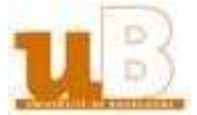




**BIOGÉOSCIENCES**  
unité mixte de recherche CNRS / uB 6282



# PINOT NOIR : IS IT HOME SWEET HOME?

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Institut Jules Guyot – Climate Research Center

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# University Institute of Vine and Wine

*Institut Jules Guyot*



**Founded in 1992**

**1<sup>st</sup> university term in 1994**





Institut Jules Guyot  
**2 SITES**

Director : Dr Michèle Guilloux-Benatier



**University campus**



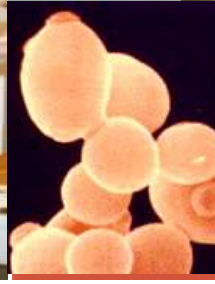
**Marsannay la Côte**

**Experimental center**

**2.4 Ha for production**

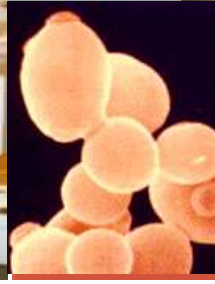
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## Teaching missions

- ◇ **269 students in 2013-14**
- ◇ **26 permanent people**
  - **14 academics**
  - **11 technicians**
- ◇ **40 partners of the wine and vine area**
- ◇ **150 partner companies**



## Education

◇ **University degrees**

**BSc (2) , Master (2), Enologist graduate**

◇ **Continuing education**

**4 degrees**





## Research areas

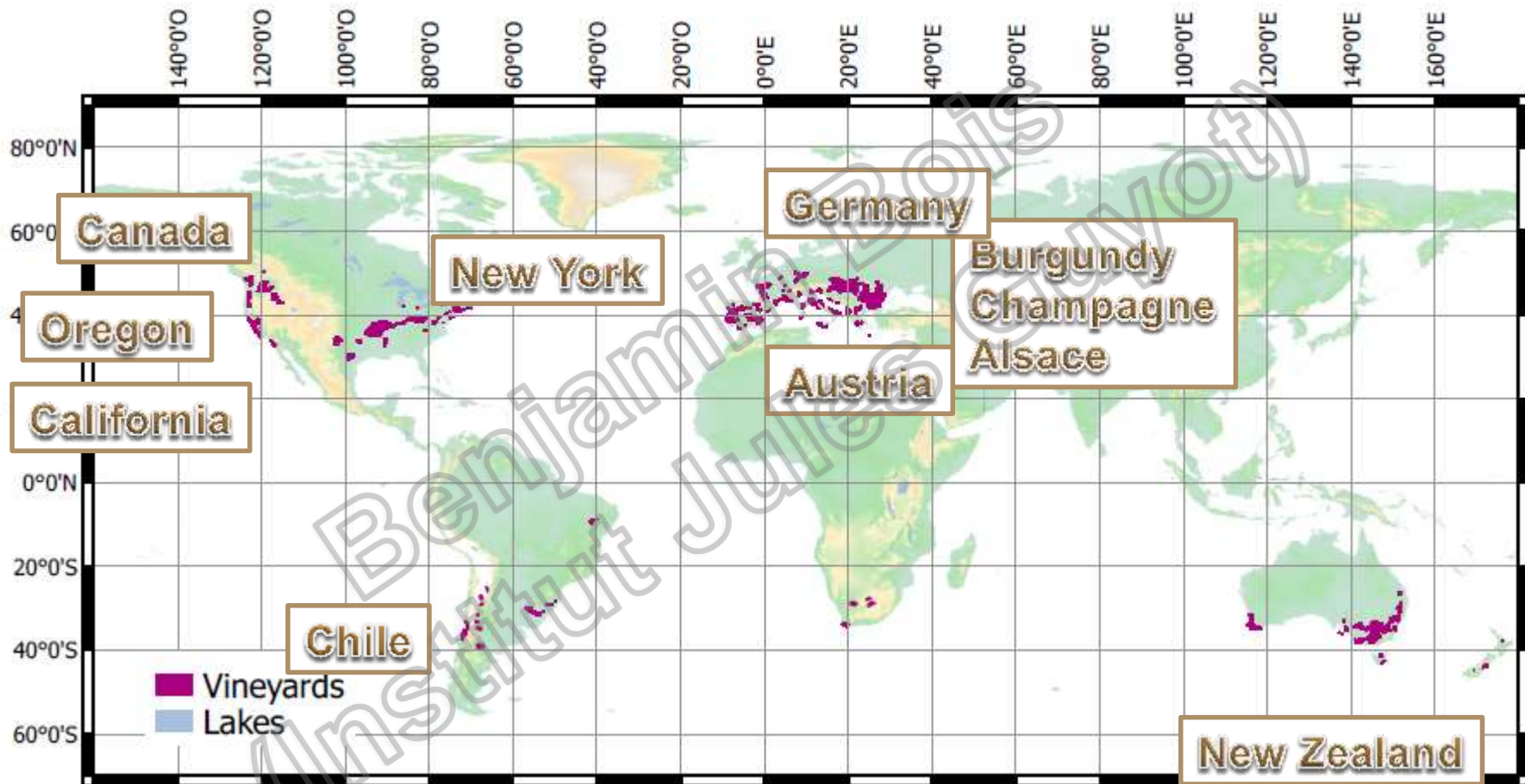
### o Vine science

- Vine natural defenses
- Climate viticulture relationships

### o Wine science

- Microbiology
- Physical chemistry
- Sensory analysis

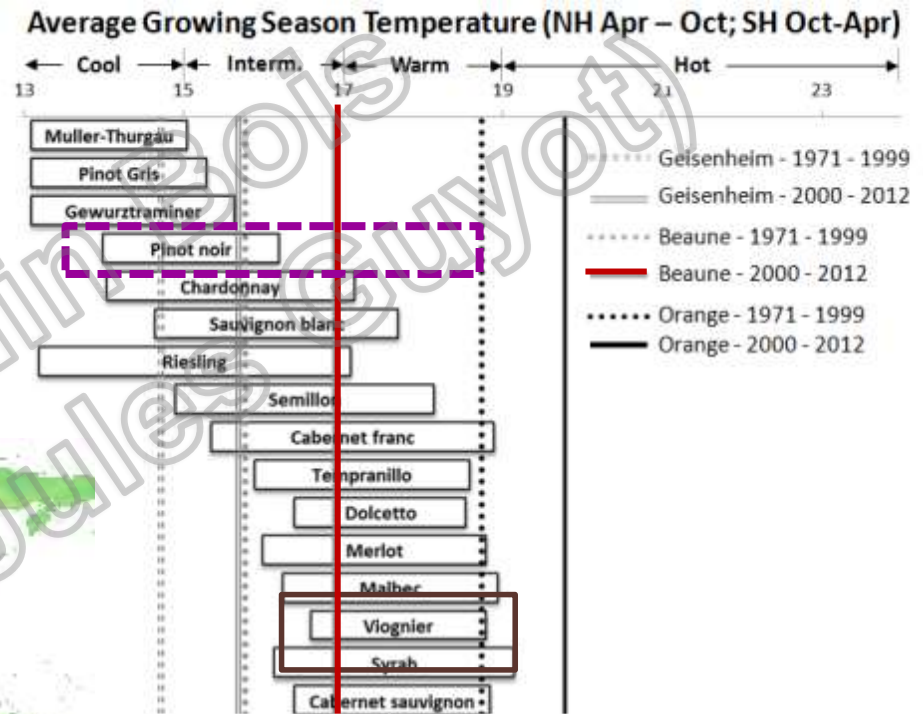
# Pinot noir in the world



....and others!

# Climate conditions worldwide

- From 14 to 18.5°C during the growing season (Apr. to Oct)



| °C | °F   |
|----|------|
| 15 | 59   |
| 17 | 62.6 |
| 19 | 66.2 |

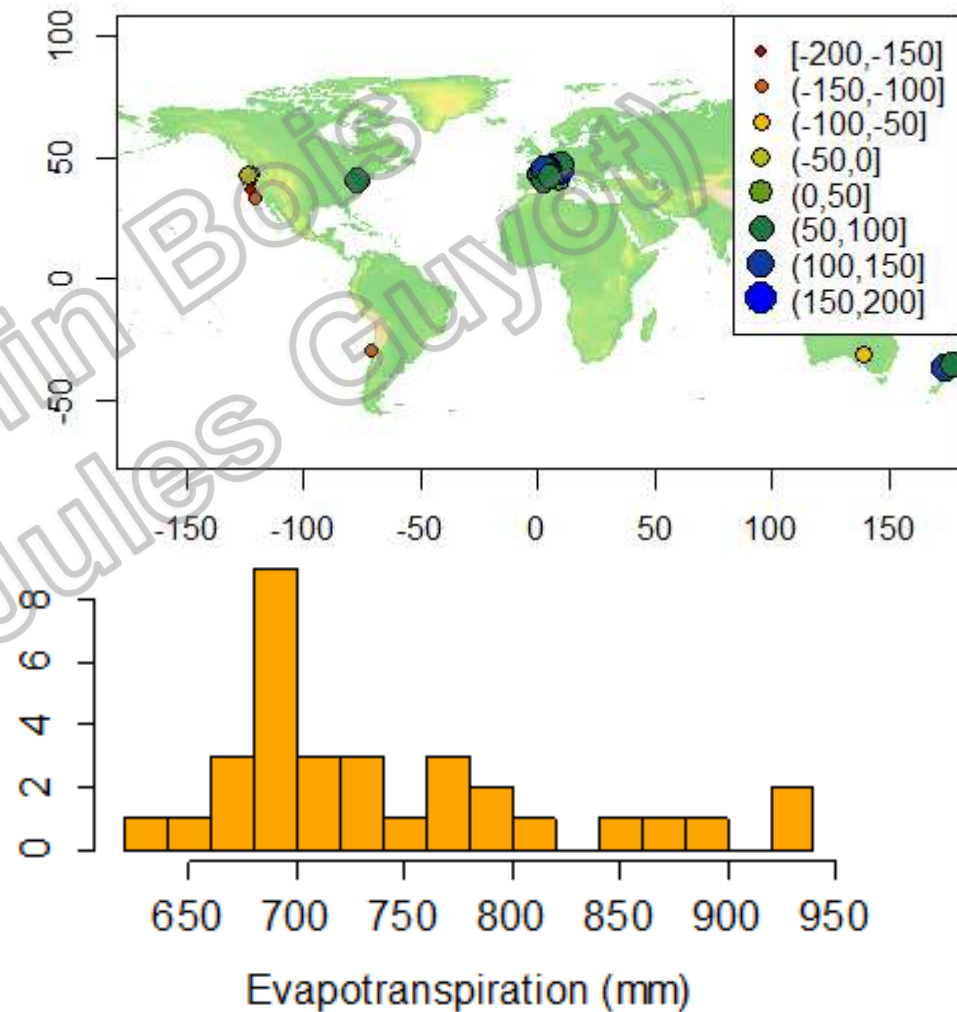
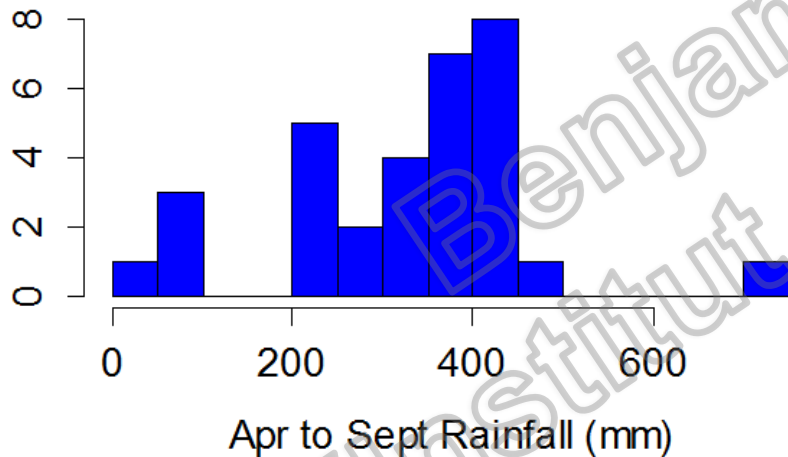
|             |    |
|-------------|----|
| Australia   | 1  |
| Chile       | 1  |
| France      | 17 |
| Germany     | 2  |
| New Zealand | 2  |
| Switzerland | 2  |
| USA         | 6  |



