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March 22 2019 Athens

SPRING OF
INNOVATION

2019

Promoting Innovations for quality and adaptation to climate change in the French wine industry

Jean-Marc Touzard, Director of Research, INRA
Marc Nougier, Research Engineer, INRA



Key message of this presentation:



Increasing environmental concerns and climate change are challenging the wine quality and the whole wine industry...

These challenges are not calling for new domains of innovation, but for a new way to innovate

Wines in France

A long history, initiated by the settlement of Greek migrants (6th century BC)...

Huge extension during XIX and XX centuries

Growth in volume, then in quality and value...



...leading to a strategic sector

40 millions hectoliters, 720 000 hectares

250 000 direct jobs

€ 13 billions in export (2018), second item !

Externalities on tourism, culture



...based on a strong regulation of quality

National organization INAO (PDO, PGI, Organic labels)

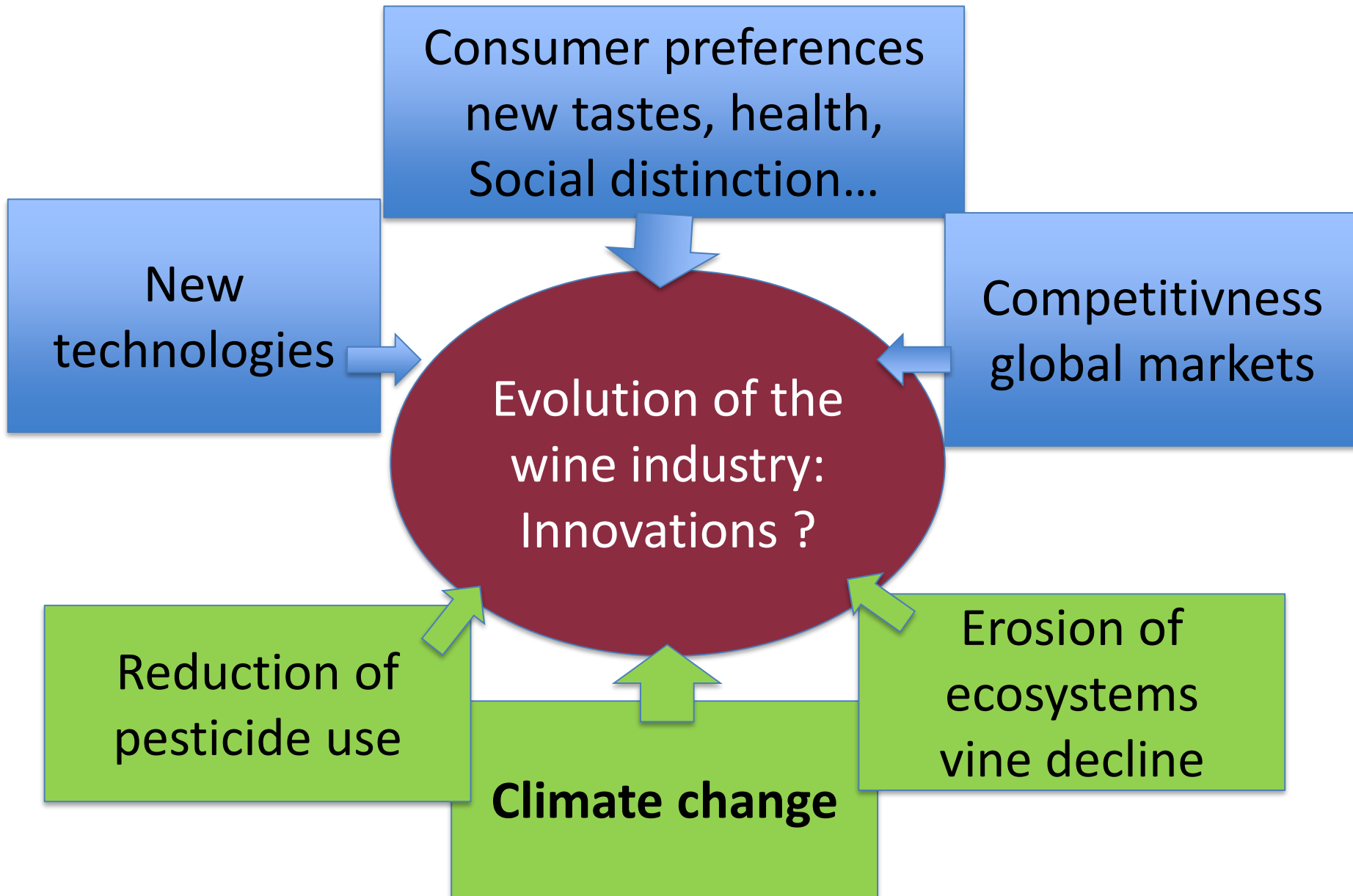
Powerful regional wine organizations

initiatives from each local wine producers union

50% PDO (AOP) wines, 28% PGI (IGP), 15% brandies

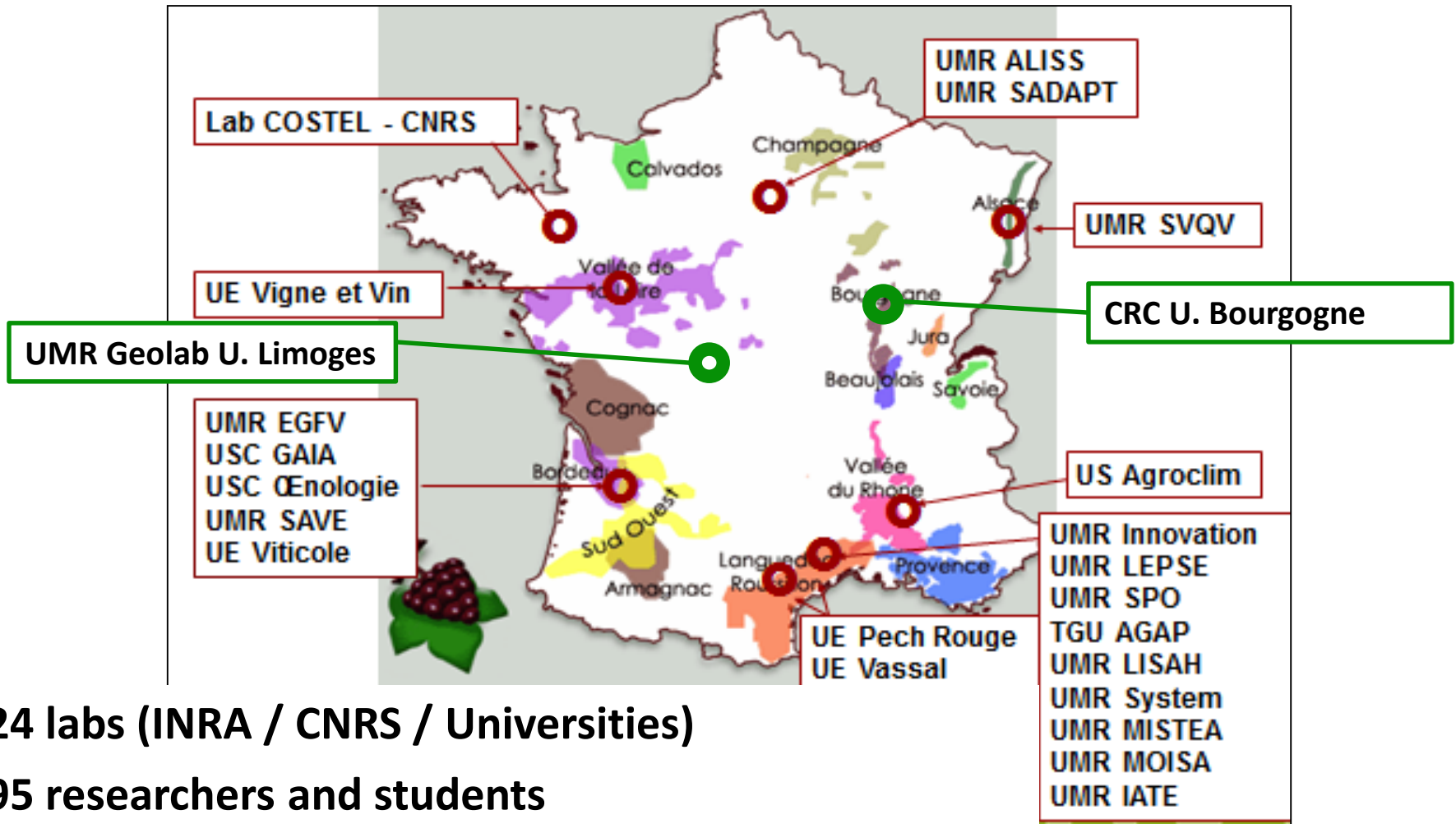


The competitiveness of the sector is threatened !



LACCAVE project (2012-2016) (N. Ollat, J.-M.Touzard)

- Impacts of climate change on vine and wine
- Innovations for adaptation in the wine industry



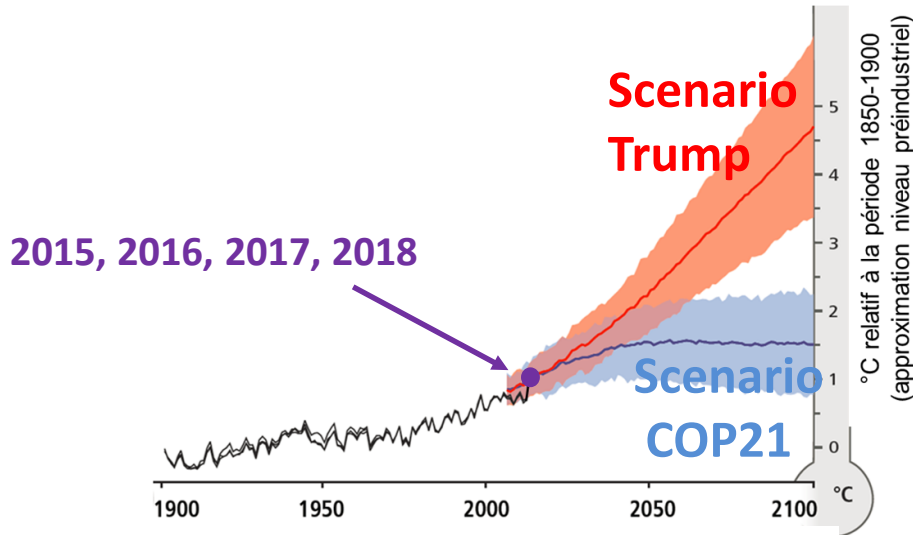
24 labs (INRA / CNRS / Universities)

95 researchers and students

Climatology, genetic, écophysiology, agronomy, œnologie, économiques, sociology....

