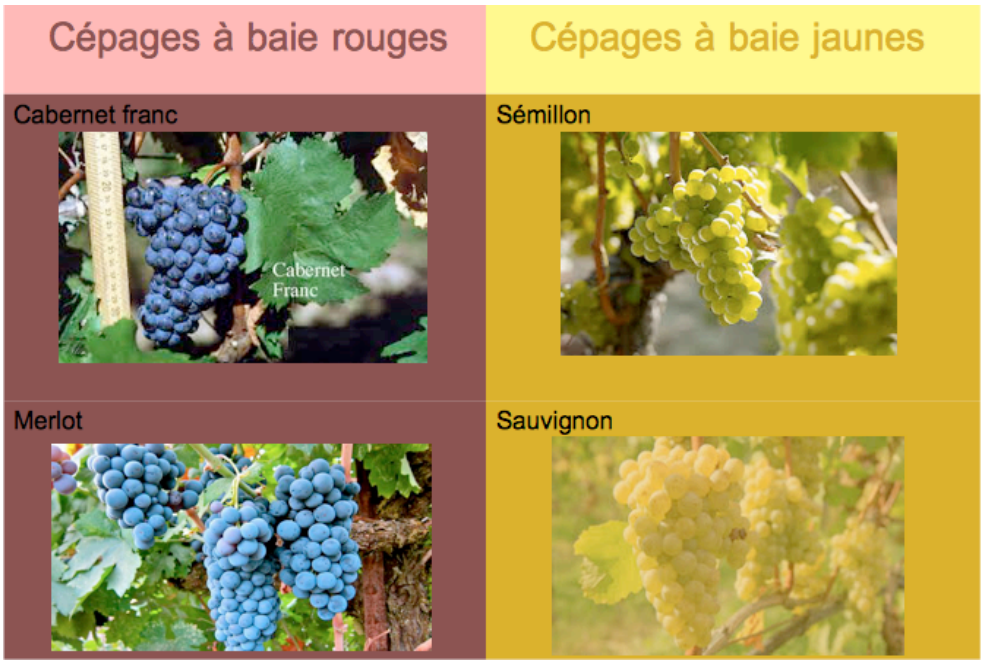
3 ème A
Parcours Langue
Collège Jules Ferry
LANGON



TOUJOURS LE VIN SENT SON TERROIR

California and Bordeaux vineyards comparison


Des collégiens maîtres de leur destin

Les élèves avancent dans leur projet de comparaison des terroirs des Graves et de Californie. Et gèrent eux-mêmes les différentes approches, y compris financières.


Langon

Leur projet sur le terroir les amènera en Californie

COLLÈGE JULES-FERRY

2017/2019

Summary

I- Synopsis

Our project, named “toujours le vin sent son terroir” is a scientific and linguistic project. During our studies, we have improved in english and studied our soil thanks to different type of subjects like chemistry, biology or geography. The aim of this project is to compare our observations, our knowledge about our region with California’s wineries. At the beginning, we started with nothing, without any help. But then we got support from many different partners and sponsors, and without them, our studies and finance earnings could not have been possible. After, thanks to them, to our many events (dance shows, parties, bake sales...) and our entry in many scientific contests such as C-Genial, the contest from the teaching ministry, the symposium Globe international, we collected enough money to be able to go to California. During this amazing trip to the United States, the students from the Middle School Jules Ferry in Langon will be the ambassadors of the whole of France, in California.

II- Questions

California and Bordeaux vineyards are internationally renowned for their gustatory qualities, and yet, here in France, we know very little about our vineyards and even less about the Californian vineyards. Every day, we drive through the vineyards of Sauternes to go to school, we cross the “Ciron”, we appreciate our landscapes, we are exposed to different weather conditions and we appreciate our warm summer days.

Are these environmental conditions the only ones responsible for the gustatory values of our wines and is it possible within the framework of a technology and expertise transfer to make Sauternes in California and vice versa?

What are the differences? And could there be an exchange of expertise?

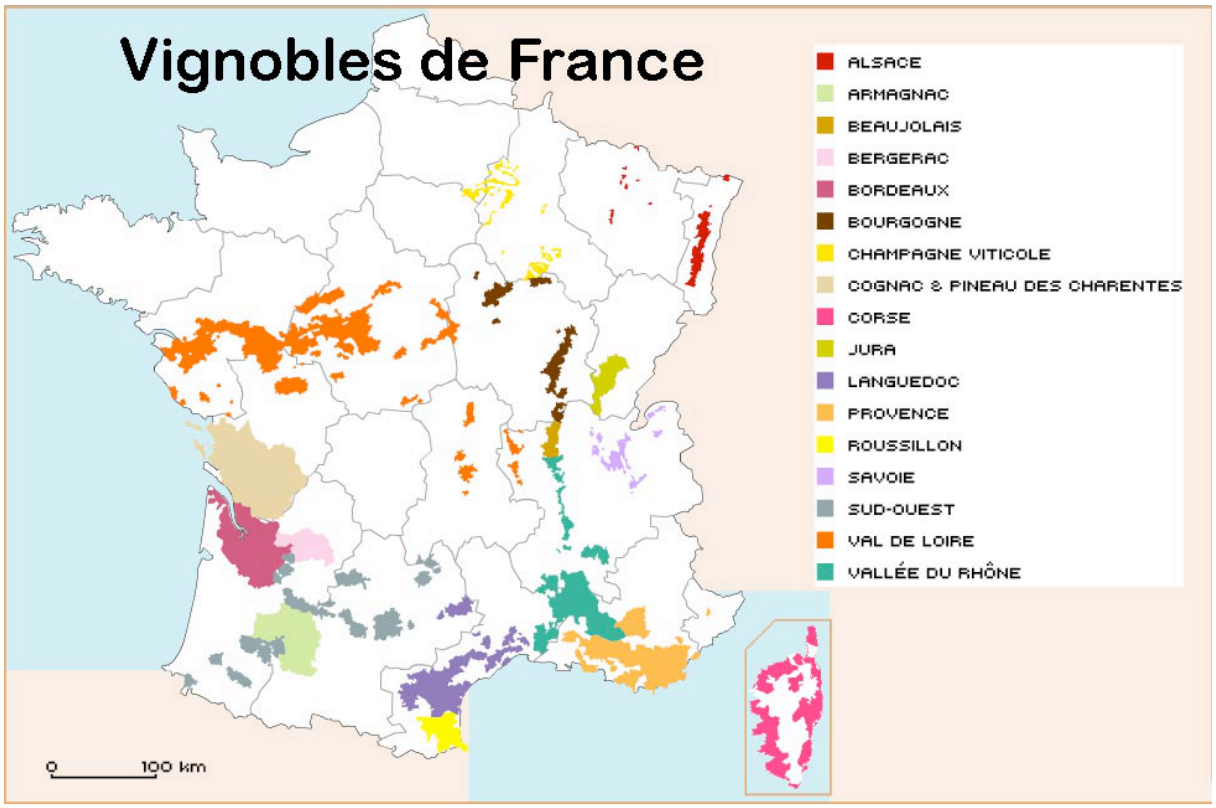
III- Hypothesis

The biological, physical and environmental characteristics make our terroirs, Sauternais and Californians exceptional.
(work carried out in France and the United States in 2017/2019)

IV - Geographical factors

A/ FRANCE

1/ French Vineyards



France has many vineyards, of which the most important are located in the following regions:

-The « Languedoc »,

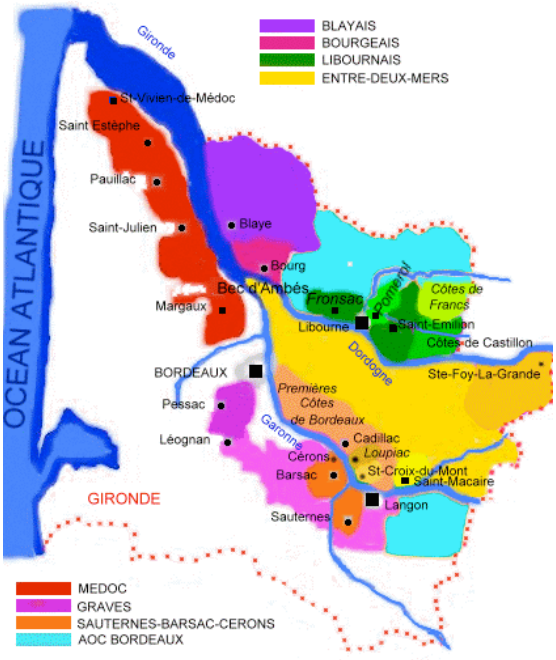
-The « Bourgogne »,

-The « Alsace »,

-The « Bordelais ».

2/The vineyards in our surrounding area

The vineyards of Graves and Sauternes in our surrounding area are located to the south-west of Bordeaux, on the left bank of the Garonne.



The Graves get their name from the mixture of gravel with sand and clay deposited by the Garonne.

The Sauternes gets its name from the town of Sauternes.

The territories of Graves and Sauternes are crossed by a stream: the Ciron. It is a tributary of the Garonne.

Its source is in Spain and eventually meets the Atlantic Ocean: its estuary is the Gironde.

3/The effects of morning fog

Morning mists in the fall are caused by the meeting of the cold waters of the Ciron, the warmer water of the Garonne and these natural elements allow for the development of a microscopic mushroom: Botrytis Cinerea.

Due to this mushroom, the grape loses much of its moisture, It is suffering from “pourriture noble “ (noble rot). The grapes then become purple, wrinkled, dry and covered with "small white hairs".

Botrytis Cinerea on the grape

4/ The effect of the Landes forest

The Landes pine forest situated in New Aquitaine halts the progression of sands and sanitizes the soil that is too humid. It protects the vineyard from the rains and the winds originating from the ocean (oceanic influences).

Bordered by the Atlantic Ocean, the Landes forms a vast triangle covering three departments (Gironde, Landes and Lot et Garonne).

The Landes forest

5/Field trip of Friday, January 26th 2018

On January 26th 2018, we went to investigate our hydrographic network and observed the geography of our territory.


From the Garonne, we have taken a water sample to do some analysis: including water temperature, latitude and longitude of the site and altitude.

Starting in Langon, we went North West to reach Barsac where we examined the direction in which the Ciron flows.The Ciron flows to the Garonne. To arrive in Barsac, we went through the towns of Langon, Toulenne and Preignac.

Then, we went to Pujols-sur-Ciron to take a sample of the water and analyze it (temperature, depth, site's geographic coordonates).

	Water 's surface	In depth (few meters)
Ciron (Pujols-sur-Ciron)	10,2°C	10,2°C
Garonne (Langon)	10,2°C	10,3°C

Our winter measurements do not show a temperature difference between these two rivers, but we will have to come back at the end of summer to see if the same is true at that time.

B/ CALIFORNIA

1/ Vineyards

There are some vineyards in California such as Napa Valley, Monterey county or Sonoma Valley. We are working specifically on Sonoma.

California is a state situated in the west of the united states, bordered by the Pacific Ocean, Oregon to the north, Nevada to the east and northeast and Arizona to the southeast.

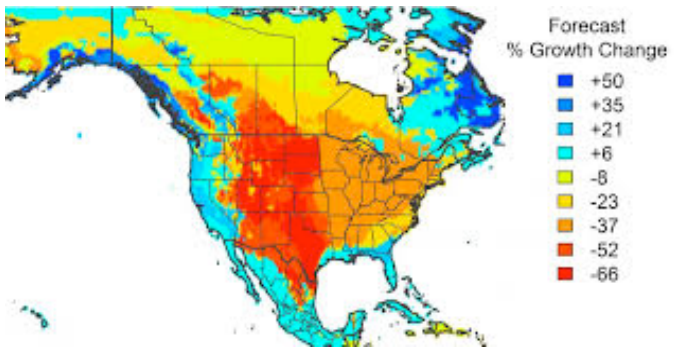
2/ Situation

Sonoma valley is located to the north of San Francisco. It is the birthplace of California's wine industries and this valley is home to some of the earliest vineyards. This California's region is known for its terroir and wineries.

3/ California's climate

California has a particular Mediterranean climate due to the state's large size: its climate can pass from polar to subtropical.

There is summer fog near the coast because of the cool California's current. But further, summers are hot and winters are cool. The north is rainier than the south because of the California's mountains.



4/ The effect of the Mountain

This county is protected against the wet and the cool influence of the Pacific Ocean thanks to the Sonoma Mountain. Some of the mountains in the west help to protect the valley from excessive rainfalls. The cool air which affects the region comes from the south.

C/ CONCLUSION

The production of Graves and Sauternes wines therefore depends on the geographical factors of their terroir, just as the Californian wines which are also affected by their own geographical factors.

First of all, the presence of the Landes forest (in France) and mountains (in California) protect the vineyard from the rain and wind coming from the ocean. Secondly their hydrographic networks bring water and humidity necessary for the cultivation of the grapes.

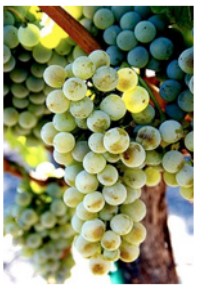
But what about biologically?

V - Biological factors

Merlot

A/« The life of a grape »

There are currently only one thousand wineries in production worldwide according to Wolkovich and Al. There are several thousand varieties of wine that belong to the same subspecies: Vitis Vinifera. Since the beginning of the project, we have tasted different types of grapes. At Chateau Pouyanne we tasted a Merlot and a Cabernet Franc. Merlot gives the grapes juice a suppleness and roundness which creates a fruity flavor that appears to melt in your mouth. The wines obtained with these grapes are more structured with the textural element tannin dry and spicy flavors. The wines obtained with yellow berries combine often two varieties of grapes including Sauvignon (35%) and Semillon (65%).



Sauvignon

Sémillon

In September, we tasted these two varieties of grapes. The berries were botrytised. This means that they had been attacked by a fungus called Botrytis Cinerea (noble or grey rot). By settling on the fruit, this fungus absorbs almost all of the moisture in the grapes, leaving mostly sugar. Therefore, the grapes are very rich in sugar and this gives the Sauternes wine its signature sweet taste.

Botrytis cinerea

But how is it settling on the fruit and why?

As previously stated, all of these red-berry and yellow-berry varieties of grapes belong to the same subspecies: Vitis Vinifera. Despite this similarity in subspecies origins, they are very different. Without being able to observe all the many existing varieties, we were still able to determine that each variety possesses particular tastes and qualities which allow the wine makers to vary the aromas of the wines.

We were blindfolded for a tasting test, and sought to recognize different aromas using only our senses of smell and taste. Some aromas and flavors surprised us and it was beyond our imagination to think they could be detected in the wine. Some of the scents we smelled were: cinnamon, dried apricot, blackcurrant and pineapple.

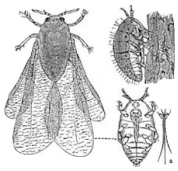
Some of the flavors we tasted were: butter, coffee, acacia, honey and banana. We are still unsure of how such unique aromas and flavors can be accomplished, but we eagerly await next year to discover the process.

B/ Plants around vineyards

In 2018 and 2019, we were lucky to be able to meet Sophie Ladril who works in L'auringleta's society. With her, we made a herbarium to present the species around the vineyards. Depending on the species, we can evaluate whether the soil is polluted or not. According to our research, we confirmed that in chateau Pouyanne and in chateau Guiraud soil wasn't polluted.

C/ Harmful and helpful insects

We learned that if we have grapes, it's partly thanks to different insects: helpful insects which kill harmful insects. For example, wine producers use ladybugs to protect their vine stocks against aphids. They facilitate helpful insects development by installing insect hotel. In Order to avoid Phylloxera, they can also use rootstocks.

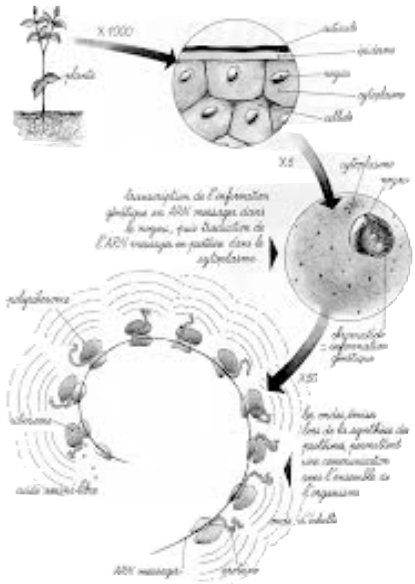


D/ Weed killers and pesticides

We learnt that weed killers are very dangerous for the environment because they kill so many underground insects, and they are bad for us humans: pesticides are carcinogenic and increasingly there are reports that people who live next to vineyards have serious health problems. They are bad to use it because even if they help us to have less harmful insects, we destroy our vine stocks faster. Furthermore, when you start using pesticides, it becomes very difficult to stop. The soil takes a very long time to become wholesome again.