# Climate conditions worldwide

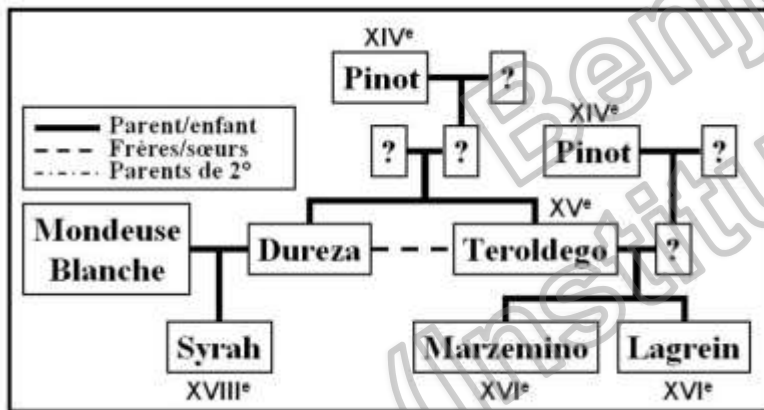
Dryness index

- Whole range of hydric status conditions...



# Pinot history, genealogy and genetics

- Origins : North-East of France Cultivated at least during the 14<sup>th</sup> century in Burgundy (Charles VI banning the Gamay southwards for Pinot N)
- No Pinot parent was ever found
- Known for a large genetic diversity
- Some varieties are mutants of Pinot
  - Rosé or Red : Pinot gris (or Beurot), Pinot meunier...



Vouillemoz et al (2007)

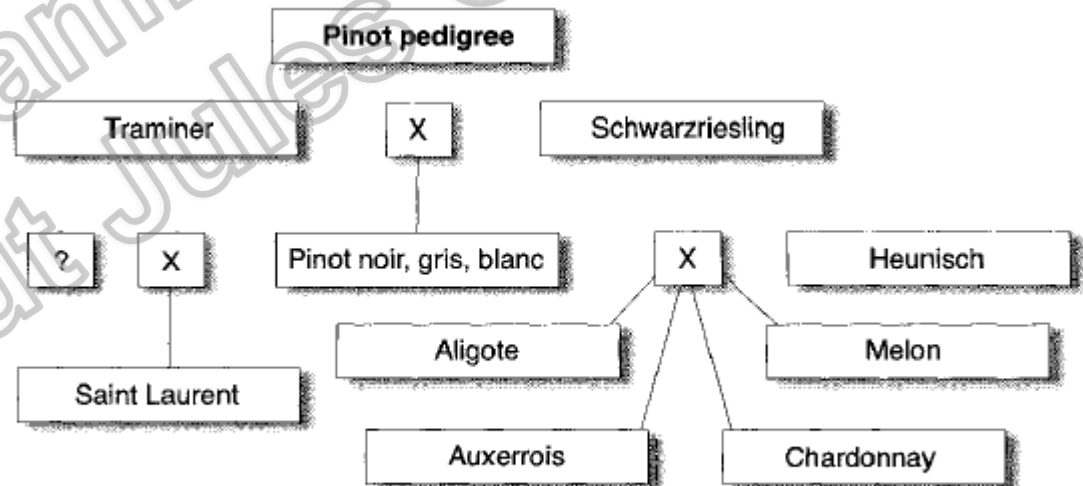
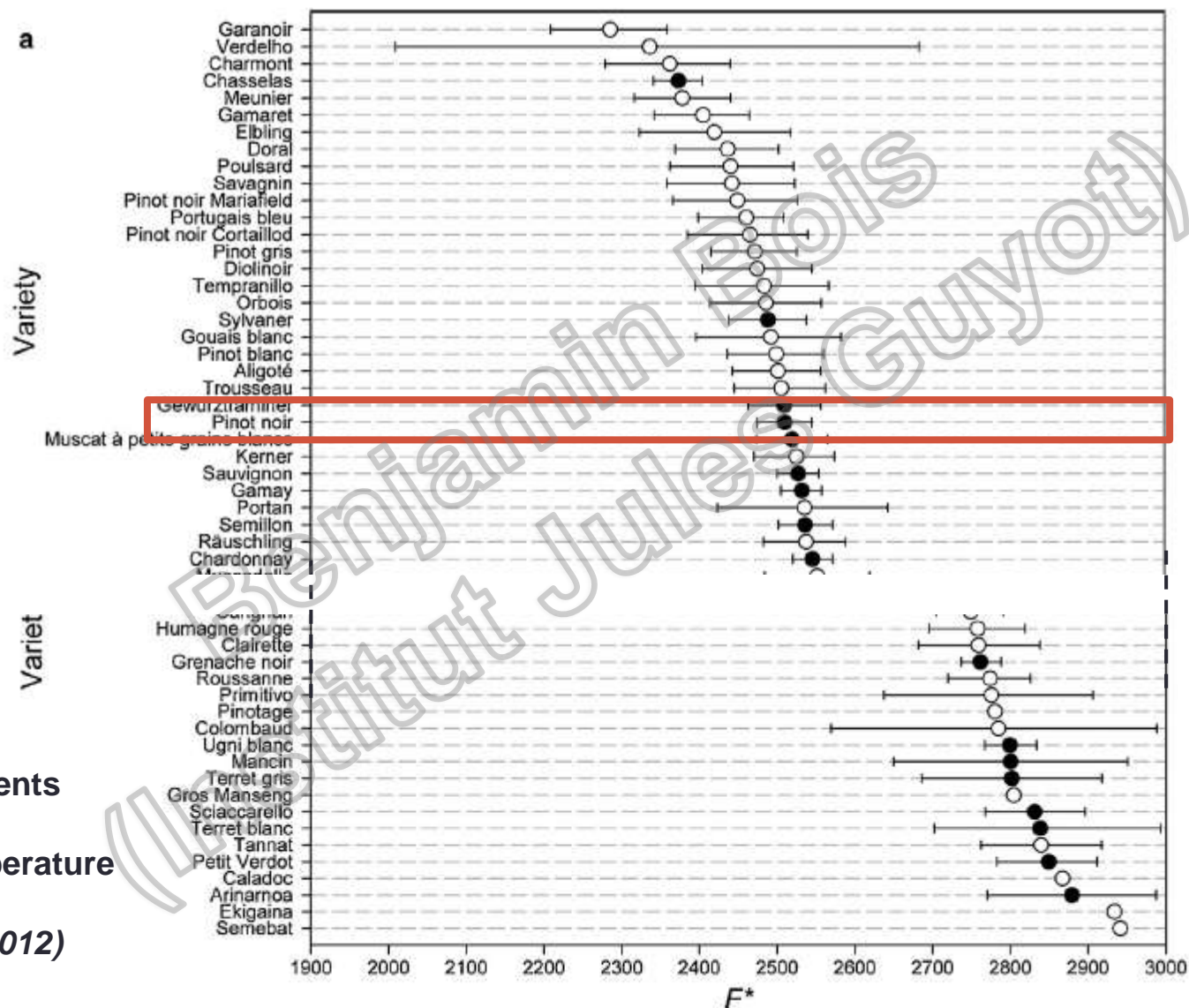


Fig. 2. Proposal for the pedigree of the Pinots and some related cultivars.

# Ecophysiology and agronomy

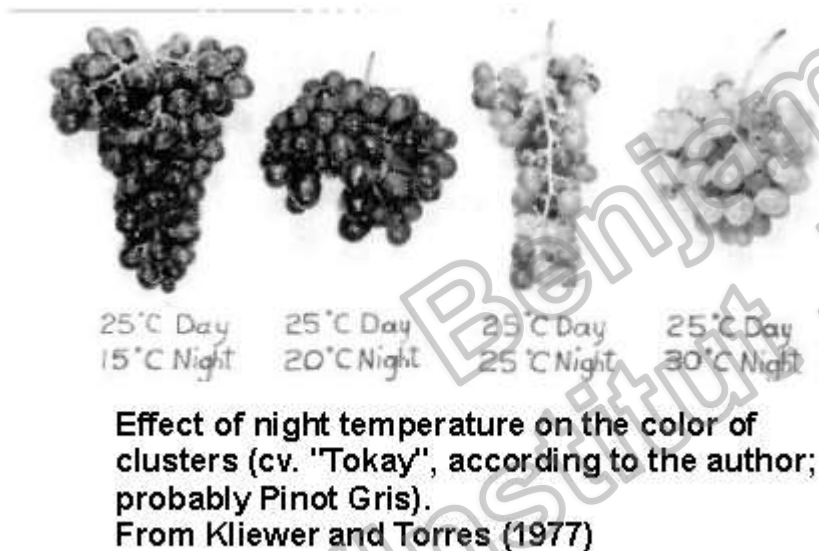
- Pinot N is early
- Climate: high temperature → risks of over ripening, lower anthocyanin, wines too « soft ».
- As many red cultivar → moderate hydric deficit leads to higher brix, more anthocyanins and less acids in grapes (e.g. Spring, 2010)
- Sensitivity to leaf/fruit ratio?
  - Burgundy → AOC grand Cru : less than 45 hL/ha i.e. 6 tons / ha for 1.5 of exposed leaf area → 2.5 m<sup>2</sup> leaf / kg.