Climate Change observed, simulated

Evolution de la température moyenne de la surface du globe
(GIEC 2013 et NCDC 2016)



1. Increase of average **temperature**

observed : + 1°C (+1,4°C in France)
between +1,5 and +2,5°C in 2050
till + 5,5°C en 2100

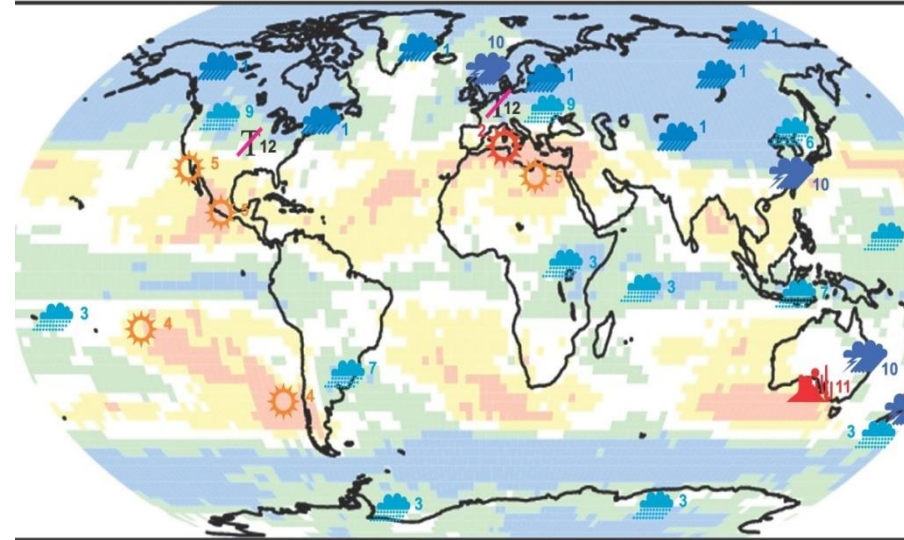
According to our GHG emissions

3. Evolution of Climate **variability**

Summer droughts

Interannual variations

Extrem events: hot waves, rain...



2. Modification of **rainfall**

first observed impacts, simulated:

- Increase North Europe
- Decrease South Europe

4. Indirect influences

Sea level, salinisation

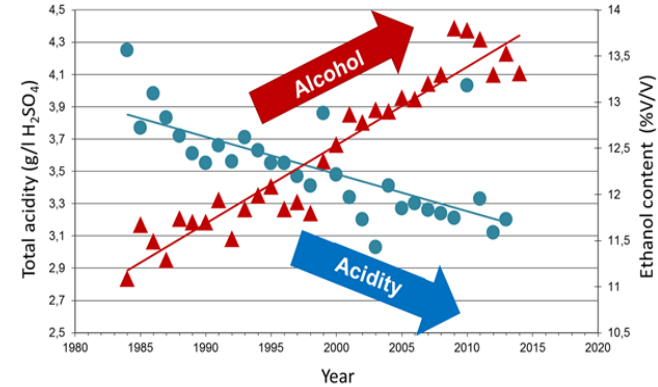
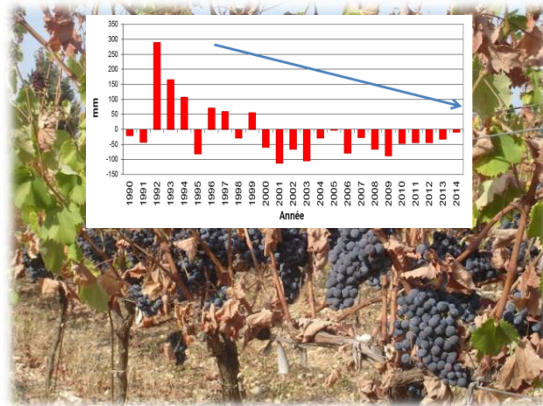
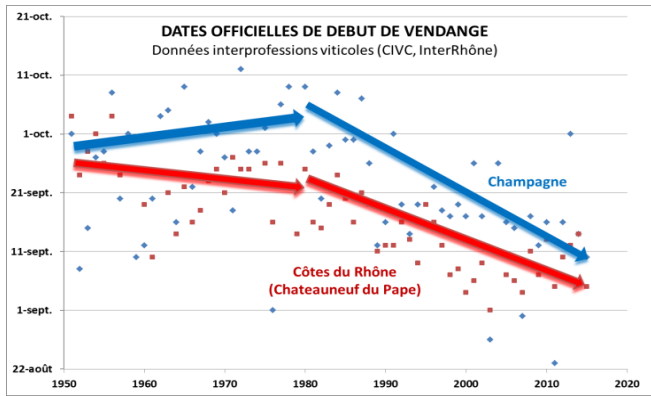
Erosion of biodiversity

Microorganisms, pests,

Ecosystems, soils, landscape...

