Sancy summit in the Vallée des Bains at 1,886m.

The summit of Capucin at 1,463m (Photo 17), which overlooks the town of Mont-Dore, takes its name from its hood-like shape, similar to those worn by the friars of the mendicant orders. It is a trachyandesite rock with a covering of welded tuffs on its northern slope below.

Located furthest north, the vallée des Bains is also the coldest. *Abies alba*, a native species, is particularly abundant here, unlike in the other, more eastern or southern valleys of the Dore Massif, which also receive less rainfall. These fir forests, always mixed with beech, are not recent; they were already well established at the beginning of the 19th century, as evidenced by the drawing of the Vallée des Bains made by Delécluze in 1821. (Fig. 10).

Vegetation series and plant communities visited:

The vegetation observed during the excursion will be exclusively fir forests and their edges, in the mid-montane zone, corresponding to the "*Abietetum albae*" of Luquet and placed in the *Piceion excelsae* sensu Luquet 1926. Our visit will be located in a place close to a site of one of the 9 relevés of the table of Luquet.



Photo 17 - Capucin summit in the Vallée des Bains at 1,463m.



Figure 10 - The vallée des Bains and the old spa village of Mont-Dore in 1821, drawing by Étienne-Jean Delécluze (1821, MARQ art museum).

The first forest visited is at the Salon du Capucin. This forest is managed as an uneven-age forest-selection stand of *Abies alba* (Photo 19). This type of silviculture promotes the natural regeneration of the fir, a shade-loving species, as saplings can germinate and develop in the shade of the larger trees. It avoids clear-cutting and gives the stand a structure where all age classes are represented. *Fagus sylvatica* is present and consistent in this type of forest.



Photo 19 - Acidophilous fir forest from the Salon du Capucin (*Solidago virgaureae*-Fagetum, sylvofacies to *Abies alba* = *Abietetum albae* Luquet 1926, *Luzulo*-Fagion).

Acidophilous species are abundant and dominant in the herbaceous layer, including *Dryopteris dilatata*, *Luzula sylvatica*, *L. nivea* (Photo 20), *Vaccinium myrtillus*, *Prenanthes purpurea*, and *Avenella flexuosa*. The flora includes a few rare mesotrophic species: *Festuca altissima* and *Senecio cacaliaster*; neutromesophilous species are also rare, with only *Stellaria nemorum*.

The moss layer is abundant, which is characteristic of the structure of these evergreen coniferous forests. It is dominated by *Rhytidiadelphus loreus*.

This plant community has not any notable qualitative floristic differences with the acidophilous beech forest observed in the region, under the name *Solidago virgaureae*-Fagetum (*Luzulo*-Fagion), in which it can be classified as well as in the mesomontane acidophilous climatophilous holoserries H3b.

Along the path, we can observe shaded mesophilous shaded edges (cf. *Agrostio capillaris*-*Lactucetum plumieri*, *Melampyro-Poion chaixii*) with *Euphorbia hyberna*, an Atlantic species, reflecting significant atmospheric humidity.



Photo 20 - *Luzula nivea*, an acidiphilous species from the mountains of southern Europe.

A second fir forest is observed at the end of the via ferrata, on a steep northern slope (Photo 21): it is a fir-beech species-rich forest with *Acer platanoides* and a group of neutromesophilous species, including *Festuca altissima*, *Lamium galeobdolon*, *Galium odoratum*, *Paris quadrifolia*, *Milium effusum*, *Tractema liliohyacinthus*, nitrophilous species, *Impatiens noli-tangere*, *Geranium robertianum*, *Galeopsis tetrahit*, mesotrophilous species of higher altitude, *Polygonatum verticillatum*, *Lactuca alpina*, *Adenostyles alliariae*, *Ribes petreum*. Acidophilous species are present but not abundant: *Prenanthes purpurea*, *Dryopteris dilatata*, *D. carthusiana*, *Oxalis acetosella*. Bryophytes include *Plagiomnium affine*, *Plagiochila asplenoides*, and *Plagiomnium undulatum*, moderately acidiphilous mosses.

This type of *Abies* forest shows very few floristic differences from the neutral Atlantic beech forests in the Chaudesfour valley, *Adoxo moschatellinae*-Fagetum (*Eu*-Fagenion) and belongs to the Atlantic climatophilous mesomontane holoserries H1b.



Photo 21 - Neutrophilous Atlantic beech-fir forest on the north-facing slope below the Capucin (*Adoxo*-Fagetum, *Eu*-Fagenion).

We observe in thinnings and internal clearings fringe vegetation with *Calamagrostis arundinacea* belonging to *Knautia dipsacifoliae* (cf *Doronic austriaci-Calamagrostietum*).

In the intra-forest embankments and ditches of the more humid sectors, exposed to the north, a wet fringe develops, dominated by montane and aerohygrophilous species (Photos 22 and 23) of the tall-forb plant community *Saxifraga rotundifoliae-Petasitetum albi* (*Arunco dioici-Petasition albi*).

Syntaxonomic and nomenclatural discussion:

In these fir forests observed at Capucin, only a few species are noted as characteristic of coniferous forests, such as *Abies alba*, *Dryopteris dilatata*, *Festuca altissima*, *Struthiopteris spicant*, *Rhytiadelphus loreus*, and they are not exclusive to this, also being found under beech forests.

However, more specialized species from the class *Vaccinio-Piceetea* or the order *Piceetalia* are absent or rare in the forests of the Dore mountains, such as *Listera cordata*, *Orthilia secunda*, *Moneses uniflora*, *Vaccinium vitis-idaea*, *Lycopodium annotinum*, *Huperzia selago*, *Luzula luzuloides*, and, among the mosses, *Plagiothecium undulatum*, *Bazzania trilobata*, *Sphagnum quinquefarium*, and *S. capillifolium*.

In some relevés, Luquet had found the first two, but this characteristic assemblage is quite small, and we are here outside the natural range of *Picea abies*, a non-native species in the Massif central, as well as in a fully oceanic climate. So it seems inappropriate, according to the criteria that prevail today, to link these fir forests to the more eastern class *Vaccinio-Piceetea* and order *Piceion*. But they should rather be classified in the *Carpino-Fagetea*.

In the Forez mountains, east of the Massif central, the characteristic species are more numerous, the Atlantic influence is less pronounced, and several fir stands attributed to these class and order have been described (Thébaud et al. 2014).

From a nomenclatural point of view as shown by Thébaud and Bernard (2018) the *Piceion excelsae* Luquet 1926 is validly published and has priority over the *Piceion excelsae* Pawł., Sokołowski et Wallisch 1928 that consequently is an illegitimate name (Art. 31 de l'ICPN). However, this latter name has been used much more in literature unlike the first. For this reason, Roux et al. (2026) propose the name *Piceion abietis* Pawł., Sokołowski et Wallisch 1928 as a conserved name and the name *Piceion abietis* Luquet 1926 as a rejected name (Art. 52).



Photo 22 and 23 - Two aerohygrophilous species present in the Capucin site: *Papaver cambricum*, an Atlantic montane species, and the lichen *Lobaria pulmonaria*.

The puy de Dôme (social dinner 10th September)

The participants of the 34th European Vegetation Survey conference will be invited to a social dinner at the summit of the puy de Dôme (Photos 24 and 25) and will be able to observe the landscapes and vegetation of the puy de Dôme and the entire Chaîne des puys by going up on the panoramic train and more especially the summit vegetation by moving freely around the top of the puy de Dôme.



Photos 24 and 25 - The puy de Dôme, summit of the "Chaîne des puys", 1,465 m (photo by Joël Damase).

The puy de Dôme is a recent volcano, formed 11,000 years ago, the highest in the Chaîne des puys, reaching an altitude of 1,465 m and rising more than 500 m above the plateau below. It is a Pelean-type volcano, characterized by a violent eruption that built a cumulo-dome, a flat-topped peak, resulting from eruptions of viscous, silica-rich trachyte lava. This type of volcanism led to the ejection of acidic trachytic material, ash, and lapilli over long distances. Its slopes, composed of scree and ejected material, reveal trachytic rocks and ridges in situ to the west and north.

Vegetation series and plant communities:

The vegetation of the puy de Dôme varies according to an altitudinal gradient. Over a short distance, several belts overlap, transitioning from submontane to subalpine. The summit vegetation forms an isolated subalpine island, the only one of its kind in the Chaîne des puys, beginning at an unusually low altitude of approximately 1,300 m. This is due to its isolated

location, lacking the protection of any other mountain, and its generally convex shape, making it exposed to all winds. These winds sweep across most of its slopes. Only the eastern slope is somewhat sheltered from the prevailing westerly winds. The puy de Dôme is thus fully subjected to the influence of the oceanic climate.

According to Roux (2017), several series of vegetation develop from bottom to top on the puy de Dôme, according to an altitudinal gradient and exposure (Fig. 11).

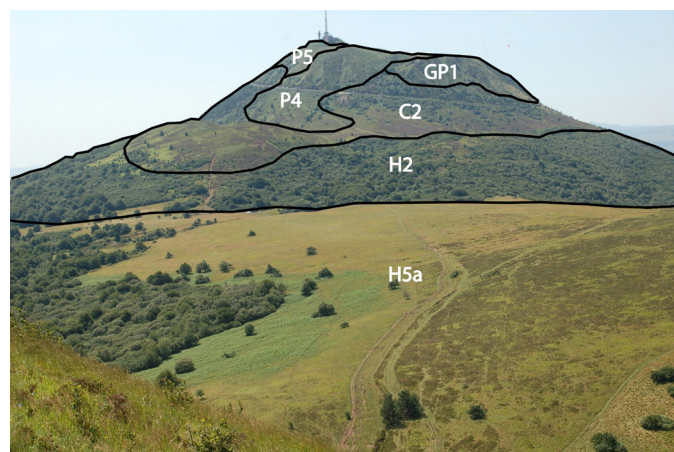


Figure 11 - Vegetation series on the north slope of puy de Dôme. GP1: geopermaseries of trachytic rocks. P4: cryophilic subalpine permaseries (*Allio-Vaccinietum uliginosi*). P5: shelter permaseries (*Heracleo-Calamagrostietum*). C2: Ubac curtaseries with *Sorbus* and *Salix*. H2: climatophilous meso-acidophilous holoserries of the beech forest with *Luzula sylvatica* on trachytic rocks. H5a: climatophilous neutrophilous holoserries of the beech forest with *Euphorbia hyberna* on basaltic or trachy-andesitic rocks.

On the basaltic plateau below, between 860 and 1,080 m, we find the submontane, neutrophilous, climatophilous holoserries of the beech forest with *Euphorbia hyberna* and *Corylus avellana* (*Euphorbio hybernae-Fagetum coryletosum avellanae*, *Eu-Fagenion*) (H5b). This series is located on recent lava flows, characterized by an irregular cover, formed of holes and bumps, called "cheires". It includes a grazed grassland, *Ranunculo bulbosi-Brachypodietum pinnati* (*Bromion erecti*), which, after abundance, is invaded by *Pteridium aquilinum* (*Holco-Pteridetum*, *Epilobion angustifolii*), then by a willow-birch grove with *Aria edulis* (*Betulo pendulae-Salicetum capreae sorbetosum*, *Sambuco-Salicion*), and then by hazel stands with *Daphne mezereum* (*Daphno-Coryletum typicum*, *Astrantio-Corylion*).

On the lower trachytic slopes of the puy de Dôme, up to approximately 1,260 m, we find the climatophilous, meso-acidophilous montane holoserries (H2) of the beech forest with *Luzula sylvatica* (*Luzula sylvaticae-Fagetum*, *Fagion sylvaticae*). Most of this area is covered by forest, except for some coniferous plantations and a few patches of pastures. It is differentiated into a typical sub-series with the heathland *Galio saxatilis-Vaccinietum typicum* (*Diantho-Vaccinion*) and a south-facing sub-series with the grassland of *Brachypodio-Dianthetum monspessulani typicum* (*Bromion erecti*), followed by the *Corylus* scrub (*Daphno mezerei-Coryletum typicum*, *Astrantio-Corylion*) (Photo 26).



Photo 26 - Community with *Corylus avellana* and *Daphne mezereum* in the Chaîne des puys (*Daphno-Coryletum*, *Astrantio-Corylion*).

This *Corylus* community forms a dense thicket, very widespread throughout the Chaîne des puys. It can be very stable and very species-rich, combining several groups: vernal, neutromesophilous beech forest species, hemiheliophilous forest edge species, species from herbaceous communities, etc. It is well differentiated by *Daphne mezereum* (Photo 27), and we find more Atlantic species, such as *Euphorbia hyberna* and *Vicia orobus* (Photo 28). The flora is differentiated with more thermophilous species on sunny slopes, such as *Geranium sanguineum*, *Brachypodium rupestre*, *Cotoneaster integerrima*, *Laserpitium latifolium*, and *Dianthus hyssopifolius*.



Photos 27 and 28 - *Daphne mezereum* and *Vicia orobus*.

Higher up the slopes, we see the widespread presence of shrublands, representing a subalpine, chionophilous climatophilous curtseries dominated by *Sorbus* and *Salix caprea* (C2). This variety exhibits north-facing variant up to 1,320m and a south-facing variant up to 1,400m. At this altitude, the wind is a major constraint for the development of beech trees, which survive as separated gnarled individuals in sheltered positions. *Sorbus aucuparia*, *Aria edulis*, *Salix caprea*, and *S. x capreola* are the dominant shrubs that are spreading as scrub and hedge, *Stellario-Rubetum idaei* (*Epilobion angustifolii*) on north-facing slopes or *Cirsio erisithales-Teucrietum* (*Knautia dipsacifoliae*) on south-facing ones.

Non-forest vegetation extends across the summit and highest slopes of the puy de Dôme, corresponding to several permseries according to the geomorphology and exposure.

The summit subalpine climatophilous permseries of the *Allium victorialis* and *Vaccinium uliginosum* heath (*Allio victorialis-Vaccinietum uliginosi vaccinietosum uliginosi*, *Genisto pilosae-Vaccinietum*) (P4) is found on the summit and part of the highest northern slopes. Unfortunately, due to overuse, this heath has almost completely disappeared from the summit that now supports trampled, eroded, and/or nitrophilous replacement grasslands that are difficult to classify. The endemic *Alchemilla basaltica* (included in *A. transiens*) (Photo 29) is found there.