E/ Ecological method to avoid chemical treatments

Genodics



We had the opportunity to have the visit of a man who works at Genodics. It's a company who uses vibrations to detect diseases, cares for and helps plants to grow and develop.

Scientists researchers found that sounds could influence protein synthesis. Every proteins could be stimulated by a frequency.

Since 2008, when the physicist Joël Sternheimer discovered that its company is the only to do that, it developed gradually.

The process is simple: he sends good vibrations to plants to become better and he boots protein for animals. It's a big job, everything is calculated, the frequencies, the wave scales for accurate casing of hemoglobin. Everything is controlled, studied, tested before being taken out on the plants.

"Musicbox playing in fields"

F/ Our vine stocks

To truly understand how grapes grow, though, we needed to observe vines on a more frequent and intimate basis. Thanks to Mr. Luc Planty of Château Guiraud and Mr. Zausa of Château Pouyanne, we have two vines planted our school that we can observe more often and over a longer period: a Sauvignon Blanc grape variety and a Merlot grape variety.

We added a hole to the plant (graft) and covered this hole three-quarters with soil. We then packed the soil well together, making sure to fully cover the vine stock. We added water and waited until it was fully absorbed. To avoid any air pockets, we then added some soil.

Grafting vine is an essential practice for winegrowers in all regions of France. Grafting vine creates genetic variety and therefore increases protection to diseases. Thanks to the process of grafting, there are now rootstocks that can withstand the dreaded disease Phylloxera. In the 19th century, the insect that spreads this disease had a devastating effect for many French vineyards. We will study this insect and its effects on vines later this year.

We will continue to observe our plants regularly. The vines are currently in stage A which is known as the winter bud. Normally, this narrative should have continue but our vines froze and then we won't be able to observe other life stages, for example: the reproductive cycle.

G/ *Grape's components*

Grape is a slow burning carbohydrate fruit, and grape's water contains vitamin C and B.
What are the different types of components in a grape?

- *Is there starch in grapes?*

To do this experiment, we had to crush grape and take out the juice. Then we added a few drops of iodic water and gave the solution a good shake. The solution did not become blue, which shows that there is no starch in grapes.

- *Is there glucose in grapes?*

To do this experiment, we put some grape juice drops on the glucose strip. We observed that the strip color became green, this shows there is glucose in grapes. More precisely there is over 20g of glucose per liter of juice.

- *Is there acidity in grapes?*

To measure acidity in a grapes, we used pH-paper. We had to pull out and rip off around 1cm of pH-paper and put a few drops of grape juice on it. Then we compared the pH-paper color to the color scale to determine pH value. The pH-paper color was yellow, which shows that grapes are acid.

- *Are there calcium ions in grapes?*

We had to shake grape juice with a few drops of ammonium oxalate solution. A white precipitate did not develop which shows there isn't any calcium ions in grapes.

- *Is there chloride ions in grapes?*

We had to take a few drops of grape juice and add a few drops of silver nitrate solution. The white precipitate was not present which means that there are no chloride ions in grapes.

- *Is there water in grapes?*

To detect water presence, we had to use anhydrous copper sulfate. We put anhydrous copper sulfate in grape and the solution became blue. This is a positive result which shows that there is water in grape.

H/ Iron and wine

All wines contain iron. Winemakers need to know the quantity of iron in their wine. This is very important since iron can react with phosphate or tannin to make a lot of particles: these particles are called “casse ferrique”.

How can we determine the quantity of iron in white wine?

If an aqueous iron solution reacts with potassium thiocyanate, the solution becomes red. This red color depends on iron concentration: the more it is red, the more the iron concentration is important. Here are the different solution we prepared:

Solution number	1	2	3	4	5	6	7	8	9
Volume of iron solution (ml)	1	2	3	4	5	6	7	8	9
Volume of distilled water (ml)	9	8	7	6	5	4	3	2	1
Volume of chlorhydric acid (ml)	1	1	1	1	1	1	1	1	1
Volume of potassium thiocyanate (ml)	1	1	1	1	1	1	1	1	1
Iron quantity (mg/L)	2	4	6	8	10	12	14	16	18

We did each of the experiments (in the table above) with similar doses and then we did a tenth experiments with 10mL of white wine, 1mL of chlorhydric acid and 1mL of potassium thiocyanate.

Then we compared this experiment with the others to determine the amount of iron in white wine. We found there is around 8 to 10mg/L in white wine. This wine can be drunk because there is less than 15mg/L.

The presence of our vines is connected to the presence of particular weather conditions. What are they exactly and how are they going to change?

VI - Atmospheric factors (annex)

The terrestrial atmosphere is the combination of several gases (such as: dinitrogen, oxygen, argon, carbon dioxide…) and of some particles (such as: dust, pollen, pollution…) which surround our planet. These play an essential role in the maintenance of life, and the composition of the atmosphere greatly influences the climate which reigns on Earth.

A/ Climatology and Meteorology

We will begin with the difference between climatology and meteorology. The difference between climatology and meteorology is that meteorology is the measure of weather over a small period of time and a small area whereas climatology is the measure of weather spread over a long period and a vast area.

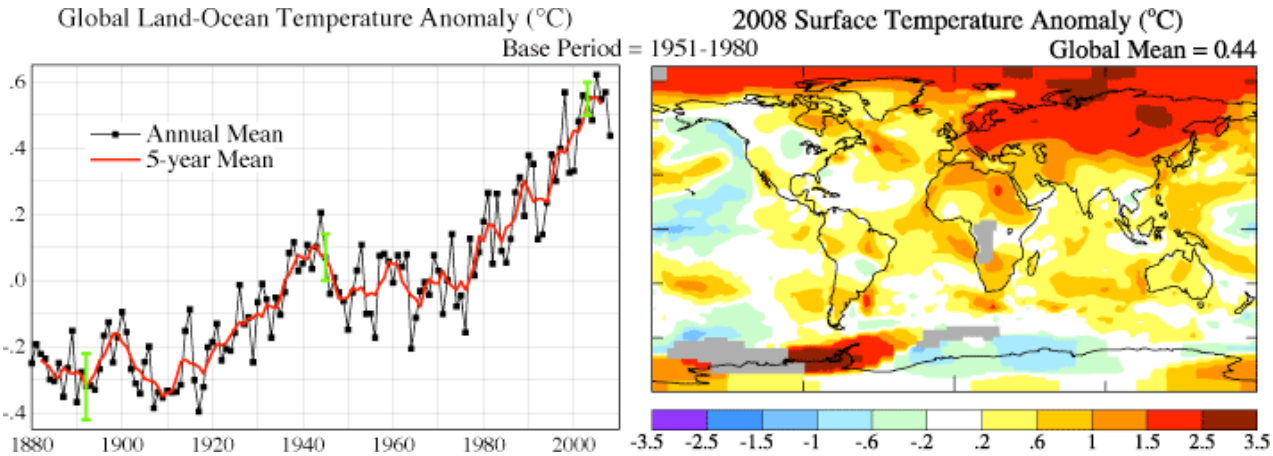
1.Climatology

The climate is the study of weather over a long period of time and a vast area considering factors such as:

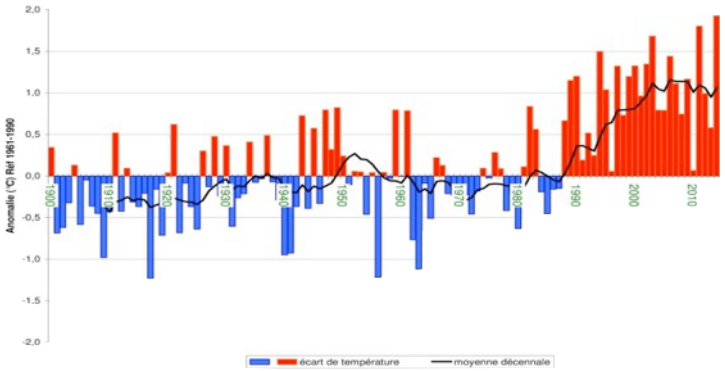
- the average temperature (minimum and maximum) ;
- rainfalls ;
- the hours of sunshine.

Here, in Gironde, we are in an oceanic climate, it means that there is a very small temperature difference between winter and summer and that the air is neither humid nor dry. There is generally more rain during winter than in the summer months.

Example:

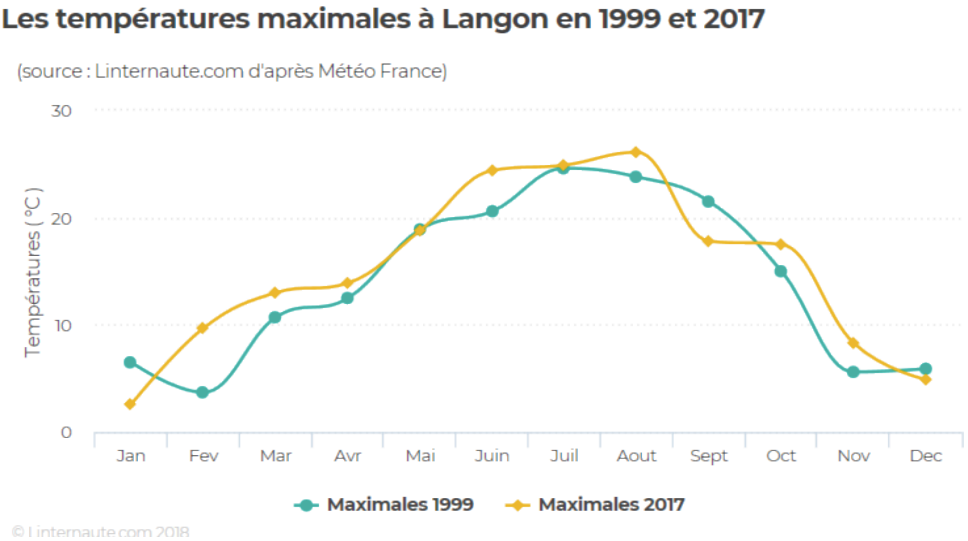


Rise in temperature in France

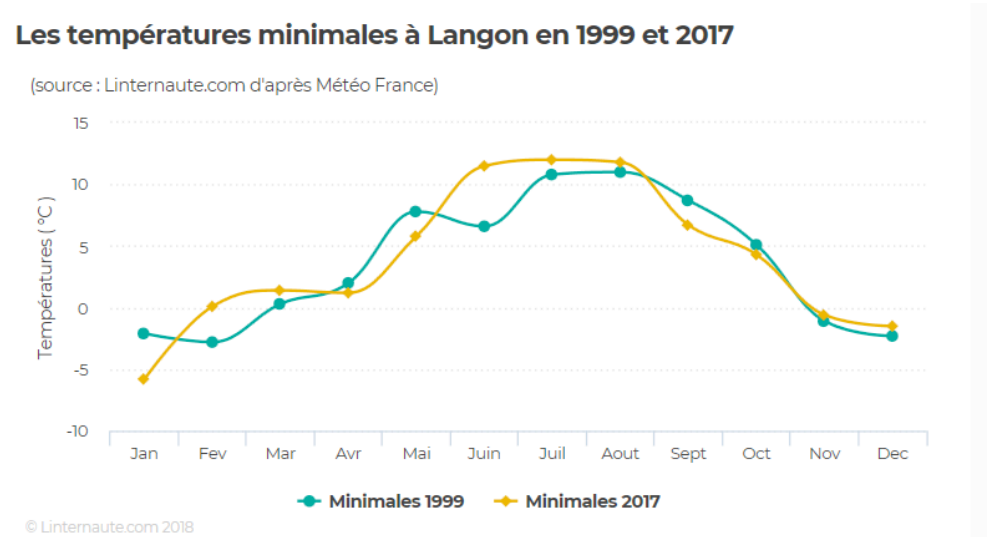


Rise in temperature in France

With these graphs, we can observe that temperature averages have increased by almost 2°C since 2010 while it was rather constant from 1900 till 1990.



Maximum temperatures in Langon from 1999 and 2017



Minimal temperatures in Langon in 1999 and 2017

With these graphs, we can observe that temperature differences have constantly increased over the last twenty years.

Through all these observations, we can see that over the years, an increase in temperature has appeared. This yearly increase creates anomalies. This can be seen as a consequence of global warming and a predictor of events to come (i.e.melting sea ice…)

2. Meteorology

Meteorology is the study of weather over a very short period of time and a small area.

We take daily meteorological measurements taking into account:

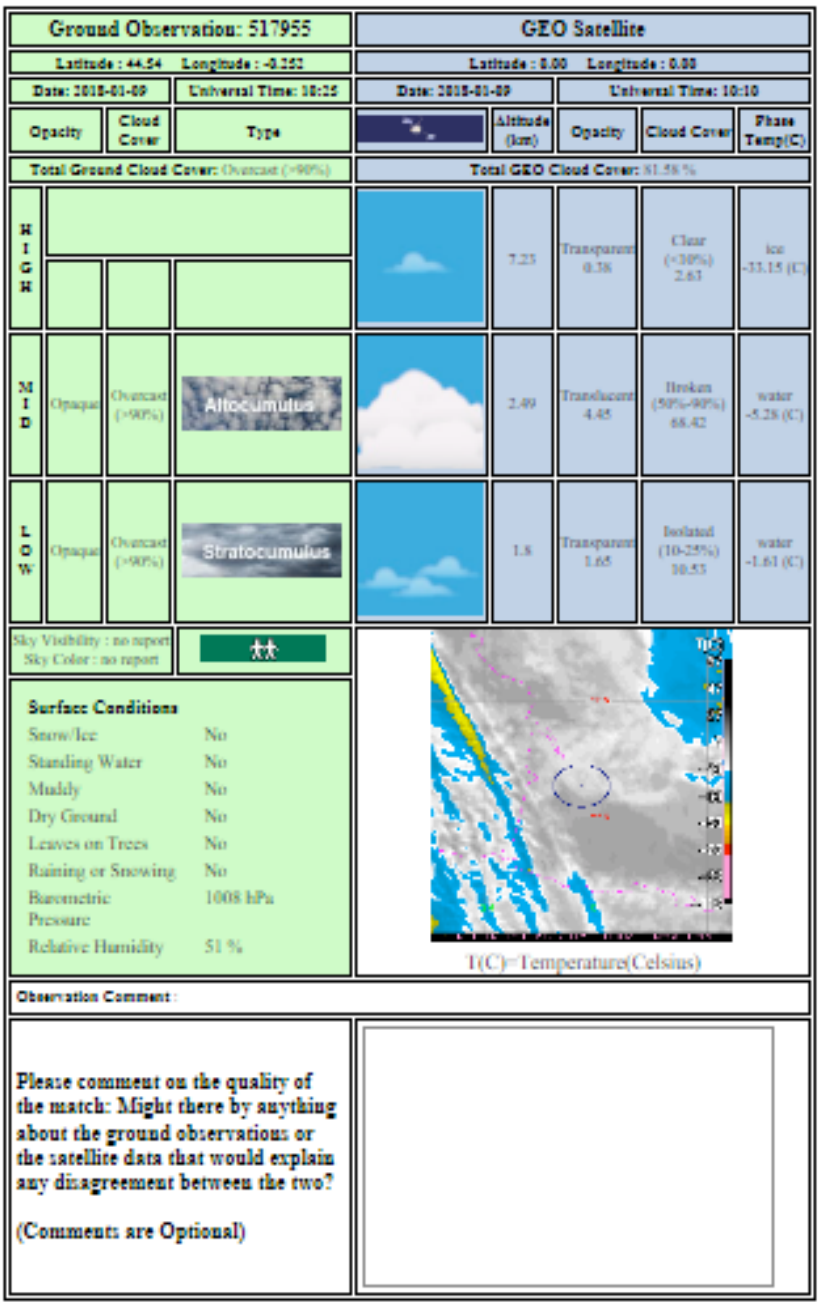
- the ambient temperature;
- the relative humidity;
- rainfalls;
- the speed and the direction of the wind;
- atmospheric pressure;
- clouds types, their opacity and the percentage of the sky covered by these clouds;
- the color and the visibility of the sky.

We sent these measurements to the Globe International website which, in return, made us participate in a contest.

Date	Air temperature (°C)	Relative Humidity (%)	Station pressure (mbar)	Wind direction	Wind force (km/h)
12/05/2017	6	72	1035	NE	3
12/06/2017	0	77	1030,8	E	0
12/07/2017	3	77	1024,5	/	13
12/11/2017	10	71	982,5	SW	0
12/12/2017	5	48	1013,02	W	8
12/13/2017	7	67	1014,5	SW	13
12/14/2017	12	70	1009,4	W	3
12/18/2017	9	50	/	W	2
12/19/2017	3	77	1033,1	NW	0
01/09/2018	8	51	1008,6	SW	0
01/10/2018	8	69	/	W	3

Legend: data collected between 12/05/2017 and 01/10/2018.

NASA is following our project: we sent them these observations then:



They asked us:
“Please comment on the quality of the match: Might there by anything about the ground observations or the satellite data that would explain any disagreement between the two?”