Impacts of climate change on vine and wine

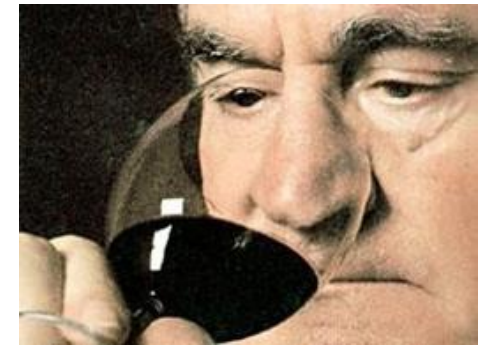
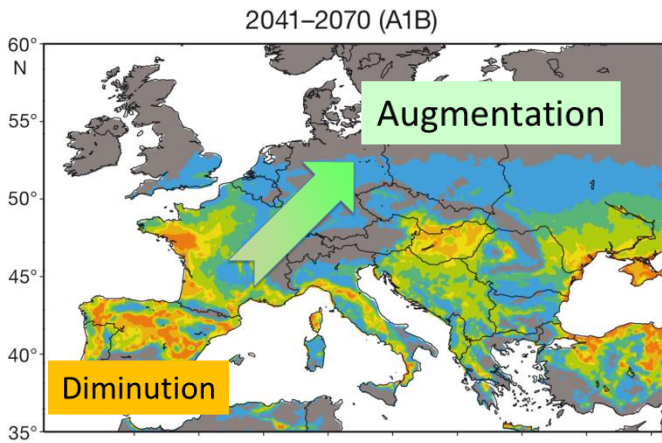
observed, simulated



All development stages of vine are affected: earlier harvest

Water balance and stress
Affect yield (and quality)

Change in berry composition
More sugar, less acidity
Modification of aromas



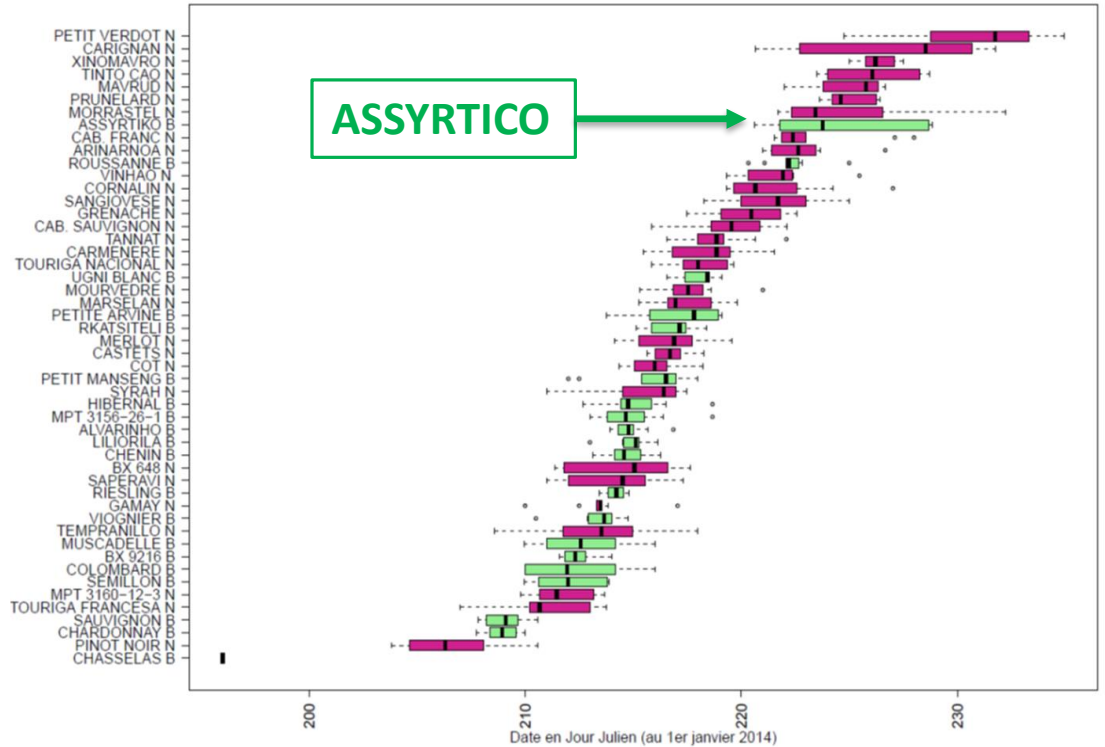
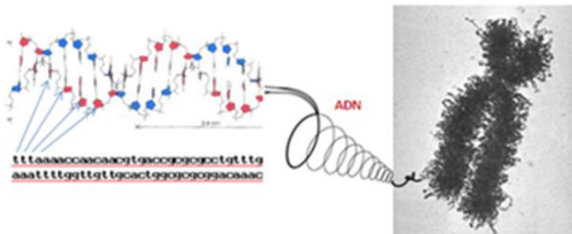
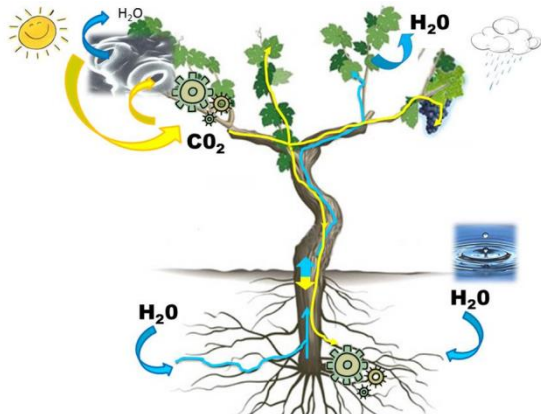
Evolution of potential planting areas

Economic impacts
Incomes, assets, competitiveness

Perception of actors ?
consumption ?

