

THE TERROIR

– GEOLOGY, SOIL TYPES AND CLIMATE

The geology stares at you right in the face in the vineyards of the French Alps. And, because the higher mountains are snow-capped all year round, there is often a misapprehension that these wines are somehow miraculously born from a bitterly cold, snowy climate. Spend a little time here, even in winter, feeling the strength of the sun beating down on the rocky vineyards, and you begin to understand why vines can thrive.

Even in the northernmost parts of the Savoie and Bugey wine regions you can find almond, fig and apricot trees, and in summer you can hear the distinctive buzzing of crickets or cicadas. Once you arrive in the Diois or Hautes-Alpes, olive trees appear, along with Mediterranean-style scrubland.

Savoie and Bugey are south of France's watershed, meaning the rivers all head south to the Mediterranean. They lie at a latitude halfway between the north pole and the equator, near the magic parallel of 45°N, known by wine enthusiasts for running through the vineyards of Bordeaux, the Rhône Valley and Piemonte.

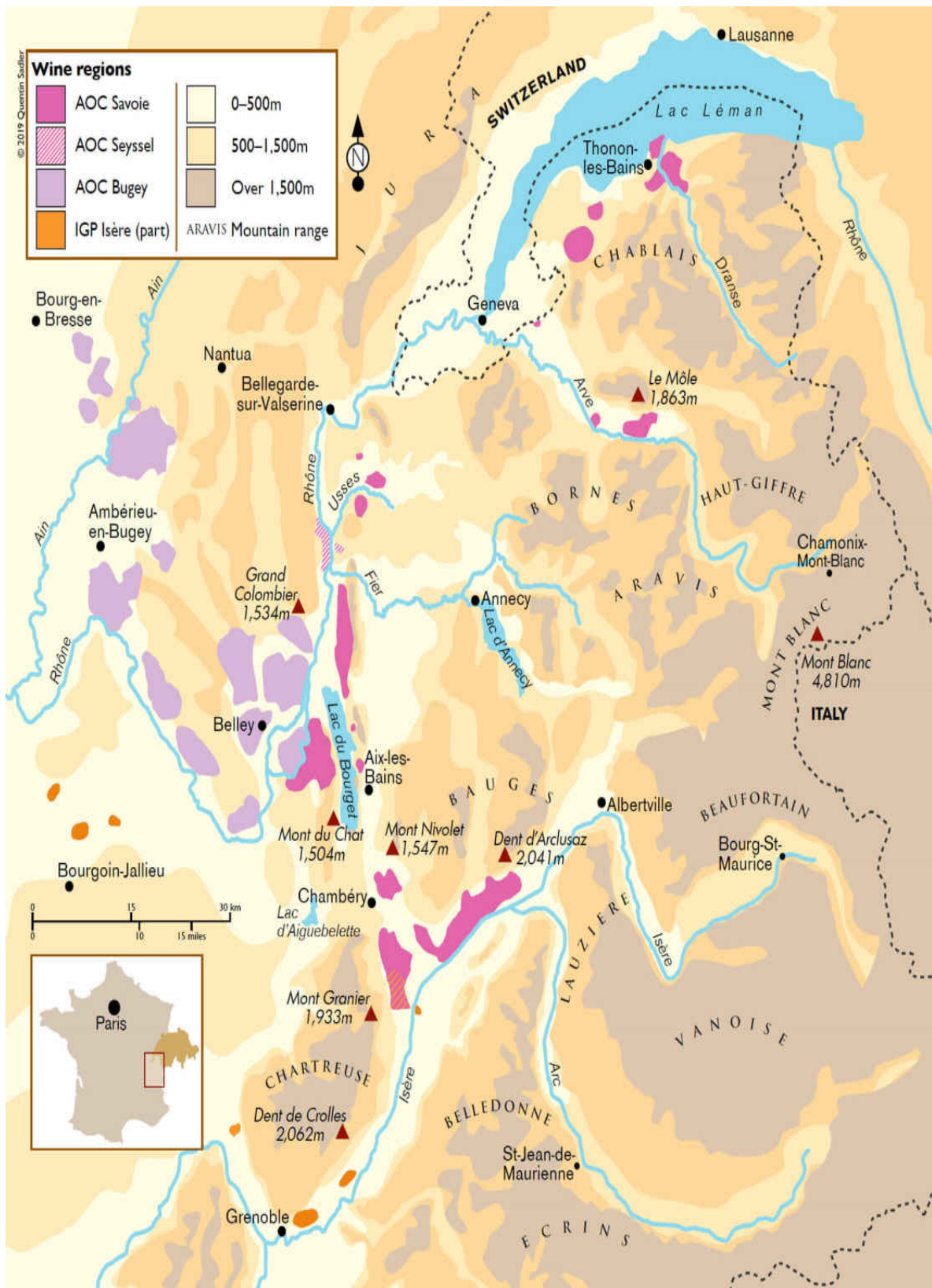
From the map that follows it becomes clear that the French Alpine vineyards are located in between the mountains, often near the waterways, and indeed this is essentially where there is habitation and agriculture in general. In terms of geology and vineyard soils it is the limestone-dominated Prealps (whose peaks culminate below 3,000m above sea level) that interest us, rather than the tougher, more varied rocks of the main Alps. The high Alps, though, have a big influence on the weather systems, notably in bringing regular precipitation and wind. Mountain areas tend to be the focus of dramatic weather systems as well as dramatic landscapes.