We answered them:
“The satellite match and our observations are different because there were many middle clouds (altostratus) which therefore hid low clouds from the satellite and high clouds from us.”

So, satellite matching and our observations complete each other and help everybody to study our atmosphere.

B/ Study of atmospheric Graphs

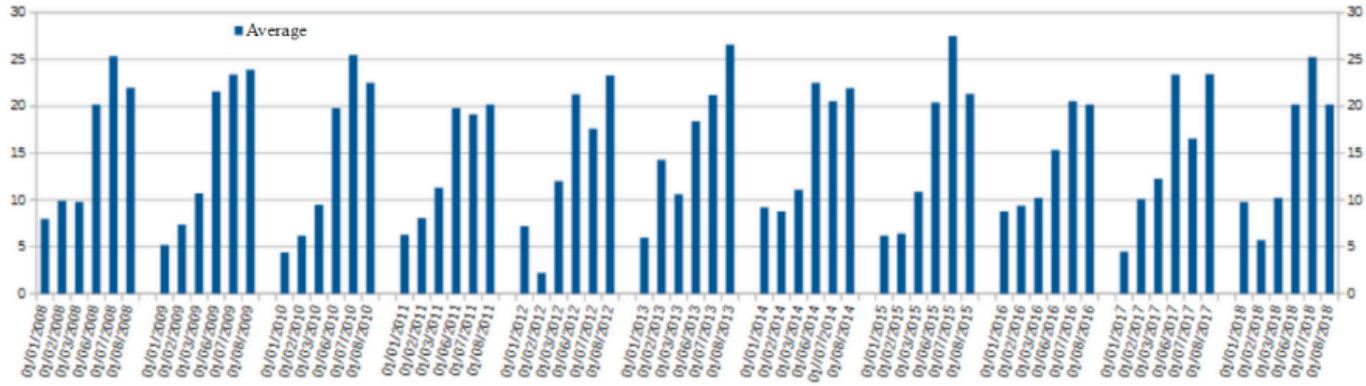
Can we verify the increase of the temperature we announced in the meteorology and climatology part?

The easiest way to see the temperatures increasing, is to study graphs of summer and winter periods between 2008 and 2018. We did so but because there was too much data to do graphs of all periods (winter, spring, summer and autumn) we only chose summer and winter.

Our data comes from the “Lycée Bernard PALISSY” (Globe data) and La Garenne (InfoClimat data) in Agen. The majority of the data that we took comes from Globe (59%) and the rest comes from InfoClimat (41%).
These are the places where we took the temperatures:

We did three graphs showing:

- temperature averages between 2008 and 2018 during six months (January, February, March, June, July and August),
- minimum and maximum temperatures in winter periods,
- minimum and maximum temperatures in summer periods.



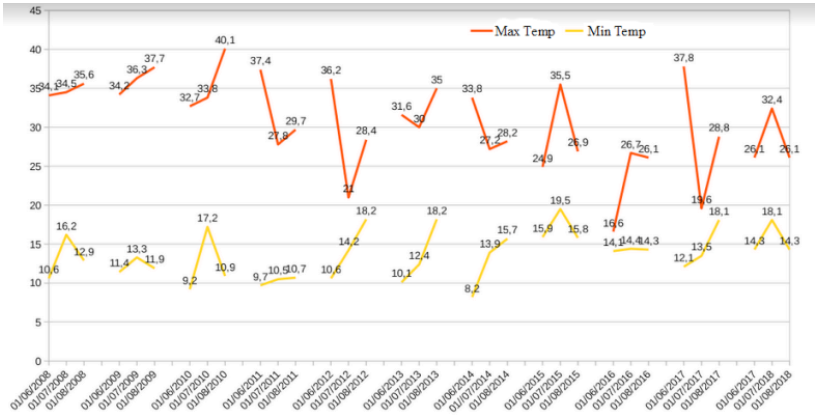
<u>Graph of winter periods (January, February, March) and summer periods (June, July, August) from 2008 to 2018</u>

In this graph, we can observe that the winter average temperatures are between 2,2 and 14,3°C. Usually, they are around 10°C.

Therefore, the warmest months of this period are March (except in 2013) and the coldest month is January (in 2008, 2009, 2010, 2011, 2013, 2015, 2016 and 2017) or February (in 2012, 2014 and 2018).

We can observe that the summer average temperatures are between 15,35 and 27,5°C. Usually, they are around 21°C. The warmest months in this period are July (in 2008, 2010, 2015, 2016 and 2018) or August (in 2009, 2011, 2012, 2013, 2014 and 2017).

We conclude that temperatures remain stable between 2008 and 2018 because to see the temperature increasing, we have to study a longer period, for example between 1968 and 2018.

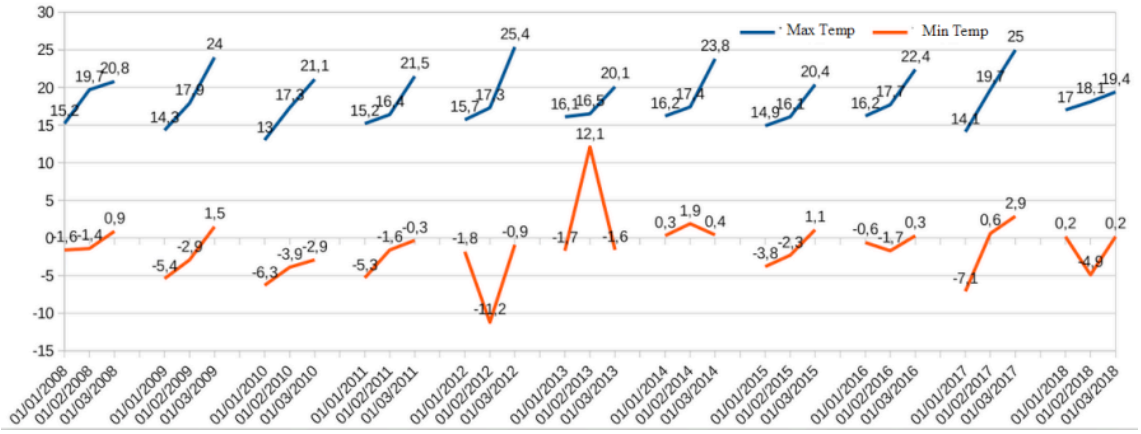


Graph of minimum and maximum temperatures during summer periods between 2008 and 2018

In this graph, we observe that there is a part with maximum temperatures: on June 1st, 2008, the temperature was 34,1°C and on August 1st, 2010 the temperature was 40,1°C. On June, 1st 2016, the temperature was 16,6°C and on August 1st 2018, the temperature was 26,1°C.

There is another part with minimum temperature: on June 1st 2008, the temperature was 10,6°C, on June, 1st 2014, the temperature was 8,2°C and on July, 1st 2015, the temperature was 19,5°C and on August, 1st 2018, the temperature was 14,3°C. We observe that the warmest temperature between 2008 and 2018 is 40,1°C (in 2010) and the coldest temperature was 8,2°C (in 2014).

We conclude that between 2008 and 2012, there was a big temperature difference between minimum and maximum data but after 2012, maximum and minimum temperatures became closer than before. Since 2008, the maximum temperatures are decreasing (except in 2017) but minimum temperatures remain stable.



Graph of minimum and maximum temperatures during winter periods between 2008 and 2018

In this graph, we observe that there is a part with maximum temperature: on January, 1st 2008, the temperature was 15,2°C, on January 1st 2010, the temperature was 13°C, on March, 1st 2012, the temperature was 25,4°C and on March, 1st 2018, the temperature was 19,4°C.

There is another part with minimum temperature: on January, 1st 2008, the temperature was -1,6°C, on February, 1st 2012, the temperature was -11,2°C, on February, 1st 2013, the temperature was 12,1°C and on March, 1st 2018, the temperature was 0,2°C.

We conclude that January is the coldest month of our winter period and March is the warmest month in the maximum temperatures part but in the minimum temperatures part, all data remains stable. We don't see a big rise between 2008 and 2018.

Through all these observations, our hypothesis isn't confirmed because we do not see the temperature rise in ten years. We think that between 2008 and 2018, the period is too short to see an evolution. We could study a longer period, like from 1900 to 2000, to confirm our hypothesis.

Climatologists have studied the climate on long or very long periods (century or millenary) so to observe climate change, ten years is too short to do a conclusion.

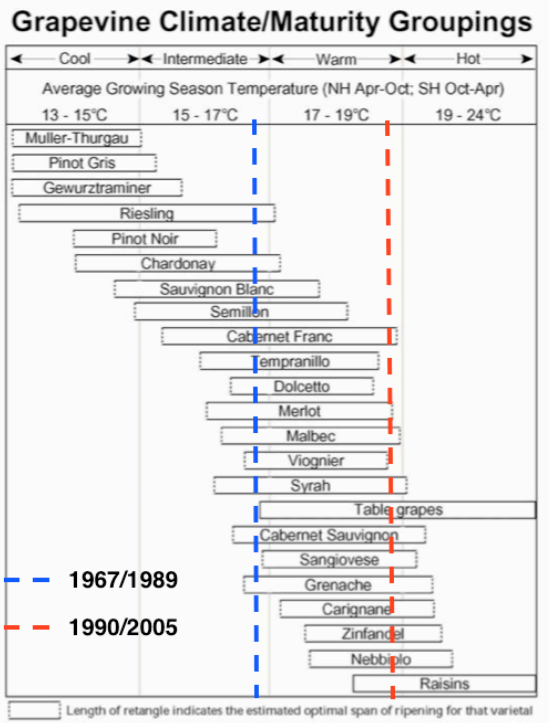
Therefore we decided to observe a graph which started in 1900 to have more meaningful observations.

We observe that between 1900 and 1989, the average annual temperature was approximately 15°C and it increased from 1989 to 2004.

Now we see that between 1900 and 2018, temperatures have increased by 2°C.

We conclude that the data's report is right: there has been an increas in temperatures since1989. In the last twenty years, the temperature has increased of 2 degrees. This confirms what climatologists are saying about global warming.

We observed that some grape varieties need a cooler temperature to thrive than others. Due to global warming, some grape varieties, which need the cooler temperatures will become rarer and eventually disappear. Therefore, there will be changes in vineyards.



C/ Conclusion:

Throughout the different studies that we did and from the observed changes in atmospheric composition and the gradual temperature increase over the years, we can conclude that: This is global warming!

This rise in global temperature could lead to the melting of sea ice which could cause an increase in ocean water levels.

This phenomenon could cause the extinction of some animal or insect species. Ultimately, global warming could change the delicate climate and ecosystem of some grape varieties.

VII - Soil factors: The nature of soils (annex)

We study soil to show that this is one of the facts that makes our terroir so special. The soils have four main elements:

- Minerals of different sizes.
- Organic matters from decomposition of animals and plants.
- Water that fills empty spaces.
- Air that fills empty spaces.

A/ Utilization of soil

What can grow in the soil depends on the amount present of each of these elements. For example, a good soil for agriculture should contain about 45% minerals, 5% organic matter, 25% water and 25% air.

The properties of a soil at any moment are the result of five factors of soil formation, mainly:

- The material from which soil was formed

- The climate that will break down the initial material

- Organisms that will shape the soil (decomposition of waste, aeration...)

- Topography

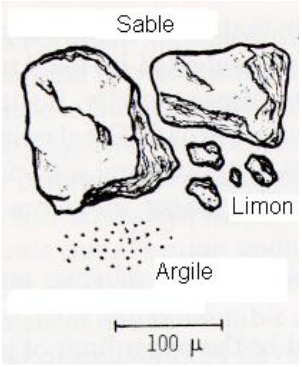
- The weather

To discover the nature of the soils of our region, first we each took a soil sample of our gardens and used the Globe protocols (presented in annexes) to determine their characteristics. Then, in a second step, we went to our two Château partners to study the viticulturist soils with more details.

We marked on a map the different places where the samples were made and then we identified the texture of each sample.

The texture of the soil corresponds to the proportion of mineral particles that compose it (the presence of stones and gravel is important but not to study the texture of the soil).

The sand has particles visible to the naked eye (between 2mm and 20 microns), the silt is smaller (between 50 microns and 2 microns) and the clay is even smaller (measuring less than 2 microns).



The soil we've studied consisted of a mixture of the three different types of soil (sandy, silty, clay), each having more or less effects on the characteristics of the natural soil.

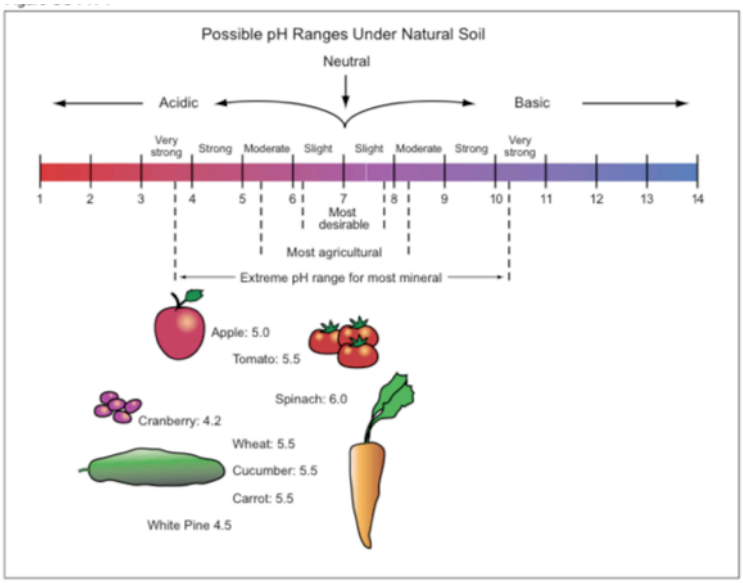
The effect of clay is the most important: it creates a viscous soil that retains water and nutrients. The silt makes the ground slippery. The sand creates a loose soil which is well ventilated and well drained.

The presence of surface gravel was observed in each vineyard parcel; it explains the name given to our terroir (Graves).

We also learned that the pH value was important. The pH measures whether the soil is more acidic or basic.

The ideal pH value for the soil is between 6 and 8.

The pH of rainwater is 6, making it a bit acid. This acidity should not be too prevalent otherwise the vines would perish. In contrast, the soil should not be too basic either. If the pH increases in the soil, the amount of iron decreases, therefore preventing the plants from creating chlorophyll, which makes them become yellow.



B/ Area of experimentation and samplings

Samples were taken from eight municipalities in our geographic area. The precise location of our samples is presented in the appendix.

We then completed a soil identification sheet for each site. We limited ourselves to observing the surface layer, with on-site identification of the sample using the specific Globe soil identification protocol, and then took a sample to accurately determine the percentage of clay, silt and sand.

Places of samples	Texture
Sauternes	Sandy Clay Loam
Brouquet	Loamy Sand
Langon	Loamy
Fargues	Sandy Clay
Bommes	Loamy Sand and Silty Loam
Preignac	Sandy Clay Loam and Loamy Sand
Barsac	Sandy Clay
Budos	Loamy Sand
La Saubotte	Loamy Sand

On January 26th, we went to sample the soils of our partner Châteaux thanks to the Gironde Green programm for funding this field trip.

In addition, the CIVB (Inter-professional Council for Wine of Bordeaux) and Cap Sciences (Center of Scientific Culture scientific of Bordeaux Aquitaine) joined forces to help us explore the soils of our partner vineyards by providing us with a one-day bus.

We were able to study the characteristics (location, structure, texture, possible presence of carbonates) of the soils on site, but we also took samples to determine the moisture content, the percentages of fine particles (sand, silt, clay), and the pH of these soils according to the Globe protocols (annex).

C/ Measurement presentations

1- Château Pouyanne

Survey area n°1: (clay's area)

Horizon	Top	Bottom	Roots	Rocks	Structure	Consistence	Texture	Carbonates
1	0 cm	25 cm	None	None	Granular	Firm	Clay Loam	Strong
2	25 cm	60 cm	None	Few	Rocky Granular	Firm	Clay Loam	Slight

Survey area n°2: (sand's area)

Horizon	Top	Bottom	Roots	Rocks	Structure	Consistence	Texture	Carbonates
1	0 cm	25 cm	None	None	Rocky	Loose	Sandy	None
2	20 cm	30 cm	None	Many	Granular	Extremely Firm	Sandy	None
3	30 cm	32 cm						

Precise location of the two samples:

Survey Area(s)	X	Y	Z
1	44,540,28	-0,40278	57 m
2	44,5375	-0,40083	65 m

We marked the presence of gravel in the two survey areas, as well as many fossils of gastropods at the bottom of the survey area n°1. According to Mr. Zausa, the owner of the plots, the limestone found at the bottom of the excavation of the survey area n°1 is at the level of the surface in parcels located lower and closer to the Garonne. Only survey area n°1 tested positive for carbonate in the soil.