# Phenology

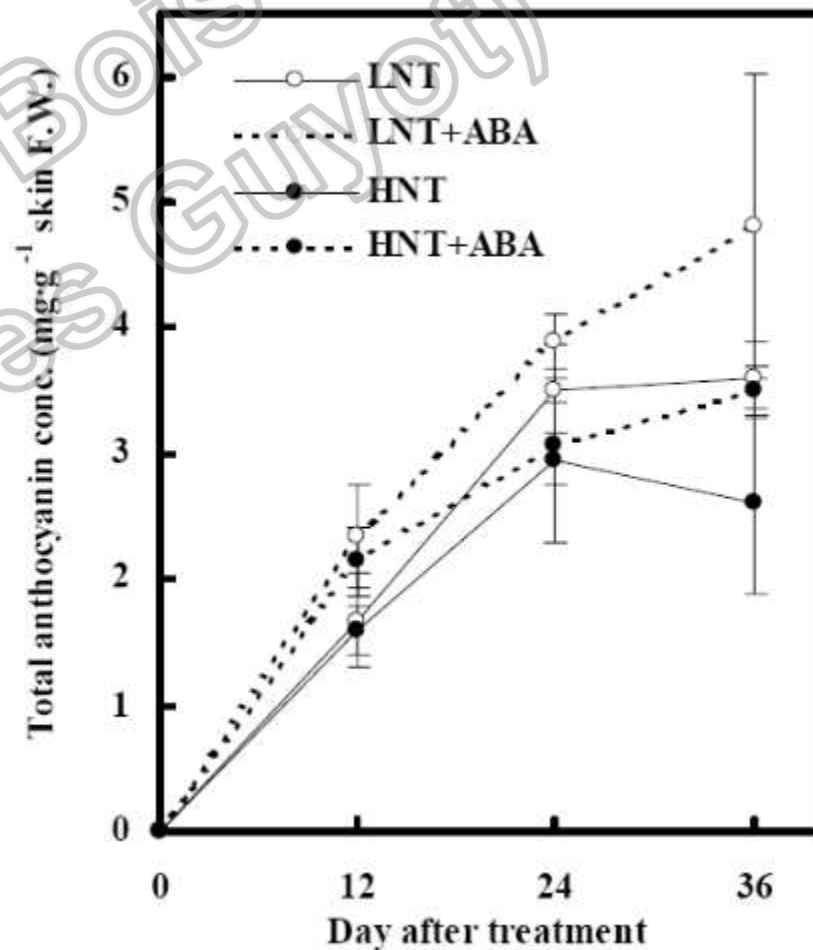


# Climate

- Sensitivity to high temperatures

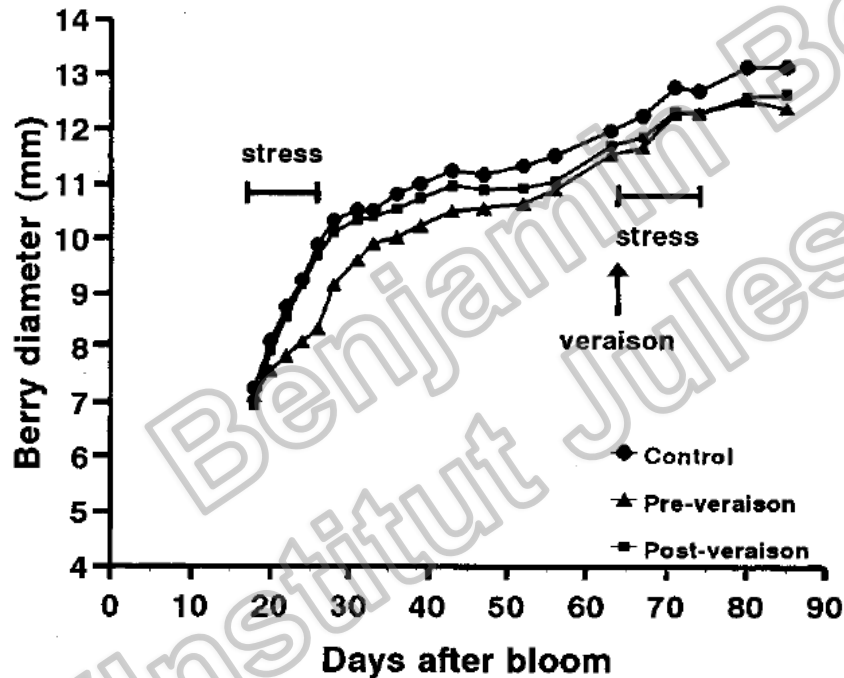


*Pinot noir*, Mori et al. (2005)



# Water status

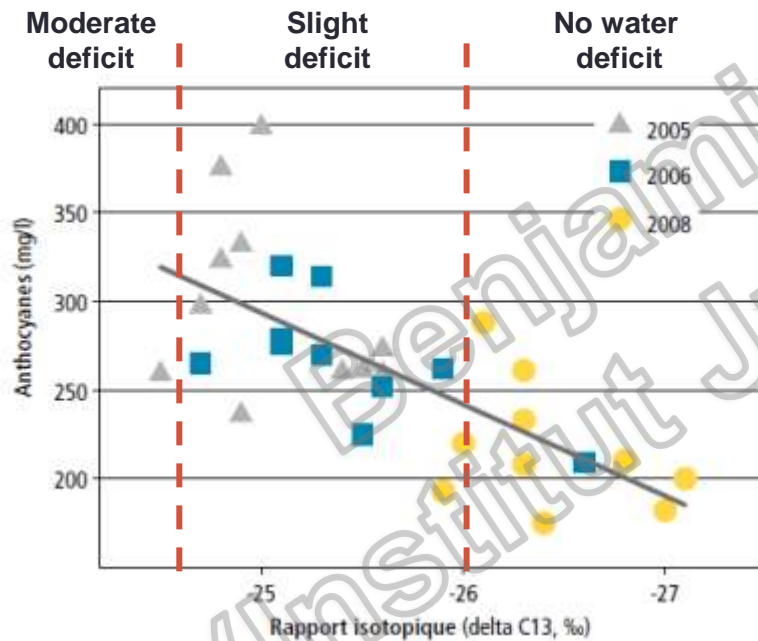
- Water status and grape quality



*Pinot noir in Valais, Switzerland*  
Zufferey et al. (2000)

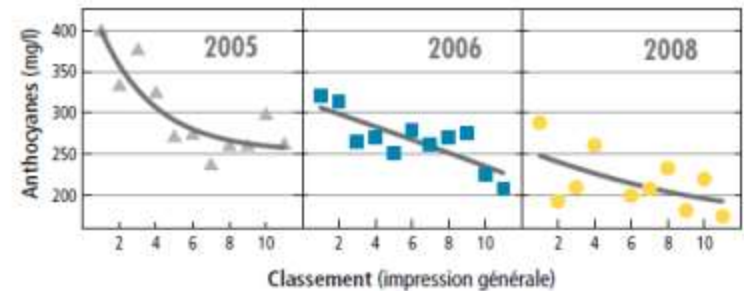
# Water status

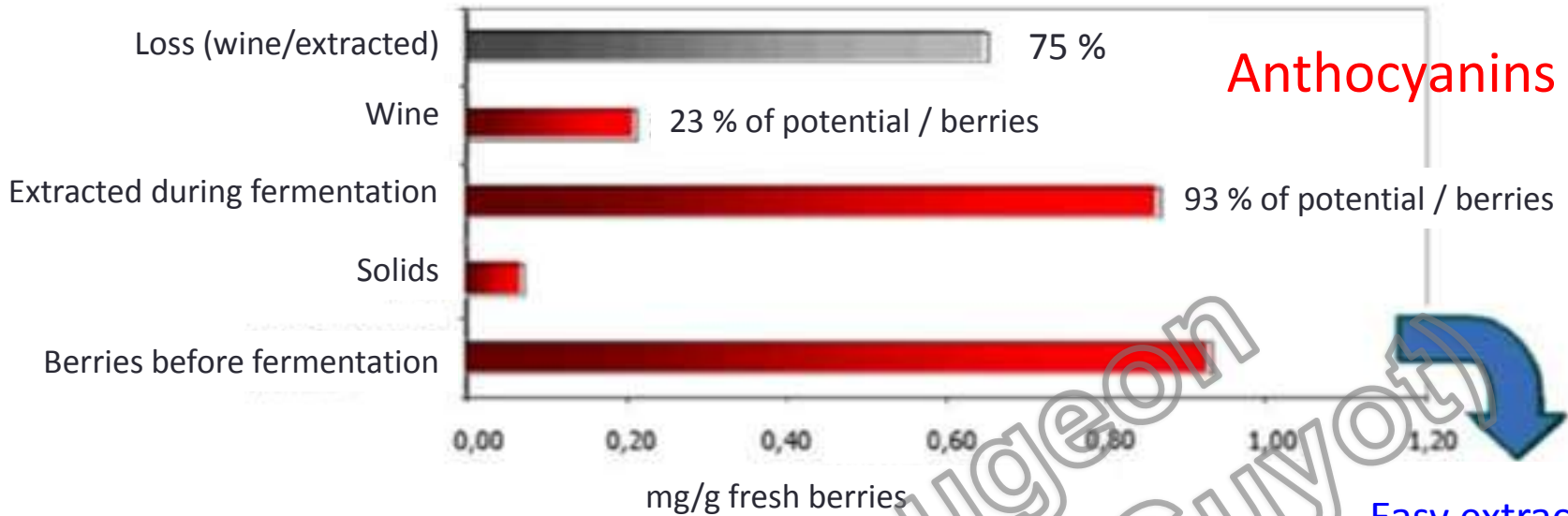
- Water status and grape quality



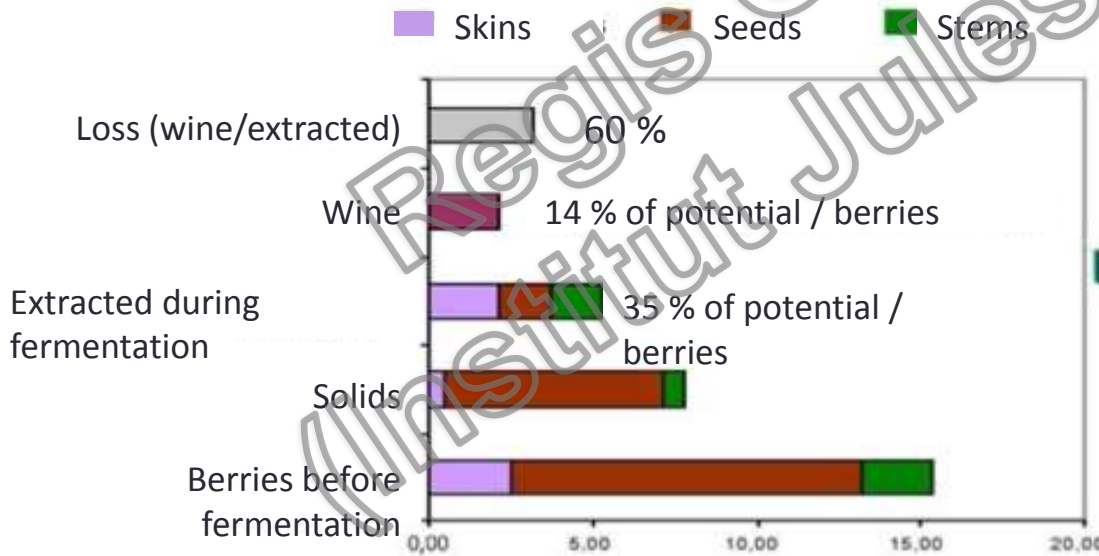
*Pinot noir in Valais, Switzerland*  
Zufferey et al. (2000)