The diverse rocks of the Alps and the Prealps and the effects of the recent ice age when the glaciers formed are responsible for the

incredibly varied soils in the French Alps wine regions, soils which frequently erode with the vagaries of man and the weather. Most of the vineyards are on hillsides, some of them extremely steep and challenging to work.

Legacy of the glaciers

Rising above the internationally famous ski resort of Val d'Isère, the Isère river, regularly filled with snow-melt, runs close to many of the Savoie and Isère vineyards along the valley of a former glacier. Like the Arve river in Haute-Savoie, the Ain in Bugey, the Drôme in the Diois and the Durance in Hautes-Alpes, the Isère is a tributary of the Rhône. One could say all rivers lead to Rhône. The Rhône itself runs through many vineyards on its journey from the Valais in Switzerland to the Mediterranean near Marseille, passing Seyssel, Bugey and Jongieux en route. The original glaciers that became rivers created the large Alpine lakes – pretty Lake Annecy, the larger Lac du Bourget and also Lac Léman (formed by the Rhône, for example). The proximity of these waterways has a profound influence on both the climate and the soils.



At altitudes below 500m vineyards lie in the forelands and foothills of the Prealps. The map, covering Savoie, Bugey and Isère wine regions, indicates the main Prealps and Alpine ranges, along with important mountain peaks.

Skating through Alpine geology



Soil diversity: a large rounded pebble from glacial deposits and a limestone rock in a vineyard of Domaine des Plantaz, southern Bugey.

On clear days the highest peak in the Alps, Mont Blanc (4,810m or 15,780 feet), can be seen in the distance from the upper slopes of many of the Savoie and Bugey vineyards. Geologically speaking, the Alps are a young mountain range, formed by the collision of the Afro-Arabian and Euro-Asian tectonic plates during Cretaceous times, roughly 65 million years ago.

There were three important stages in the development of the Prealps. Firstly, between around 245 and 65 million years ago, that is, in the Triassic, Jurassic and Cretaceous periods, the Tethys Ocean covered the whole area and far beyond; sedimentary rock, specifically limestone, formed at the bottom of these oceans; some of the sea life is today found as fossils. Secondly, starting at the end of the Cretaceous period, the Alps underwent a major uplift, when limestone from the bottom of the ocean was thrust up and pushed westwards to the edge of the high Alps to form what we now call the Prealps, which adjoin the Jura mountains, formed much earlier. Thirdly, since that time erosion has changed the landform of the Prealps and continues to do so. The landscape has been altered:

- by the scouring action of glaciers over the last two million years
- in association with chemical weathering, which over time has degraded some rocks into soft, easily eroded clays