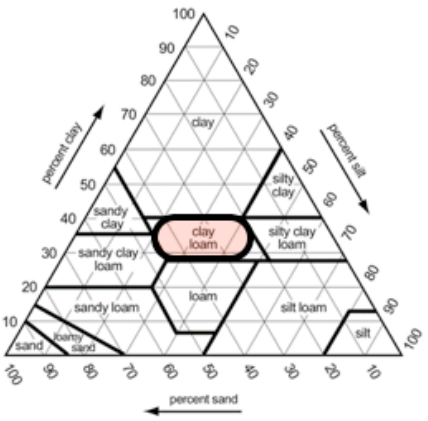
Back in class, we determined the exact texture of the samples.

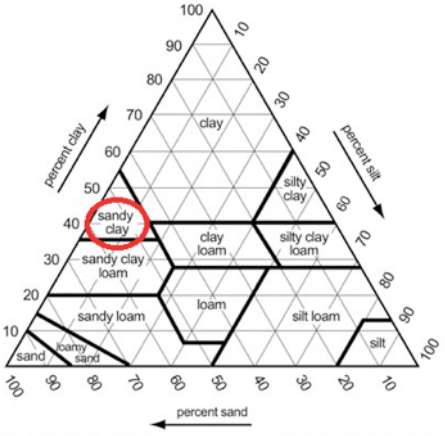
For the Survey Area n°1:

- **For the first horizon:** Clay Loam
- **For the second horizon:** Clay Loam

For the Survey Area n°2:

- **For the first horizon:** Sandy Clay
- **For the second horizon:** Sandy Clay





We also determined the amount of moisture in the soil. It is important to note that a few days before our arrival, it had rained significantly and the soil was "gorged" or saturated with water.

On site, we took a sample of soil. When we arrived in class, we weighed our wet samples and waited until the next week for the water to evaporate to weigh them again. We found the following results:

Survey Area n°1:

Horizon 1: 3,9 %

Horizon 2: 1,1 %

Survey Area n°2:

The hole was full of water

We then measured the pH of the soils. As we stated earlier, this is important because the success of the crops depends heavily on the acidity of the soil.

Sondage 1 :

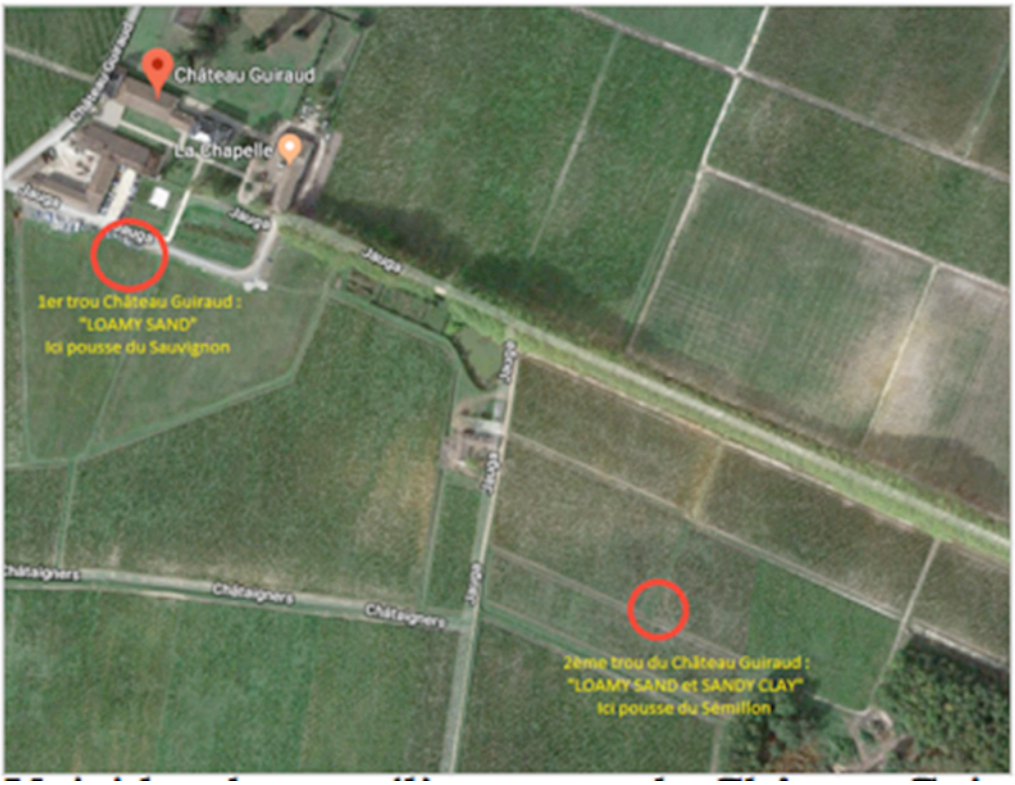
Horizon	pH
1	7
2	7

Sondage 2 :

Horizon	pH
1	6,4
2	7,4

We use a pH measurement equipment and a pH meter for measuring the pH of samples.

2- Château Guiraud



Here are the two samples taken from Château Guiraud.

Precise locations of the two samples:

Sondages	X	Y	Z
1	44,53222	-0,33278	71
2	44,52972	-0,32778	74

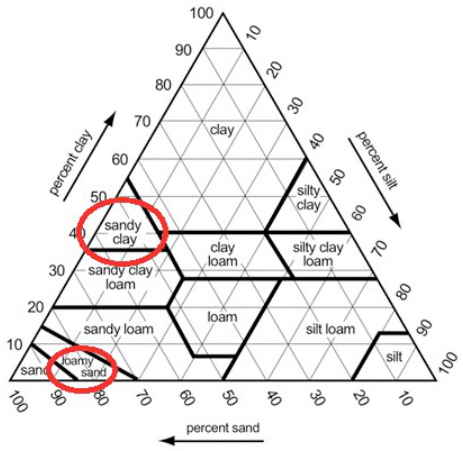
Survey area n°1

Horizon	Top	Bottom	Roots	Rocks	Structure	Consistence	Texture	Carbonates
1	0 cm	31cm	Many	Many	Granular	Loose	Loamy sand	None

Back in class, we determined the exact texture of the samples. Here are the results for Château Guiraud samples.

For Survey Area n°1:

-**For horizon 1:** Loamy Sand



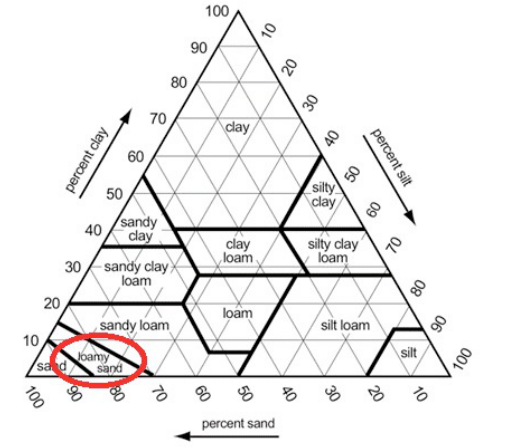
Survey area n°2

Horizon	Top	Bottom	Roots	Rocks	Structure	Consistence	Texture	Carbonates
1	0 cm	80 cm	None	Many	Granular	Loose	Loamy sand	None
2	80 cm	200 cm	None	None	Granular	Friable	Sandy clay	None

For Survey Area n°2:

- **For horizon 1:** Loamy Sand

- **For horizon 2:** Sandy Clay



Sondage 1

Horizon	pH
1	5
2	7

Sondage 2

Horizon	pH
1	7,4
2	5,8

Measurement were taken in 2010 by the design office Solenvie. They recorded the following measurements:

Sondages	pH	Texture
1	5,3 et 7,1	« sandy loam »
2	6,8 et 6,2	« sandy clay loam »

3- California soils

During our trip to California, we will analyse many different soils, from the wineries we will be visiting. We will analyse them the same way we did for the french ones, this way when we come back, we can compare them with the french soils. So we will be studying the characteristics (location, structure, texture, possible presence of carbonates) of the soils, we will also take samples to determine the moisture, the percentages of fine particles (sand, silt, clay), and the pH of these soils according to the Globe protocols (annex).

D/ Interpretation of results

In addition, we took samples in our gardens. We observed two major varieties of soils: sandy clay and loamy sand. In many cases, these samples were taken from herbaceous areas close to our home. This means that the soil could have been modified during the construction of houses.

At Château Pouyanne, the first survey area, was at an altitude of 57 meters and had a soil that was very balanced in fine particles. The clay present without excess, allows to limit the evaporation, and the maintenance of the moisture at the level of the roots of the vines. The sand aerates the soil.

The second survey area was at an altitude of 65 meters therefore higher than the first area and was sandier. We observed a very hard layer of 30 cm in depth, aquifers that had formed over time due to the action of groundwater and rainwater (the iron welded the grains of sand in a more or less thick layer). Water infiltrates faster in the summer, but in rainy weather, the water does not seep in and stays stuck on the surface, which is why our second hole was saturated with water.

Since the pH is close to 7, the soils are neither too acidic nor too basic and do not require the addition of particular products to modify the acidity. However, our pH measurements are not entirely accurate considering our material (pH paper and pH meter). We would need a laboratory analysis to precisely define the pH values. In this area, (at 65 m altitude) there is the presence of gravels that were originally on mountains because the Garonne has transported them over time.

At Château Guiraud, the first hole at 71m of altitude had very poor soil quality and was in fine particles. Roots and gravels were present without excess.

The second survey area had an altitude of 74 m so altitude was higher than the first and also had much more clay. We observed a layer of black earth and a large layer of clay. The pH was close to 6, this makes the soil rather acidic and requires some special products for taking care of the vineyards (unlike Château Pouyanne). However, as we previously stated, our pH measurements are not entirely accurate considering our limited material (pH paper and pH meter). We would need a laboratory analysis to precisely define the pH values.

The two types of soils observed are therefore very different:

- On the left bank of the Ciron, the presence of limestone makes it possible to have less acidic soils and the vines can be rooted more solidly in the ground.

- On the right bank of Ciron, soils are more gravelly, aerated and flexible (because of the presence of sand in greater quantity).

E/ Conclusion:

The production of Graves and Sauternes wines depends greatly on its geographical, climatic and soil factors. The grape varieties are therefore chosen to withstand the specific conditions of our terroir.

For example, the presence of the Landes forest is important to the selected vine growth locations. Due to the fact that it is located to the West of the vine growth areas, between them and the ocean, it, therefore, not only protects the vineyards from the rain and the winds coming from the ocean, but also brings water through its hydrographic network and provides the humidity necessary to help the vines prosper.
Weather conditions are changing and climate change could lead to a major evolution in the current wineries.

Indeed, the increase of 2°C in the average temperature over the Bordeaux region for the last 30 years has placed the grape varieties that are currently used in our region at the limit of development in favourable conditions.

However, our wine region is special because of the different soils it offers. The clayey and sandy soil allows rainwater to provide the elements necessary for its development without the need to irrigate the vineyard parcels.

Our Wine Region is special thanks to the different soils varieties it offers. Each vineyard has its specificities that give different wines very different tastes. However, the winemaking conditions and the treatments applied to the vine can also change its taste.

VIII - Partners

We are going to present you our partners who are helping us with the organization for our trip to California. Château Guiraud, Château Pouyanne and Sonoma Valley High School are our partners.

Thanks to them, we have already learned about the soil and history of wine. Now, we are going to present them to you and their role in our project.

A/ Château Guiraud

Château Guiraud is a winery which covers an area of 128 hectares (1.28 square kilometers). The Château is 45 kilometers away from the south of Bordeaux in a village known for its sweet wine, named «Sauternes». The soil is composed of 80% sand and 20% clay.

Château Guiraud is famous for being “premier grand cru classé des vins de Bordeaux”, name given to the top-quality wines of Bordeaux. The Château follows a specific natural process for the production of its wines. It consists of the growth of a mushroom named the «botrytis-cinerea» or «noble fungus», which absorbs the water in the grapes to make the taste of the sugar stronger. This process only works in humid and sunny areas like Sauternes.

In some regions, this mushroom is known as a threat to the growth of their grapes which is then called «grey fungus». It is thanks to this mushroom that we have this famous taste of sugar in Sauternes white wine! In 2011, the Château received the title of «organic agriculture», it is the only «premier grand cru classé» to have received it. The average amount of bottles produced each year is of 100 000 bottles.

We have had the chance to been contact with them so they could become one of our patners, not only financially but also academically. Château Guiraud has contributed to our project by receiving us on two different occasions to talk to us about soil, its history and its production process.

We also had the chance to participate at the open doors days on the weekend of the 11th and the 12th of November 2017. At the open doors day we had the opportunity to present our project to the visitors. We then asked for donations as a way to help to finance our trip and accompany us along the way.

B/ Château Pouyanne

Château Pouyanne is a family-owned winery created in 1964 by Elie Zausa with 5 hectares (50 000 square meters). Since 1990, Château Pouyanne has been run by two brothers, Christophe and David Zausa. The vineyard is composed of 55 hectares, of which 40 hectares are red wine vines and 15 hectares are white vines. The red wine vines are composed of 60% «Merlot» and 40% «Cabernet», and the white wine vines are composed of 20% «Sauvignon» and 80% «Semilion», (they are different species of red and white grapes).

The winery is located 40 kilometers away from the south east of Bordeaux, in a town called Budos. The vineyards are located on a hill. The soil is composed of gravel on the higher part of the hill and clay and limestone on the lower part of the hill. The wine cellars are air-conditioned and allow. There for the production of wine in respect to the Bordeaux tradition.

Sales of this wine are done exclusively in bottles. Two thirds are sold equally in France to restaurants, private individuals and wine merchants. The rest is sold all around the world but, it can vary from year to year.

A peculiarity about the property of Pouyanne is that their vines are treated with a specific music that helps to reduce vine mortality caused by ESCA disease. This disease attacks the wood of the vine and causes a sudden death during the summer and warm periods. It is a parasitic disease composed of two types of fungus: Stereum Hirsutum and Phellinus Igniarus. It has been four years since the owners have adopted this method and the results are encouraging.

This is a natural process because there are no chemicals, only sound. The sound is emitted by music boxes, placed at various degrees throughout the vines.

Château Pouyanne participates in our project trough varying actions:

- they gave us two grape varieties (Cabernet and Merlot) for tasting in class.
- they also gave us a vine stock which we planted in the school garden so that we will be able to follow its growth and the next generation will be able to eat its grapes.
- finally, for a half day, they allowed us to visit the château and its property and take some samples of soil to later study in class.

C/ Sonoma Valley High School

We have been in contact with Sonoma Valley High School since June 2017. This high school is the only high school in Sonoma Valley. We work with a class which follows a special program amongst the «Sustainable Agriculture Academy» which is part of the high school. This special program called a «curriculum» is the course which follows a student in this educational system. This curriculum is consisting of many phases of work, during many years:

-10th grade, the students study the science of soil and plants,

-11th grade, the students study viticulture,

-12th grade the students study business and marketing.

This academy is run by four teachers: the head of this team is named Felicia Rush, but she has been replaced by Dan Aschwanden because she had the opportunity to be accepted in a High school where she always wanted to be, with whom we got into contact, thanks to Celine Ouziel, who works at the U.S Embassy in Paris. Celine Ouziel later knew a person who works at Santa Rosa junior college in California named Theresa Tope, who then told us about Sonoma Valley High School. Then we contacted Felicia via the site of the school and we have been in contact with them since this time.

By being a part of this course, students have the opportunity to get internships and job shadows. They also have the chance to go on school trips and meet guest speakers.

D/ Interactions with Sonoma students

At the beginning of our 8th grade year, we all sent a video in which we had to introduce ourselves in english to the Californian students. A few days later, they answered us with a video where they also introduced theirselves. Then, they sent us a lot of documents which were about Sonoma Valley City and about their vineyards. They talked about : agriculture in Sonoma; known wineries in their area (Buena Vista Winery, Gloria Ferrer Winery or Robledo Family Winery); their high school whose name is Sonoma Valley High School; history of important people; their vineyards (process of grape wine making/ types of grapes…); Californian climate; the Sonoma Valley City (restaurants, activities like minigolfing, cinema, wine tours or landscapes…).

IX - CONCLUSION

The production of Graves and Sauternes wines therefore depends greatly on its geographical, climatic and soil factors. The grape varieties are therefore chosen to withstand the specific conditions of our terroir.

For example, the presence of the Landes forest is important to the selected vine growth locations. Due to the fact that it is located to the West of the vine growth areas, between them and the ocean, it, therefore, not only protects the vineyards from the rain and the winds coming from the ocean, but also brings water through its hydrographic network and provides the humidity necessary to help the vines prosper.

Weather conditions are changing and climate change could lead to a major evolution in the current wineries.

Indeed, the increase of 2°C in the average temperatures over the Bordeaux region for the last 30 years, have placed the grape varieties, that are currently used in our region, at the limit of development in favorable conditions.