Adaptation 1. New vine varieties

Later varieties, resistant to dryness, high temperature and diseases producing less sugar, more acidity



Comparing existing varieties : date of maturity, acidity...

Different options :

- clones : variability in a same variety
- old varieties
- varieties cultivated in other regions/countries
- creation of new varieties (hybrids)

New knowledge on genetic and Physiology
(Coupel-Ledru et al.PNAS, 2016)

Adaptation 2. New viticultural practices



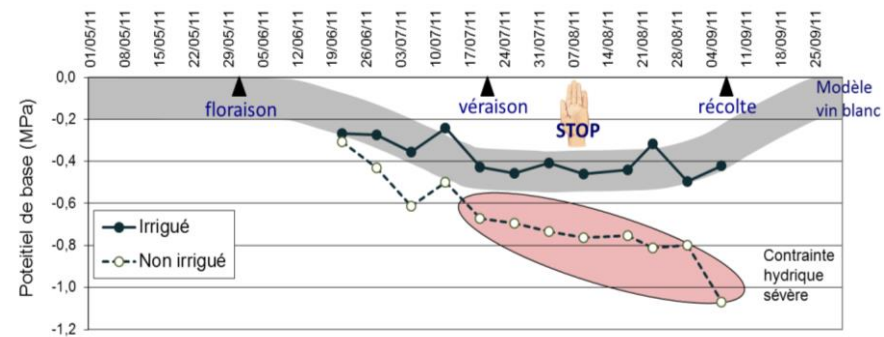
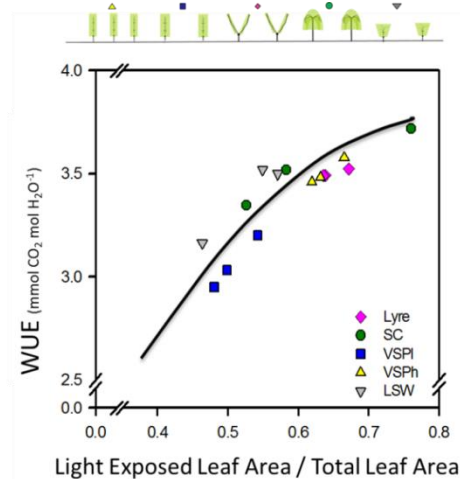
Tests and trade-off between practices

- stripping
- Density, pruning, height of grapes
- Soil management and agroecology
- Agroforestry

irrigation according
To the need of the vine,
goals of production
And available resource (Re-use)



3D scene Reconstruction



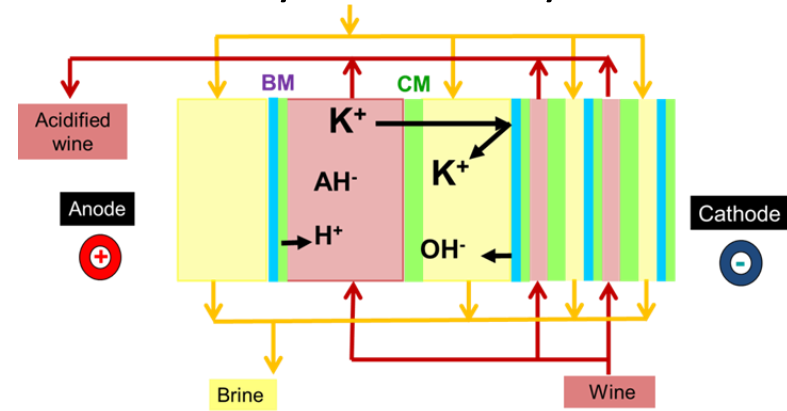
Irrigation according to « hydric potential pathway »

Adaptation 3. Enological technologies = corrective solutions

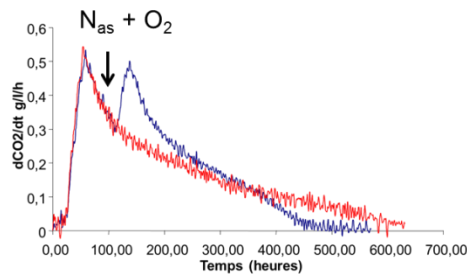
Reducing ethanol with
semi permeable membranes



Adjusting Ph, Increasing acidity
by Electrodialysis

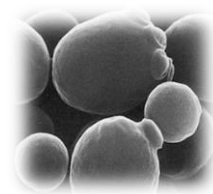
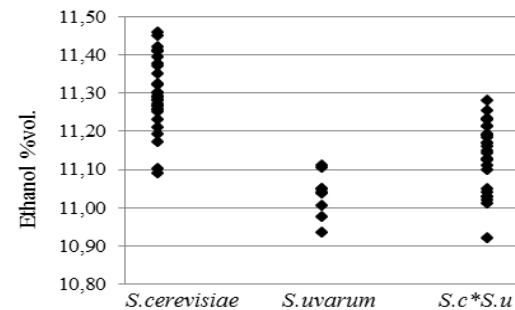