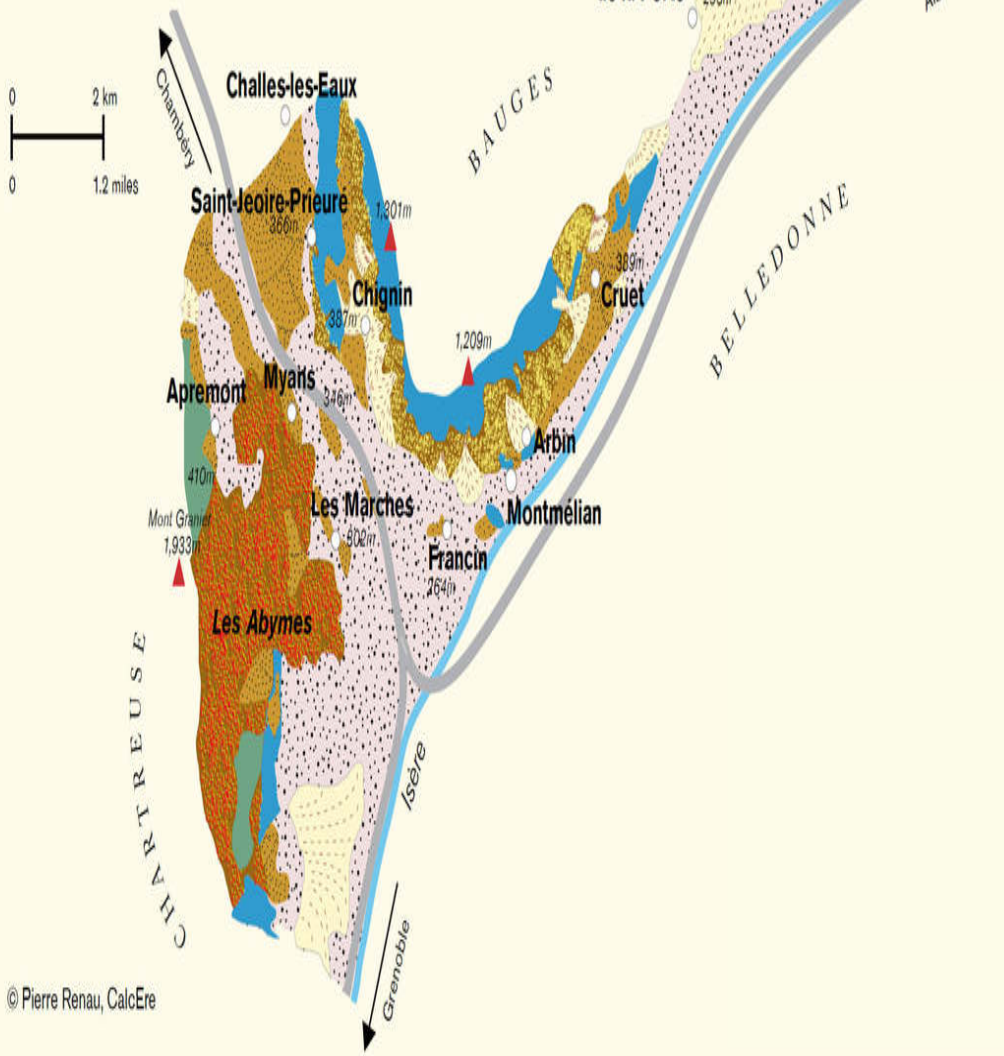
- by gelifraction: repeated freezing and thawing, which breaks up the rocks
- by human activity such as extensive deforestation to provide firewood for an increased population in the 19th century – this later caused instability on the slopes.

The vineyard slopes throughout French Alpine wine regions owe their terroir to these different and ancient geological processes.