However, our wine region is special because of the different soils it offers. The clay and sandy soils allow rainwater to provide the elements necessary for the grape development without the need to irrigate the vineyard parcels. (annexes)

Each vineyard has its specificities that give different wines very different tastes. However, the winemaking conditions and the treatments applied to the vine can also change its taste.

During these 2 years we learned to work with the Gantt diagram and also to use different scientific tools like the Calitoo, a sun photometer which is used to measure aerosols rates.

We learned that if we have grapes, it’s partly thanks to different insects: helpful insects which kill the harmful insects. We have discovered Genodics, a company which uses vibrations to detect diseases of wine and which also help vines grow and develop.

We studied the flora of wine and made a herbarium (in annexes).

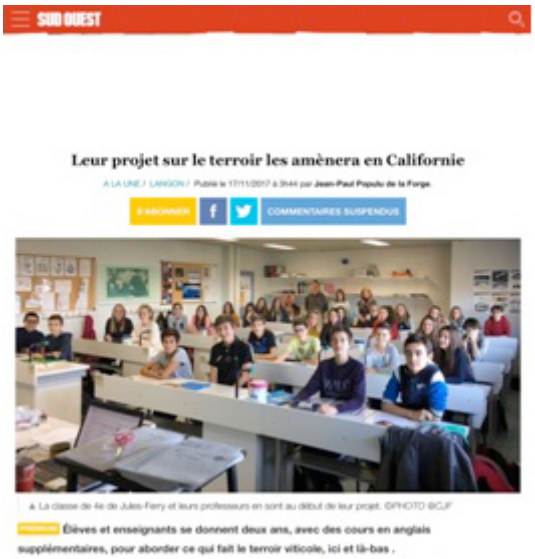
During these two years, we had the chance to meet Sophie Ladril, who works for l'Auringleta. She came to teach many different facts about winemaking at different times of the year.

All we have to do now, is wait until we go to California!

BADGES

- ***Be a stem storyteller*** : *We have to describe how we creatively shared our project through a blog, a play, a social network account... :*

At the beginning of our project, a journalist from our local newspaper came to our school, and he wrote an article about the beginning of our project and all the actions that we will be doing for two years. This journalist will then follow us during two years and write many articles about our project …



The first article about the project was published on November 17, 2017

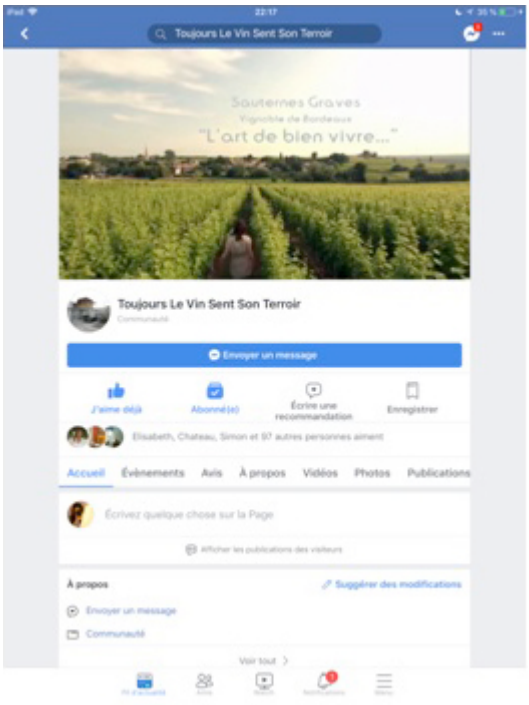
The second article was published on January 19, 2018

The third article was published on February 6, 2018

The fourth article was published on April 10, 2018

The fifth article was published on October 10, 2018

To make us known via social networks, we created a Facebook page and an Instagram account.



https://m.facebook.com/pages/category/Community/Toujours-Le-Vin-Sent-Son-

On our Facebook, about a hundred people liked our page and support us.

The dance school Séverine Bonnin-Limousin has created a promotional clip to publicize our project and it allows us to present our project:

https://m.youtube.com/watch?v=fLuEBGZmODg

Some students in the class also created a video that presents our project and that we published on our social networks:

https://m.facebook.com/story.php?story_fbid=272607040258532&id=108723536484768&anchor_composer=false

A speaker from the town hall of Langon came to interview some students of the class to present the project in a few words. This video was then put on the Facebook page of the city:

https://m.facebook.com/story.php?story_fbid=2203943539895194&id=1458254224464133

During our trip, our parents will be able to have news thanks to the website:

https://www.ondonnedesnouvelles.com/

Everyday, the site will be updated by an adult who will supervise us...

Thanks to all the communications we have put in place, we have made ourselves known and have established many partnerships ... People interested in our project regularly hear from us and will be able to follow our adventure closely when we are in California.

- ***Be a STEM professional:*** *We have to describe collaboration with scientists or scientific organizations, how they helped us to improve the research methods and precision.*

We can get this badge because we worked with many scientists, because with our project, we discovered all the work around wine (like oenologist, winegrowers, etc...) with scientists. All of this since to make wine we need to have a minimum of knowledge about science and physics. So we worked with a winegrower and an association called "L'auringleta", that was here, along the two years, to explain to us everything about vineyards. We also worked with NASA because they asked us for some information, to compare theirs with our own. Lastly, we met the winegrowers from our partners, Château Pouyanne and Château Guiraud.

- ***Be a Data scientist:*** *The final report must include an analysis with our own datas, make inferences, hypothesis, but we can also use these datas to answer questions. We also have to consider other datas from other schools or databases.*

We can get this badge because for the past two years, we have worked with data that we collected, such as soil samples, water samples, weather plans... Every day students reported the weather conditions and put them on the Globe website. We used all of this to ask ourselves questions, to hypothesize and answer our hypotheses. We also used globe data, data from the school of Agen because we needed it.

We also answered a question from NASA asking us to compare their data and our own. We also asked NASA to verify all our data.

ANNEXES

Annex 1 : Scholarship:

Introduction

As a part of our class project, the teacher wanted students to work on an ambitious project bringing together different subjects.

Financial research:

To be able to finance our Scientific Trip to California, we had to look for grants and organize different actions and presentations for our project. Among these actions, we organized parties, we sold wine and we presented our project to CEOs during open houses... You will find the details of our grants in the annex (the Chateau Filhot and its Christmas gifts, Halloween party for the 6th and 7th Grade, Shows: dance and theater, The generosity of the sponsors...). To complete our project, we needed to find students to partner with in California.

The Château Filhot and its Christmas presents:

With the participation of Château Filhot and Mrs Rakowitz-Do (Art teacher):

To support our project (“Toujours le vin sent son terroir”), we had an idea: to sell bottles of sweet wine for Christmas with labels we designed ourselves. To do this, Château Filhot has graciously accepted to sell us, at a very affordable cost, some bottles of sweet wine. We had to resell each bottle at sixteen Euros each to earn a good profit.

To personalize our bottles, we, students of the European class 8th Grade AB of Jules Ferry Middle School made our own labels for the bottles with a specific goal. Our work was led by our Art Teacher : Mrs Rakowitz-Do. She gave us a protocol and she then helped us get organized for our project.

All the labels were hand-made and with deadlines. For the first deadline, we researched how to draw pictures on wine labels and each student drew their own picture with pencils. Then, we did a sharpening with India ink and we finalized each drawing with white paint and black pen.

Finally, each student presented their drawing to the School Principal and the Art Teacher. The winning picture was sent to the Chateau Filhot and it was then approved by the winery. The drawing was printed on each bottle before sales. At the end of the selling period, we sold one thousand one hundred (1,100) bottles! We earned 7,700€, 700€ to buy labels and 7,000€ for our project. This sale was very important because it covered over 26% of our final budget.

We have also been to the Raison D'Or organized by the Château Filhot to look for sponsors and to tell them about our project.

Main project information:

With the permission of Château Guiraud:

Château Guiraud is a partner for our project : " Toujours le vin sent son terroir ". We received the extreme honor to go the open-days at the winery. There, we presented and talked about our project to many visitors and tourists who came from all over the world to visit this popular winery. Some people donated money to our project.

Halloween Party-6th Grade and 7th Grade:

With the participation of volunteer parents, Jules Ferry Middle School Teachers and some of the students of our European class:

We organized a private party in the Jules Ferry Middle School which only the 6th Graders and 7th Graders of the Middle School were allowed to enter. Everybody had to come disguised : witches, scary clowns, vampires, costume ideas were left to free reign to the imagination of Halloween. The entrance see was 10€ per person, but an all-you-can-eat buffet was at the disposable of the guests. The party was from 6 p.m to 10 p.m with the schedule being : music, buffet, dance and fun ensured. In total, with 100 guests, we earned 1000€. This is a very good sum of money. We also plan to have a second party with the students.

Shows: dance and theater:

With the participation of Mrs Bonnin-Limousin (the dance teacher), Mrs Bisalli (the teacher in charge of the Theater club of our Middle School) and Mrs Rakowitz-Do:

Séverine Bonnin-Limousin, a classical danse and jazz teacher in Langon and mother of one of the students of our project, was kind enough to create a dance show especially for our project and promised to give us all the money raised with the tickets sold for the show.

Knowing that the shows of Mrs Bonnin-Limousin have a good reputation and are admired for their technique and their beauty, we hope that we will raise a lot of money thanks to this show. In addition, the teacher of our school, Mrs Bisalli, has given us profiles from several small shows like sketches.

At the end of these shows, we will have a big part of our final budget. The two shows will take place in the Carmes (a big auditorium in Langon). In order not to lose money buying flyers, we will create our own information flyers, always with the continued help of Mrs Rakowitz-Do. We will make sure that they are original so that people will notice them.

Circus Show:

With the participation of the "CompagnieDesMoi" and Mrs Rakowitz-Do:

Once again Mrs Rakowitz-Do offered to help us create original flyers that will have an impact on people to tell them about our show. We hope to gain the biggest possible profit from the show and to break even on expenses. The "CompagnieDesMoi" will organize a circus show at the Carmes to help the financing of the California Trip of the European Class.

The generosity of sponsors:

With the donations of the "Rotary Club", of the "Lion's Club", some sponsors of the "Raisin D'Or" and of the château Guiraud:

The Rotary Club is an association composed of local business owners and actors. In November of 2017, Mrs Giammattei and Mrs Chevillot, two organizers of our "European Section", went to present our project to this club. The club was enthusiastic and interested.

As a contribution to our project, the Rotary club gave us a generous donation of 2,000€! In addition, the Lion's Club has given us 250€ which is also a huge help for our project.

Other sponsors also gave a little bit of money to support our project at the open-days of the Château Guiraud and of the Raisin D'Or.

Other efforts:

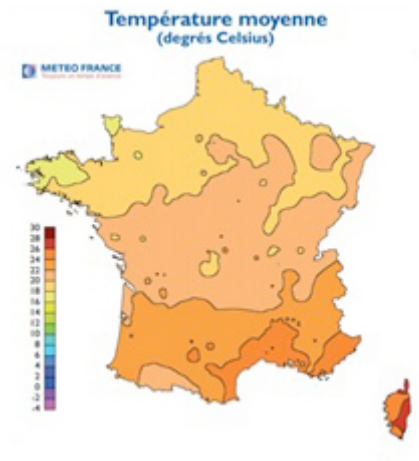
We also had other ambitions to earn the necessary money for our trip. We also want to do a raffle. Each action will enable us to achieve our objective : organize a Scientific and Linguistic Trip to California! As a part of these efforts, we organized parties, we sold sweet wines, and we presented our project to sponsors during winery open-days...

Annex 2:The temperatures

The temperature represents the heat energy of an element (here we can see air).

We can measure it with thermometers and represent it in degree Celsius (°C), Fahrenheit (°F) and Kelvin (K)

Average temperatures in France



HUMIDITY

Humidity is the quantity of the water or the watervapor in the air.

We can measure it with a hygrometer and express it in percentages (%).

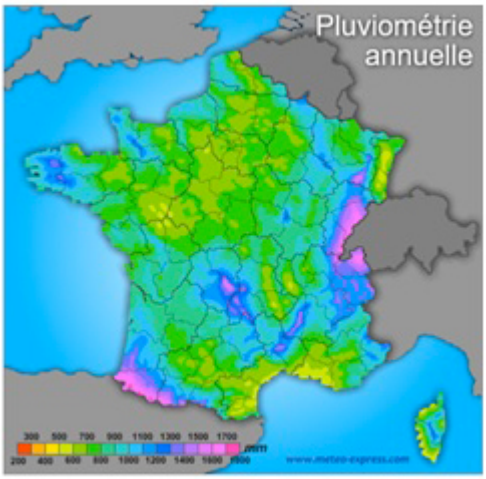
- 100% humidity is considered saturated air (relsulting of clouds, rain, fog, dew...)
- 0% is equivalent to perfectly dry air (this value is never reached in nature, though, not even in the desert where some humidity still remains).

RAINFALL

Rainfall is the recording of the quantity of precipitation levels and changes according to the nature of the precipitation (rain, snow, hail and fog).

We can measure rainfall levels with a rain gauge and express it in millimetres (mm).

Annual rainfall averages in France



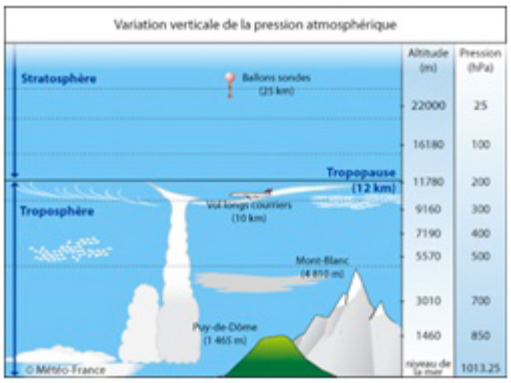
ATMOSPHERIC PRESSURE

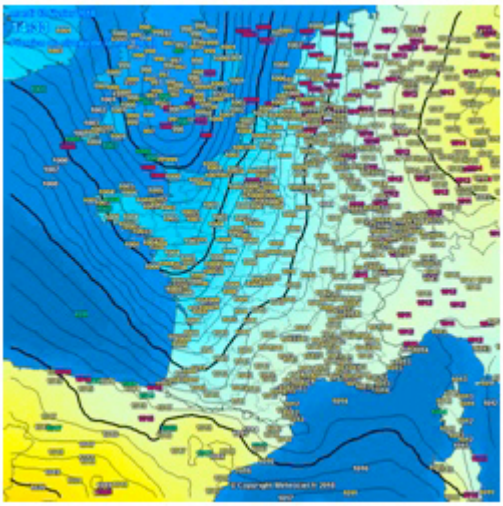
Atmospheric pressure is the pressure generated by a column of air at a given point. Air is composed of molecules that have mass.

This pressure level differs depending on if you are at the top or bottom of the column: the pressure changes depending on the altitude. It also varies according to the temperature of the air.

Atmospheric pressure is measured with a barometer and is expressed in hectopascals (hPa) and in millibars (mbar).

Vertical variations of atmospheric pressure



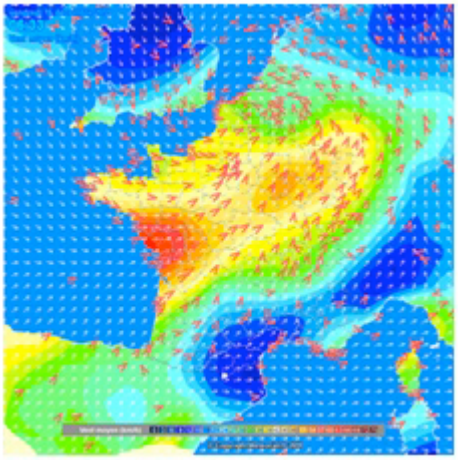


WIND

The difference of temperatures between the hot zones and the cold zones of the planet is the origin of the modification of pressures in the atmosphere which causes the movement of air masses. This phenomenon of changing pressures creates wind.

An anemometer measures the wind speed in Km/h. A weather vane can determine the average direction orientation of the wind.

Map of the wind direction and speed



CLOUDS

There are several different types of clouds, we can classify them into four groups:

- The high clouds (more than 6km high) : cirrus, cirrocumulus and cirrostratus.
- The middle clouds (between 2 and 5km high) : altostratus and altocumulus.
- The low clouds (less than 2km high) : stratus, stratocumulus and nimbostratus.
- The convective clouds: cumulonimbus (which can stretch in the three levels) and cumulus (low clouds which can stretch in the mid level).

There are three descriptive terms for the different types of clouds:

- CUMULUS for white puffy clouds.
- STRATUS for layered clouds.
- NIMBUS for clouds which produce precipitation.

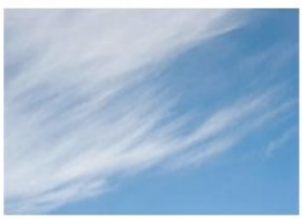
And there are prefixes which define the height of clouds:

- CIRRO- or CIRRUS for high level clouds.
- ALTO- for middle level clouds.

