



Thesis title: Application of ecoclimatic indicators to analyse the quantity and quality feasibility of wine grape production in Vaucluse department-France.

Student name:

Utku GUNDOGDU

Institution/company involved:

-UMR EMMAH, INRA Avignon,
-UPM, SPAIN

Tribunal members (name/position):

- Prof. Pilar BAEZA (Universidad Politécnica de Madrid)
- Prof. Carlos Lopes (University of Lisbon - Portugal)
- Prof. Wendu TESFAYE (Universidad Politécnica de Madrid)
- Prof. Santiago BENITO (Universidad Politécnica de Madrid)

Date & location of the oral examination:

Thursday, October 8th, 2015
Conference-Room CEIGRAM Building (Experimental fields)
Universidad Politécnica de Madrid
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Madrid, Spain

Confidential: Yes No

Abstract (max 300 words)

Topic position:

Assessment of how the climate is favorable for wine grape production in a given area is highly useful for viticulturists who establish a vineyard parcel or who can propose and apply adaptation strategies to improve the potential of viticulture. Ecoclimatic indicators could be used for this purpose. These indicators e.g. heat degree days, frost days, amount of rainfall, water stress frequency or average radiation calculated on phenological stages of the grapevine i.e. budburst, flowering, veraison and maturity, provide synthetic information derived from climatic variables on the effect of climate in an area on quality and quantity of production of wine grapes.

The present work aims at using an existing biophysical database, in particular soil and climate data to calculate spatialized indicators and relate these indicators to data collected on yield and vintage quality in Vaucluse department.

Objectives:

- 1- To test ability of ecoclimatic indicators to explain quantity and quality of wine grapes production.
 - Proposing adapted ecoclimatic indicators through literature analysis
 - Selecting the most effective ones, using production and quality data through statistical analysis
 - Modeling quality and quantity of production in study area based on ecoclimatic indicators
- 2-To create thematic maps of the ecoclimatic indicators and of quality as a representation of the viticultural potential of a region.
- 3-To check the effect of the spatial resolution of climatic data on the results.

Methods:

Method steps:

1. Proposal of adapted ecoclimatic indicators
 - Bibliography
2. Calculation of ecoclimatic indicators
 - Data – Climate and soil
 - Calculation of phenological stages of grapevine with Phenology Modeling Platform (PMP)
 - Calculation of ecoclimatic indicators with R code/script
3. Statistical analysis of ecoclimatic indicators on quantity and quality of production
 - Quantity and quality data (Quality data: Chateauneuf du Pape, Quantity data: Côtes du Rhône Regional)
 - Simple correlation and multivariate regression analysis
4. Modeling at the department level of quality and quantity of production with "Random Forest"
5. Mapping quality potential at the department level

Results:

Tendency of the modelled phenological stages has been plotted along time (1961-2012). It appeared that the harvest dates have tended to be earlier than before with a rate of change of 7 days per 10 years for Vaucluse department, and 5 days per 10 years for Chateauneuf du Pape.

Ecoclimatic indicators proposed for the quality aspect have been related with vintage rating data and results showed that indicators regarding rain sum, extreme humid conditions between veraison and maturity negatively correlated with vintage rating. Furthermore severe water stress between veraison and maturity positively correlated with vintage rating data in Chateauneuf du Pape and considerably explained vintage quality in the region.

Moreover model created with ecoclimatic indicators regarding estimation of vintage quality is able to explain vintage quality.

Ecoclimatic indicators proposed for the quantity aspect have been related with production data i.e. wine yield per hectare and results showed that rainy days during flowering and high windy days between budburst and veraison negatively correlated with production data and explained yield loss.

Main conclusions:

Interest of the method

-The method is easy to apply with few input data.

Limits

-Present work concerns only one grape variety i.e. Syrah which is a late ripening variety.

-The spatial resolution of climatic data is not adapted to capture the variability of local climates that are characteristics of viticultural areas of the region.

Further studies

-An early ripening variety e.g. Chardonnay can be studied in order to check different aspects of climatic effects.

-Using high resolution climatic data could give a better assessment of actual temperature and be more precise: the demonstration achieved on Chateauneuf du Pape was not so evident because of the flat topography and poor spatial variability. It should be implemented in more hilly landscapes.

-Climate change scenarios could be run with this method in order to allow the design of adaptation strategies.

Keywords (5): Ecoclimatic indicators, Viticulture, GIS, Vaucluse, Chateauneuf du Pape

Corresponding contacts + emails of supervisors

- **Marta Debolini – UMR EMMAH INRA Avignon + marta.debolini@paca.inra.fr**
- **Martine Guérif – UMR EMMAH INRA Avignon + martine.guerif@avignon.inra.fr**
- **Pilar Baeza – UPM SPAIN + pilar.baeza@upm.es**
- **Antonio Morata – UPM SPAIN + antonio.morata@upm.es**