Soil types

The soils formed by this mountain geology are thus derived from sedimentary rocks, principally limestone (*calcaire* in French). As can be seen by the geological map of the heart of the Savoie wine region (opposite), above this limestone are incredibly varied soils and this is repeated throughout the French Alps. Many soils are very rocky, with scree (*éboulis*) a common feature. Other typical soil types include those developed from limestone: limestone scree mixed with clay, marls (*marnes* – a fine-grained mixture of clay and limestone), glacial till (principally clay but with disorganised bodies of sand, gravel, pebbles and boulders), *molasse* (clayey calcareous sandstone) and the sands and gravels of alluvial fans (*cônes de déjection*). These alluvial fans are formed from rivers depositing their sediments in a fan-like shape and the resulting good drainage makes them very desirable for vineyards. Most soils derived from sedimentary rocks are well-drained, and also their relative softness allows the vine roots to stretch deep for water in times of drought. A summary of soils in each area is shown [here](#).

The geology of the Combe de Savoie



Around 80 per cent of Savoie's vineyards are on the foothills of the Chartreuse and Bauges Prealpine ranges, above the Isère river and opposite the Belledonne range. The geological map shows that on the lower slopes of the mountains, limestones and occasional marls give way to scree or in places glacial till, along with alluvial cones, all of which provide well-drained slopes ideal for vineyards, planted with a range of grape varieties. The annotation for Les Abymes, which is the name of a cru, indicates the area where the Mont Granier landslide extended. The alluvial soils closer to the river are less suitable for vineyards.

The biggest terroir change of all – Mont Granier

The dramatic history of Mont Granier is arguably our cover story. Mont Granier, at 1,933m altitude, lies at the northern end of the Chartreuse range. During the night of 24 November 1248, a catastrophic collapse of the mountain peak took place, which set off a massive landslide, unleashing an estimated 500 million cubic metres of rock, burying five villages across an area of about 25km². Old texts wrote that 5,000 people lost their lives, along with their livestock, but more recently this number has been estimated at around 1,000 people: it's still a huge number.

The collapse created the distinctive 700m-high vertical cliff face we see today and is supposed to have been caused by a period of excessive rainfall that destabilized the mountain, which had many inner caves and waterways. The rockfall then slid across the marl layers below, causing mud to build up and carry down yet more rocks, before being stopped by the high glacial moraine of the villages of Myans and Les Marches. Part of the Apremont and all of the Abymes vineyards lie on the residue of Mont Granier's landslide, known as the Abîmes/Abymes de Myans – *abymes* meaning abyss.

Although vineyards probably existed before the landslide, the difficulties of clearing the land were immense. Huge boulders littered the area, some of which can be seen today across the

vineyards; most notable is the Pierre Hachée in Apremont, [pictured below](#). The land began to be cleared properly from the 1730s, but vineyards were not extensively planted until the end of that century. Jacquère became the grape variety of choice on the rocky soil of marls and limestone, possibly because it ripened the most easily in this cool spot and possibly because white grapes were in demand.

Mont Granier remains unstable and there were two major landslides (*éboulements*) in January and May 2016, videos of which can be found on YouTube. This time the debris did not reach the vineyards, although dust was noticeable and the road to the Col du Mont Granier was cut off for some time.



Climate and weather

Overall, the climate is continental, characterized by very cold winters and very warm summers. In Savoie and Bugey, however, the climate is also said to have Atlantic influences. Given that the ocean is about 500km away as the crow flies, this seems incredible, but the weather is indeed driven by the damp westerly winds from the Atlantic. As you move towards the southern Alps, the Mediterranean influence becomes more important, bringing warmer weather and drier winds with slightly lower rainfall. However, it is the proximity of the high Alps that make the

weather systems so complicated and sometimes both unpredictable and challenging in these vineyards, creating a multitude of macro- and meso-climates. A rough summary for each area is shown [here](#).

The difference between day and night temperatures becomes more significant for the higher altitude vineyards. Most vineyards are on slopes and one plot may vary in altitude by 100m or more from its highest to its lowest point. Ignoring wind chill, there is an average decrease in temperature of 0.6°C per 100m and this influences everything from what grape varieties are grown to picking times between the top and bottom of a vineyard. In Savoie and Bugey AOC areas, vines are not planted above 500m – higher than this and ripening is considered risky. Higher slopes also tend to be steeper and more solid rock, rather than soil.