High clouds :

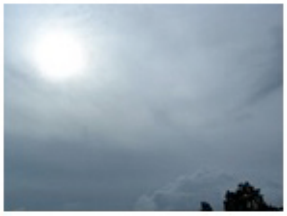
Cirrus : These are very thin clouds which are often present before atmospheric disruptions (storms). They are composed of many microscopic ice crystals.

Cirrocumulus : They are little ovoid clouds made of ice crystals and sometimes of very cold water (less than 0°C).



Cirrostratus : They are clouds made of several layers which have the ability to partly hide the sun. Like the cirrus clouds, they are often present before atmospheric disruptions (storms).

Middle clouds :



Altostratus : They are clouds made of several layers which appear like a white veil that can give the impression of “hiding the sky” by partially covering the sun.

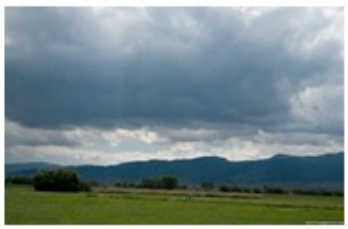
Altocumulus : They are clouds made of microscopic drops of water. They are composed of several layers of white or grey clouds. They can often be seen before a storm.

Low clouds :

Stratus : They are very low clouds which can touch the ground (known as fog) .

They can produce snow if the temperature is less than 0°C.

Stratocumulus : They are ovoid clouds which rarely produce precipitation.



Nimbostratus : They are clouds made of microscopic drops of water, of ice crystals and sometimes of snowflakes.

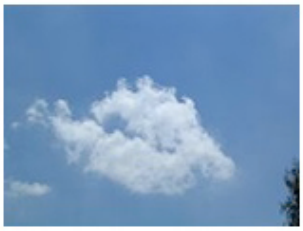
They do not produce much precipitation, but they cover a vast zone.

Their base is situated in the low level and their top can stretch into the level above.

Convective clouds :

Cumulonimbus : They are big grey clouds with a crucial vertical expansion : their top can reach 15, 000 meters high. They are made, in their upper part, of ice crystals and at their bottom, of microscopic drops of water.

They produce precipitation and they are the only clouds which produce storms.



Cumulus : They are low clouds which stretch in the middle level. They are clouds that are present during good weather.

Contrails

Contrails are clouds made by steam condensation.

They are made by planes at 8, 000 meters high, in temperatures of less than -39°C and in air with more than 68% relative humidity.

Annex 3 : Globe protocols

Soil Characterization Protocol

Field Guide

Task

Identify, measure and record the horizons in a soil profile at a study site. Measure and record the physical and chemical properties that characterize each horizon. Photograph the soil profile. Collect soil samples from each horizon.

What You Need

- ❑ Spray mist bottle full of water
- ❑ Golf tees, nails or other marking device that can be pushed into a soil horizon
- ❑ Trowel, shovel, or other digging device
- ❑ Soil color book
- ❑ Marking pen
- ❑ Camera
- ❑ Pencil or pen
- ❑ Acid bottle filled with distilled vinegar
- ❑ *Soil Horizon Definitions page* from Site Definition Sheet
- ❑ Paper towels
- ❑ Meter stick or tape measure
- ❑ Rolling pin, hammer, or other utensil for crushing peds and separating particles

In the Field

Identifying and Measuring Horizons

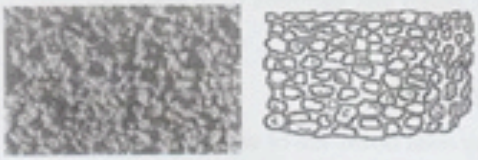
1. Make sure the sun shines on the profile if possible.
2. Use a trowel to scrape a few centimeters of soil off of the profile to expose a fresh soil face.
3. Determine whether the soil profile is moist, wet, or dry. If the soil profile is dry, moisten it with the spray mist bottle.
4. Start at the top of the profile and observe the characteristics of the soil moving towards the bottom of the profile.
5. Look carefully at the soil profile for distinguishing characteristics such as color, texture, shapes, roots, rocks, small dark nodules (called *concretions*), worms, small animals, insects, and worm channels. These observations will help to define the horizons.
6. Working in a straight vertical line, place a marker (such as a golf tee or nail) at the top and bottom of each horizon to clearly identify it. Be sure there is a consensus from all of the students regarding the depths of the soil horizons.
7. Measure the top and bottom depth of each horizon beginning at the top (surface) of the profile. Start with the meter stick or tape measure at 0 cm at the top of the profile. Note the depths at which each horizon starts and ends.
8. Record the top and bottom depth of each horizon on the *Soil Horizon Definitions page*.

Protocol which helps us to determine « horizons »

Measuring Structure

1. Use a trowel or other digging device to remove a sample of soil from the horizon being studied.
2. Hold the sample gently in your hand and look closely at the soil to examine its structure.
3. Come to a consensus with other students in the group on the type of soil structure of the horizon. Possible choices of soil structure are:

Granular: Resembles cookie crumbs and is usually less than 0.5 cm in diameter. Commonly found in surface horizons where roots have been growing.



Blocky: Irregular blocks that are usually 1.5 - 5.0 cm in diameter.

Prismatic: Vertical columns of soil that might be a number of cm long. Usually found in lower horizons.

Columnar: Vertical columns of soil that have a white, rounded salt "cap" at the top. Found in soils of arid climates.

Platy: Thin, flat plates of soil that lie horizontally. Usually found in compacted soil.

In certain cases, soil samples may have no structure. These would be classified as either:

Single Grained: Soil is broken into individual particles that do not stick together. Always accompanies a loose consistence. Commonly found in sandy soils.

Massive: Soil has no visible structure, is hard to break apart and appears in very large clods.

4. Record the structure type on the *Soil Horizon Definitions page* from *Site Definition Sheet*

Protocol which helps us to determine the soil structure.

Measuring Soil Texture (for help with this category, refer to the Textural Triangle under "Frequently Asked Questions")

Step 1

- Place some soil from a horizon (about the size of a small egg) in your hand and use the spray mist bottle to moisten the soil. Let the water soak into the soil and then work it between your fingers until it is thoroughly moist. Once the soil is moist, try to form a ball.
- If the soil forms a ball, go on to **Step 2**. If the soil does not form a ball, call it a **sand**. Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

Step 2

- Place the ball of soil between your thumb and index finger and gently push and squeeze it into a ribbon. If you can make a ribbon that is longer than 2.5 cm, go to **Step 3**. If the ribbon breaks apart before it reaches 2.5 cm, call it a **loamy sand**. Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

Step 3

- If the soil:
  - Is very sticky
  - Hard to squeeze
  - Stains your hands
  - Has a shine when rubbed
  - Forms a long ribbon (5+ cm) without breaking,

Call it a clay and go to Step 4.

Otherwise, if the soil:

- Is somewhat sticky
- Is somewhat hard to squeeze
- Forms a medium ribbon (between 2-5 cm)

Call it a clay loam and go to Step 4.

Otherwise, if the soil is:

- Smooth
- Easy to squeeze,
- At most slightly sticky,
- Forms a short ribbon (less than 2 cm)

Call it a loam and go to Step 4.

Step 4

- Wet a small pinch of the soil in your palm and rub it with a forefinger. If the soil:
  - Feels very gritty every time you squeeze the soil, go to **A**.
  - Feels very smooth, with no gritty feeling, go to **B**.
  - Feels only a little gritty, go to **C**.

A. Add the word **sandy** to the initial classification.

- Soil texture is either:
  - sandy clay,
  - sandy clay loam, or
  - sandy loam
- Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

B. Add the word **silt or silty** to the initial classification.

- Soil texture is either:

Protocol which helps us to determine the soil structure whitout the triangle.

`

- silty clay,
- silty clay loam, or
- silt loam

• Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

C. Leave the original classification.

• Soil texture is either:
- clay, clay loam, or loam

• Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

Measuring Roots

1. Observe if there are **none, few,** or **many** roots in each horizon.
2. Record your observation on the *Soil Horizon Definitions page*.

Measuring Rocks

1. Observe and record if there are **none, few,** or **many** rocks or rock fragments in the horizon. A rock or rock fragment is defined as being larger than 2 mm in size.
2. Record your observation on the *Soil Horizon Definitions page*.

Measuring Free Carbonates

1. Set aside a portion of the exposed soil to use for the free carbonates test. Make sure not to touch it with your bare hands.
2. Open the acid bottle and squirt vinegar on the soil particles, starting from the bottom of the profile and moving up. Be sure to use caution and point the bottle directly at the soil, not toward other students, especially toward eyes. If vinegar gets into your eyes, rinse with water for 15 minutes.
3. Look carefully for the presence of effervescence. The more carbonates that are present, the more bubbles (effervescence) you will observe.
4. For each horizon, record on the *Soil Horizon Definitions page* one of the following as the result of the Free Carbonate Test:

• **None:** if you observe no reaction, the soil has no free carbonates present.
• **Slight:** if you observe a very slight bubbling action; this indicates the presence of some carbonates.
• **Strong:** if there is a strong reaction (many, and/or large bubbles) this indicates that many carbonates are present.

Photographing the Soil Profile

1. Place a tape measure or meter stick starting from the top of the soil profile next to where the horizons have been marked.
2. With the sun at your back, photograph the soil profile so that the horizons and depths can be seen clearly.
3. Take another photograph of the landscape around the soil profile.
4. These photos can be included in student research projects or used for comparison when exploring other exposed soil profiles.

Continuation of the texture protocol and protocol that measures the number of roots, rocks and carbonates and explains how to take a picture of the hole.

Measuring Main Color and Second Color

1. Take a ped from the horizon being studied and note whether it is moist, dry, or wet. If it is dry, moisten it slightly with water from your water bottle.
2. Break the ped and hold it next to the color chart.
3. Stand with the sun over your shoulder so that sunlight shines on the color chart and the soil sample you are examining.
4. Find the color on the color chart that most closely matches the color of the inside surface of the ped. Be sure that all students agree on the choice of color.
5. Record on the *Soil Horizon Definitions page* the symbol of the color on the chart that most closely matches the soil color that covers the largest area of the ped (dominant or main color). Sometimes, a soil sample may have more than one color. Record a maximum of two colors if necessary, and indicate (1) the dominant (main) color, and (2) the sub-dominant (second) color.

Measuring Soil Consistence

1. Take a ped from the soil horizon being studied. If the soil is very dry, moisten the face of the profile by squirting water on it, and then remove a ped for determining consistence.
2. Holding the ped between your thumb and forefinger, gently squeeze it until it pops or falls apart.
3. Record one of the following categories of soil ped consistence on the *Soil Horizon Definitions page*.

Loose: You have trouble picking out a single ped and the structure falls apart before you handle it. **Note:** Soils with **single grained structure *always have* loose consistence**.

Firm: The ped breaks when you apply a larger amount of pressure and the ped dents your fingers before it breaks.

Friable: The ped breaks with a small amount of pressure.

Extremely Firm: The ped can't be crushed with your fingers (you need a hammer!)

Protocol which helps us to determine the soil consistence.

Soil pH Protocol

Lab Guide

Task

To obtain three pH readings for a soil horizon

What You Need

- ❑ Dried sieved soil
- ❑ Distilled water
- ❑ 100-mL graduated cylinder
- ❑ Four 100-mL containers
- ❑ Balance (accurate to 0.1 g)
- ❑ *pH Data Sheet*
- ❑ Pencil or pen
- ❑ Glass stirring rod or other stirring device
- ❑ pH meter or pH paper

In the Lab

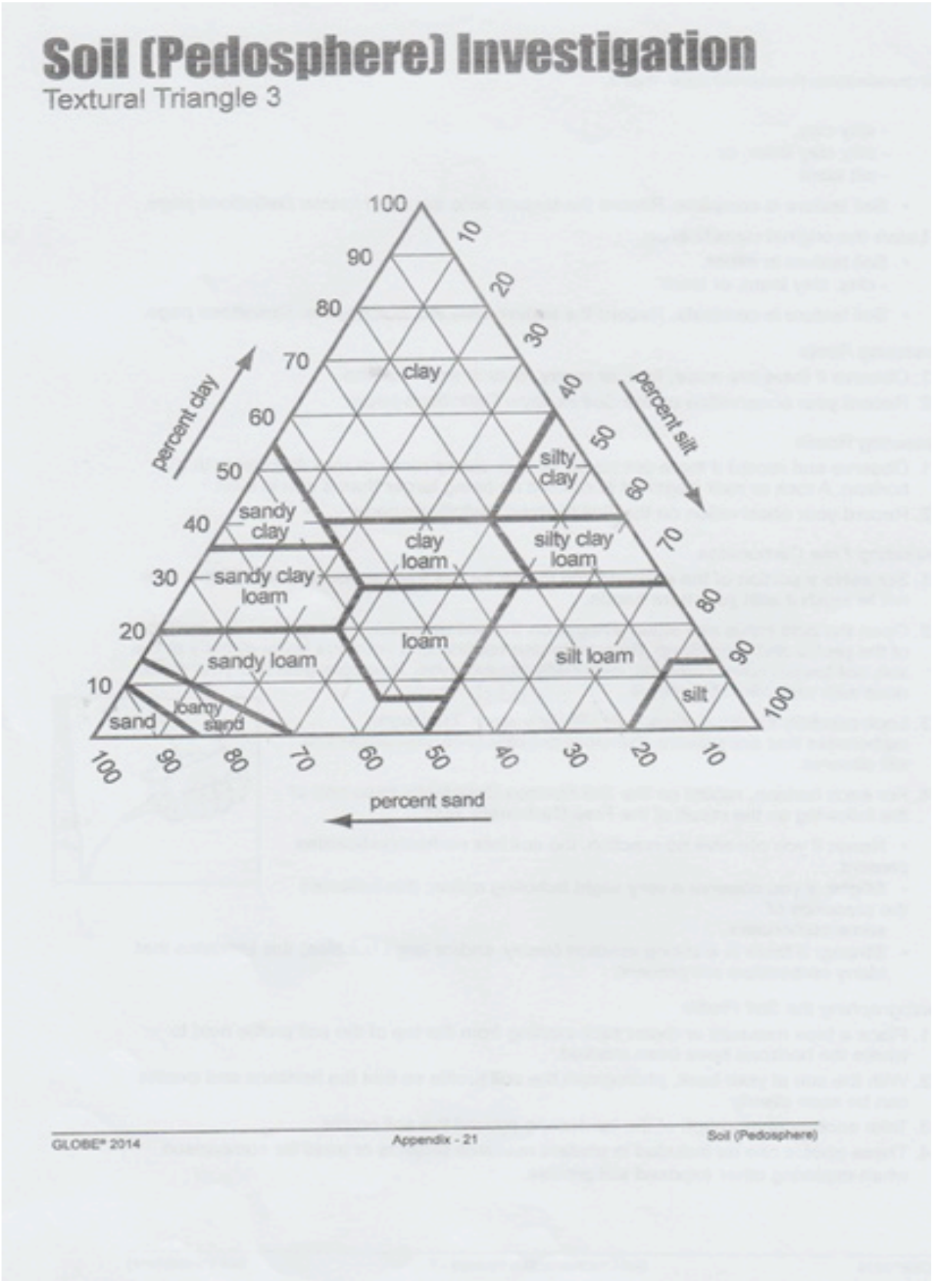
1. In a cup or beaker, mix 40 g of dried and sieved soil with 40 mL of distilled water (or other amount in a 1:1 soil to water ratio) using a spoon or other utensil to transfer the soil.

2. Stir the soil/water mixture with a spoon or other stirrer until it is thoroughly mixed. Stir the soil/water mixture for 30 seconds and then wait for three minutes for a total of five stirring/waiting cycles. Then, allow the mixture to settle until a supernatant (clearer liquid above the settled soil) forms (about 5 minutes).

3. Measure the pH of the supernatant using the pH paper or meter. Dip the pH paper or calibrated pH meter in the supernatant. Record the pH value on the *Soil pH Data Sheet*. If pH meter requires calibration, gloves should be worn.

4. Repeat steps 1-3 for two more samples from the same horizon.

Protocol which helps us to determine the Ph of the soil.



Triangle which helps us to identify the soil texture.

Soil Horizon Définitions

Study site : Château Rouyème **date :** 29/01

Horizon Number	Date (Year / MM/DD)	Top depth (cm)	Bottom depth (cm)	Moisture estimate (Select one : unknown, dry, moist, wet)	Structure estimate (Select one : unknown, granular, Blocky, Platy, prismatic, Columnar, Single grained, Massive)	Consistence estimate (Select one : extremely firm, firm, friable, loose, unknown)	Texture field estimate (select one : unknown, sandy clay, Sandy clay loam, Sandy loam, silty clay, silty clay loam, silt loam, loamy sand, sand, silt, clay, clay loam, loam organic)	Root quantity estimate (Select one : unknown, none, few, Many)	Rock quantity estimate : (Select one : unknown , none, few, many)	Carbonates (Select one : unknown , none, slight, strong)
①	26/01	0cm	25cm	moist	granular	firm	unknown.	none	few	slight.
②	26/01	25cm	60cm	moist	granular blocky	firm	clayish loam	none	none	strong

Note : the top Depth of any horizon must be the same depth or lower than the bottom depth of the horizon above it, it cannot be higher that the bottom depth above it,

Comments on the site .....