Better control of key winemaking operations



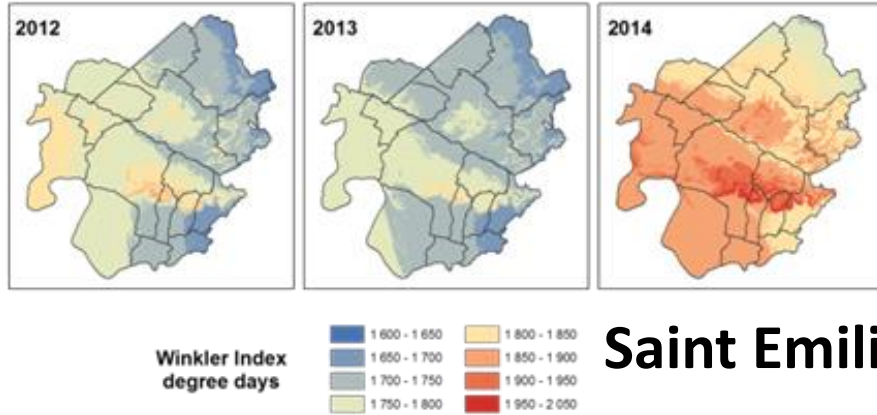
Limiting oxydation with Lower temperature
Management of nutrients for better fermentation

Selecting yeast for adaptation to CC



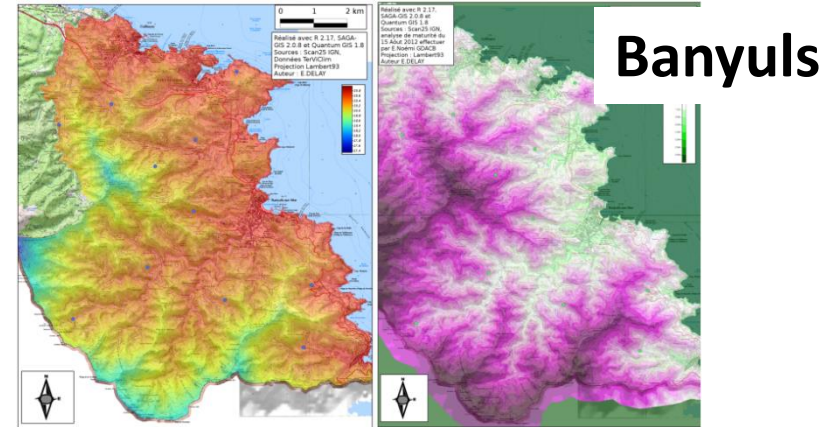
Decrease of ethanol : **0.6 – 1.3%**
Increase of total acidity

Adaptation 4 : changing the location of vines

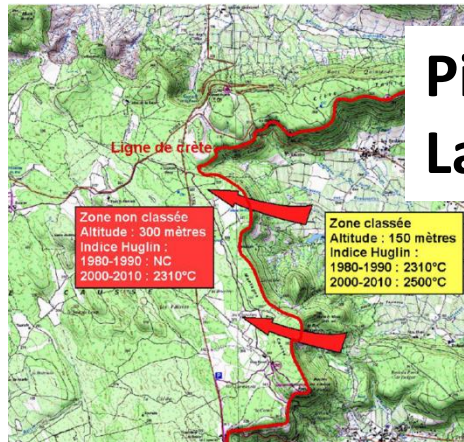


Saint Emilion

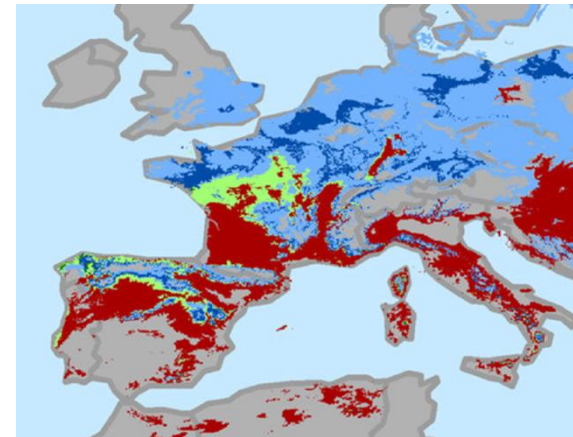
Better understanding of climate variability at local scale : relocation of vines in a same terroir



Simulation of climate change at local scale, with wine producers



Changing the delimitation of wine producing areas (AOP) : higher altitude



Creating new vineyards in north of France, Europe ?

Adaptation 5. Changing the institutions...



New varieties, practices and location are codified in rules and « code of practices ».

Support for climate services (capture of C by soils, agroforestry)



Tools for risk management
: insurances, investment management,
wine storage and blending, local solidarity,
Diversification of activities...



To improve R&D clusters in wine regions

Adaptation 6. To co-construct knowledge by integrating consumers and citizens

To know the consumers **perceptions on** :

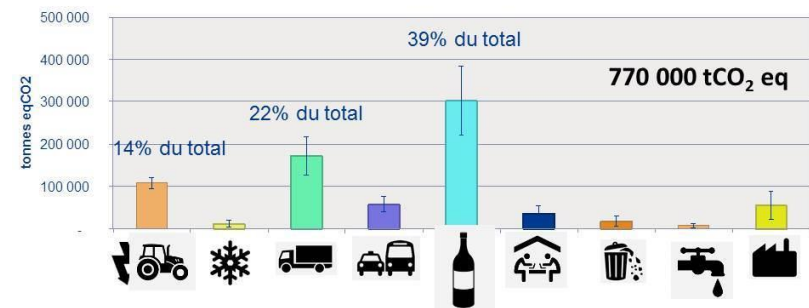
- CC impact on wine quality
- solutions adopted for adaptation



Experimental economics

To combine actions for **adaptation** and **mitigation**,
to communicate on that.