## Ratings





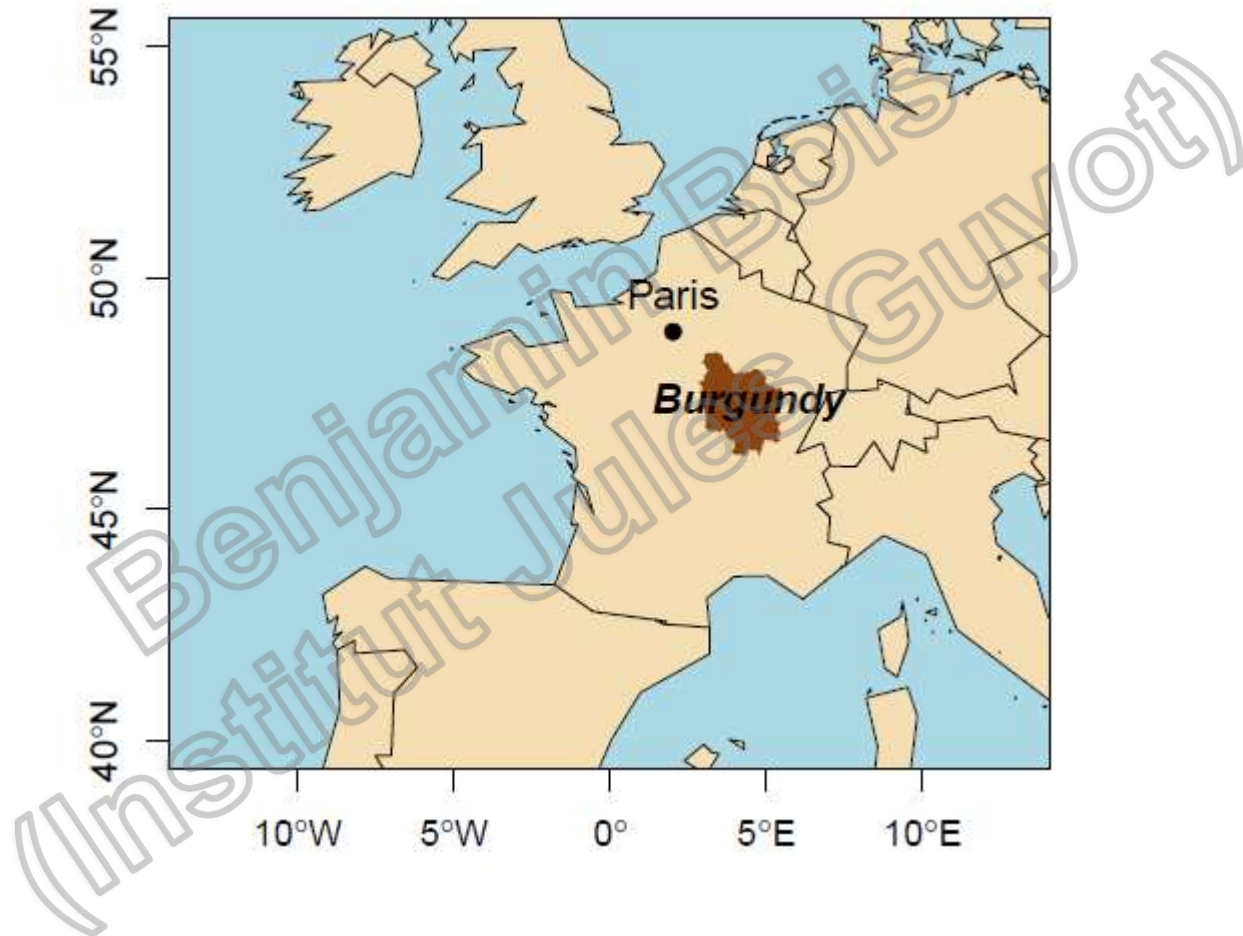
Easy extraction  
Important loss



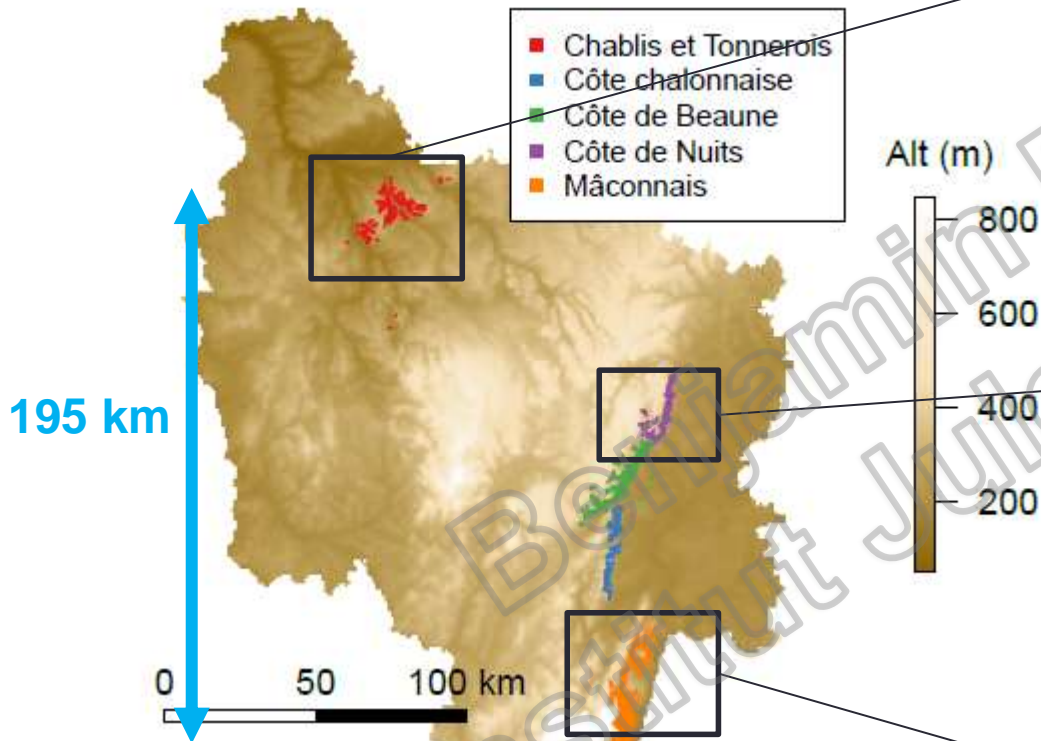
Difficult extraction  
Inferior loss



# Pinot from Bourgogne (Burgundy)



# The terroirs of Burgundy



**230 to 470 m asl (mostly around 280 m)**

# Burgundy: some figures



27 966 ha (3 % of french vineyards)

Whites: 15 706 ha

Reds: 10 412 ha

Sparkling: 1 848 ha

185,7 millions of bottles

Whites: 60 %

Reds: 32%



100 "Appellations d'Origine Contrôlées" (477 in France)

684 "climats" (premiers crus including 33 grands crus)

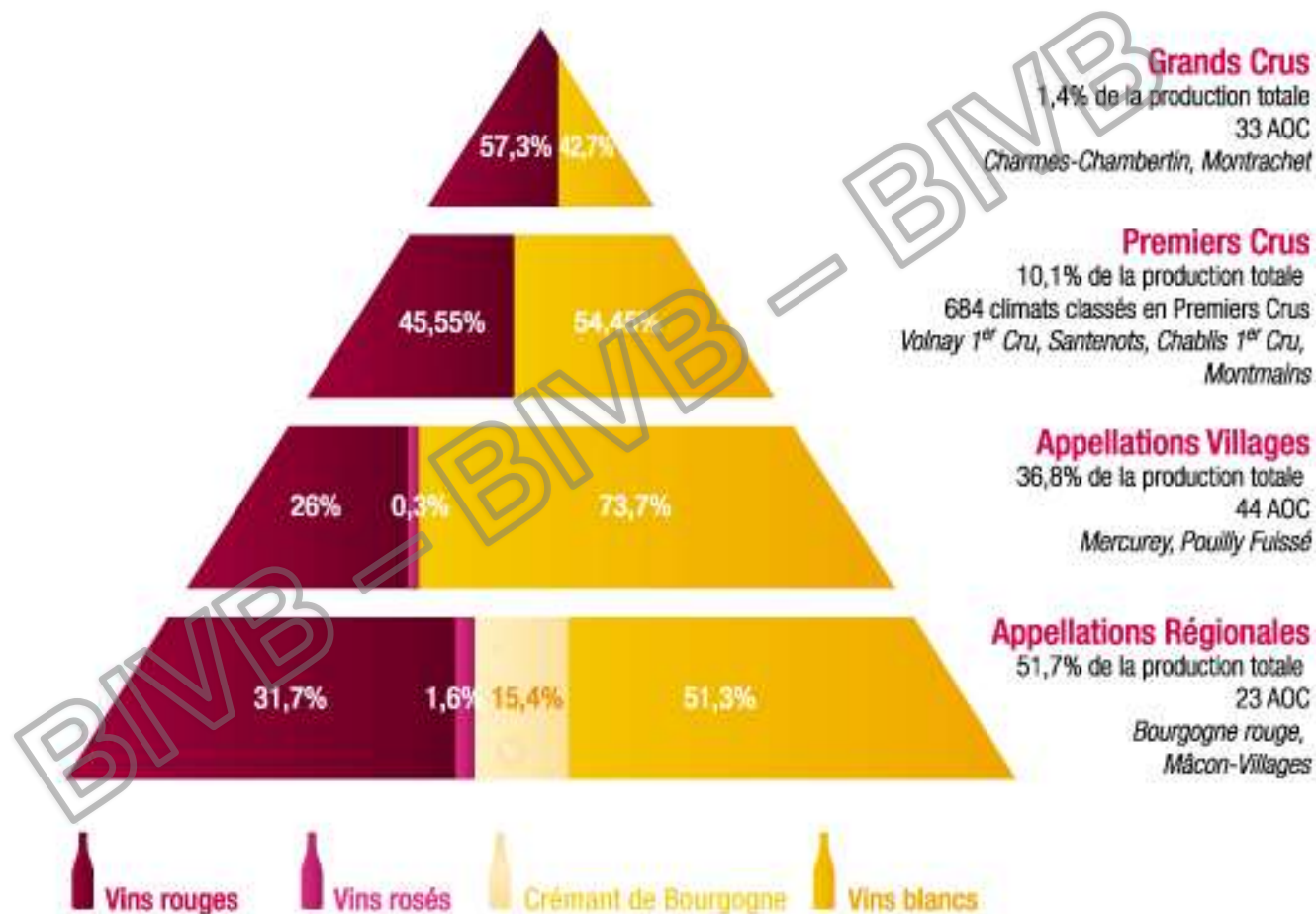
3800 wineries ("domaines viticoles")

250 trading wineries ("négoce")

23 shared wineries ("caves cooperatives")

"Grands crus" appellations : 550 ha (194 ha white – 356 ha red)

# Hierarchical production system



# The "Côte d'Or"

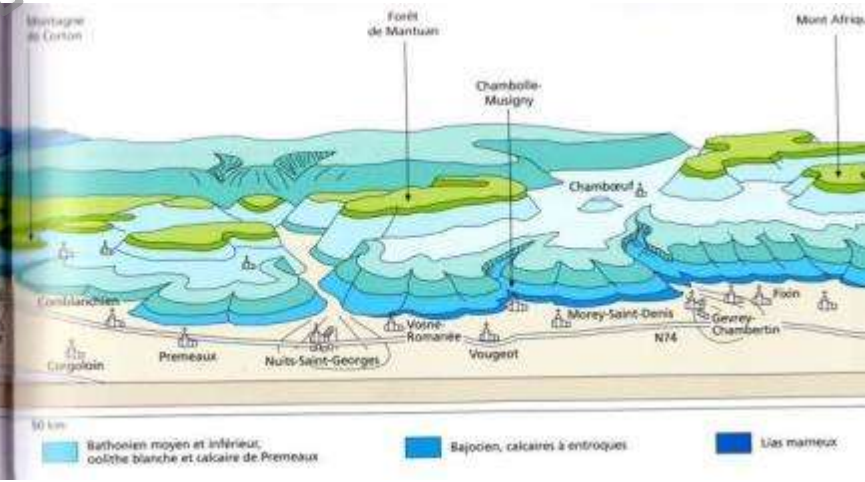
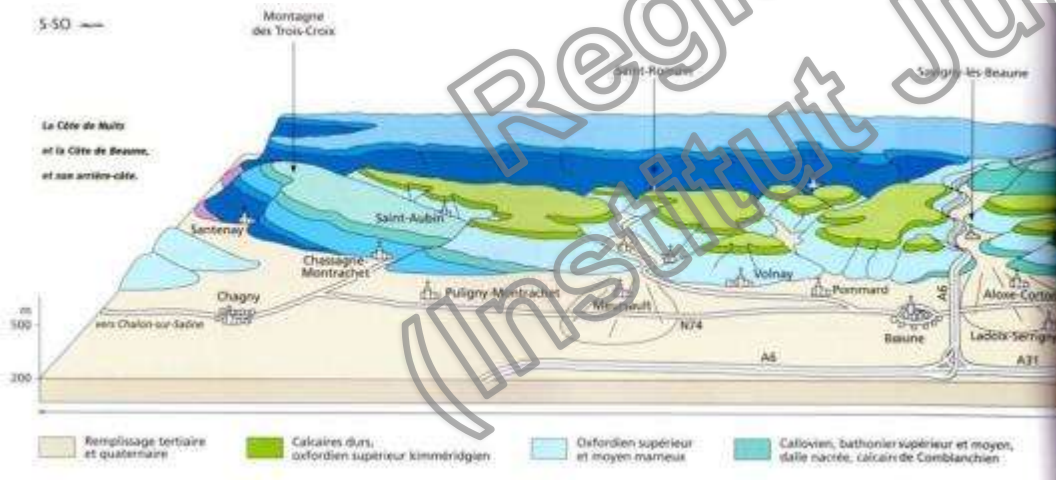
3 775 ha  
89 % Pinot noir  
11 % Chardonnay