An example of a board (Identity card cited at the beginning) which helps us to identify soils.

Annexe 4 : Location of Samples

Location of samples we took in our geographical area:

Budos ↑

La Saubotte ↑

Barsac ↑

Preignac ↑

Bommes ↑

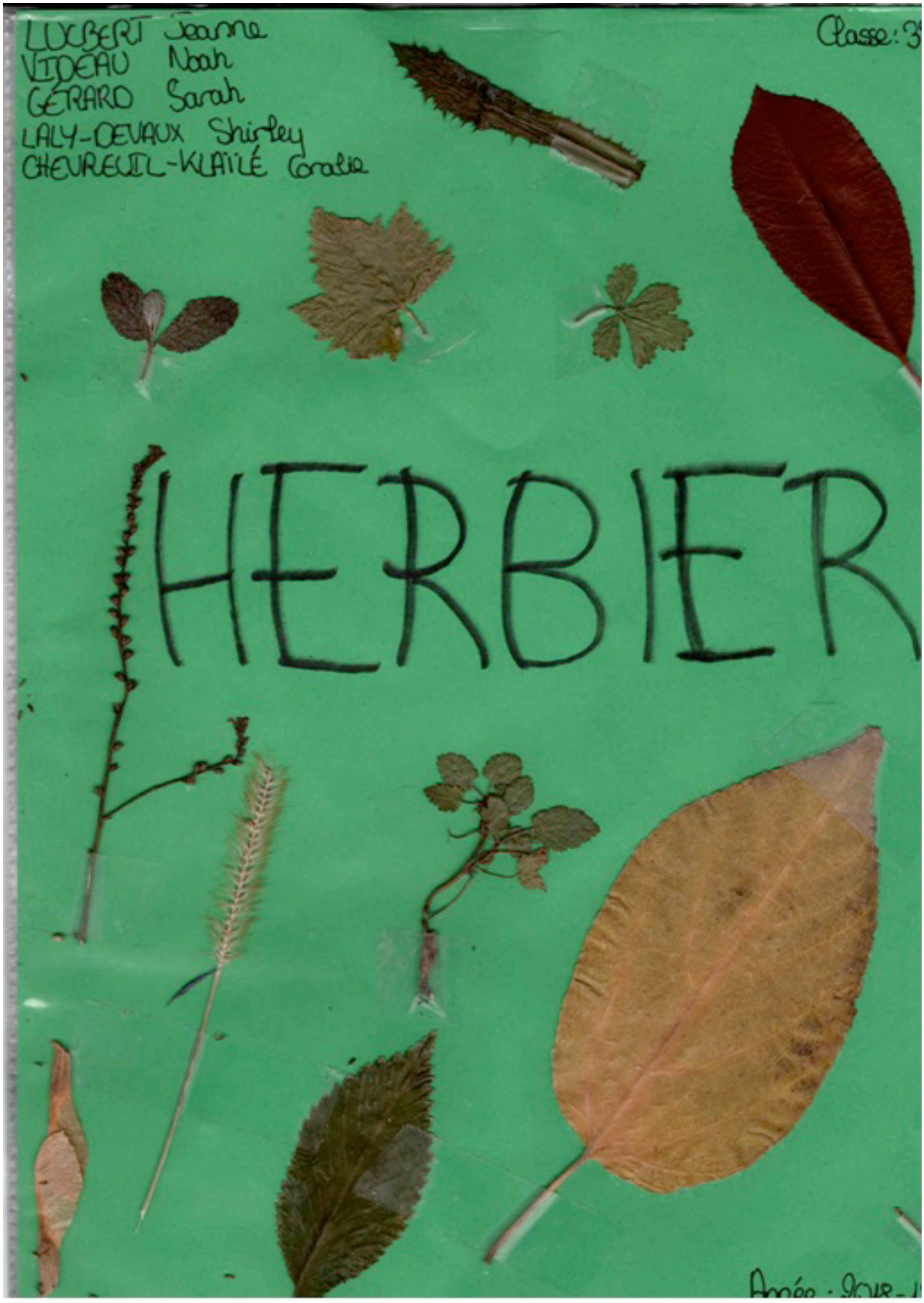
Fargues ↑

Langon ↑

Sauternes et Brouquet ↑

Annexe 5 : Our herbariums

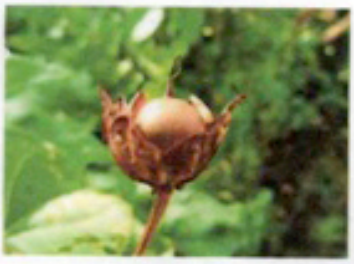
An example of an Herbarium we made this year:



Château Guiraud

quadro 4

Liseron des champs
(Convolvulus arvensis)
De la famille des Convolvulacées



Fruit

Caractéristiques :

- Plante vivace herbacée rampante, grimpante, à racines traçantes
- Feuilles petites et sagittées
- Fleurs à corolle en entonnoir, blanches ou roses, solitaires ou géminées sur des pédoncules axillaires grêlées plus long que la feuilles
- Le fruit est une capsule glabre réfléchie

Chiendent rampant
(Elytrigia repens)
De la famille des Poaceae

Caractéristiques :

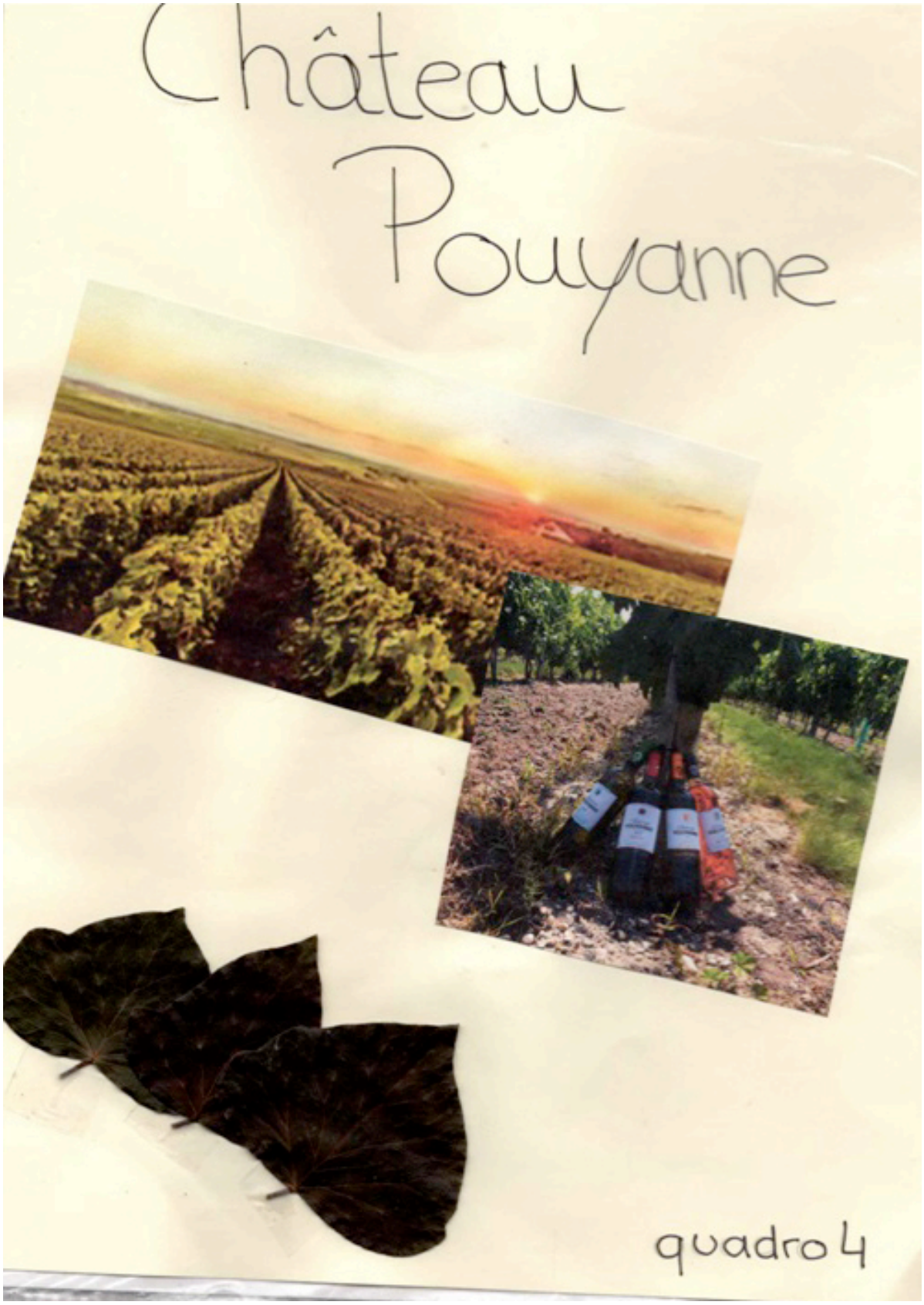
Graminée vivace herbacée à rhizomes traçants
Tiges souterraines, ramifiées, très longues de couleur blanche
Feuilles plates, allongées et aiguës
Fleurs en épis dressées, aplatis et formés d'épillets espacés

Pourpier
(Portulaca oleracea)
De la famille des Portulacaceae

Fruit

Caractéristiques :

- Plante annuelle glabre, ressemblant à un plante grasse, presque entièrement couchée sur le sol
- Feuilles charnues en forme de cuiller
- Petites fleurs solitaires à l'aisselle des feuilles à 5 pétales jaunes
- Fruit en capsule s'ouvrant en boîte à savon


Château
Pouyanne
quadro 4

Menthe
(Menthae)
De la famille des Lamiacées

Caractéristiques :

- Possède 4 étamines
- Corolle à 2 lèvres légères
- Feuilles persistantes, opposées, vertes, gaufrées, légèrement dentées et très odorantes.

Luzerne cultivée
(Medicago Sativa)
De la famille des Fabaceae

Fruit

Caractéristiques :

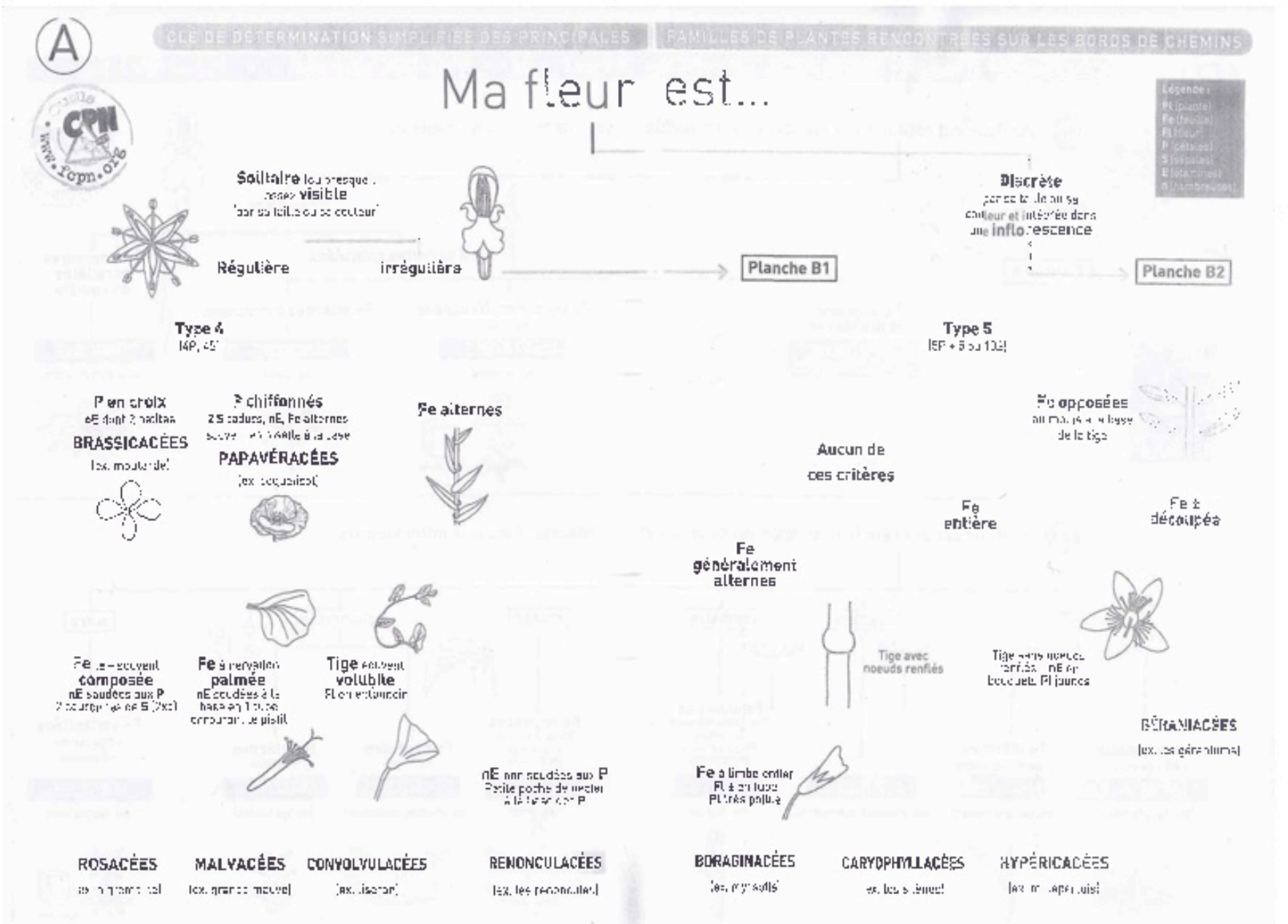
- Aussi appelée «grand trèfle»
- Feuilles à trois folioles oblongues, pubescentes, dentées au sommet, sont d'un vert gris
- Fleurs violettes groupées en grappes fournies
- Le fruit en gousses recourbées en hélice senestre

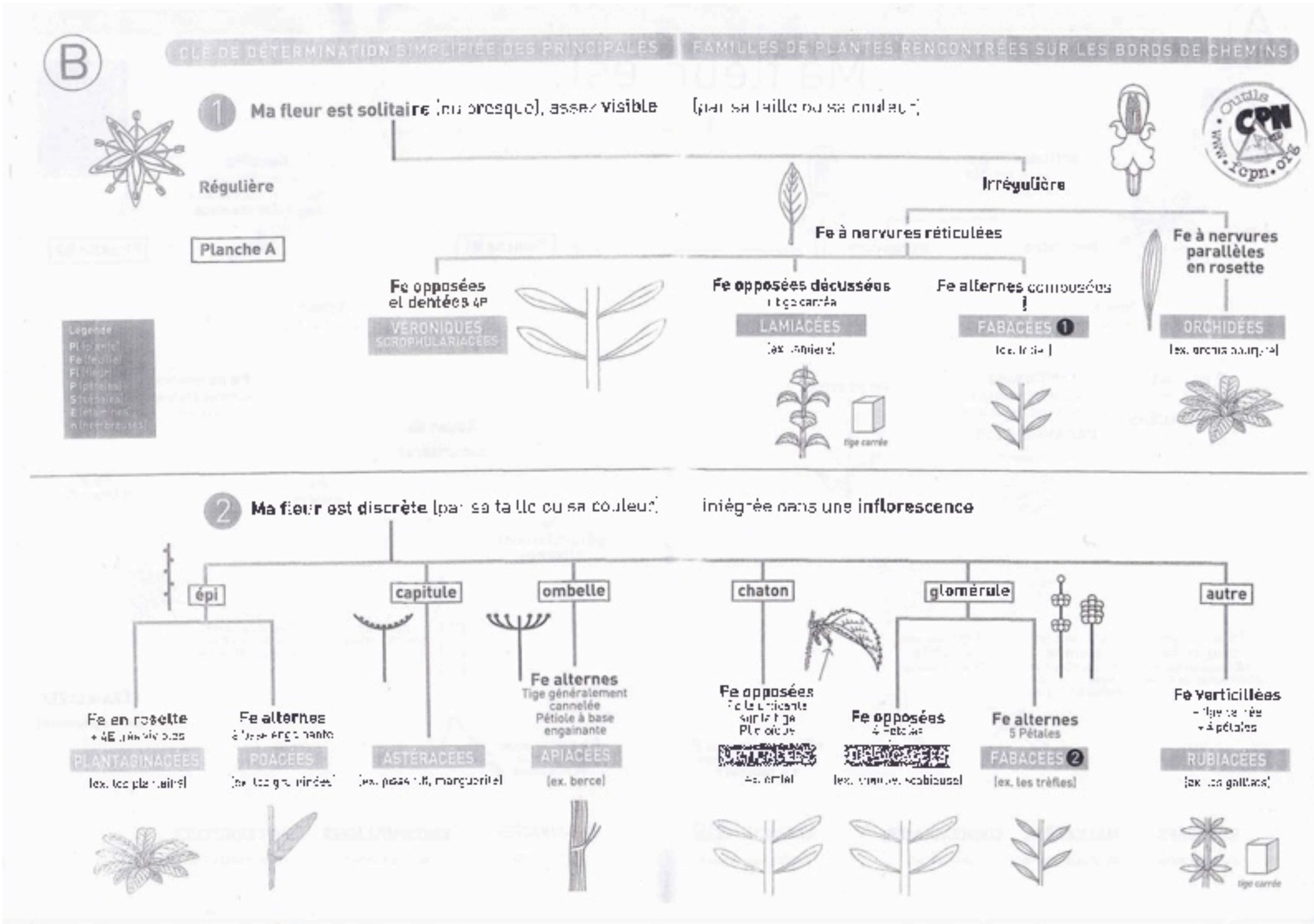
Carotte sauvage
(Daucus Carota)
De la famille des Apiaceae