The subalpine, sheltered, chionophilous permseries of the *Calamagrostis arundinacea* and *Heracleum sphondylium* tall-herb vegetation (*Heracleo sphondylii-Calamagrostietum*, *Calamagrostion arundinaceae*) (P5) is confined to sheltered eastern slopes or well-exposed gullies between trachytic ridges. *Cirsium erisithales*, *Lilium martagon*, *Lactuca plumieri*, *Aconitum lycoctonum*, and *Cyanus montanus* are found there.



Photo 29 - *Alchemilla basaltica* Buser, an endemic species of the Massif central.

The subalpine geopermaseries of high trachytic rocky slopes (GP1) brings together specialized communities which coexist in the ridges and rocky corridors below the summit (Photos 30 and 31): in particular, xerophilous and cryophilous heath of the convex land forms (*Alchemillo saxatilis*-*Vaccinietum uliginosi*, *Genisto pilosae*-*Vaccinion*), with cryophilous species such as

Alchemilla basaltica, *Vaccinium gaultherioides*; *Calamagrostion* communities in snowier, more humid corridors (*Luzulo sylvaticae*-*Calamagrostietum*) or mesophilous types on deep soils (*Heracleo sphondylii*-*Calamagrostietum*), or drier types (community with *Libanotis pyrenaica* and *Calamagrostis arundinacea*).



Photos 30 and 31 - Alternating sheltered ravines with *Calamagrostis* tall-herb community (*Heracleo-Calamagrostietum*) and cold, windy trachytic rocky ridges covered by heathland (*Alchemillo saxatilis*-*Vaccinietum uliginosi*, *Genisto-Vaccinion*) in the GP1 geopermaseries of the summit of puy de Dôme.

The Cantal mountains (post-conference excursion 11th-13th September)

The post-conference excursion following the 34th European Vegetation Survey conference will take place from Friday, September 11th, to Sunday, September 13th, 2026.

On the morning of September 12th, participants will visit the Plomb du Cantal Chain. In the afternoon, they will go to the Saint-Antoine chapel in the Murat region and the town of Murat.

On September 13th, they will visit the Impradine cirque near puy Mary.

The first three sections provide general information on the sites visited and the routes. The fourth section presents a detailed characteristic of plant communities and associated flora in the supra-forest landscape.

A table of relevés published by J. Braun-Blanquet (1926) is presented on pages 33 and 34 (Tab. 1).

Chain of the Plomb du Cantal: 12th September (morning)

The Plomb du Cantal, reaching an altitude of 1,855m, is the highest point of the massif. It forms a small basaltic outcrop, reduced to a volcanic chimney 80m in diameter. This is the result of the most recent volcanic event in the Cantal region, which occurred approximately 3 million years ago.

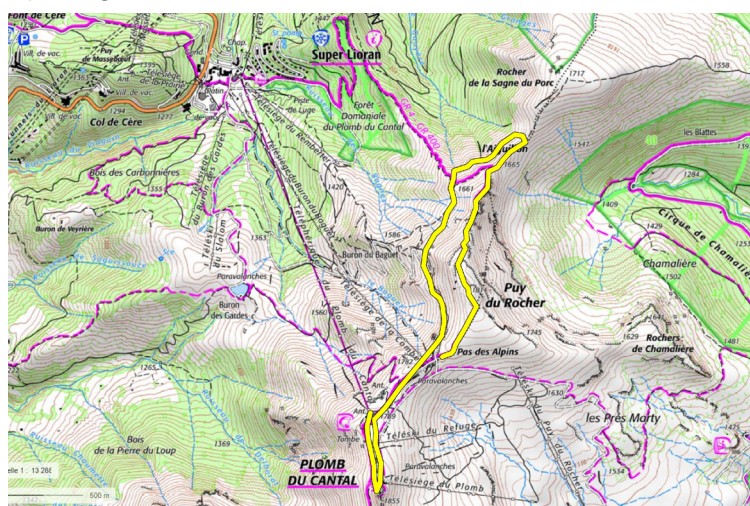


Figure 12 - Itineraries of the September 12 excursion to Plomb du Cantal and Aiguillon (Nardion, Genisto-Vaccin, Cardamino-Montion, Festucion varia), map source: IGN.

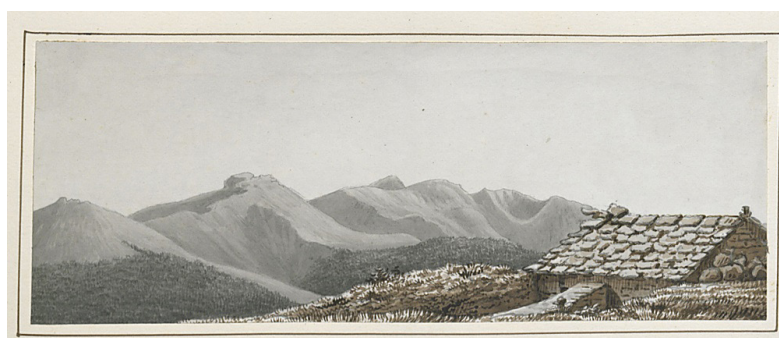


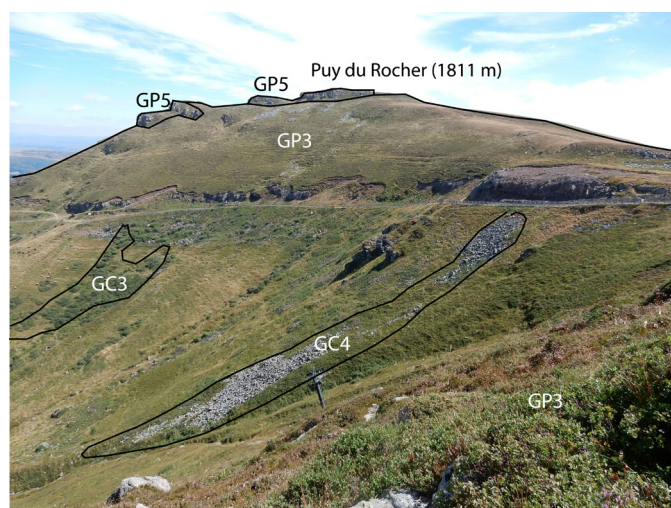
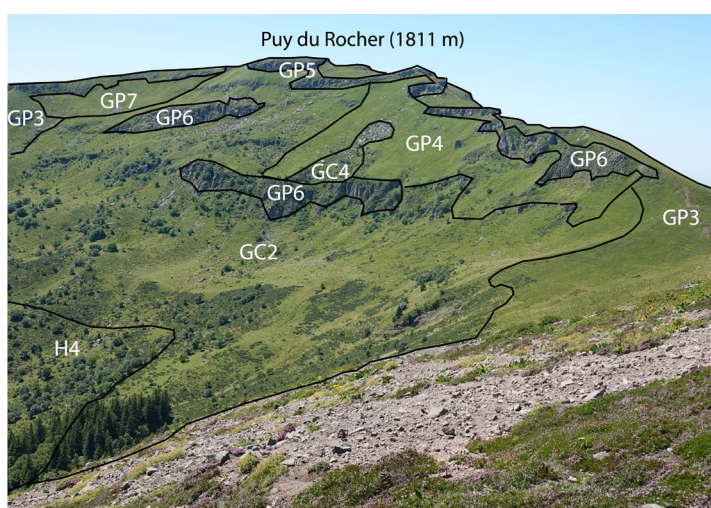
Figure 13 - The Plomb du Cantal chain drawn in 1821 by Étienne-Jean Delècluze, (1821, MARQ Art Museum, City of Clermont-Ferrand). In the foreground, a "buron", summer pasture dwelling.

To the north, the ridges from puy du Rocher to Aiguillon are composed of hard, acidic trachyandesites. On the slopes, layers of lava alternate with deposits of breccia (agglomerated blocks of rock resulting from pyroclastic flows). These breccias line the bottom of the valleys of the Gouyère stream, the destination of our route.

All the peaks except the ridges are covered with moraines from the Würmian glaciation of the Cantal massif, which ended more than 10,000 years ago. On the eastern slope of the ridge, two spectacular glacial cirques can be seen, including the Cirque de Chamalière to the north.

The chain of Plomb, located in the southeast of the Cantal mountains, enjoys a relatively sheltered climate compared to the other ranges of the Massif, especially that of puy Mary, which is colder and wetter (Loos 2024).

Participants will be taken by a cable car to the Plomb du Cantal mountain range. The group will follow the ridge trail on foot (6 km round trip, 250m elevation gain, with rocky sections equipped with ladders), and return via the Plomb du Cantal cable car (Fig. 12). The non-forested peaks of the Plomb range drawn by Delècluze (1821) (Fig. 13), were not very different from those of today. Figures 14 and 15 show the landscape units that participants will encounter on the east and west slopes of the puy du Rocher, north of the chain of Plomb du Cantal. On these summits and their high slopes, we witness the maximum expression of the vegetation of the subalpine belt, between (1,450) 1,500 and 1,855 m.



Figures 14 and 15 - Sketch of subalpine vegetation series north of the Plomb range. At the left, the eastern slope of the Chamalière cirque under puy du Rocher. At the right, the western slope of the puy du Rocher. H4: uppermontane climatophilous holoserries of the beech forest. GP3: climatophilous geopermaseries of cold summits and slopes. GP4: climatophilous geopermaseries of snow-covered shelter slopes. GP5: edaphoxerophilous geopermaseries of cold rocks. GP6: edaphoxerophilous geopermaseries of warm rocks. GP7: edaphochionophilous geopermaseries with a short growing season. GC2: climatophilous geocurtaseries of warm, dry slopes. GC3: peaty edaphohygrophilous geocurtaseries at the head of the valley. GC4: edaphoxerophilous geocurtaseries of scree slopes with large boulders.

We will be able to observe, south of the cable car, on the plateau located north of the Plomb du Cantal, the site of a relevé of the “association à *Genista pilosa* et *Calluna*” of Braun-Blanquet (= *Pulsatillo vernalis*-*Cytisetum decumbentis* typicum), short grassy heath, anemocryophilous and xerophilous of the upper subalpine belt (geopermaseries GP3).

Next, we will go to the summit of Plomb for a panoramic view of the Cantal mountains, the largest volcano in Europe. We will be able to observe a thermophilous, acidoneutrophilous grassland with *Festuca arvernensis* subsp. *costei* on basalt on the sunny side of the summit (cf. *Bupleuro ranunculoidis*-*Festucetum costei*), while the northern slope of Plomb is home to very cryophilous vegetation.

From Le Plomb, we will take the ridge path northwards, from where we can see numerous subalpine habitats surrounding puy du Rocher (1,811 m). The view will encompass the eastern slope with the Chamalière cirque and the western slope above the Lioran ski resort. Several subalpine geopermaseries can be observed, featuring vegetation of the *Genisto-Vaccinion*, *Calamagrostion*, *Galio-Patzkeion*, *Nardion*, *Festucion airoidis*, *Salicion herbaceae*, and *Dianthion gratianopolitani*. In particular, we will note the north-facing nivation niches (geopermaseries GP7) with the very rare pioneer and open community of *Plantagini alpinae*-*Agrostietum rupestris*, linked to a long duration and overabundance of snow.

Further north, south of the Aiguillon (1,665m), we will have a view of the north of the Plomb chain and will be able to observe the diverse vegetation of the Chamalière cirque, with the thermoxerophilous open grassland *Leucanthemo delarbrei*-*Patzkeetum paniculatae*, type association of *Festucion varia* Braun-Blanq. 1926 (geopermaseries GP6).

To the northwest, we will visit the valleys of the small rivulets that give rise to the Gouyère stream, where the locus classicus of the *Nardion* Braun-Blanq. 1926 (geopermaserie GP7) is located, as well as the locus classicus of the “association à *Vaccinium*

uliginosum et *V. myrtillus*” of Braun-Blanquet (*Vaccinietum myrtillo-uliginosi*), and the locus classicus of the “association à *Bryum schleicheri* et *Montia rivularis*” of Braun-Blanquet (*Montio fontanae*-*Bryetum schleicheri*). This area constitutes an extensive grazing range for one of the few sheep/goat flocks in the Cantal mountains, within the *Vaccinietum myrtillo-uliginosi* heath.

The return to Le Lioran will allow us to observe, by cable car, the landscapes of the western slope of the Plomb, from the upper subalpine geopermaseries to the lower subalpine ones (GC1), uppermontane ones (H4), and mesomontane forests of beech and fir trees. The Alagnon valley, north of Le Lioran, is one of the few valleys where *Abies alba* is dominant in the forest canopy.

Region of Murat: 12th September (afternoon)

The town of Murat is located east of the main ridge of the Cantal mountain, in the valley of the Alagnon River (Fig. 16). It lies within a basin bordered to the north and south by large basalt plateaus, known as “planèzes,” which correspond to a more recent and peripheral phase of Cantal basaltic volcanism. Quaternary glaciations sculpted several valleys, the confluence of which is located upstream from the town. Among these, the Alagnon valley is the widest and most representative, particularly at the village of Laveissières, upstream from Murat, with its U-shaped relief, flat bottom, and significant drop in elevation. The basin is covered with moraines and fluvio-glacial deposits.