Impact carbone des vins de Bordeaux



To **link the climate challenge with other issues** (income, quality, health, environment,...)

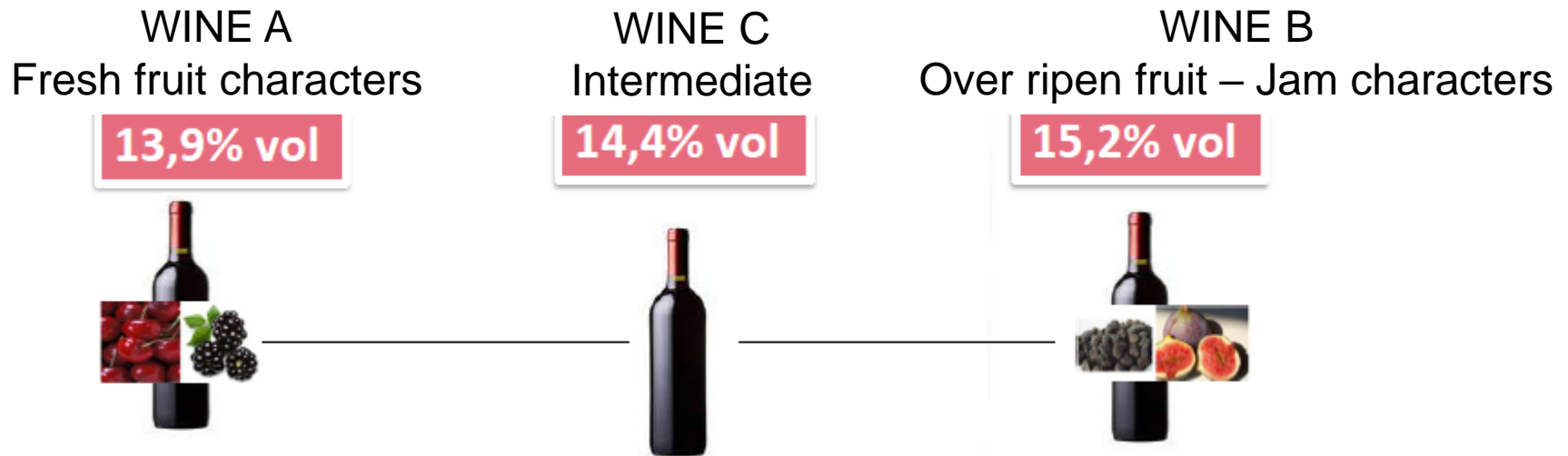
To discuss and **involve consumers and citizens**



Testing the acceptance of consumers

Experimental Economics

Experimental Economics



First tasting : $B > A$
Repeated tasting : $A > C \gg B$

De la Fuentes et al., 2016

1. Consumers could be « seduced » by the novelty of the « wines of climate change » but they prefer current wines when they repeat their consumption

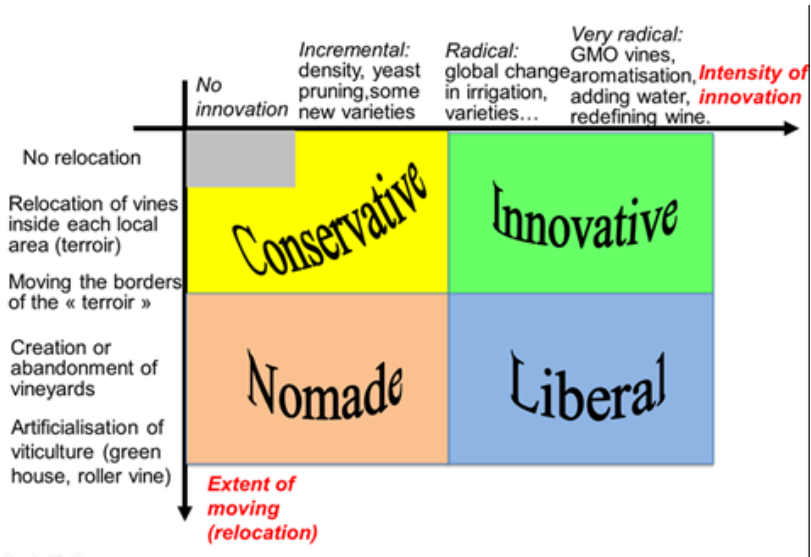
2. Different acceptances of the corrective technologies :
young and women vs old and men

How to combine these levers of adaptation in shared strategies and at different scales?



1. Prospective workshops In seven wine Regions

80-100 stakeholders react on first scenarios and propose strategies by using tablets available on discussion tables.