60 km



6 013 ha  
57 % Pinot noir  
43 %  
Chardonnay

# The "Côte d'Or": slopes...



Source: *Les terroirs du Vin*, Jacques Fanet

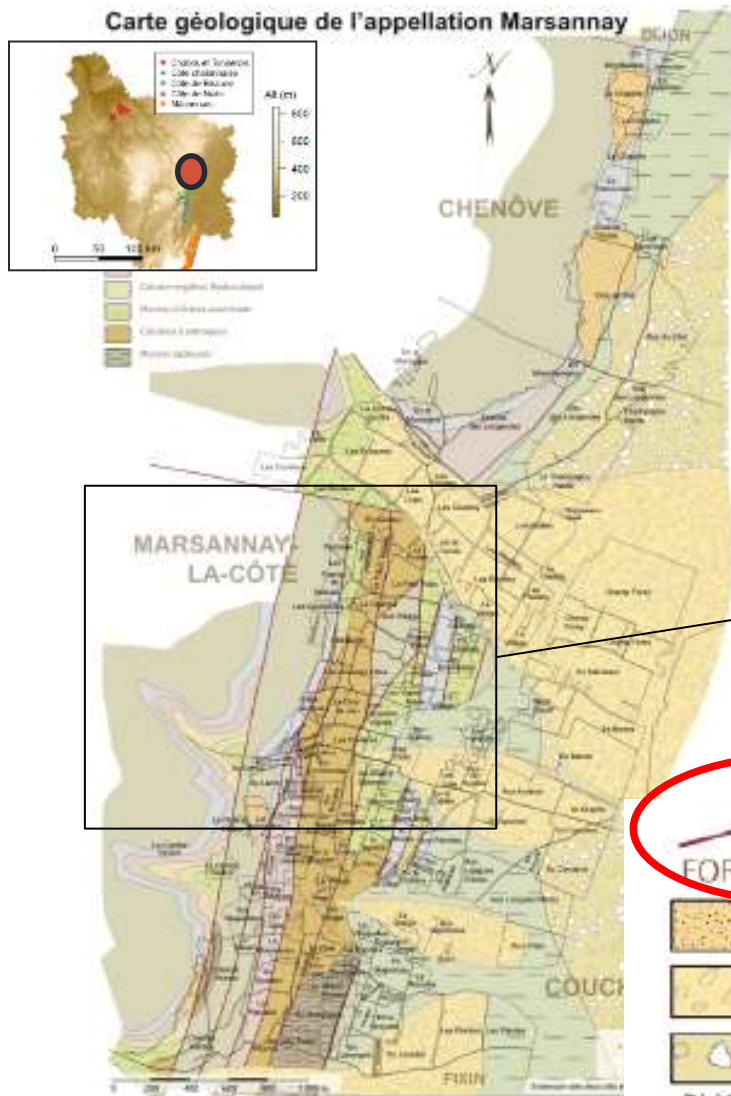
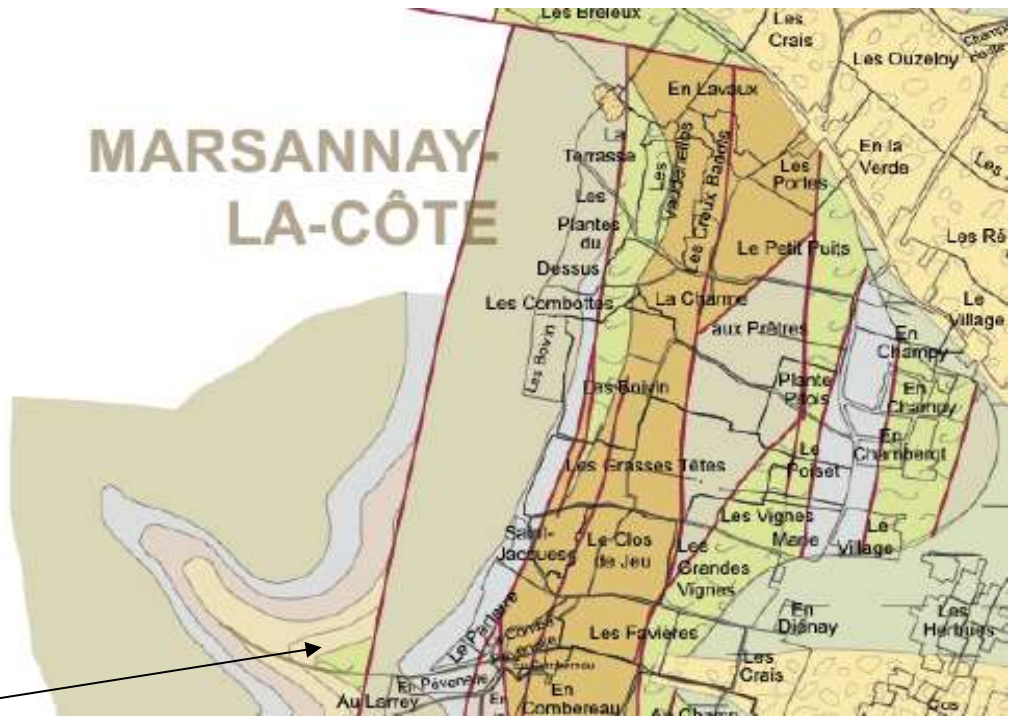


Figure 2. Carte géologique de l'appellation Marsannay.



**Faults**

- FORMATIONS SUPERFICIELLES**
- Ebois : Grès lités
  - Alluvions : Cailloutis de cône
  - Alluvions : Cailloutis supérieur de l'Ouche
- PLIOCENE**
- Marnes de Bresse

- JURASSIQUE**
- Calcaires de Dijon-Corton
  - Calcaires de Comblanchien
  - Oolithe Blanche
  - Calcaires de Prémieux
  - Calcaire argileux (hydraulique)
  - Marnes à *Ostrea acuminata*
  - Calcaires à entroques
  - Marnes sableuses

# The hierarchy of terroirs

Grands Crus

Romanée-Conti

1ers Crus

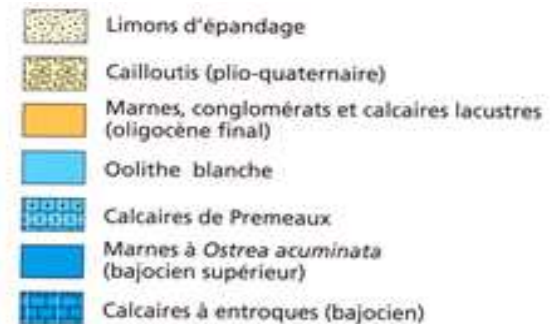
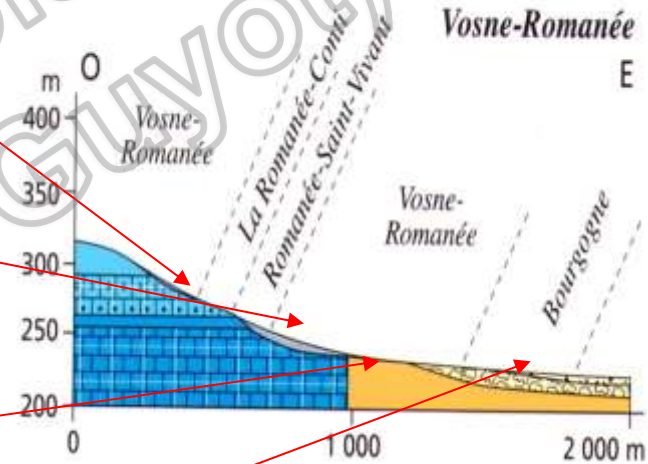
Vosne-Romanée  
1er cru les Chaumes

Communale

Vosne-Romanée

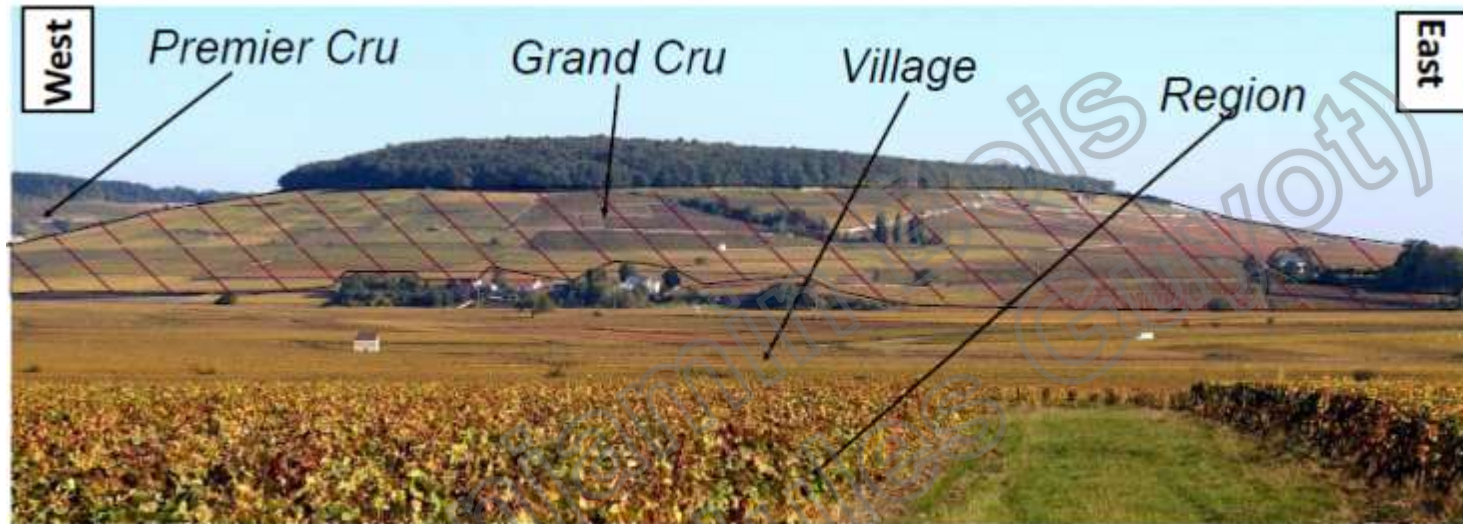
Régionale

Bourgogne Grand Ordinaire

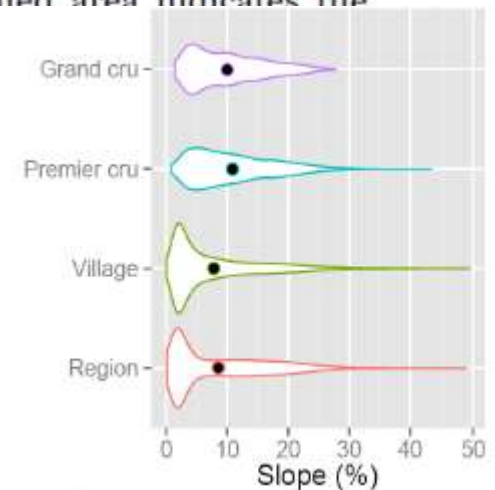
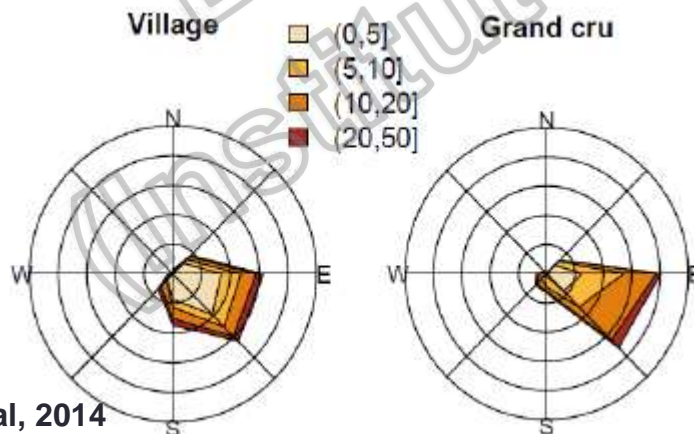