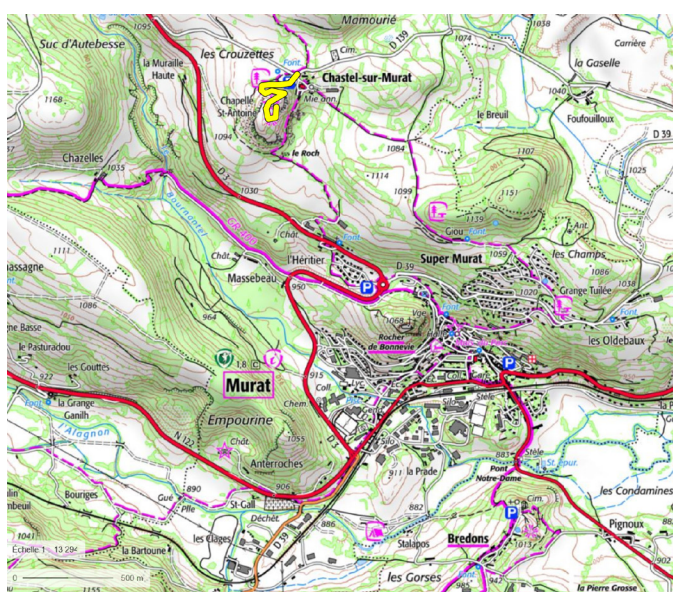


Figure 16 - Itineraries on the basaltic hill of the Saint-Antoine chapel northwest of Murat. Map source: IGN.

Several volcanic peaks overlook the town and its surroundings: Bonnevie rock, just above the old town; Bredons, to the south; and Saint-Antoine chapel rock, to the north (Fig. 17 and 18). These three outcrops of basanite, a very dark rock rich in olivine, correspond to volcanic necks or dikes originating from the same eruptive fissure, which occurred approximately 3 to 4 million years ago. Prismic cliffs can be observed at Bonnevie and Bredons.



Figure 17 - The town of Murat in its Cantal volcanic landscape setting. Drawing from 1821 by Étienne-Jean Delécluze, (1821, MARQ Art Museum).



Figure 18 - The town of Murat with the Bonnevie rock and basalt columns above. Drawing from 1821 by Étienne-Jean Delécluze, (1821, MARQ Art Museum).

Murat enjoys a sheltered climate, less subject to oceanic influences, significantly drier at the same altitude (400mm less), and warmer than that of the western slope of the Cantal mountain.

This more continental climate explains the abundance of *Pinus sylvestris* on the eastern lawns (Pinatelle forest). There is also an upward trend of thermoxerophilic vegetation in the eastern part of Cantal, particularly at favorable exposures on the edges of valleys. This is the case of the vegetation that will be visited at the Saint-Antoine Chapel.

Vegetation series and plant communities visited:

At these two sites we will see the xerothermophilous vegetation on basaltic volcanic rock, very widespread in the region between Saint-Flour, Murat, Neussargues and Allanche. This is vegetation of the *Koelerio-Phleion* alliance at its upper altitudinal limit in this area. They are part of a larger complex on volcanic rock that includes the sheltering slopes of Cézallier and Dore mountains (Roux & Brocard 2023). They had been studied by Luquet (1937) as part of research along an altitudinal gradient from the plain of Limagne near Clermont-Ferrand.

The vegetation of these rocky areas in a sheltered climate can be described as two typical landscape units:

A submontane to montane edaphoxerophilous saxicolous geopermaseries (GP2) in which several mosaic plant communities can be distinguished.

Cliff chasmophytic vegetation with *Sempervivum tectorum* subsp. *arvernense* and *Saxifraga fragosoi* (*Sempervivum arvernensis-Saxifragetum continentalis*, *Asplenion septentrionalis*). In addition to the eponymous species, we find *Sedum dasyphyllum*, *Asplenium septentrionale*, *A. trichomanes*, and *Hylotelephium maximum*.

An open pioneer grassland dominated by perennial species, on lithosols of subhorizontal rock slabs and basaltic prism heads, with *Sempervivum arvernense* (Photo 32), *S. arachnoideum*, and *Festuca arvernensis* (*Sempervivum arvernensis-Festucetum arvernensis sempervivetosum arachnoidei*, *Sedo-Scleranthion*). *Sedum acre*, *S. album*, *Petrosedum rupestre*, *P. forsterianum*, *Allium*

sphaerocephalon, *Poa bulbosa*, *Scleranthus perennis*, *S. annuus*, and *Jasione montana* are also found here. In the surrounding area, these vegetation types also support *Gagea bohémica*.

Annual vegetation with a mixture of acidophilous and neutrophilous species is differentiated with *Ornithopus perpusillus*, *Teesdalia nudicaulis*, *Vulpia myuros*, *Myosotis stricta*, *Trifolium striatum*, *T. glomeratum*, *Alyssum alyssoides*, *Saxifraga tridactylites* (Photo 33), *Arenaria serpyllifolia*, *Petrorhagia prolifera*, *Teucrium botrys*, *Veronica verna* (cf. *Spergulo pentandrae*-*Veronicetum dillenii*, *Thero-Airion*).

Among the flora, we note *Sempervivum x pomeli* Lamotte, a hybrid between *S. tectorum* subsp. *arvernense* and *S. arachnoideum*.

A submontane to montane edaphoxerophilous curtserie on rocky south-facing slopes (C3). On dry slopes with shallow soils and exposed rocks, a fairly widespread silicicolous grassland is present, dominated by *Festuca* gr. *ovina*, which was studied by Luquet (1937) in his work "Les colonies xéothermiques de l'Auvergne" and compared with those of the Limagne hillsides in the Clermont-Ferrand region.

Luquet highlighted a progressive decrease in Mediterranean and thermophilous species along an altitudinal gradient of nearly 900m. He had differentiated the highest-altitude basalt grasslands under the name "Festuca ovina dry grassland group." Roux & Brocard (2023) showed that this community now

corresponds to a more montane, original plant association with *Carlina acanthifolia* and *Phleum phleoides* (*Carlino acanthifoliae-Phleetum phleoidis*, *Koelerio-Phleion*, Photo 34).

The *Carlino-Phleetum* is dominated by *Festuca arvernensis*, *F. lemanii*, and the more frequent species are *Poterium verrucosum*, *Phleum phleoides*, *Potentilla verna*, *P. fagineicola*, *Scabiosa columbaria*, *Genista sagittalis*, *Eryngium campestre*, *Helianthemum nummularium*, *Trifolium incarnatum* var. *molinieri*, *Tordylium maximum*, *Lathyrus sphaericus*. Pioneer species such as *Scleranthus perennis*, *Sedum acre*, *Arabidopsis thaliana* also differentiate this lawn, including rather basiphilous annuals, such as *Alyssum alyssoides*, *Arenaria serpyllifolia*, and *Saxifraga tridactylites*. Rarer species can be found here, such as *Veronica scheererii* or *Cruciata pedemontana* (Photo 35), a thermophilic southern species with its only locality in Cantal here (Roux et al. 2022).

Thermophilic herbaceous fringes of *Oreoselinum nigrum* surround these lawns (cf. *Cervario rivini-Oreoselinetum nigri*, *Geranion sanguinei*), with *Hypericum perforatum*, *Vicia lutea*, *Brachypodium rupestre*, and the rare *Gasparrinia peucedanoides* present in the nearby region.

These grasslands and edges appear to be dynamic with a thicket of *Juniperus communis*, *Prunus spinosa*, and *Rosa* sp. (cf. *Juniperus communis-Amelanchieretum ovalis*, *Amelanchiero-Buxion*). *Rhamnus alpina*, a basiphilous species, rare for the Auvergne, can also be found there.



Photo 32 and 33 - Xerophilous saxicolous vegetation on basalt with *Sempervivum tectorum* subsp. *arvernense* (Lecoq & Lamotte) Rouy & E.G.Camus; *Saxifraga tridactylites*.



Photo 34 and 35 - Xeric grassland *Carlino acanthifoliae-Phleetum* on the basalt hill of the Saint-Antoine Chapel; *Cruciata pedemontana*.

The Impradine cirque and the Brèche de Rolland: 13th September (morning)

The slopes of the Impradine valley are covered in lahars, debris flows formed from volcanic pyroclastic rocks reworked by meltwater runoff. Upstream in the valley lies one of the most beautiful glacial cirques in the Massif central, facing northeast. Here, trachyandesitic ridges rise above stacks of scoriaceous potassic trachybasalt flows, forming the cirque's cliffs. Below, a scree slope forms the base, before the trachyandesitic rock reappears. The bottom of the cirque is scattered with erratic boulders. The cliffs alternate with deep, dark gullies, the widest of which is the Brèche de Rolland, a gash visible from afar that cuts the ridge.

The cirque is dominated by the puy Mary at 1,783m. This giant was originally a cumulo-dome of viscous lava, trachyte, built up more than 6 million years ago, which was subsequently reshaped by four glaciers during the Quaternary period, flowing into the adjacent valleys. To the east, the ridge extends to the puy de

Peyre Arse at 1,806m (Fig. 19). These areas are regularly grazed by a herd of "Salers" breed cows.

This site, given its pronounced relief, supports a great diversity of environments and vegetation types. We gradually move from the highland level to the lower subalpine level, then to the upper subalpine level, above 1,600m. All these ecological landscape units are shown in figure 20.

The excursion will begin at the Eylac pass at around 1,440m. We are here in the upper montane belt in the climatophilous holoseris H4, where oligotrophic, species-rich *Nardus* pastures (*Diantho pseudocollini-Scorzoneroideum pyrenaicae*, *Nardo-Agrostion tenuis* Sillinger 1933) are very widespread. The locus classicus of the montane subassociation "*festucetosum rubrae*" of the *Nardetum* of Braun-Blanquet (1926), "created by grazing", is located not far from here, probably a little further north at 1,350m altitude. The *typicum* sub-association, seen on September 12, is located in the chaîne of Plomb du Cantal at the Gouyère ravine. The series head is the *Doronicum austriacum* beech forest (*Doronicum austriaci-Fagetum*, *Aceri-Fagetum*).

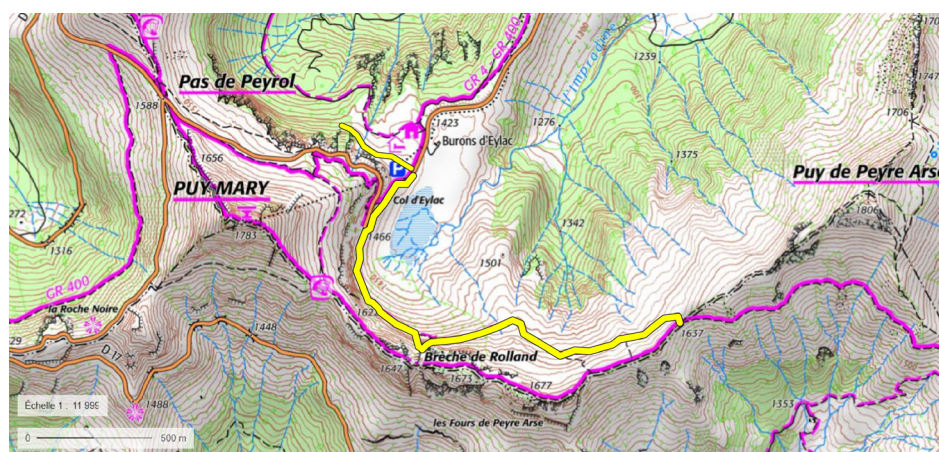


Figure 19 - Walking itinerary on September 13 in the upper Impradine valley and to the Brèche de Rolland. Map source: IGN.

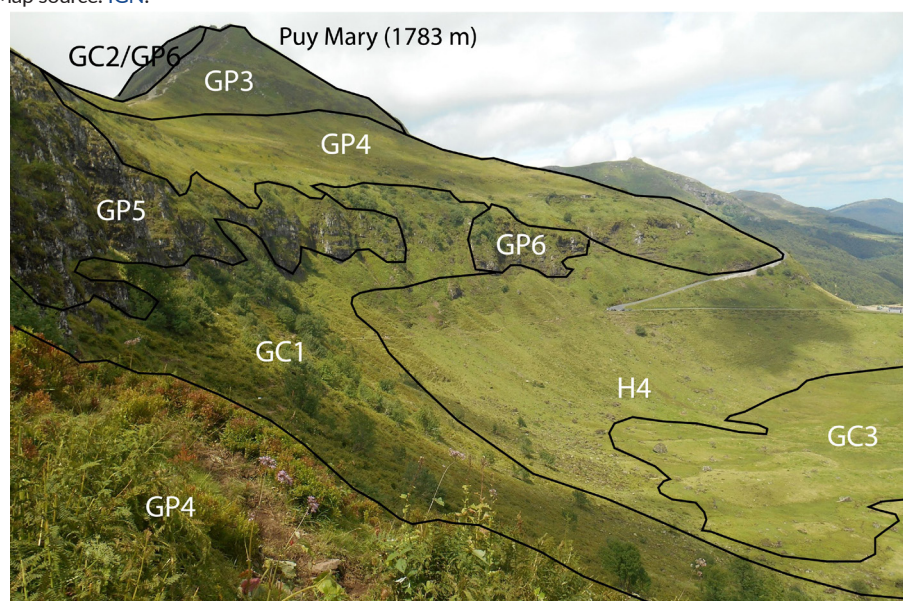


Figure 20 - Sketch of vegetation series and geoseries in the Impradine-puy Mary cirque. H4: Climatophilous holoseris of the beech forest *Doronicum austriaci-Fagetum*; GP3, climatophilous geopermaseries on cold subalpine summits and slopes; GP4, climatophilous geopermaseries on sheltered subalpine slopes; GP5, subalpine edaphoxerophilous geopermaseries on cold, shaded rocks; GP6, subalpine edaphoxerophilous geopermaseries on warm, sunny rocks; GC1, climatophilous geocurtaseries of lower subalpine slopes and snowy timberline; GC2, subalpine climatophilic geocurtaseries on warm, dry south-facing slopes; GC3, edaphohydrophilic peaty geocurtaseries of the heads of valleys.

Participants will follow the mid-slope hiking trail to gradually reach the subalpine belt. Initially, the trail will cross shrubby edges which are the site of a late snowpack in the lower part of the subalpine zone (geocurtaseries GC1), with shrub communities of *Pruno petraeae-Sorbion aucupariae* and rich-species heaths (*Euphorbio hybernae-Vaccinietum myrtilli*) and fern communities.

Towards the Brèche de Rolland, participants will reach north-east-facing, snow-covered shelter slopes on deep soils characterizing the geopermaseries GP4, where we find a rich natural meadow (*Pediculario foliosae-Geranium sylvatici*) and a tall-forb community (*Imperatorio ostruthii-Adenostyletum alliariae*). The latter takes full expression in the Brèche of Rolland, where the locus classicus of the *Adenostyletum alliariae* Braun-Blanquet 1926 and the *Adenostylion* Braun-Blanquet 1926 is located. It takes place on a steep slope and very humid soils with unstable blocks.