The French Alps vineyards are warm in summer, with abundant and intense sunshine, around 2,000 hours per annum in Savoie, Bugey and Isère, and a greater number further south. However, an important characteristic of mountain weather is regular precipitation – it is very rare to have a completely dry month. Most regions receive between 900mm and 1200mm per year. And what about snow? The higher the altitude the more likely winter precipitation falls as snow, but it occurs no more often than, say, in Burgundy. When snow does fall, it may be somewhat deeper and it may stick around for longer on certain cool sites. The hardy vignerons in these mountain areas just carry on with the pruning and when the sun does come out, the views blow everyone away, hence the classic Savoie snowy vineyard photos, which lead to that misapprehension I mentioned earlier!

Temperature inversions are a common feature of mountain weather systems – mist or cloud may lurk on the lower vineyards, while clear skies reign above. The dampness created by the mists gives greater risk of spring frosts or, later in the season, fungal diseases.

***Adret* and *ubac*: whose side are you on?**

The aspect of the slopes dictates not only the intensity of the sun, but also how many sunshine hours a vineyard receives and whether it arrives in the cool mornings or the warm afternoons. While this applies to any slope, in the Alps the difference between north-facing (*ubac*) and south-facing (*adret*) slopes is extremely stark. This can be a major factor in accounting for style differences, for example between the Jacquère

wines of Apremont (more *ubac* slopes) and Chignin (more *adret*). For other grape varieties in Chignin such as Roussanne (for Chignin Bergeron) on rocky soils, which reflect the heat, some vines on *adret* slopes are at risk of sunburn and grapes may lose acidity quickly in their final ripening period.

Also important is the steepness of the vineyard slopes. The average slope in many French Alps vineyard areas varies from 45% to 60% (or 31°), the latter in Chignin, for example. Some vineyard slopes may reach up to 75% or even 100% (45°) at the very top – this is likely to be the maximum angle where it remains feasible to work the vineyards.

Regional winds

Mountain areas are particularly prone to wind, which can have a big effect on the vines – sometimes negative, sometimes positive. Although most areas here experience a prevalent damp westerly wind the following are a regular feature:

- Foehn – a very warm, dry wind first studied in the Alps, but now known to exist in all mountain areas under different names, such as chinook in the US. Usually occurring in winter and early spring, it can cause rapid snow melt (thus hated by skiers), dramatic temperature rises and alleged mood changes. It may contribute to early bud break, leaving vineyards exposed to spring frost.
- Bise – a cold dry northerly wind that occurs at any time of the year in the northwestern Alps, affecting most Savoie and Bugey vineyards. It is welcome if it arrives in summer after a rainy period, because it will dry off any rot on the grapes, but it can be bitter in winter, especially when it appears as a *bise noire*, which is a damp, rainy or even icy version.



Looking towards the Belledonne from Chignin. Snow often falls on the vineyards between January and March, but rarely hangs around for long.

- Lombarde – a very strong wind coming from northern Italy, especially affecting Hautes-Alpes and southeastern Savoie or Isère. It tends to bring very heavy rainfall.

Weather hazards

Hazards that affect many of the world's vineyards hit the Alpine regions with unusual ferocity and help explain why these areas have always been considered marginal. What has changed in modern times is that today the result is rarely a poor harvest in terms of quality (and ripeness is easily achieved) but is all too frequently a poor harvest in terms of quantity, putting smaller producers' livelihoods at risk. One issue that

never changes is the risk of severe fungal disease due to high humidity and this is covered in more detail [here](#). Extreme heat is a growing problem, a result of climate change. The two big hazards, which growers are almost powerless to control, are spring frost and hail.

The spring frost of April 2017 was brutal in the French Alps. Following a very mild March and early April leading to advanced vine growth, there were two nights, two weeks apart, of severely low temperatures, giving air as well as ground frost. Whereas ground frost tends to hit lower-lying, flatter vineyards, air frost can affect hillside ones too. Cerdon lost about 70% of its potential crop; several other sections of Bugey, Savoie and the Diois had 50% loss. Recently, spring frost has occurred more frequently than before.