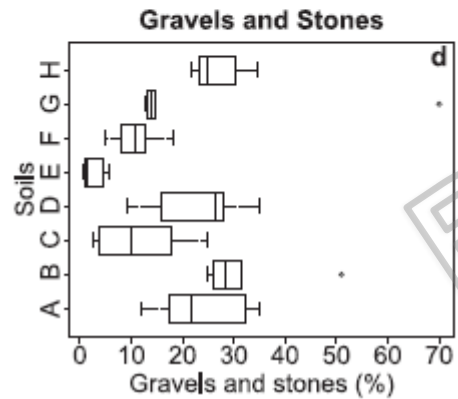
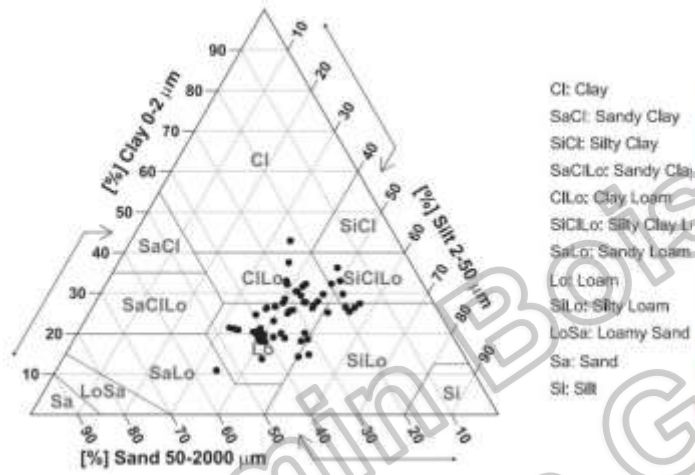
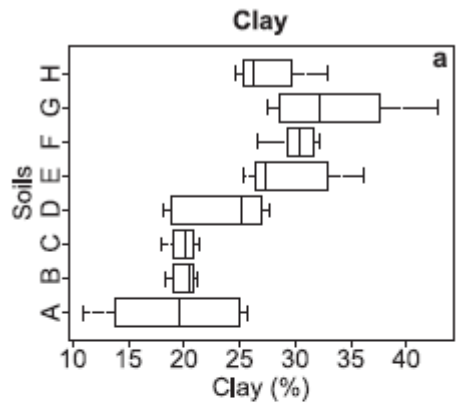
# The hierarchy of terroirs



Hierarchical levels around the hill of Corton. The dashed area indicates the Grand Cru vineyards (credits : E. Vincent).



# Soils



SWC from 40 to 180 mm

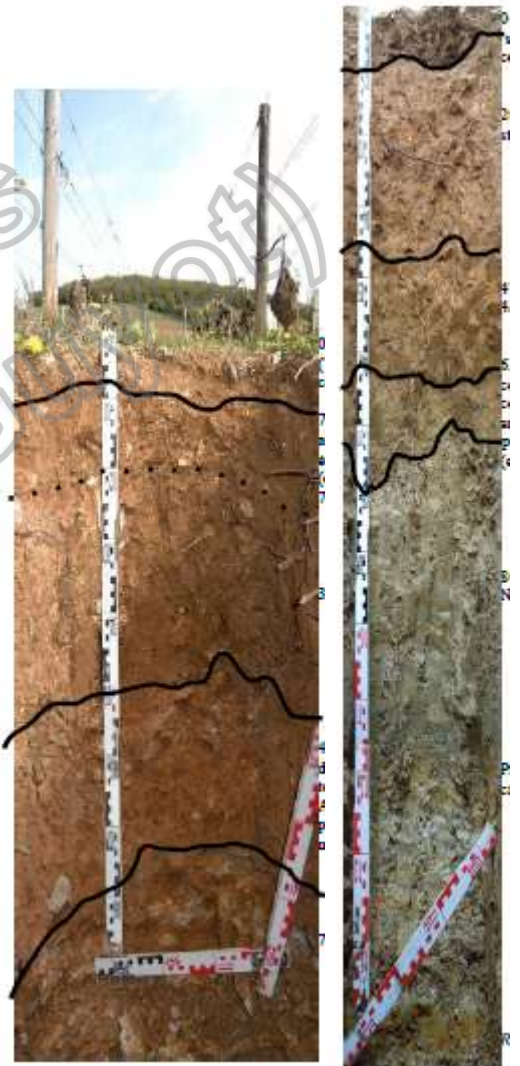


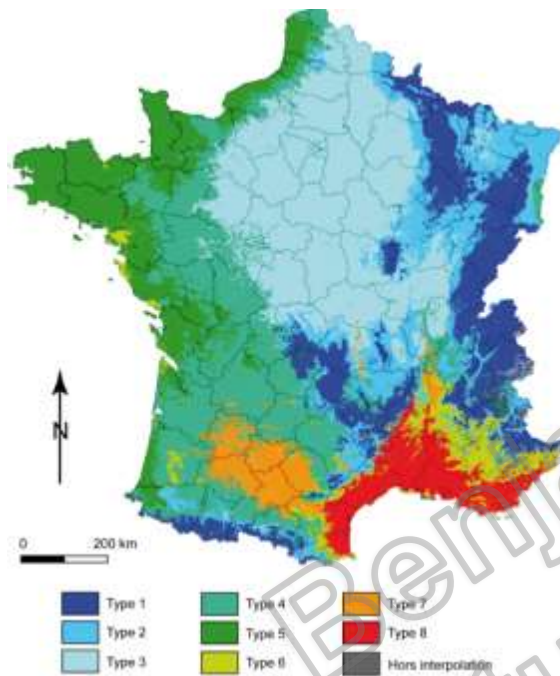
Figure 7. Profil pédologique de la parcelle Ycl P1 (Chacabé) (standard trois collonnes)

A « rendzine » soil

A « limestone » soil

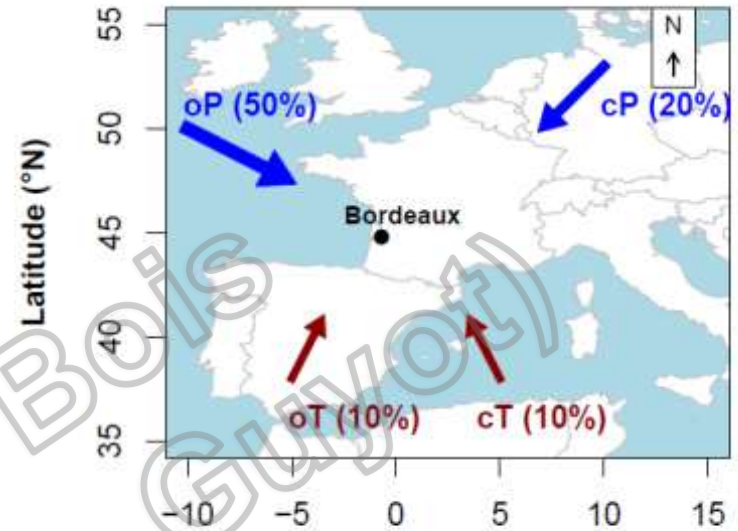
A marl soil

# Climate

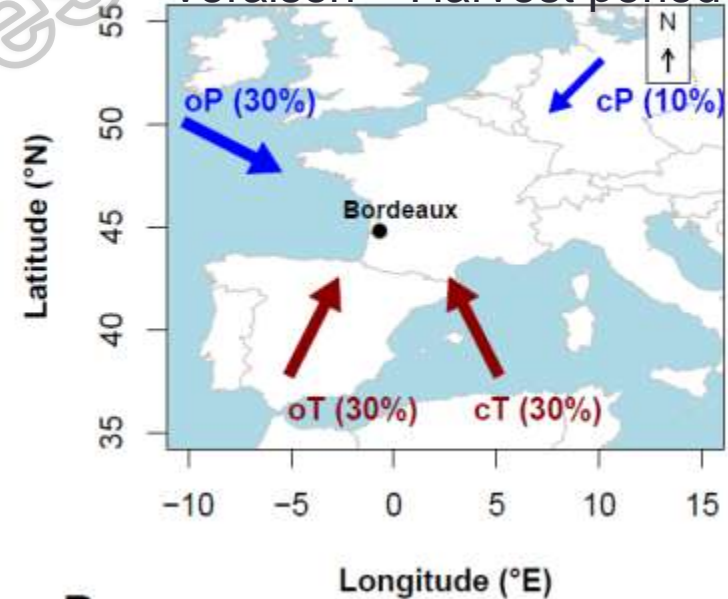


Climate classified as *fading oceanic climate* by Joly et al (2010) or sub-humid cool climate with very cool nights (Tonietto, 1999 ; r Jones et al, 2009)

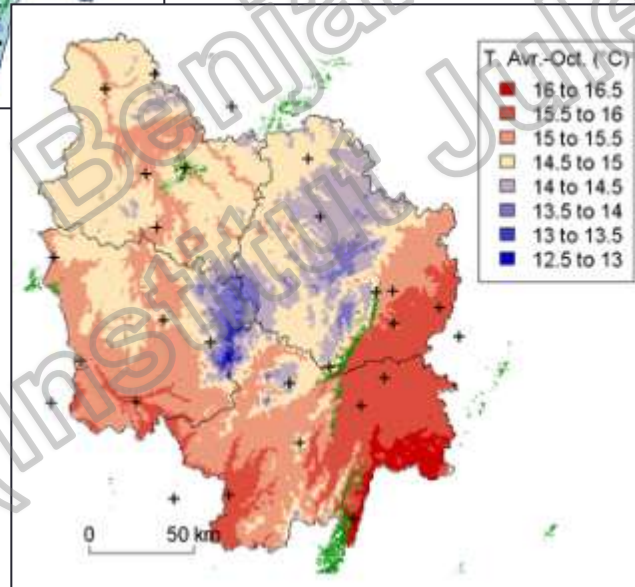
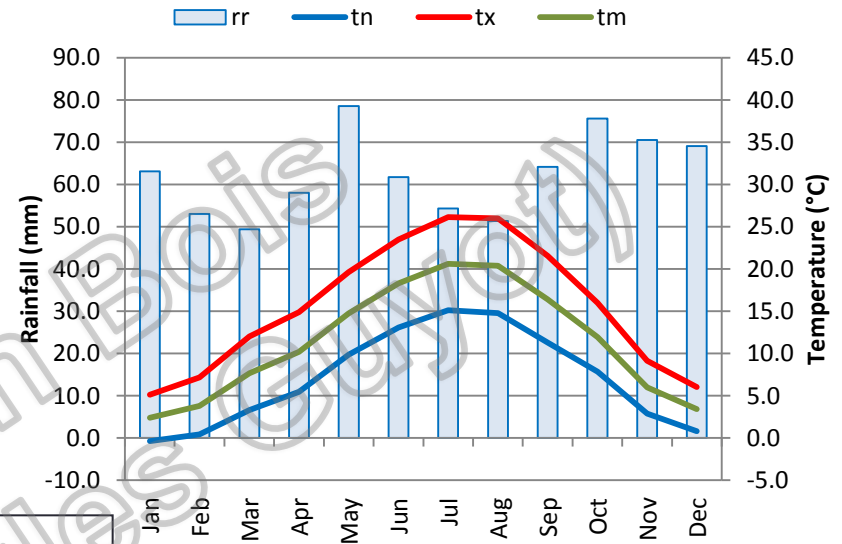
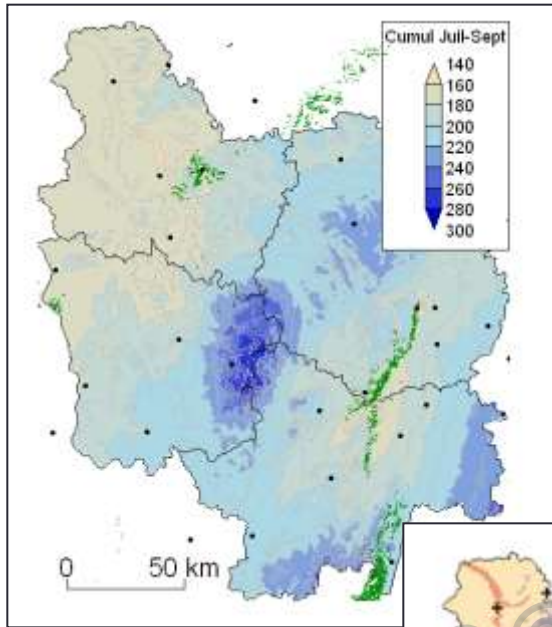
Winter