Near this site, participants will be able to observe the shaded and damp base of the cliffs, which represent accessible fragments of geopermaseries GP5.

Then they will reach the ridge where we can enjoy a panoramic view of the southwestern part of the Cantal mountains. This ridge is occupied by the heaths of *Genisto pilosae-Vaccinion*, mesophilous *Vaccinietum myrtillo-uliginosi* or xerophilous *Pulsatillo vernalis-Cytisetum decumbentis* on the cold slopes and summits of the upper subalpine belt (geopermaseries GP3).

On the drier and warmer slopes on the other side of the ridge, it

will be possible to see the “association with *Festuca spadicea* and *Chrysanthemum delarbrei*”, the type of the alliance of *Festucion variae* Braun-Blanquet 1926 (*Leucanthemo delarbrei-Patzkeetum paniculatae* Braun-Blanquet 1926, *Galio saxatilis-Patzkeion paniculatae*) whose locus classicus is found on the southern slope of puy Mary around 1,750m. These xerophilous slopes correspond to the geopermaseries GP6.

On the return journey to the col d'Eylac, which follows the same pass, there will be a view of the flat bottom of the Impradine valley, covered in wetlands (geocurtaseries GC3). This wet ecological compartment shelters the locus classicus of the “*Caricetum fuscae*” and the *Caricion fuscae* of Braun-Blanquet (1926).

These landscape compartments are delineated in figure 20. Figure 21 shows the whole of the Cantal mountains.

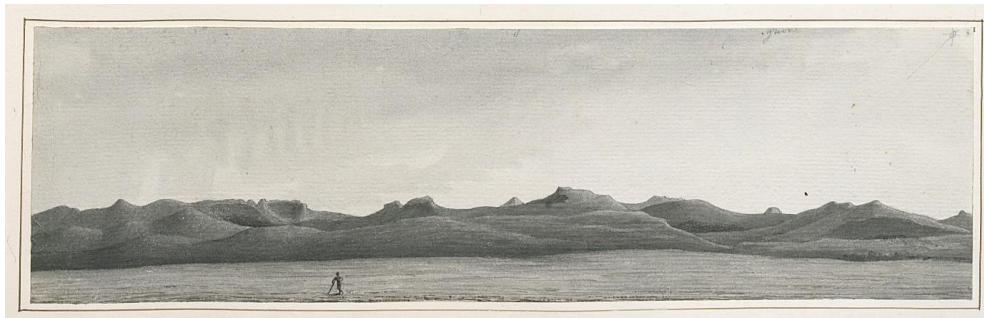


Figure 21 - The Cantal mountains seen from the northwest, with the puy Mary, roughly in the center, appearing as a small cone in the distance. Drawing from 1821 by Étienne-Jean Delécluze (1821, MARQ Art Museum).

Landscape units, plant communities, and flora of the supra-forest areas of the Cantal mountains

The summits of the Cantal mountains, transitioning from the upper montane to the upper subalpine belts, host a rich diversity of environments. They harbor numerous specialized, restricted, and contrasting plant communities due to the combination of different topographic conditions, varied volcanic soils, and a generally humid climate with an oceanic character. These communities are organized within vegetation complexes, linked by dynamic ecological and geomorphological characteristics that shape the landscape. The traditional and current use of these areas for cattle grazing, from late spring to early autumn, for five months of the year, is also an essential element of the Cantal landscapes.

We present below an outline of the landscape units of the summit areas of the Cantal mountains, with the plant communities and flora that characterize them. We will begin with the climatophilous units, linked to climate and altitudinal gradient, generally quite extensive, followed by the edaphophilous units, more specialized and covering smaller areas. Examples are given in sites of Cantal mountains of their distribution: north of the Plomb chain (Fig. 14), Impradine and puy Mary (Fig. 20).

Climatophilous holoserries of the beech forest *Doronico austriaci-Fagetum* in the snowy edges of the uppermontane belt (H4). Several communities make up this series.

Nardus grassland (*Diantho pseudocollini-Scorzonoidetum pyrenaicae*, *Nardo-Agrostion tenuis*) is a mesoacidiphilous species-rich community on oligotrophic soil. It is linked to extensive cattle grazing.

Grassy *Vaccinium* heaths, belonging to the alliance of *Genisto pilosae-Vaccinion*: *Euphorbio hybernae-Vaccinietum myrtilli*, species-rich with subalpine optimum; *Allio victoralis-Vaccinietum myrtilli vaccinietosum*, altimontane and impoverished (Photo 36).



Photo 36 - *Allium victoralis*.

High heath with *Cytisus oromediterraneus*, "purging broom" (*Silene vulgaris-Cytisetum oromediterranei*, *Cytisium oromediterranei*). In this zone, this community corresponds to dynamic stages on warm slopes after grazing has ceased (Photo 37).



Photo 37 - *Cytisus oromediterraneus* dominated community grazed by "Salers" cows in the uppermontane belt of Cantal.

Various herbaceous fringes, including the *Doronico austriaci-Calamagrostietum arundinaceae* (*Knautia dipsacifoliae*), which is a *Calamagrostis* meadow forming clearings in beech forests or in stages of forest recolonization.

Shrub groves with *Betula pubescens*, *Sorbus aucuparia*, *Aria edulis*, *Lonicera nigra* (*Sorbo aucupariae-Lonicereturum nigrae*, *Pruno petraeae-Sorbion*). In the visited area, they mainly consist of open woodlands where herds graze and take shelter.

Timberline beech forest (*Doronico austriaci-Fagetum*, *Aceri-Fagion*). This community is present in its typical form with trunks and shoots of *Fagus*, *Acer*, or *Sorbus* bent by the snow, and herbaceous layer rich in tall herbs (Photo 38). It appears that the distribution range of this series is currently undergoing an altitudinal shift due to global warming, as evidenced by the active expansion of shrub thickets.



Photo 38 - Snow-twisted beeches in the *Doronico austriaci-Fagetum* at the Eylac pass, series head of the uppermontane belt climatophilous holoserries H4.

This landscape unit is characterized by numerous tree or shrub forest species, *Fagus sylvatica*, *Abies alba*, *Acer platanoides*, *Corylus avellana*, *Salix caprea*, *Lonicera nigra*, *Betula pubescens*, *Sorbus aucuparia*, *Aria edulis*, as well as, herbaceous species, such as *Phyteuma spicatum*, *Prenanthes purpurea*, *Luzula sylvatica*, *Euphorbia hyberna*, *Stellaria holostea*, *Teucrium scorodonia*, tall herbs *Allium victorialis*, *Polygonatum verticillatum*, *Epilobium angustifolium*, *Doronicum austriacum*, *Lactuca plumieri*, *Senecio cacaliaster*, *Senecio ovatus* subsp. *ovatus*, *Calamagrostis arundinacea*, and acidophilous species of lawns or heaths, including *Arnica montana*, *Galium saxatile*, *Poa chaixii*, *Vaccinium myrtillus*.

Climatophilous geocurtaseries of the shrub edge above the snowy timberline in the lower part of the subalpine belt (GC1). The upper forest edge offers a sheltered climate from prevailing winds and snow accumulation. It also supports shrub growth, particularly in wind-sheltered concave landforms. The deeper colluvial soils support the development of mesophilous communities with high species richness. It is difficult to clearly differentiate the communities of this geocurtaseries from some communities of the upper montane holoseris (H4) based on their floristic characteristics. Four permaseris and one curtaseries comprise its composition.

Calamagrostis arundinacea tall-herb community of the *Calamagrostion arundinaceae* alliance: *Luzulo sylvaticae*-*Calamagrostietum arundinaceae*, mesohygrosciophilous, at the bottom of slope, often north-facing; *Calamagrostietum arundinaceae* in warmer conditions.



Photo 39 - *Lonicera alpigena* in the timberline.



Photo 40 - *Rosa pendulina* (GC1).

Grassy heaths dominated by *Vaccinium myrtillus*, belonging to the *Genisto pilosae*-*Vaccinietum* alliance: *Euphorbia hybernae*-*Vaccinietum myrtilli typicum*, species-rich, and *Allio victorialis*-*Vaccinietum myrtilli*. These heaths may be in a dynamic relationship with shrubby formations.

Shrubby formations and low woodlands dominated by *Sorbus aucuparia*, *Aria edulis*, and *Betula pubescens*, with occurrence of *Ribes petraeum*, *Sorbus chamaemespilus*, *Lonicera alpigena* (cf. *Rosa pendulina*-*Sorbetum chamaemespili*, *Pruno petraeae*-*Sorbion*). These formations have herbaceous layer dominated by tall herbs of *Mulgedio*-*Aconitetea*. They have been little studied in the Cantal mountain, unlike in the Dore mountains (Seytre 2008).

Various herbaceous fringes that were not studied.

This landscape unit is characterized by numerous shrub species that are also present in meadows and heaths, including *Sorbus chamaemespilus*, *Lonicera alpigena* (Photo 39), *Rosa pendulina* (Photo 40), *Ribes petraeum*, *Prunus padus* and by subalpine tall forbs *Polygonatum verticillatum*, *Senecio cacaliaster* (Photo 41), *Doronicum austriacum*, *Ranunculus platanifolius*, *Chaerophyllum villarsii*, *Allium victorialis*, *Trollius europaeus*, *Rumex arifolius*, *Streptopus amplexifolius*, *Cirsium erisithales*, *Aconitum lycoctonum*, and *Knautia basaltica*.



Photo 41 - *Senecio cacaliaster*.

Climatophilous geocurtaseries of warm and dry south-facing slopes (GC2). These slopes can experience some summer drying. Several herbaceous or heathland communities are found here, forming two characteristic permaseres and one curtaseries.

Tall-grass meadow with *Betonica officinalis* and *Patzkea paniculata* (*Betonico officinalis-Patzkeetum paniculatae*, *Galio saxatilis-Patzkeion*). The floristic composition of this mesophilous/mesoxerophilous, species-rich southern community makes it intermediate with *Calamagrostion arundinaceae*. It falls into the South European order of *Festucetalia spadiceae* (Photo 42).

Bilberry dominated heath with *Patzkea paniculata* (*Patzkeo paniculatae-Vaccinietum myrtilli*, *Genisto pilosae-Vaccinion*). It comes into contact and dynamics with the previous community.

Cytisus oromediterraneus dominated formation from the lower subalpine belt (*Silene vulgaris-Cytisetum oromediterranei*, *Cytision oromediterranei*). It represents dynamic stages after pasture abandonment. Once settled and mature, it can be fairly stable or give way to *Vaccinium myrtillus* heath or *Nardus* grasslands and does not constitute climax groups as those on rocks.

This landscape unit is differentiated by thermoxerophilous orophytes such as *Patzkea paniculata*, *Cytisus oromediterraneus*, *Jacobea adonidifolia* (Photo 43), *Dianthus hyssopifolius*, *Serratula tinctoria* subsp. *monticola*, *Crepis conyzifolia*, *Senecio doronicum*, *Libanotis pyrenaica* subsp. *pyrenaica*, *Festuca arvernensis* subsp. *costei*, *Campanula scheuchzeri* subsp. *lanceolata*, *Genista tinctoria* subsp. *delarbrei*, *Leucanthemum delarbrei*, *Festuca microphylla*, *Thymus pulegioides* subsp. *chamaedrys* (=subsp. *similialpestris* Debray).



Photo 42 - *Betonico-Patzkeetum* tall/grass community (GC2).



Photo 43 - *Jacobea adonidifolia*

Climatophilous geopermaseries of heaths on the cold summits of the upper subalpine belt (GP3). It corresponds to the ridges, the summit plateaus, and the slopes surrounding them, subject to strong and cold winds, at altitudes above 1,600m. It includes four permaseres.

Xerophytic *Calluna* dominated dwarf heath with *Pulsatilla vernalis* and *Cytisus decumbens* (*Pulsatillo vernalis-Cytisetum decumbentis typicum*, *Genisto pilosae-Vaccinion*). This fairly rich xerophytic heathland is especially well represented in the Plomb chain compared to other Cantal ridges (Photos 44 and 45).



Photo 44 - Dwarf cryoxerophilous heath *Pulsatillo vernalis-Cytisetum* (GP3).

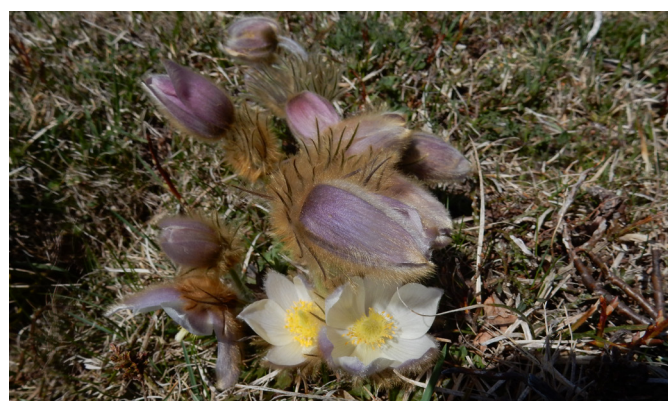


Photo 45 - *Pulsatilla vernalis*.

Xerophytic *Calluna* heath with *Jasione laevis* (*Jasione laevis-Callunetum vulgaris*, *Genisto pilosae-Vaccinietum*). This dwarf heath is more common in the Dore mountains; in the Cantal region, it is well represented on acidic lava, phonolites or trachytes of the puy Griou and puy Mary.

Heath codominated by *Vaccinium myrtillus* and *V. gaultherioides* (*Vaccinietum myrtillo-uliginosi*, *Genisto pilosae-Vaccinietum*). It comprises several subassociations depending on the exposure and is located around the summits on the higher, slightly snowier slopes.

Semi-cryptogamic dwarf heath, featuring *Empetrum nigrum* and *Huperzia selago* (*Racomitrio lanuginosi-Empetretum nigri hyperzietosum selaginis*, *Genisto pilosae-Empetretum hermaphroditum*), grows on the north-facing slopes below the ridge. It is particularly exposed to northerly winds (Photo 46). Unlike the previous heathlands, it belongs to the alpine class *Loiseleurio-Vaccinietea*.