Hail too appears with worrying regularity and affects larger areas than previously. The risk period is essentially the whole growing season. Parts of both Montagnieu and Cerdon in the Bugey were devastated by hail in 2018 and in 2017, when both had also suffered frost damage. Ayze in Savoie was another victim later in the 2018 season following bad frost in 2017. Parts of the Combe de Savoie have been hit several times in recent years.

Climate change: a double-edged sword

Along with overall warming, climate change equals weather uncertainty and increasingly common extraordinary weather events, such as frost and hail. Climate statistics show rising temperatures over the past 30 years. What is perhaps more alarming – especially in the Montmélian area in the heart of the Savoie vineyards – is the increased volume of rainfall in late spring and early summer, giving added disease pressure. The worst scenario for fungal diseases is greater warmth allied with higher rainfall, an example being the particularly wet May and June in 2018, which led to severe outbreaks of mildew. In the end, the very dry later months resulted in a splendid harvest.

On the bright side, the extra warmth is welcomed by marginal areas such as these, especially for red grapes. A much-quoted

saying in France is 'September makes the harvest' and with frequent warmer and drier Septembers this is of particular benefit to late-ripening varieties such as Mondeuse and Jacquère.

The warming climate

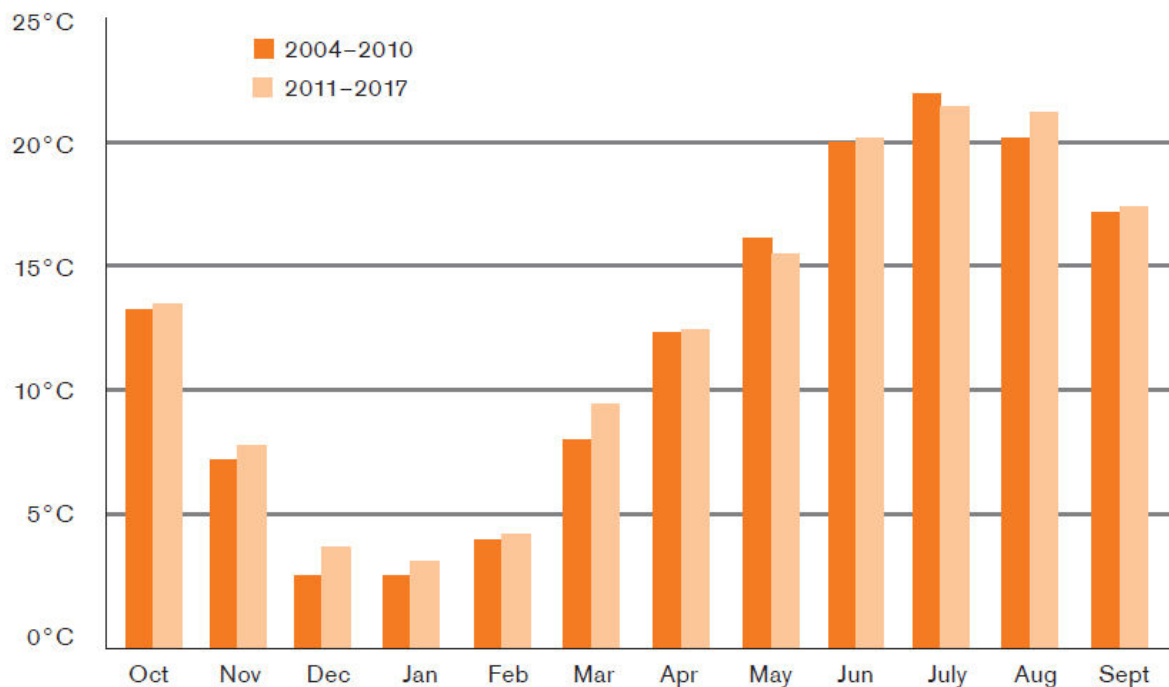
All over the French Alps, vigneronns have noticed significantly warmer springs and summers; harvest dates regularly occur as much as three weeks earlier than for previous generations.

Statistics for the temperature graph below were provided by the French meteorological service. Unfortunately, comparative statistics that exactly matched over a longer period were impossible to obtain as the locations for official weather stations have changed.