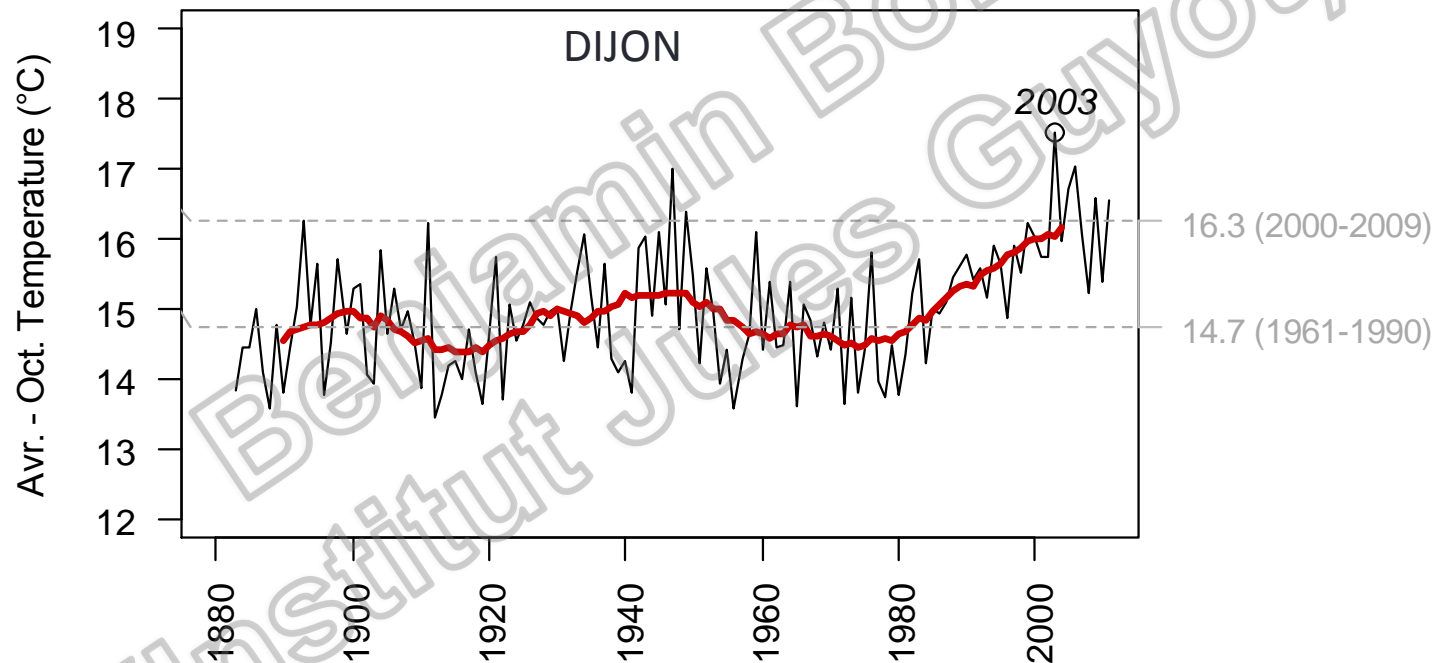
Veraison – Harvest period



# Climate

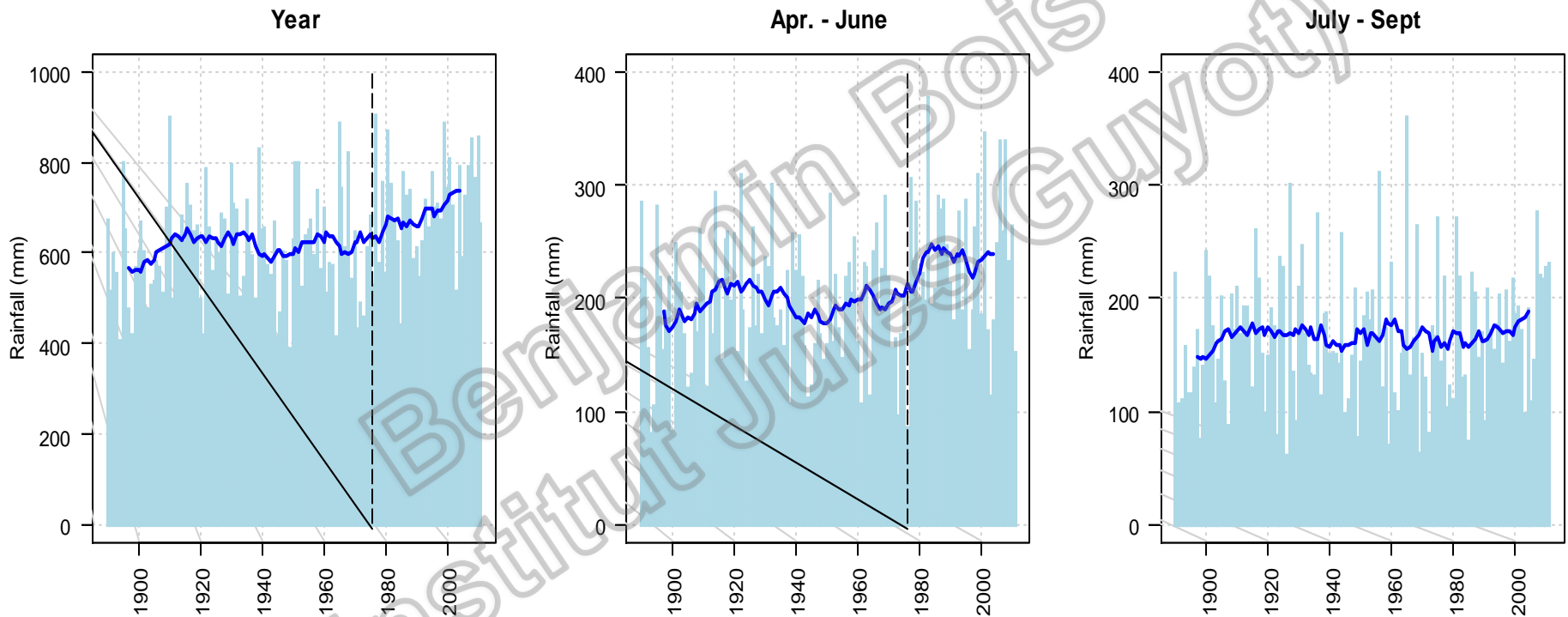


# Recent climate change in Burgundy



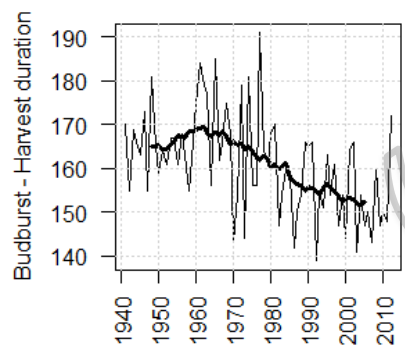
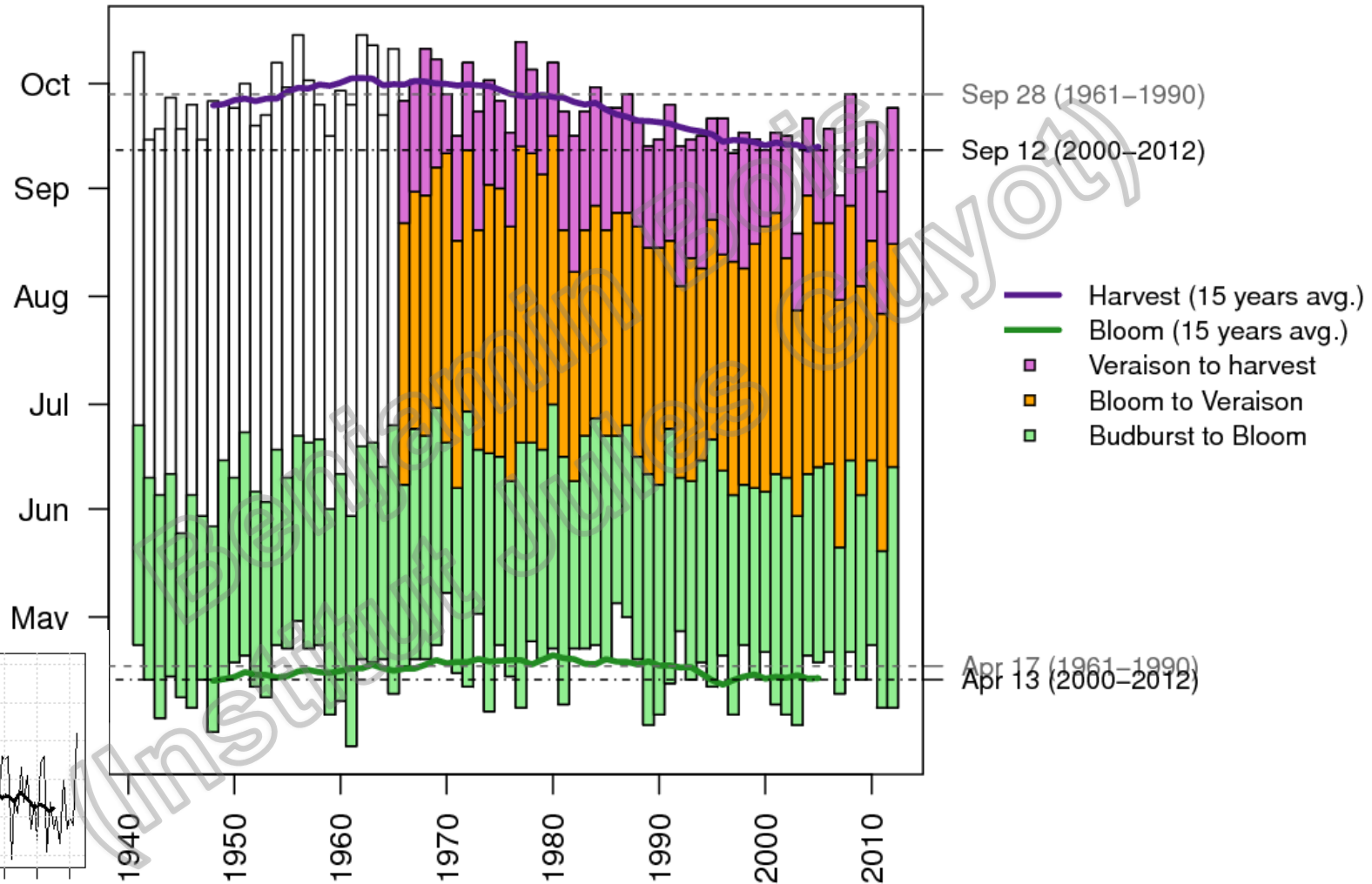
# Recent climate change in Burgundy