This landscape unit is rich in cryophilous species of alpine lawns (class *Juncetea trifidi*), *Phyteuma hemisphaericum*, *Agrostis rupestris*, *Luzula spicata*, *Avenula versicolor*, *Pedicularis comosa*, *Festuca airoides*, *Pulsatilla vernalis*, *Silene ciliata* (Photo 47), *Euphrasia minima*, and it also includes *Alchemilla saxatilis*, *Antennaria dioica*, *Solidago virgaurea* subsp. *alpestris*, *Huperzia selago*, *Gentiana verna*, *Sabulina verna*, and *Androsace halleri*.



Photo 46 - Cryosciophilous heath *Racomitrio lanuginosi-Empetretum* (GP3).



Photo 47 - *Silene ciliata*.

Climatophilous geopermaseries of sheltered, snow-covered slopes on deep soils (GP4). This landscape unit is common on steep eastern slopes, sheltered from the winds, in cirques and corridors between cliffs. Snow accumulates there and melts in the spring. The soils are mesotrophic or eutrophic, due to active mineralization. The following characteristic plant communities and permaseries are found there:

Briza media and *Agrostis capillaris* grassland (*Briza mediae-Agrostietum capillaris*, *Nardo-Agrostion tenuis*). These are rich, mesoacidophilous and mesophilous, well-watered grasslands, associated with snowdrifts or diffuse runoff. They may be linked to grazing and have dynamic connections with subalpine *Vaccinium* heaths.

Tall-herb meadows with *Calamagrostis arundinacea* of the *Calamagrostion arundinaceae*: *Heracleo sphondylii-Calamagrostietum arundinaceae*, meso-eutrophic, in corridors or under cliffs (Photo 48) and *Calamagrostietum arundinaceae*, mesophilous and mesotrophic, on rock talus slopes.



Photo 48 - *Heracleo-Calamagrostietum* on shelter slope (GP4).

Heath of *Euphorbia hyberna*, *Vaccinium myrtillus* (*Euphorbia hybernae-Vaccinietum myrtilli*), already seen in the previous unit (GC2).

Tall herb community with *Pedicularis foliosa* and *Geranium sylvaticum* (*Pediculario foliosae-Geraniatum sylvatici*, *Calamagrostion arundinaceae*), linked to long periods of snow cover and a warm microclimate, often found in small, sheltered cirques. It is rare in the Cantal, but more common in the Dore mountains.

Tall forb with *Imperatoria ostruthium* and *Adenostyles alliariae* (*Imperatorio ostruthii-Adenostyletum alliariae*, *Adenostylion alliariae*), the association originally described for the alliance of *Adenostylion* Braun-Blanq. 1926 (Photo 49).

This landscape unit is differentiated by small shrubs such as *Sorbus chamaemespilus*, *Rosa pendulina*, tall mesophilic and orophilous grasses and meadow species, *Adenostyles alliariae*, *Imperatoria ostruthium*, *Rumex arifolius*, *Epilobium trigonum*, *Pedicularis foliosa*, *Crepis lamsanoides*, *Cirsium erisithales*, *Allium*

victoralis, *Hieracium prenanthoides*, *Pimpinella major*, *Aconitum lycoctonum*, *Trollius europaeus*, *Chaerophyllum villarsii* (Photo 50), *Bupleurum longifolium* (Photo 51) *Geranium sylvaticum*, *Vicia orobus*, *Gentiana lutea*, *Alchemilla glabra*, *Anemone alpina* subsp. *apiifolia*.

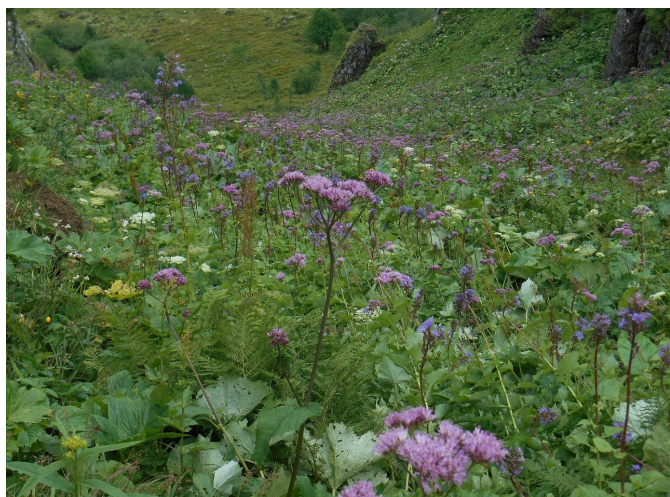


Photo 49 - *Imperatorio-Adenostyletum* in Brèche de Rolland, locus classicus of *Adenostylium* (GP4).



Photo 50 - *Chaerophyllum villarsii*.



Photo 51 - *Bupleurum longifolium*.

Edaphohygrophilous upper montane to subalpine geocurtaseries of wetlands at the emergence of the hydrographic network (GC3). This unit corresponds to a mosaic of communities in topogenous and soligenous basins, springs, fens, and wet grasslands. The ombrogenous peat bogs are reduced there due to prolonged snow cover. It comprises four permaseres and one curtaseries.

Spring moss-rich community (*Montio fontanae-Bryetum schleicheri*, *Cardamino-Montion*), of flowing cold whitewater, rheophilous and meso-acidiphilous, stenothermal.

Small-sedge fens (*Bartsio alpinae-Caricetum nigrae*, *Caricion nigrae*), slightly acidic, in snowy hollows around springs, rivulets and seeps (Photo 52).



Photo 52 - *Bartsio-Caricetum* (GC3).

Small-sedge fens, often dominated by *Carex nigra* or *Juncus filiformis* (*Juncus filiformis-Caricetum nigrae*, *Caricion nigrae*), in stagnant water of flat areas and small basins, on peaty acidic soils.

Low hummocks and carpets dominated by *Sphagnum* (*Carici nigrae-Sphagnetum magellanicum*, *Sphagnion medii*). This community corresponds to an early stage of ombrotrophic peatland. The significant snow cover at this altitude and the short growing season limit the development of raised bogs.

Low hygrophilous thicket with *Salix bicolor* and *S. lapponum* (*Salicetum bicolori-lapponum*, *Salicion helveticae*), well-differentiated especially in the Plomb chain (Photo 53).



Photo 53 - *Salicetum bicolori-lapponum* (GC3).

This landscape unit is differentiated by hygrophilous orophytes, including *Salix lapponum*, *S. bicolor*, *S. repens*, *S. aurita*, *Montia fontana*, *Micranthes stellaris* (Photo 54), *Myosotis martini* (Photo 55) = *M. scorpioides* subsp. *lamottiana* Braun-Blanq. 1926, *Stellaria alsine*, *Epilobium anagallidifolium*, *E. alsinifolium*, *Juncus filiformis*, *Bartsia alpina*, *Trichophorum cespitosum*, *T. alpinum*, *Eriophorum angustifolium*, *E. vaginatum*, *Carex* spp., *Viola palustris*, *Pinguicula vulgaris*, *Parnassia palustris*, *Festuca rivularis*, *Sarmentypnum exannulatum*, *Bryum schleicheri*, *Blindia acuta*, *Philonotis seriata*, *Campylium stellatum*, and *Amphidium mougeotii*.



Photo 54 - *Micranthes stellaris*.



Photo 55 - *Myosotis martini* = *M. scorpioides* subsp. *lamottiana* Braun-Blanq. 1926.

Edaphoxerophilous geocurtaseries of silicate large boulders screes (GC4). These formations resulting from post-glacial gelifraction and gelifluction are frequent. They consist of thickly stacked trachy-andesitic blocks, more or less fixed, and often sparsely vegetated, mainly supporting species-poor vegetation, with three permaseres and one curtaseries.

Dryopteris oreades formation (*Dryopteridion oreadis*) forming margins of dense vegetation dominated by *Dryopteris*, taking place on the fixed and humified part at the edge of the scree (Photo 56).



Photo 56 - *Dryopteris oreades* boulders fields (GC4).

Pioneer species-poor vegetation dominated by *Cryptogramma crispa* (*Cryptogrammetum crispae*, *Androsacion alpinae*) on bare boulder screes.

Chionophilous communities dominated by *Athyrium distentifolium* (*Senecioni cacaliastris*-*Athyrietum distentifolii*, *Dryopterido*-*Athyrium*) on stabilized and long snow-covered boulder screes, rich in fine fraction, often facing east below the ridges.

Formation dominated by *Cytisus oromediterraneus* (*Teucro scorodoniae*-*Cytisetum purgantis senecionetosum cacaliastris*, *Cytision oromediterranei*). These are mature, primary broom stands located on scree slopes with large, fixed and humus-rich boulder fields, on adrets (Photo 57).



Photo 57 - *Teucro-Cytisetum oromediterranei* (GC4).

This ferns-rich landscape unit includes specialized orophilous species such as *Cryptogramma crispa*, *Dryopteris oreades*, *D. expansa*, *Gymnocarpium dryopteris*, *Phegopteris connectilis*, *Valeriana tripteris*, *Cytisus oromediterraneus*, with some tall grasses and tall forbs, such as *Athyrium filix-femina*, *A. distentifolium*, *Calamagrostis arundinacea*, *Senecio cacaliaster*, *Epilobium angustifolium*, *Jacobea adonidifolia* and acidophilous heath species, including *Gentiana lutea*, *Vaccinium myrtillus*, and *Festuca nigrescens*.

Edaphoxerophilous geopermaseries of cold summit rocks and walls (GP5). These are the highest rocky peaks of the massif and the north-facing walls and cliffs (Photo 58). They are subject to both edaphic drought, in a context of high atmospheric humidity, and cold temperatures during the growing season. The characteristic rupicolous or saxicolous permaseres are as follows:



Photo 58 - Roches taillades under puy Mary (GP5).

Outcrop community with *Silene ciliata* and *Festuca airoidis* (*Silene ciliatae-Festucetum airoidis*, *Festucion airoidis*). This open, anemophilous grassland is confined to small areas of a few square meters on the humus deposits of summit rocks above 1,700m. It



Photo 59 - *Biscutello arvernensis-Festucetum airoidis* (GP5).

is a true alpine enclave in the subalpine belt, particularly rich in orophytes (Le Gloanec & Le Hénaff 2024). Floristically, it is very similar to the low-lying heathland of *Pulsatilla vernalis*-*Cytisetum decumbentis*, which is more frequent.

Semi-chasmophytic lawn (*Biscutello arvernensis-Festucetum airoidis*, *Festucion airoidis* Braun-Blanq. 1948) (Photo 59).

Cryptogam-rich *Empetrum nigrum* dwarf heath (*Racomitrio lanuginosi-Empetretum typicum*, *Genisto pilosae-Empetrium hermaphroditum*). It occupies steep, north-facing rocky slopes.

Chasmophytic moderately insolated community on dry rock walls (*Valeriano tripteridis-Phyteumetum hemisphaerici*, *Dianthion gratianopolitani*) it is quite widespread from the upper montane to subalpine belt.

Chasmophytic community on cold and shady rock walls (*Saxifragetum lamottei*, *Dianthion gratianopolitani*), strictly subalpine.

Chasmophytic community on cold, wet and shaded north-facing rock walls (*Micranthetum hieraciifoliae*, *Dianthion gratianopolitani* Focquet 1982), neutrophilous on trachy-basalts, very rare; it only exists in Impradine and Rhue cirques.

Rheophilic spring community of subalpine seeping walls on volcanic tuffs (*Sagino procumbentis-Pedicularietum verticillatae*, *Arabidion soyeri*), meso-acidophilous/neutrophilous community resulting from permanent flows on the walls (Photo 60).



Photo 60 - *Sagino-Pedicularietum verticillatae* (GP5).

This landscape unit is distinguished by numerous subalpine to alpine orophytes: *Salix hastata*, *Silene ciliata*, *Agrostis rupestris*, *Festuca airoides*, *Biscutella arvernensis*, *Cerastium alpinum*, *Dryas octopetala* (rare), *Ligularia sibirica*, *Sabulina verna*, *Pedicularis verticillata* (Photo 61), *Gentiana verna*, *Androsace halleri*, *Cochlearia pyrenaica*, *Phyteuma hemisphaericum*, *Empetrum nigrum* subsp. *hermaphroditum*, *Arabis alpina*, *Saxifraga bryoides*, *S. lamottei* (rare), *S. oppositifolia* (Photo 62, rare), *S. androsacea*, *S. paniculata*, *S. fragosoi*, *Micranthes stellaris*, *M. hieraciifolia* (Photo 63, rare), *Dianthus gratianopolitanus*, *Alchemilla amphisericia*, *A. alpigena*, *A. saxatilis*, *Thymus callitrichefolius* Sennen, *Asplenium viride*, *Polystichum lonchitis*, and *Hieracium piliferum*.


Photo 61 - *Pedicularis verticillata*.

Photo 62 - *Saxifraga oppositifolia*.

Photo 63 - *Saxifraga hieraciifolia* (source Flora danica).

Edaphoxerophilous geopermaseries of warm and sunny rocks (GP6). This unit brings together four xerophilous, saxicolous, heliothermophilous plant communities, which constitute characteristic permaseres.

Stripped grassland, mainly dominated by *Festuca arvernensis* subsp. *costei* (*Bupleuro ranunculoidis-Festucetum costei*, *Galio saxatilis-Patzkeion paniculatae*), neutrophilous, on humic soil and steep basaltic rocky south-facing slopes, on small areas, forming bare steps.

Stripped grassland mainly dominated by *Patzkea paniculata* (*Leucanthemo delarbrei-Patzkeetum paniculatae* Braun-Blanq. 1926), often on rocky slopes just below the ridges, on trachyandesitic skeletal soils (Photo 64).

Open and rocky grasslands on pavements on lithosol with *Sedum* (*Sileno rupestris-Sedetum annui*, *Sedo-Scleranthion*).