Average annual temperature for the seven years to 2017 in Montmélian in the Combe de Savoie was 12.41°C, up from 12.0°C for the preceding seven years. The 1992 book *Les Vins des Terroirs de Savoie* by André Combaz included graphs indicating the average temperature over 30 years: for Montmélian this was 10.2°C – thus an increase of two degrees in recent decades. The higher temperatures in March especially mean the vine's growth begins sooner, raising the risk of frost damage if the temperatures suddenly drop to freezing or below in April or May. The fear is that the devastating frosts of April 2017 will become a regular occurrence.

The lowest temperature recorded in the 14 years to 2017 was -14.5°C in November 2005. The highest was 39.8°C in July 2015. In 2018, the French Alpine regions experienced the hottest summer since the abnormally hot 2003, around 1.5–2°C hotter than the average from 1981–2010. In Grenoble, 2018 saw 126 days with maximum temperatures above 25°C, compared to 120 days in 2003 and an average of just 95 in the years 1981–2010. This has led to much concern considering that this was the fourth very hot summer in a row. One way vigneronns are trying to address the warming climate is by planting rare grape varieties, such as Bia Blanc or Joubertin, which previously struggled to ripen.

Average monthly temperature in Montmélian 2004–2017 (°Celsius)



Main terroir variations

Considering the intricate geological, soil and climate variations in the French Alps, the following is but a snapshot. When appropriate, more specifics will be found in the introductions to each area in Part 3, and within producer profiles. Altitude is mentioned below only when it is outside the normal 250–450m range.

Savoie – Lac Léman and Ayze On relatively gentle slopes close to the lake, with alluvial soils along with clay-limestone, Lac Léman vineyards are some of the highest in Savoie, reaching up to 500m, and some of the wettest, but the weather is tempered by the proximity to the lake. The Ayze vineyards in the Arve Valley are high too, with soils of limestone scree, *molasse* and some red clays.

Savoie – around the Rhône and Lac du Bourget Much of this area is known as the *avant-pays* or foreland. Seyssel and Jongieux

lie on the southernmost foothills of the Jura mountains, whereas Frangy and Chautagne are between the Jura and the Prealps and are somewhat warmer than areas near Chambéry. Chautagne, close to Lac du Bourget, has the warmest overall climate of Savoie, though is somewhat wetter. This whole area has much influence from glacial till, but also limestone screes, marls and *molasse*.

Savoie – around Chambéry and the Combe de Savoie The diagram [here](#) indicates the wide variations of soil types in the heart of the Savoie vineyards. The Montmélian climate graph opposite shows the temperature trends.

Isère The Grésivaudan valley below the Chartreuse range is an extension of Savoie's southern vineyards with mainly limestone scree soils. Its climate is similar too. The hilly Balmes Dauphinoises are somewhat wetter, with soils including *molasse*, sandy loam and limestone.

Northern Bugey An extension of the Revermont in the southern Jura wine region, but higher, with many vineyards climbing up to 500m on limestone scree, as shown in the photo below. Cerdon's climate can be extreme in terms of rainfall and other weather hazards.

Southern Bugey Close to the Rhône and on the lower Jura foothills, with varied aspects. The climate and soils on the eastern side, near Belley, are similar to Jongieux, west of Lac du Bourget. On the western side, which includes Montagnieu, the vineyards are more exposed to dramatic weather and on very rocky slopes.

The Diois The vineyards lie mainly on both sides of the Drôme river at altitudes between 300m and 700m. On the southern foothills of the Vercors mountains, they are on limestone scree, white marls and clay-rich black marls, with some alluvial soils. The Mediterranean influence is obvious, with intense sunshine and warm days in summer, which allows Muscat to ripen fully.

However, the Alpine influence makes itself felt with cool nights and regular rainfall.

Hautes-Alpes It is difficult to generalize about the scattered vineyards here, which are located between 600m and 1,000m altitude. The main vineyards are above the Durance river and its tributaries, on very stony diverse soils, principally clay-limestone scree, on the foothills of the Ecrins mountains. The region has low rainfall and plenty of sun; however, it is the stark differences between day and night temperatures that mark the particularity of the Hautes-Alpes.