## DIJON



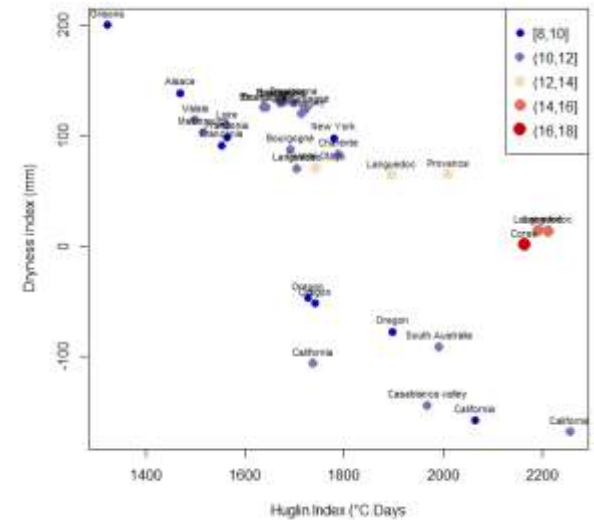
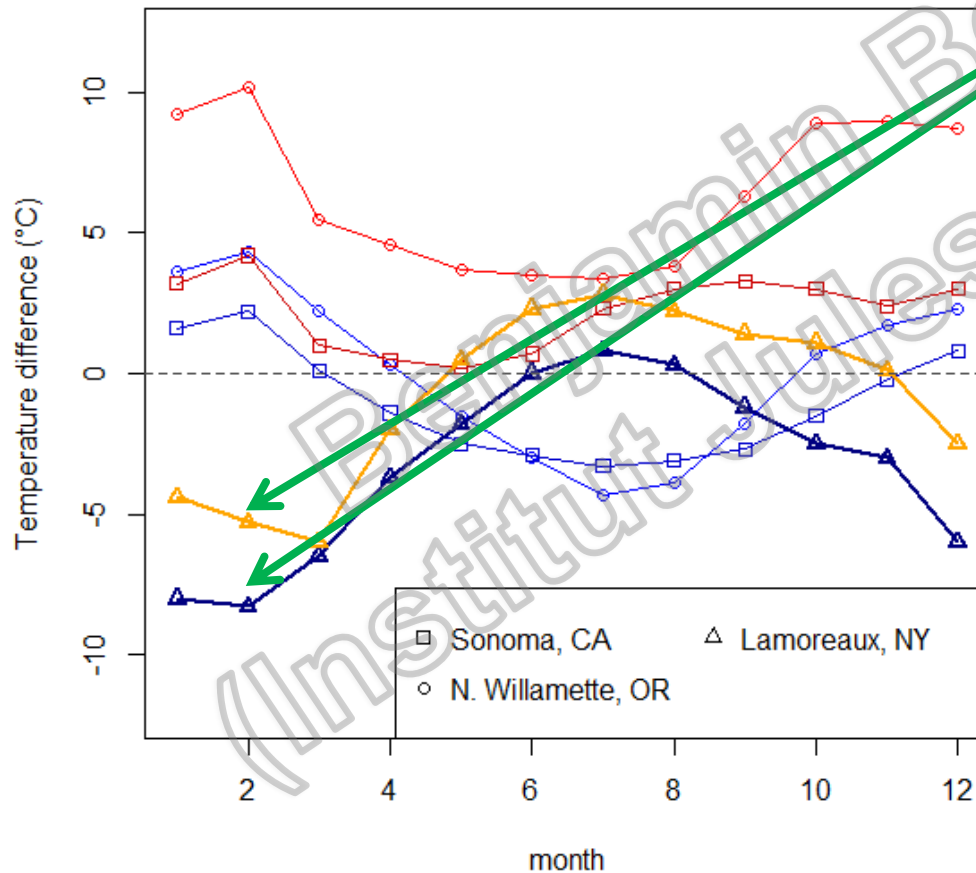
Source : Météo-France (Homogenized data)

# Recent climate change in Burgundy



Phenology from Savigny-lès-Beaune and Aloxe Corton

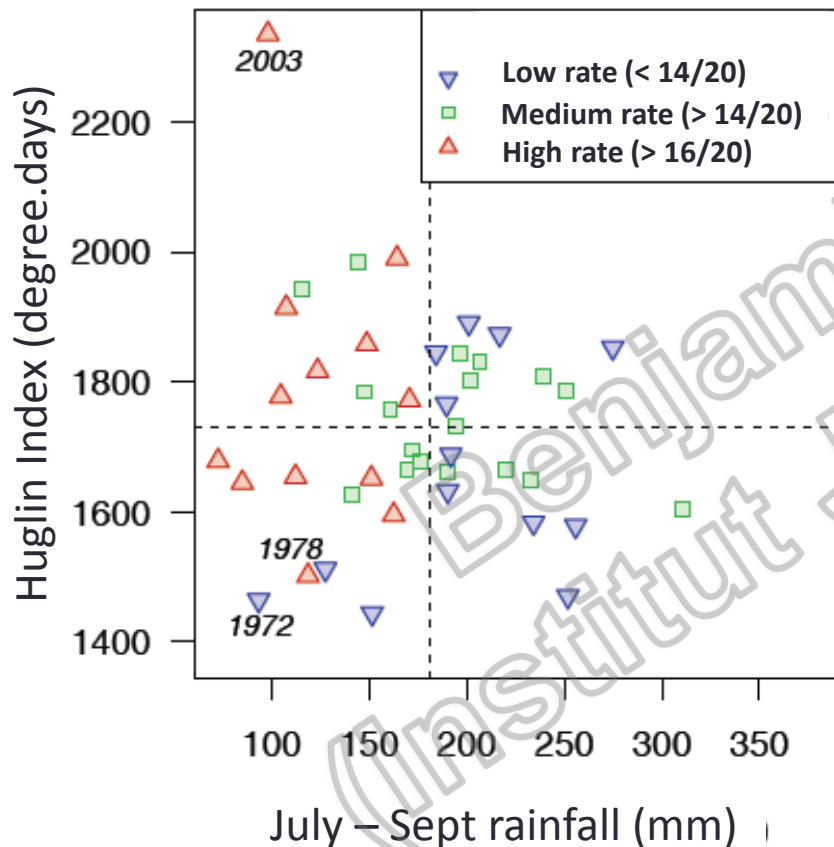
# Comparing with other regions



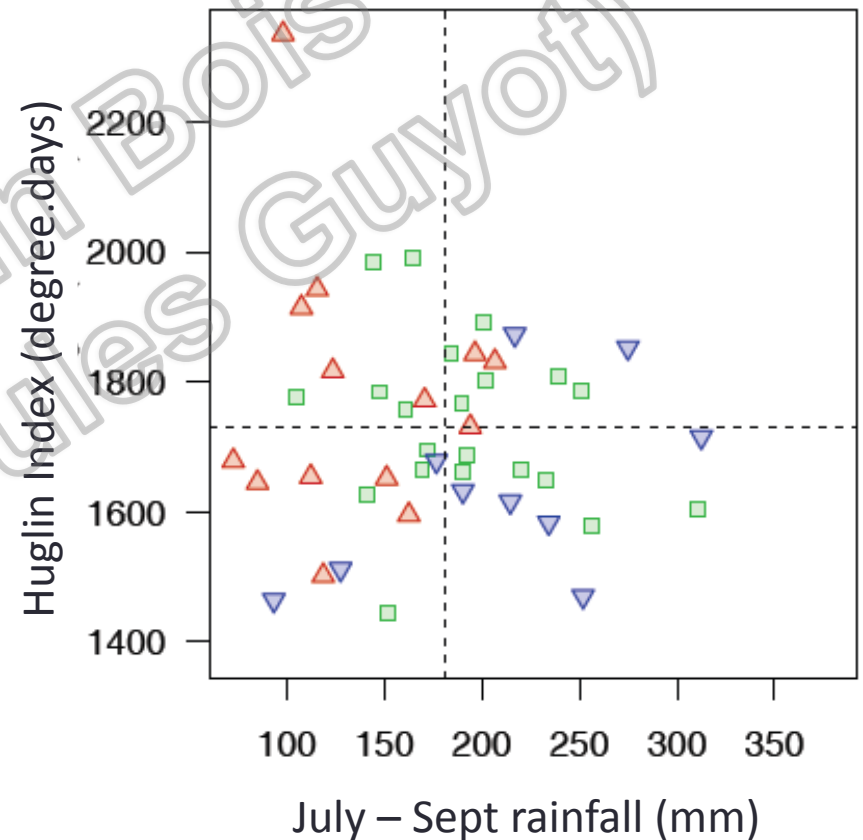


# A good vintage in Burgundy?

Red wines (Bourgogne)

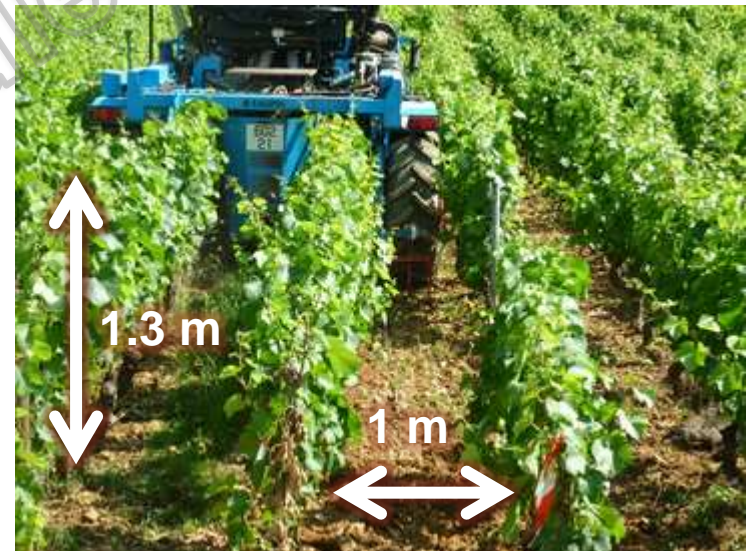


White wines (Bourgogne)



# In the vineyard

- High density
- Lots of soil tillage (5 times à year)..
- ...and thus lots of erosion



# In the vineyard

- VSP training system
- Guyot pruning (+ cordon, gobelet)
- Early shoot removal (4/5 unfolded leaves)
- Trimming when too high (10 to 30 cm over the row)
- Major diseases (from 6 to 12 spraying a year)
  - Mildews (dawnny and powdery)
  - Esca
- Hand picking mostly (sometimes mandatory)



# Winemaking

- In vat (20 % stems, no crushing)
- Prefermentation (4-5 days, 13-14 ° C)
- SO<sub>2</sub>
- Enzymes 2 g per 100 kg of harvest  
(function of phenolic maturity)
- Alcoholic Fermentation
  - Indigeneous yeasts
  - punching / pumping over
  - Temperature control (26-27 ° C) at the end
- Devatting after 17 to 20 days
- Sedimentation with pressed wine added
- Tasting
- Barrels
  - Turbidity
  - MLF, ageing on lees (% coarse/fine lees....)





**Thanks !**

Acknowledgements :

Regis Gougeon (Institut Jules Guyot)  
Michèle Guilloux-Bénatier (Institut Jules Guyot)  
Luca Brillante (Université de Bourgogne)  
Greg Jones (South Oregon University)  
Alain Carbonneau (Montpellier SupAgro)  
BIVB (funding)



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