Photo 64 - *Leucanthemo delarbrei-Patzkeetum paniculatae* Braun-Blanq. 1926 (GP6).

Dwarf heath on convex, rocky landforms with *Arctostaphylos uva-ursi* (*Pulsatillo vernalis-Cytisetum decumbentis scabiosetosum columbariae*, *Genisto pilosae-Vaccinion*), in the sheltered parts of the sites, more heliothermophilous than other communities.

This landscape unit is characterized by saxicolous or xerothermophilous orophytes: *Cotoneaster integerrima*, *Rosa spinosissima*, *Arctostaphylos uva-ursi*, *Bupleurum ranunculoides* subsp. *ranunculoides* (Photo 65), *Dianthus gratianopolitanus* (Photo 66), *Epilobium angustifolium*, *Festuca arvernensis* subsp. *costei*, *F. billyi*, *Hylotelephium maximum*, *Laserpitium latifolium*, *Leucanthemum delarbrei*, *Patzkea paniculata*, *Pilosella peleteriana*, *Scabiosa columbaria* var. *spreta* Jord., *Sempervivum tectorum* subsp. *arvernense*, *S. arachnoideum*, *Sedum annuum*, *S. dasyphyllum*, *S. hirsutum*, *S. forsterianum*, *Silene saxifraga*, and *Thymus pulegioides* var. *vestitus*.


Photo 65 and 66 - *Bupleurum ranunculoides* subsp. *ranunculoides*; *Dianthus gratianopolitanus*.

Edaphochionophilous geopermaseries (GP7). This unit brings together four communities in diverse concave landforms, basins, adapted to a prolonged snow cover and a short growing season, corresponding to four characteristic permaseres:

Mat-grass sward community of wet snowmelt ravine *Plantagini alpinae-Nardetum strictae* Braun-Blanq. 1926, *Nardion strictae* Braun-Blanq. 1926).

Mat-grass sward mesophilous community of snowy depressions under the ridge (*Euphrasio minimae-Nardetum strictae*, *Nardion strictae*, *Eu-Nardenion strictae*) (Photo 67).

Snow-patch, moss-rich, open community (*Plantagini alpinae-Agrostietum rupestris*, *Salicion herbaceae*), linked to an erosive snow overload, below plateaus acting as feeding surfaces.

Species-poor formations dominated by *Luzula desvauxii* (*Veratro albi-Luzuletum desvauxii*, *Mutellino adonidifoliae-Luzulion desvauxii*) in the snowy, eroded, and damp ravines, on steep slopes, which represent the latest snowdrift areas of the massif (Photo 68).

This landscape unit is differentiated by chionophilous species such as *Trifolium alpinum*, *Mutellina adonidifolia*, *Luzula desvauxii*, *Plantago alpina*, *Poa alpina*, *Sedum alpestre* (Photo 69), *Murbeckiella pinnatifida*, *Geum montanum* (Photo 70), *Scorzoneroideis pyrenaica*, *Potentilla aurea*, *Pseudorchis albida*, *Festuca heteromalla* (= *F. rubra* subsp. *fallax*), *Athyrium distentifolium*, *Micranthes stellaris*, *Alchemilla alpina*, *Kiaeria starkei*, *Oligotrichum hercynicum*, *Lophozia sudetica*, *Marsupella sparsifolia*, *Racomitrium macounii*, *R. heterostichum*, *R. fasciculare*...



Photo 67 - *Euphrasio minimae-Nardetum* (GP7), in small basins in heathlands of Peyre Arse.



Photo 68 - *Veratro-Luzuletum desvauxii* in snowy ravines of puy Mary (GP7).



Photo 69 - *Sedum alpestre*.



Photo 70 - *Geum montanum*.

Table 1 - Correspondence between the relevé numbers in Table 1 and the Braun-Blanquet numbers from the 1926 publication, including original and current syntaxon names (for author names, refer to the synsystem in this booklet). **1** (1 p. 32/33): Association à *Nardus* et *Plantago alpina* (*Plantagini alpinae-Nardetum strictae*); ravin de la Goulière. **2** (2 p. 34): *Nardetum festucetosum rubrae* (= *Diantho pseudocollini-Scorzoneroidetum pyrenaicae*); cirque d'Impradine. **3** (1 p. 36/37): Association à *Festuca spadicea* et *Chrysanthemum Delarbei* (*Leucanthemo delarbei-Patzkeetum paniculatae*); puy Mary. **4** (1 tab. 2 p. 44): Association à *Genista pilosa* et *Calluna* (= *Pulsatillo vernalis-Cytisetum decumbentis*); Plomb du Cantal. **5** (3 tab. 2 p. 44): Association à *Genista pilosa* et *Calluna* (= *Pulsatillo vernalis-Cytisetum decumbentis*); Between Brèche de Rolland and puy Mary. **6** (4 tab. 2 p. 44): Association à *Vaccinium uliginosum* et *V. myrtillus* (*Vaccinietum myrtillo-uliginosi*); ravin de la Goulière. **7** (5 tab. 2 p. 44): Association à *Vaccinium uliginosum* et *V. myrtillus* (*Vaccinietum myrtillo-uliginosi*); Plomb du Cantal. **8** (7 tab. 2 p. 44): Association à *Vaccinium uliginosum* et *V. myrtillus* (*Vaccinietum myrtillo-uliginosi*); Roc de Mandailles. **9** (1 p. 38): Association à *Adenostyles alliariae* et *Cicerbita alpina* (*Imperatorio osthutii-Adenostyletum alliariae*); Brèche de Roland. **10** (1 p. 39/41): *Cardaminetum amarae subatlanticum*; vallon de l'Impradine. **11** (1 tab. 1 p. 40): Association à *Bryum schleicheri* et *Montia rivularis* (*Montio fontanae-Bryetum schleicheri*); cirque d'Impradine. **12** (2 tab. 1 p. 40): Association à *Bryum schleicheri* et *Montia rivularis* (*Montio fontanae-Bryetum schleicheri*); Col des Rombières. **13** (3 tab. 1 p. 40): Association à *Bryum schleicheri* et *Montia rivularis* (*Montio fontanae-Bryetum schleicheri*); Peyre Arse. **14** (4 tab. 1 p. 40): Association à *Bryum schleicheri* et *Montia rivularis* (*Montio fontanae-Bryetum schleicheri*); ravin de la Goulière. **15** (1 p. 43): Association à *Carex fusca* (*Junco filiformis-Caricetum nigrae*); cirque de l'Impradine.

Relevés of J. Braun-Blanquet (1924)	<i>Nardion</i>			<i>Genisteto-Vaccinion</i>					<i>Adenostylion</i>	<i>Cardamineto-Montion</i>					<i>Caricion fuscae</i>
Names of alliances of J. Braun-Blanquet (1926)															
Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Relevé area (m2)	50	500	100								20	20	20	20	100
Altitude	1620	1350	1750	1800	1660	1600	1800	1680	1600	1350	1350	1540	1600	1610	
Exposure (°)	N	N	S		S	NNE		NE	N		E	NE	S	NE	
Slope (°)		15	40	10	30			10	35	5	5	5	25	25	
Accidental species	0	0	0	4	6	7	0	4	0	0	0	0	1	0	0
Number of species	23	55	38	21	24	26	26	23	24	6	19	22	16	14	11
Herb layer															
<i>Geum montanum</i> L.	+					+									
<i>Luzula desvauxii</i> Kunth	+								1						
<i>Poa alpina</i> L.	p														
<i>Plantago alpina</i> L.	2														
<i>Agrostis rupestris</i> All.	2			+											
<i>Trifolium alpinum</i> L.	2	+		1			+	r							
<i>Nardus stricta</i> L.	3	4													
<i>Galium saxatile</i> L.	+	+				+									
<i>Ranunculus serpens</i> Schrank	1														
<i>Achillea millefolium</i> L.	+														
<i>Ajuga reptans</i> L.	+														
<i>Alchemilla glabra</i> Neugent.	+														
<i>Anemone nemorosa</i> L.	+														
<i>Carex caryophyllaea</i> Latourr.	+														
<i>Carex leporina</i> L.	+														
<i>Carex pallescens</i> L.	+														
<i>Carex pilulifera</i> L.	+														
<i>Conopodium majus</i> (Gouan) Loret	+														
<i>Euphrasia micrantha</i> Rchb.	+														
<i>Genista sagittalis</i> L.	+														
<i>Ornithoglossum sylvaticum</i> (L.) Sch.Bip. & F.W.Schultz	+														
<i>Luzula sudetica</i> (Willd.) Schult.	+														
<i>Bistorta vivipara</i> (L.) Delarbei	+														
<i>Phleum alpinum</i> L.	+														
<i>Plantago lanceolata</i> L.	+														
<i>Prunella vulgaris</i> L.	+														
<i>Rhinanthus minor</i> L.	+														
<i>Scorzoneroides autumnalis</i> (L.) Moench	+														
<i>Silene nutans</i> L.	+														
<i>Stellaria graminea</i> L.	+														
<i>Trifolium pratense</i> L.	+														
<i>Trifolium repens</i> L.	+														
<i>Veronica officinalis</i> L.	+														
<i>Polygala serpyllifolia</i> Hose	+														
<i>Centaurea nigra</i> L.	+														
<i>Cerastium fontanum</i> s. <i>vulgare</i> (Hartm.) Greuter & Burdet	+														
<i>Pilosella lactucella</i> (Walt.) P.D.Sell & C.West	+														
<i>Pilosella officinarum</i> F.W.Schultz & Sch.Bip.	+														
<i>Thymus pulegioides</i> L.	+	+													
<i>Viola lutea</i> s. <i>lutea</i> Huds.	+	+													
<i>Lasione laevis</i> Lam.	+	+				+									
<i>Patzkea paniculata</i> (L.) G.H.Loos			3												
<i>Leucanthemum delarbei</i> Timb.-Lagr. ex Lamotte			1												
<i>Cytisus oromediterraneus</i> Rivas Mart. et al.			1												
<i>Thymus pulegioides</i> v. <i>vestitus</i> (Lange) Jalas			1												
<i>Biscutella arvensis</i> Jord.			+												
<i>Crepis conyzifolia</i> (Gouan) A.Kern.			+												
<i>Jacobaea adonidifolia</i> (Loisel.) M. rat			+												
<i>Linaria repens</i> (L.) Mill.			+												
<i>Phyteuma betonicifolium</i> Vill.			+												
<i>Polygala vulgaris</i> L.			+												
<i>Scabiosa columbaria</i> L.			+												
<i>Sedum annuum</i> L.			+												
<i>Senecio doronicum</i> (L.) L.			+												
<i>Euphrasia officinalis</i> s. <i>rostrkoviana</i> (Hayne) F.Towns.			+												
<i>Pilosella peleteriana</i> (M. rat) F.W.Schultz & Sch.Bip.			+												
<i>Laserpitium latifolium</i> s. <i>latifolium</i> L.			+												
<i>Sempervivum tectorum</i> s. <i>arvense</i> L. Lecoq & Lamotte			+												
<i>Silene vulgaris</i> s. <i>vulgaris</i> (Moench) Garcke			+												
<i>Hieracium juranum</i> Rapin			+												
<i>Atocion rupestre</i> (L.) Oxelman			+												
<i>Thesium alpinum</i> L.			+												
<i>Cytisus decumbens</i> (Durande) Spach				+											
<i>Pedicularis comosa</i> L.				+											
<i>Carex umbrosa</i> var. <i>umbrosa</i> Host				+											
<i>Pulsatilla vernalis</i> (L.) Mill.				+											
<i>Phyteuma hemisphaericum</i> L.	+	+	+				+								
<i>Genista pilosa</i> L.			+		3										
<i>Serratula tinctoria</i> L.			+		1										
<i>Luzula spicata</i> (L.) DC.					+										
<i>Hieracium lanceolatum</i> Vill.					+										
<i>Knautia godetii</i> Reut.					+										
<i>Hypericum maculatum</i> Crantz					+		+								
<i>Dianthus seguieri</i> s. <i>pseudocollinus</i> (P.Fourn.) Jauzein		+			+	+									
<i>Pulsatilla alpina</i> (L.) Delarbei	r			+		1	+								
<i>Poa chaixii</i> Vill.		+				+	+								