- 1) They **specified the pathways** leading to the four scenarios and explore their impacts (common vision)
- 2) They voted for **strategic attitudes** on each pathway
- 3) They suggest **concrete actions** to promote or avoid the scenarios



2. Co-construction of national climate strategy for the wine industry

Presentation at the **National Assembly** of the first results from the regional workshops

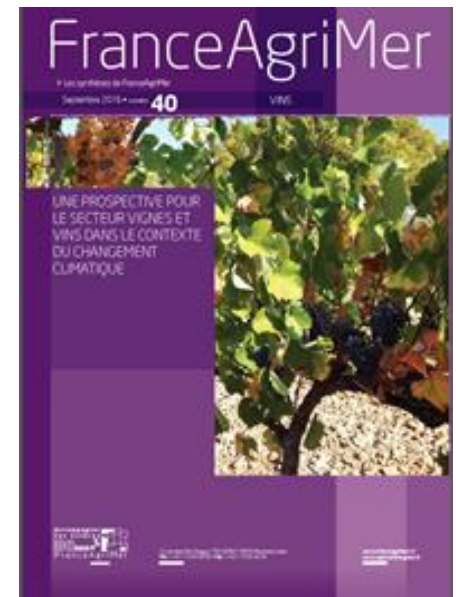
Setting up of a **national group** including researchers and the main Wine organizations

Specific analysis of the **2600 actions** proposed by the 7 regional workshops

Elaboration of **strategic document**

voted by the national wine organizations :

- Orientation of R&D policy
- Revision of regulations, code of practices
- Communication
- Support to local solutions, collective actions,



3. The first Hackathon in a wine village



Design of a specific method to generate solutions

60 Participants from all backgrounds : vinegrowers, scientists, students, start-ups, local government...

Six operational solutions:

sustainable water management device, wine Agora , experimental vineyard, local certification of projects, livestock in the vineyards, collective startup....



4. Open innovation platform for climate smart agriculture





AGRISOURCE
Open Innovation Platform

The screenshot shows the top section of the AGRISOURCE website. At the top left is the AGRISOURCE logo. To its right is a navigation menu with links: HOME, THE AGRISOURCE PROJECT, INDEX, MAP, VALUE CHAINS, and JOIN AGRISOURCE !. Below the navigation is a large banner image of a plant growing in soil. The banner contains the AGRISOURCE logo and the text "Innovation, Knowledge and Networks of Agriculture in the context of Climate Change". Below the banner is a search bar with the text "EXPLORE" and "South Pole Group" on the left, and navigation arrows on the right. Below the search bar is a horizontal menu with icons and counts: GLOBAL SEARCH, PLAYERS (197), DOCUMENTS (21), PROJECTS (29), and INNOVATIONS (36). At the bottom of this section is a search input field with the text "Search..." and a blue "SEARCH" button with a magnifying glass icon.

GEOLOCATION OF YOUR AGRISOURCE NETWORK.



NEWS.

- **The first MOOC on Organic Agriculture**
VerAgro Sup launches at the beginning of the year a MOOC on organic farming entitled MOOC BIO. Powered by VerAgro
21/02/2018
 - **Food sustainability in Europe**
Sustainability of nutrition in Europe: how to reconcile nutritional recommendations and low environmental impact
16/02/2018
 - **Droughts won't leave your glass of wine empty !**
Researchers from INRA and Bordeaux Sciences Agro, in collaboration with Synchrotron SOLEIL, demonstrate that
01/02/2018
 - **Improving extreme climate events forecasting**
In a context of climate change, systems for forecasting agricultural yields in the face of extreme weather events of a
05/12/2017
- [View all](#)

EVENTS.



MOOC The Future of Farming: Exploring Climate Smart Agriculture
How can we adapt farming to an uncertain future? Could the answer be Climate Smart Agriculture? Find out with
05/03/2018 - 08/04/2018

RECENT PROJECTS.



5. New research project (2018-2020) LACCAVE2.21 (Ollat, Touzard)

**WP1 :
Integrated
expertise
for adaptation**

Water
management

Biotic
interactions

Soils

Varietal
ideotypes

Location of
vineyards

Data
management

Value chain
assesment

Definition of
futur wine

*Animation
of LACCAVE
think tank*

**WP2 :
Tools for
adapting
viticultural
systems**

Vineyard
Agroclimatic
Processing
Chain

Modeling for
plant
performance
projections

*Contribution
To CC SAFE
portal*

WP3 : Co-construction of solutions for adaptation

Toward a
national
strategy

Co-design
of cropping
systems

Tackling
climate smart
innovations

*Contribution to the wine industry governance
and the « Agrisource » Open Innovation platform*

**WP4: To build an European project on the
adaptation of Mediterranean vineyards**
*Contribution to PRIMA EU initiative and
international networking (OIV)*



Conclusion (1)

1. Many innovations already exist, adaptation strategies could be reasonably implemented in all French vineyards **if global warming stays below 2°C**
2. **Reduction of GHG** emission is imperative, to stabilize the wine industry and limit the risks : “if you like wine you must support Paris COP21 agreements”
3. **No single solution**, but different combinations of technical innovations, spatial strategies and institutional changes.
4. Solutions are combining **scientific knowledge and practical knowledge** from different stakeholders

Conclusion (2)

5. The integration of solutions must be elaborated considering **the value chain**, including the consumers
6. The adaptation strategies must be coordinated **at local and regional levels** where climate impacts are specific and where the use of resources can be optimized
7. There is room to **innovate in PDO wines**, building differentiated quality according to sustainable management of local resources
8. To develop **learning networks connecting researchers and stakeholders**, and tools to facilitate collaborative innovation at local, regional and national levels
= new way to innovate in food systems