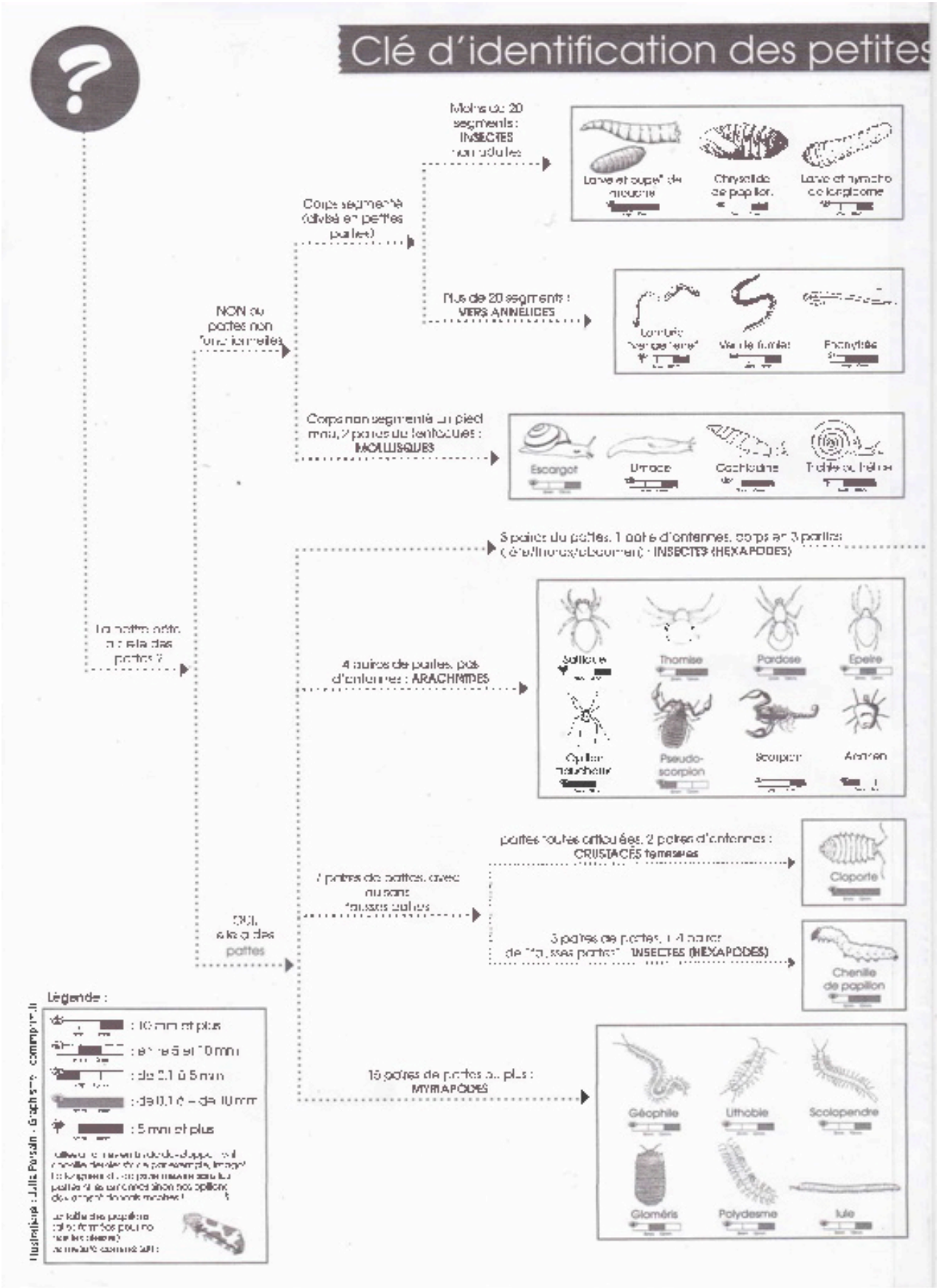
Fruits

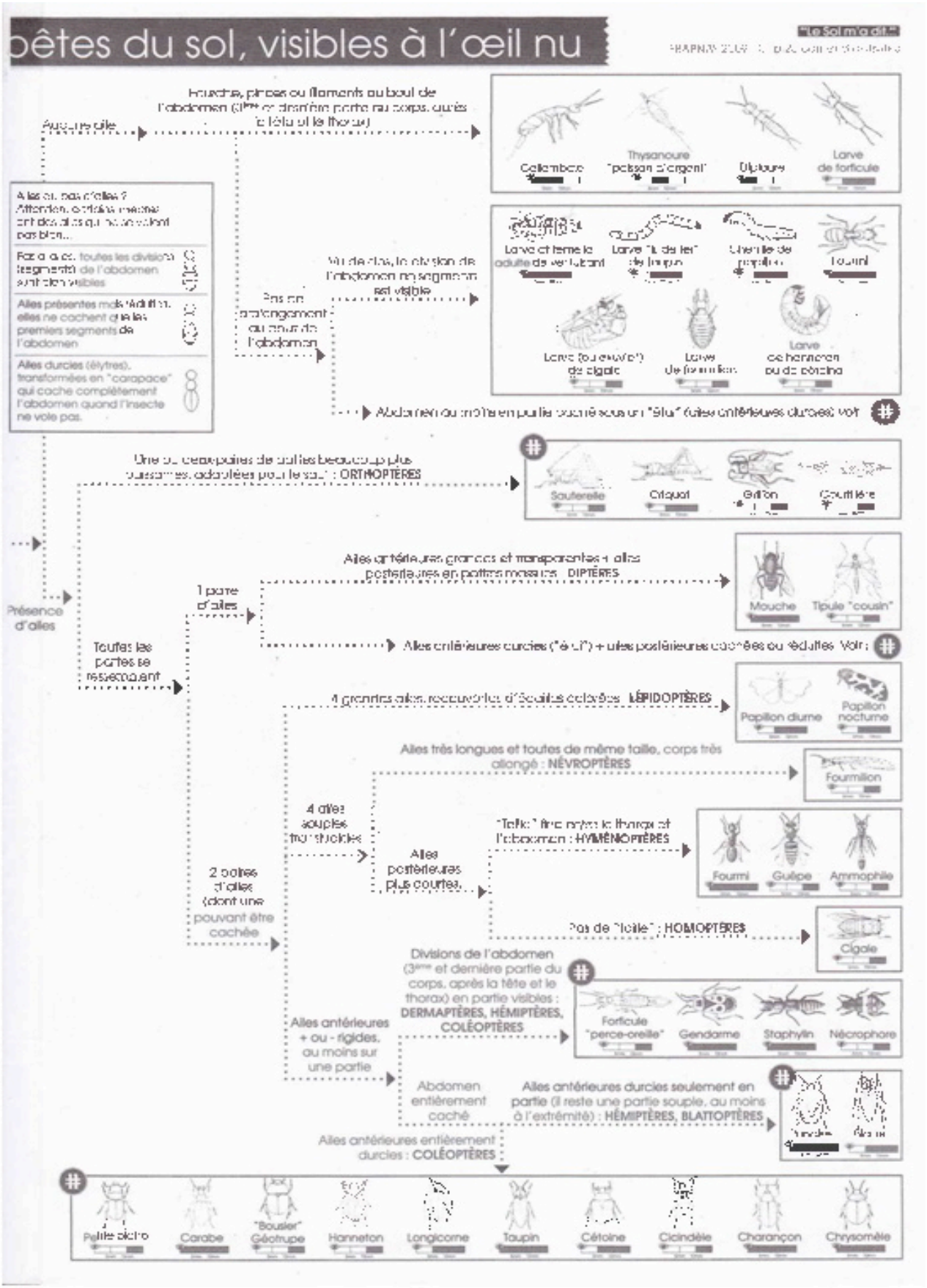
Caractéristiques :

- Feuilles bipennées avec des folioles très divisées
- Fleurs blanches et rosées
- Fruits : diakènes couverts d'aiguillons


A
CLÉ DE DÉTERMINATION SIMPLIFIÉE DES PRINCIPALES FAMILLES DE PLANTES RENCONTRÉES SUR LES BORDS DE CHEMINS
Ma fleur est...
Solitaire (ou presque : assez visible par sa taille ou sa couleur)
Régulière
Irrégulière
Planche B1
Discrète (petite ou peu colorée et intégrée dans une inflorescence)
Planche B2
Type 4
(4P, 4S)
P en croix
(E 4 ou 2 paires)
BRASSICACÉES
(ex. moutarde)
P chiffonnés
(2 S soudés, nE, Fe alternes souvent réunies à la base)
PAPAVÉRACÉES
(ex. coquelicot)
Fe alternes
Fe ± composée
nE soudées aux P
(2 courtes et 4 S (2x2))
Fe à nervation palmée
nE soudées à la base en tube entourant le pistil
Tige souvent volubile
Fe en entonnoir
nE non soudées aux P
Petite poche de nectar à la base des P
ROSACÉES
(ex. potentille)
MALVACÉES
(ex. grande mauve)
CONVOLVULACÉES
(ex. liseron)
RENONCULACÉES
(ex. les renoncules)
Type 5
(5P + 5 ou 10S)
Fe opposées
au moins à la base de la tige
Aucun de ces critères
Fe entière
Fe ± découpée
Fe généralement alternes
Tige avec noeuds renflés
Tige sans noeuds renflés, nE en boucles, Pl jaunes
GÉRANIACÉES
(ex. les géraniums)
Fe à limbe entier
Pl ± en tube
Pl très poilus
BORAGINACÉES
(ex. myosotis)
CARYOPHYLLACÉES
(ex. les silènes)
HYPÉRICACÉES
(ex. millepertuis)


B
CLÉ DE DÉTERMINATION SIMPLIFIÉE DES PRINCIPALES FAMILLES DE PLANTES RENCONTRÉES SUR LES BORDS DE CHEMINS
Outils CPN www.fcpn.org
1 Ma fleur est solitaire (ou presque), assez visible (par sa taille ou sa couleur)
Régulière
Planche A
Irrégulière
Fe à nervures réticulées
Fe à nervures parallèles en rosette
Fe opposées et dentées 4P
VÉRONIQUES
SCROPHULARIACÉES
Fe opposées décussées
tige carrée
LAMIACÉES
Fe alternes composées
FABACÉES 1
ORCHIDÉES
tige carrée
2 Ma fleur est discrète (par sa taille ou sa couleur) intégrée dans une inflorescence
épi
capitule
ombelle
chaton
glomérule
autre
Fe en rosette
PLANTAGINACÉES
Fe alternes
POACÉES
ASTÉRACÉES
Fe alternes
Tige généralement cannelée
Pétiole à base engainante
APIACÉES
(ex. berce)
Fe opposées
Fe opposées
Fe alternes
5 Pétales
FABACÉES 2
(ex. les trèfles)
Fe verticillées
+ 4 pétales
RUBIACÉES
tige carrée


Clé d'identification des petites
Moins de 20 segments : INSECTES (adultes)
Larve et pupe(s) de mouche
Chrysalide de papillon
Larve et nymphe coléoptère
Corps segmenté (divisé en petites parties)
Plus de 20 segments : VERS ANNELIDES
Lombric
Ver de farine
Enchytrée
NON ou parties non articulées
Corps non segmenté, un pied mou, 2 paires de tentacules : MOLLUSQUES
Escargot
Limace
Cochlicelle
Truite ou hélice
5 paires de pattes, 1 paire d'antennes, corps en 3 parties (tête/thorax/abdomen) : INSECTES (HEXAPODES)
Les pattes articulées ou nombre des pattes ?
4 paires de pattes, pas d'antennes : ARACHNIDES
Salticide
Thomise
Pardose
Epeire
Opilion faucheur
Pseudo-scorpion
Scorpion
Araignée
7 paires de pattes, avec ou sans fausses pattes
pattes toutes articulées, 2 paires d'antennes : CRUSTACÉS terrestres
Cloporte
3 paires de pattes, 1 paire de "fausses pattes" : INSECTES (HEXAPODES)
Chenille de papillon
15 paires de pattes ou plus : MYRIAPODES
Géophile
Lithobie
Scolopendre
Glomeris
Polydesme
Iule
Légende :
: 10 mm et plus
: entre 5 et 10 mm
: de 2,1 à 5 mm
: de 0,1 à 2 mm
: 5 mm et plus
Illustrations : Julia Parsain - Graphisme : commun.li


bêtes du sol, visibles à l'œil nu
"Le Sol m'a dit..."
Aucune aile
Fourches, pinces ou filaments au bout de l'abdomen (3ème et dernière partie du corps, après la tête et le thorax)
Collembole
Thysanoure "poisson d'argent"
Diploure
Larve de forficule
Ailes ou pas d'ailes ? Attention, certains insectes ont des ailes qui ne sont pas bien...
Pas d'ailes : toutes les divisions (segments) de l'abdomen sont bien visibles
Ailes présentes mais réduites, elles ne cachent que les premiers segments de l'abdomen
Ailes durcies (élytres), transformées en "carapace" qui cache complètement l'abdomen quand l'insecte ne vole pas.
Pas de changement au niveau de l'abdomen
Malgré cela, la division de l'abdomen en segments est visible
Larve et femelle adulte de ver luisant
Larve "fil de fer" de taupin
Chenille de papillon
Tourni
Larve (ou nymphe) de cigale
Larve de fourmilion
Larve de hanneton ou de pâtière
Abdomen ou mâle en pupe caché sous un "étui" (ailes antérieures durcies) voir #
Une ou deux paires de pattes beaucoup plus puissantes, adaptées pour le saut : ORTHOPTÈRES
Sauterelle
Criquet
Grillon
Courtilière
Présence d'ailes
Toutes les pattes se ressemblant
1 paire d'ailes
Ailes antérieures grandes et transparentes + ailes postérieures en petites masses : DIPTÈRES
Mouche
Tipule "cousin"
Ailes antérieures durcies ("étui") + ailes postérieures cachées ou réduites. Voir #
2 paires d'ailes (dont une pouvant être cachée
4 grandes ailes recouvertes d'écailles colorées : LÉPIDOPTÈRES
Papillon diurne
Papillon nocturne
4 ailes souples membraneuses
Ailes très longues et toutes de même taille, corps très allongé : NÉVROPTÈRES
Fourmilion
Ailes postérieures plus courtes...
"Taille" fine entre le thorax et l'abdomen : HYMÉNOPTÈRES
Fourmi
Guêpe
Ammophile
Pas de "taille" : HOMOPTÈRES
Cigale
Divisions de l'abdomen (3ème et dernière partie du corps, après la tête et le thorax) en partie visibles : DERMAPTÈRES, HÉMIPTÈRES, COLÉOPTÈRES
Forficule "perce-oreille"
Gendarme
Staphylin
Nécrophore
Ailes antérieures + ou - rigides, au moins sur une partie
Abdomen entièrement caché
Ailes antérieures durcies seulement en partie (il reste une partie souple, au moins à l'extrémité) : HÉMIPTÈRES, BLATTOPTÈRES
Ailes antérieures entièrement durcies : COLÉOPTÈRES
Petite staphylin
Carabe
"Bousier" Géotrupe
Hanneton
Longicorne
Taupin
Cétoine
Cicindèle
Charançon
Chrysomèle

Citations:

http://www.agr.gc.ca/fra/science-et-innovation/pratiques-agricoles/sol-et-terre/le-sol-et-l-eau/texture-du-sol-et-qualite-de-l-eau/?id=1197483793077

Chart for the average temperature for different vine varieties:

https://chaireunesco-vinetculture.u-bourgogne.fr/colloques/actes_clima/Actes/Article_Pdf/Jones.pdf

Climatic table:

https://fr.climate-data.org/location/8368/