Relevés de J. Braun-Blanquet (1924)	Nardion			Genisteto-Vaccinion					Adenostylon	Cardamineto-Montion					Carlion fuscae
Names of alliances of J. Braun-Blanquet (1926)															
Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Relevé area (m2)	50	500	100								20	20	20	20	100
Altitude	1620	1350	1750	1800	1660	1600	1800	1680	1600	1350	1350	1540	1600	1610	
Exposure (°)	N	N	S		S	NNE		NE	N		E	NE	S	NE	
Slope (°)		15	40		10	30		10	35	5	5	5	25	25	
Accidental species	0	0	0	4	6	7	0	4	0	0	0	0	1	0	0
Number of species	23	55	38	21	24	26	26	23	24	6	19	22	16	14	11
<i>Epikeros pyrenaicus</i> (L.) Raf.	p	+				r		r							
<i>Melampyrum pratense</i> L.					+	+	+	+							
<i>Arnica montana</i> L.					+	+	+	+							
<i>Campanula scheuchzeri</i> s. <i>lanceolata</i> (Lapeyr.) J.-M.Tison	+				+	+	+	+							
<i>Hieracium prenanthoides</i> Vill.					+			+							
<i>Helictotricha versicolor</i> s. <i>versicolor</i> (Vill.) Romero Zarco								+	+						
<i>Mutellina adonidifolia</i> (J.Gay) Gutermann						+	+	+	+						
<i>Trollius europaeus</i> L.								+	1						
<i>Rumex alpinus</i> L.										3					
<i>Adenostyles alliariae</i> (Gouan) A.Kern.										2					
<i>Ranunculus aconitifolius</i> L.										2					
<i>Lactuca alpina</i> (L.) Benth. & Hook.f.										1					
<i>Rumex arifolius</i> All.										1					
<i>Saxifraga rotundifolia</i> L.										1					
<i>Tozzia alpina</i> L.										1					
<i>Athyrium distentifolium</i> Tausch ex Opiz									+						
<i>Athyrium filix-femina</i> (L.) Roth									+						
<i>Chaerophyllum hirsutum</i> L.									+						
<i>Crepis lampsanoides</i> (Gouan) Tausch									+						
<i>Geranium sylvaticum</i> L.									+						
<i>Imperatoria ostruthium</i> L.									+						
<i>Streptopus amplexifolius</i> (L.) DC.									+						
<i>Silene dioica</i> v. <i>dioica</i> (L.) Clairv.									+						
<i>Gentiana lutea</i> L.	+	1	+	+		1	+	+							
<i>Calluna vulgaris</i> (L.) Hull	r	+		5	2	+	+	+							
<i>Meum athamanticum</i> Jacq.	+	1	+		+	+	+	+							
<i>Anthoxanthum odoratum</i> L.	+	+	+	+	+	+	+	+	+						
<i>Scorzoneroides pyrenaica</i> (Gouan) Holub	1	+	+	+	+	+	+	+							
<i>Festuca rubra</i> L.	+	1	2	+	+	+	+	+			+				
<i>Potentilla aurea</i> L.	+	1			+	+	+	+			+				
<i>Vaccinium myrtillus</i> L.		+	1	1	2	2	2	3							
<i>Avenella flexuosa</i> (L.) Drejer			1	2	+	2	2	2							
<i>Solidago virgaurea</i> L.			+	+	+	+	+	+							
<i>Vaccinium uliginosum</i> L.	+		+	+	+	3	4	2							
<i>Bistorta officinalis</i> Delarbre				+	+	+	1	1	+						
<i>Luzula multiflora</i> (Ehrh.) Lej.		+			+	+	+	+							
<i>Potentilla erecta</i> (L.) Raeusch.		+			+	+	+	+							
<i>Calamagrostis arundinacea</i> (L.) Roth			+		+		+								
<i>Chrysosplenium oppositifolium</i> L.										1					
<i>Veronica beccabunga</i> L.										1					
<i>Cardamine amara</i> L.										2	+				
<i>Epilobium alsinifolium</i> Vill.										1	+	+			
<i>Myosotis martini</i> Sennen											+	+			
<i>Veronica serpyllifolia</i> L.		r									+	+	+	+	
<i>Alchemilla coriacea</i> Buser											1		+	1	
<i>Sagina saginoides</i> (L.) H.Karst.											+	+	+	+	
<i>Sedum villosum</i> L.											+	+	+	+	
<i>Stellaria alsine</i> Grimm											1	+	+	1	
<i>Trifolium spadiceum</i> L.											+	+	+		
<i>Montia fontana</i> s. <i>fontana</i> L.											+	+	1	+	
<i>Micranthes stellaris</i> (L.) Galasso & Soldano											1	+	2	+	
<i>Viola palustris</i> L.	+										+	+	+	+	+
<i>Cardamine pratensis</i> L.											+	+	+	+	+
<i>Carex nigra</i> (L.) Reichard											+	+	+	+	3
<i>Carex echinata</i> Murray												+			1
<i>Carex canescens</i> L.															2
<i>Carex rostrata</i> Stokes															1
<i>Juncus filiformis</i> L.															2
<i>Comarum palustre</i> L.												+			+
<i>Lotus corniculatus</i> L.															
<i>Alchemilla</i> L.	+	+							+						
<i>Poa nemoralis</i> L.			+						+						
<i>Sorbus aucuparia</i> L.						+		+							
<i>Caltha palustris</i> L.												+	+		
<i>Epilobium nutans</i> F.W.Schmidt												+	+		
<i>Agrostis capillaris</i> L.												+		+	
<i>Caltha palustris</i> L.										+					+
<i>Bilium bonus-henricus</i> (L.) Rchb.	r														
<i>Agrostis</i> L.		+													
<i>Rumex acetosella</i> L.		r													
<i>Galium pumilum</i> Murray			+												
<i>Hieracium pallidulum</i> Jord. ex Boreau			+												
<i>Hieracium acuminatum</i> Jord.			+												
<i>Equisetum palustre</i> L.															
<i>Glyceria notata</i> Chevall.											+				
<i>Epilobium palustre</i> L.														+	
<i>Pinguicula vulgaris</i> L.														+	
<i>Agrostis stolonifera</i> L.															+
Moss Layer															
<i>Polytrichum juniperinum</i> Hedw.	1														
<i>Cladonia rangiferina</i> (L.) Weber				+											
<i>Flavocetraria cucullata</i> (Bellardi) K&nefelt & A.Thell				+											
<i>Cetraria islandica</i> (L.) Ach.				+				1							
<i>Brachythecium rivulare</i> Schimp.										+	+				
<i>Ptychostomum pseudotriquetrum</i> J.R.Spence & H.P.Ramsay											+	+			
<i>Ptychostomum schleicheri</i> (DC.) J.R.Spence ex Bell & Holyoak											4	4	4	4	
<i>Philonotis seriata</i> Mitt.											2	1	1	1	
<i>Rhizomnium punctatum</i> (Hedw.) T.J.Kop.									+			+		+	
<i>Sanionia uncinata</i> (Hedw.) Loeske	+														2
<i>Brachyneurium schimp.</i>									+						

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Position of the plant communities visited, within the phytosociological system

Potametea Klika in Klika et V.Novák 1941

Potametalia W.Koch 1926

Potamion pectinati (W.Koch 1926) Libbert 1931

Eu-Potamenion pectinati

Cf *Elodeo canadensis-Potametum alpini* Krausch ex H.Passarge 1994

Montio fontanae-Cardaminetea amarae Braun-Blanq. et Tüxen ex Klika et Hadač 1944

Montio fontanae-Cardaminetalia amarae Pawł. in Pawł., Sokołowski et Wallisch 1928

Cardamino amarae-Montion fontanae Braun-Blanq. 1925

Montio fontanae-Bryetum schleicheri Braun-Blanq. 1925

Cardamino amarae-Chrysosplenietalia alternifolii Hinterlang ex B.Foucault 2018

Caricion remotae M.Kästner 1942

Cardamino amarae-Chrysosplenietum alternifolii F.M.Maas 1959

Arabidion soyeri Julve ex B.Foucault 2018 (= *Cochlearion pyrenaicae* Bardat in Bardat et al. 2004 nom. inval.)

Sagino procumbentis-Pedicularietum verticillatae Thébaud 2025

Oxycocco palustris-Sphagnetalia magellanici Braun-Blanq. et Tüxen ex V.Westh., J.Dijk, Passchier et G.Sissingh 1946

Sphagnetalia magellanici M.Kästner et Flössner 1933

Sphagnion magellanici M.Kästner et Flössner 1933

Polytricho communis-Eriophorenion vaginati Thébaud et Pétel 2008

Carici nigrae-Sphagnetum magellanici Bick 1985

Scheuchzeria palustris-Caricetea fuscae Tüxen 1937

Caricetalia fuscae W.Koch 1926

Caricion fuscae W.Koch 1926

Bartsio alpinae-Caricetum nigrae J. et M.Bartsch 1940

Junco filiformis-Caricetum nigrae (Oberd.1957) Rivaz-Mart. et Géhu 1978 (= *Caricetum fuscae subalpinum* Oberdorfer 1957)

Asplenietea trichomanis (Braun-Blanq. in H.Meier & Braun-Blanq. 1934) Oberd. 1977

Asplenietalia septentrionalo-cuneifolii Mucina et Theurillat 2015

Asplenion septentrionalis Gams ex Oberd.1938

Sempervivo arvernensis-Saxifragetum continentalis Billy ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014

Androsacetalia vandellii Braun-Blanq. in H.Meier et Braun-Blanq. 1934

Dianthion gratianopolitani Focquet 1982 nom. inval. (Art. 5)

Valeriano trypteridis-Phyteumetum hemisphaerici Billy ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014

Micranthetum hieraciifoliae Quézel et Rioux 1954 mut. Thébaud 2025

Saxifragetum lamottei Quézel et Rioux 1954

Thlaspietea rotundifolii Braun-Blanq. 1948

Galeopsietalia segetum Oberd. et Seibert in Oberd. 1977

Galeopsision segetum Oberd. 1957

Biscutello lamottei-Galeopsietum segeti Coquillard, Geugnot et R.Michalet ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014

Androsacetalia alpinae Braun-Blanq. in Braun-Blanq. et H.Jenny 1926

Androsacion alpinae Braun-Blanq. in Braun-Blanq. et H.Jenny 1926

Cryptogrammetum crispae Jenny-Lips 1930

Dryopteridion oreadis Rivas-Mart. 1977 corr. Rivas-Mart. et al. 1984

Community with *Dryopteris oreades*

Epilobietea angustifolii Tüxen et Preising ex von Rochow 1951

Epilobietalia angustifolii Tüxen ex von Rochow 1951

Epilobion angustifolii Oberd. 1957

- Lactuco plumieri-Epilobietum angustifolii** (Billy 1997) B.Foucault in B.Foucault & Catteau 2015
- Senecioni fuchsii-Digitalietum purpureae** Pfeiffer 1936
- Stellario holostaeae-Rubetum idaei** H.Passarge 1982
- Holco mollis-Pteridetum aquilini** H.Passarge 1994
- Filipendulo ulmariae-Convolvuletea sepium* Géhu et Géhu-Franck 1987
- Loto pedunculati-Filipenduletalia ulmariae* H.Passarge (1975) 1978
- Filipendulo ulmariae-Chaerophyllion hirsuti* B.Foucault 2011
- Ranunculo aconitifolii-Filipenduletum ulmariae** Bal.-Tul. et Hübl 1979
- Mulgedio alpini-aconitetea variegati* Hadač et Klika ex Klika 1948
- Adenostyletalia alliariae* Braun-Blanq. 1930
- Adenostylion alliariae* Braun-Blanq. 1926
- Crepido paludosae-Adenostyletum alliariae** Loos et Thébaud 2024
- Doronico austriaci-Campanuletum latifoliae** Quézel et Rioux 1954
- Imperatorio osthurtii-Adenostyletum alliariae** (Braun-Blanq. 1926) B.Foucault in B.Foucault et Corriol 2013 (= association à *Adenostyles alliariae* et *Cicerbita alpina* Braun-Blanq. 1926)
- Mutellino adonidifoliae-Luzulion desvauxii* R.Michalet et T.Philippe ex Le Hénaff et al. 2021
- Veratro albi-Luzuletum desvauxii** R.Michalet et T.Philippe ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014
- Dryopterido filicis-maris-Athyrium distentifolii* (Holub ex Šýkora et Štursa 1973) Jeník et al. 1980)
- Senecioni cacaliastri-Athyrietum distentifolii** Thébaud in Loos et Thébaud 2024
- Calamagrostietalia villosae* Pawłowski et al. 1928
- Calamagrostion arundinaceae* (Luquet 1926) Oberd. 1957
- Calamagrostietum arundinaceae** Luquet 1926
- Luzulo sylvaticae-Calamagrostietum arundinaceae** R.Michalet et T.Philippe ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014
- Heracleosphondylii-Calamagrostietum arundinaceae** R.Michalet et T.Philippe ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014
- Pediculario foliosae-Geranietum sylvatici** Michalet et Philippe ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014
- Community with Libanotis pyrenaica and Calamagrostis arundinacea**
- Petasito-Chaerophylletalia* Morariu 1967
- Arunco-Petasion albi* Braun-Blanq. et Sutter 1977
- Saxifrago rotundifolii-Petasitetum albi** (Choisnet et Mulot 2008) Loos 2024 prov.
- Senecioni rupestris-Rumicetalia alpini* Mucina et Karner in Mucina et al. 2016
- Rumicion alpini* Scharfetter 1938
- Rumicetum alpini** Beger 1922
- Melampyro pratensis-Holcetea mollis* H.Passarge 1994
- Melampyro pratensis-Holcetalia mollis* H.Passarge 1979
- Melampyro sylvatici-Poion chaixii* Julve ex Boulet et Rameau in Bardat et al. 2004
- Poo chaixii-Euphorbietum hybernae** Bignon 1986 ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014
- Prenanthero purpureae-Avenelletum flexuosae** (Bignon 1986) Loos 2024 prov.
- Agrostio capillaris-Lactugetum plumieri** Loos 2024 prov.
- Trifolio medii-Geranietea sanguinei* T.Müll. 1962
- Antherico ramosi-Geranietalia sanguinei* Julve ex Dengler in Dengler et J.Krebs 2003
- Geranion sanguinei* Tüxen in T.Müll. 1962
- Antherico ramosi-Geraniion sanguinei* J.-M.Royer 2015
- Cf Cervario rivini-Oreoselinum nigri** Billy ex J.-M. Royer 2014
- Origanetalia vulgaris* T.Müller 1962

Knautia dipsacifoliae Julve ex Dengler et Boch 2008
Laserpitio latifolii-Teucrienion scorodoniae J.-M.Royer 2016

Doronic austriaci-Calamagrostietum arundinaceae (Coquillard 1993) Loos 2024 prov.

Cirsio erisithalis-Teucrietum scorodoniae Billy ex J.-M.Royer 2016

Juncetea trifidi Hadač in Klika et Hadač 1944 (= *Caricetea curvulae* Braun-Blanq. 1948)
Caricetalia curvulae Braun-Blanq. in Braun-Blanq. et H.Jenny 1926
Festucion airoidis Braun-Blanq. 1948 mut. Mucina et al. 2016

Jasione arvernensis-Agrostietum rupestris R.Michalet et T. Philippe ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014,
silenetosum ciliatae Loos 2024 prov. (= *Sileno ciliatae-Agrostietum rupestris* Le Gloanec et Le Hénaff 2024 nom. inval.)

Biscutello arvernensis-Festucetum airoidis Billy ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014

Festucetalia spadiceae Barbero 1970

Nardion strictae Braun-Blanq. 1926 (= *Galio saxatilis-Potentillion aureae* B.Foucault 1994 p.p., = *Euphrasio minimae-Nardion strictae* Le Hénaff, Hostein, M.Dumont et Pradinas 2021 nom superfl.)

Plantagini alpinae-Nardetum strictae Braun-Blanq. 1926

Euphrasio minimae-Nardetum strictae R.Michalet et T.Philippe ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014

Galio saxatilis-Patzkeion paniculatae B.Foucault 2016

Arnico montanae-Patzkeetum paniculatae R.Michalet et T.Philippe ex Thébaud, C.Roux, C.E.Bernard et Delcoigne 2014

Betonico officinalis-Patzkeetum paniculatae Loos in Loos et Thébaud 2024

Leucanthemo delarbrei-Patzkeetum paniculatae Braun-Blanq. 1926 (= association à *Festuca spadicea* et *Chrysanthemum delarbrei* Braun-Blanq. 1926)

Bupleuro ranunculoidis-Festucetum costei Thébaud in Loos et Thébaud 2014

Salicetea herbaceae Braun-Blanq. 1948

Salicetalia herbaceae Braun-Blanq. in Braun-Blanq. et H.Jenny 1926

Salicion herbaceae Braun-Blanq. in Braun-Blanq. et H.Jenny 1926

Plantagini alpinae-Agrostietum rupestris R.Michalet et T.Philippe ex Thébaud, C.Roux, C.-E. Bernard et Delcoigne 2014

Loiseleurio procumbentis-Vaccinieta Eggler ex Schubert 1960

Rhododendro ferruginei-Vaccinieta microphylli Braun-Blanq. in Braun-Blanq. et H.Jenny 1926

Genisto pilosae-Empetrium hermaphroditi Thébaud, Choynet et C.Roux 2021

Racomitrio lanuginosi-Empetretum nigri Luquet 1926

Helianthemetea guttati Rivas Goday et Rivas Mart. 1963

Helianthemetalia guttati Braun-Blanq. in Braun-Blanq., Molin. et H.Wagner 1940

Thero-Airion Tüxen ex Oberd. 1957

Spergulo pentandrae-Veronicetum dillenii Korneck 1975

Festuco-Brometea Braun-Blanq. et Tüxen ex Klika et Hadač 1944

Brometalia erecti W.Koch 1926

Bromion erecti W.Koch 1926

Chamaespartio sagittalis-Agrostienion capillaris Vigo ex J.-M.Royer et Ferrez 2020

Brachypodio pinnati-Dianthetum monspessulani Lemée et Carbiener 1956

Ranunculo bulbosi-Brachypodietum pinnati R.Michalet, Coquillard et Gueugnot ex Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014

Koelerio-Phleion phleoidis Korneck 1974

Carlino acanthifoliae-Phleetum phleoidis C.Roux et Brocard 2023

Nardetea strictae Rivas Goday et Borja Carbonell in Rivas Goday et Mayor López 1966 nom. conserv. propos. Mucina et al. 2016

Nardetalia strictae Oberd. ex Preising 1950

Nardo-Agrostion tenuis Sillinger 1933 (inclus *Galio saxatilis-Potentillion aureae* B.Foucault 1994 p.p.)

Brizo mediae-Agrostietum capillaris Thébaud 2008

Diantho pseudocollii-Scorzonoidetum pyrenaicae Billy ex Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014 mut.
 Ragache 2021, *typicum* et *galietosum veri*

Carici piluliferae-Nardetum stictae R.Michalet et T.Philippe ex Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014

Sedo albi-Scleranthetea biennis Braun-Blanq. 1955

Sedo albi-Scleranthetalia biennis Braun-Blanq. 1955

Sedo albi-Scleranthion biennis Braun-Blanq. 1955

Sempervivo arvernensis-Festucetum arvernensis B.Foucault 1987 **sempervivetosum arachnoidei** J.-M.Royer et Ferrez 2018

Sileno rupestris-Sedetum annui Oberdorfer 1957

Arrhenatheretea elatioris Braun-Blanq. ex Braun-Blanq., Roussine et Nègre 1952

Arrhenatheretalia elatioris Tüxen 1931

Trisetum flavescens-Polygonion bistortae Braun-Blanq. et Tüxen ex Marschall 1947

Rhinantho pumili-Trisetenion flavescens B.Foucault 2016

Violo luteae-Trisetetum flavescens (Luquet 1926) B.Foucault 1986

Trifolium repens-Phleetalia pratensis H.Passarge 1969

Cynosurion cristati Tüxen 1947

Festuco commutatae-Cynosuretum cristati Tüxen in Büker 1942

Cyano montani-Cynosuretum cristati (Lachapelle 1964) B.Foucault 2016

Calluno vulgaris-Ulicetea minoris Braun-Blanq. et Tüxen ex Klika in Klika et Hadač 1944

Vaccinio myrtilli-Genistetalia pilosae Schubert ex H.Passarge 1964

Diantho hyssopifolii-Vaccinien myrtilli Boulet et al. in Thébaud, Choynet et C.Roux 2021 *ad interim*.

Galio saxatilis-Vaccinium myrtillus R.Michalet, Coquillard et Gueugnot 1989

Genisto pilosae-Vaccinien Braun-Blanq. 1926

Vaccinien myrtillo-uliginosi Thébaud, Choynet et C.Roux 2021

Vaccinietum myrtillo-uliginosi Braun-Blanq. 1926

Euphorbio hybernae-Vaccinietum myrtilli Coquillard ex Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014

Patzkeo paniculatae-Vaccinium myrtilli Thébaud, Choynet et C.Roux 2021

Carici piluliferae-Vaccinienion Schaminée Hennekens et Thébaud 1993

Allo victorialis-Vaccinietum uliginosi Schaminée et Hennekens 1992

Alchemillo saxatilis-Vaccinietum uliginosi Thébaud ex Schaminée, Hennekens et Thébaud 1993

Eu-Genisto pilosae-Vaccinienion (= *Phyteumo hemisphaerici-Vaccinienion* Schaminée et Hennekens in Schaminée Hennekens et Thébaud 1993 p.p.)

Pulsatillo vernalis-Cytisetum decumbentis Quézel & Rioux 1954 *mut.* Thébaud, Choynet et C.Roux 2021 (= *Pulsatillo vernalis-Genistetum* Quézel et Rioux 1954, = association à *Genista pilosa* et *Calluna* Braun-Blanq. 1926 p.p.)

Jasione laevis-Callunetum vulgaris Michalet et Philippe ex Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014 (= association à *Calluna vulgaris* et *Genista pilosa* Luquet 1926 p.p.)

Cytisetetea scopario-striati Rivas Mart. 1975

Cytisetalia scopario-striati Rivas Mart. 1975

Cytision oromediterranei Tüxen in Tüxen et Oberd. 1958

Silene vulgaris-Cytisetum oromediterranei (Billy ex Thébaud, C.Roux, Bernard et Delcoigne 2014) Loos 2024 *nom. inval.* (Art. 1, 2a)

Teucrio scorodoniae-Cytisetum purgantis Coquillard ex Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014

Franguletea alni Doing ex V.Westh. in V.Westh. et den Held 1969

Salicetalia auritae Doing 1962

Salicion cinereae T.Müll. et Görs ex H.Passarge 1961

Salicetum pentandro-atrocinereae Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014

Rhamno catharticae-Prunetea spinosae Rivas Goday et Borja ex Tüxen 1952

Prunetalia spinosae Tüxen 1952

Amelanchiero ovalis-Buxion sempervirentis O.Bolòs et Romo 1989

Junipero communis-Amelanchieretum ovalis Billy ex B.Foucault et J.-M.Royer 2016

Sambucetalia racemosae Oberd. ex H.Passarge in Scamoni 1963
Sambuco nigrae-Salicion capreae Tüxen et A.Neumann ex Oberd. 1957

Betulo pendulae-Salicetum capreae Billy ex B.Foucault in B.Foucault et J.-M.Royer 2016, ***sorbetosum ariae***

Betulo carpaticae-alnetea viridis Rejmánek ex Boeuf, Theurillat, Willner, Mucina et Simler in Boeuf et al. 2014

Alnetalia viridis Rübel ex Karner et Willner in Willner et Grabherr 2007

Pruno petraeae-Sorbion aucupariae Rameau ex Seytre et Boeuf in Boeuf 2011

Sorbo aucupariae-Loniceretum nigrae B.Foucault 1987

Roso pendulinae-Sorbetum chamaemespili Billy ex Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014

Salicion helveticae Rübel ex Theurillat in Theurillat et al. 1995 (= *Salicion lapponum-glaucæ* Gams 1936)

Salicetum bicolori-lapponum (Lachapelle in Cusset et Lachapelle 1962) Julve 1993 *nom. inval.* (Art. 2b, 3b, 7)

Carpino-Fagetea sylvaticae Jakucs ex H.Passarge 1968

Fagetalia sylvaticae Tüxen in Barner 19

Fagion sylvaticae Luquet 1926

Eu-Fagenion sylvaticae

Adoxo moschatellinae-Fagetum sylvaticae (Luquet 1926) Rivas Mart., Báscones, T.E.Diáz, Fern.Gonz. et Loidi 1991
 (= *Fagetum sylvaticae* Luquet 1926, *Fageto-Scilletum Lilio-Hyacinthii* (Lemée 1956) Cusset 1963 *nom. illeg.*)

Euphorbio hybernae-Fagetum sylvaticae Billy ex Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014

Luzulo sylvaticae-Fagetum sylvaticae Cusset 1964

Aceri pseudoplatani-Fagion sylvaticae (Oberd. 1957) Moor 1976

Doronico austriaci-Fagetum sylvaticae Seytre in Renaux, Timbal, Gauberville, Thébaud, Bardat, Lalanne, J.-M.Royer et Seytre 2019

Astrantio-Corylion avellanae H.Passarge 1978

Daphno mezerei-Coryletum avellanae C.Roux in Thébaud, C.Roux, C.-E.Bernard et Delcoigne 2014

Luzulo luzuloidis-Fagetalia sylvaticae Scamoni et H.Passarge 1959

Luzulo luzuloidis-Fagion sylvaticae W.Lohmeyer et Tüxen in Tüxen 1954

Solidago virgaureae-Fagetum sylvaticae (Cusset 1964) Renaux, Timbal, Gauberville, Thébaud, Bardat, Lalanne, J.-M.Royer et Seytre 2019 (= *Deschampsio flexuosae-Fagetum* Lemée ex Cusset in Cusset et Lachapelle 1961 *nom. illeg* (Art. 31)

Vegetation series seen during the excursions

- H1: climatophilous, neutrophilous, mesomontane, atlantic beech forest holoserries of *Adoxo moschatellinae-Fagetum* (Chaudefour, Monneaux). H1b: the same series with matured forest dominated by *Abies alba* (Capucin).
- H2 : climatophilous, meso-acidiphilous, mesomontane, subatlantic beech forest holoserries of *Luzulo sylvaticae-Fagetum* (Chaudefour, Monneaux, Pavin, puy de Dôme).
- H3: climatophilous, acidophilous, mesomontane, species-poor beech forest holoserries of *Solidago virgaureae-Fagetum* (Chaudefour, Monneaux, Capucin). H3b: the same series with mature forest dominated by *Abies alba* (Capucin).
- H4 : climatophilous, neutrophilous and chionophilous, upper montane, beech forest holoserries of *Doronico austriaci-Fagetum* (Chaudefour, Monneaux, Plomb, Impradine).
- H5 : climatophilous, meso-acidiphilous/neutrophilous, mesomontane, atlantic beech forest holoserries of *Euphorbio hybernae-Fagetum* (Pavin, puy de Dôme). H5b : climatophilous, subneutrophilous, submontane, atlantic beech forest holoserries of *Euphorbio hybernae-Fagetum coryletosum* (puy de Dôme).
- C1 : edaphohygrophilous, mesomontane, mesotrophic/eutrophic willow grove curtaserries of the *Salicetum pentandro-atrocinereae* (Chaudefour, Monneaux).
- C2 : climatophilous, lower subalpine, mountain ash and goat willow wood curtaserries of *Pruno petraeae-Sorbion* dominated by *Sorbus aucuparia*, *Aria edulis* and *Salix caprea* (puy de Dôme).
- C3 : edaphoxerophilous, of basaltic south-facing slopes, sheltered climate, submontane to montane, thicket curtaserries of *Amelanchiero-Buxion* (Murat).
- P1 : edaphohygrophilous, montane, subject to rivular flooding, tall-forb permaserries of *Crepido paludosae-Adenostyletum alliariae* (Monneaux).
- P2 : edapho-aerohygrophilous, montane, eutrophic, tall-forb permaserries of *Doronico austriaci-Campanuletum latifoliae* (Chaudefour).
- P3 : climatophilous, thermomesophilous, mesotrophic, subalpine tall-herb meadow permaserries of *Calamagrostietum arundinaceae* (Monneaux, Plomb, Impradine).
- P4 : climatophilous, subalpine, heath permaserries of *Allio victorialis-Vaccinietum* (Monneaux, puy de Dôme).
- P5 : climatophilous, chionophilous, of sheltered slopes, subalpine, tall-herb meadow permaserries of *Heracleo sphondylii-Calamagrostietum* (puy de Dôme).
- GP1 : edaphoxerophilous subalpine geopermaseries of high trachytic rocky slopes (puy de Dôme).
- GP2 : edaphoxerophilous, under sheltered climate, submontane to montane geopermaseries on basaltic rocks (Murat).
- GP3 : climatophilous, upper subalpine, heath geopermaseries, on the cold summits (Plomb, Impradine).
- GP4 : climatophilous, subalpine geopermaseries of sheltered, snow-covered slopes on deep soils (Plomb, Impradine).
- GP5 : edaphoxerophilous, subalpine, geopermaseries of cold summit rocks and walls (Impradine).
- GP6 : edaphoxerophilous, subalpine geopermaseries of warm and sunny rocks (Plomb).
- GP7 : edaphochionophilous, subalpine geopermaseries of concave landforms, basins, ravines, with short growing season (Plomb).
- GC1 : climatophilous, lower subalpine geocurtaserries of the snowy timberline (Impradine).
- GC2 : climatophilous, subalpine geocurtaserries, on warm and dry south-facing slopes (Plomb).
- GC3 : edaphohygrophilous, peaty and flooded, upper montane to subalpine geocurtaserries of wetlands at the emergence of the hydrographic network (Plomb, Impradine).
- GC4 : edaphoxerophilous, upper montane to subalpine geocurtaserries of silicate large boulders screes (Plomb).