



Harmonising regulatory information on wine protected designation of origin in Europe

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Wine Protected Designation of Origin (PDO) products are strictly regulated and therefore highly susceptible to changes in climatic, environmental and socioeconomic conditions. Analysing the impacts of such changes has so far been challenging, because the legal specifications of wine PDOs in Europe have never been summarised in a harmonised dataset. Here, we present how we created the first inventory of regulatory information for the 1177 wine PDO in Europe, based on the geographical indication register of the European Union.

Rationale

The Protected Designation of Origin (PDO) label is a European Union (EU) quality scheme that protects products made in specific areas, under distinctive physical and biological conditions and using strictly defined production practices¹. It therefore includes strict regulations regarding cultivation and production processes together with the definition of the area where the grapes must be cultivated. These regulations are included in a set of documents (e.g., product specification) that are reviewed and accepted by the European Commission.

Due to the strong relationship between PDO wines and the specific conditions and production practices defined in the regulation documents, these products are highly vulnerable to any changes in the climatic, environmental or economic conditions in the production area. For example, warmer climate conditions are affecting the growing suitability of several traditional cultivars, the introduction of alien pest species is endangering the health of vines, economic and social preferences, are pushing to adopt new and more sustainable production practices, such as organic viticulture^{2,3,4}. All these factors are often in conflict with the specifications defined in the regulatory documents. To maintain their quality standards, PDO areas therefore may need to use different production practices to those authorised in the regulatory documents. For this reason, there is a need to thoroughly plan and develop specific adaptation strategies that consider the local conditions and legal specifications of individual PDO regions. Such strategies require knowledge about the legal specifications that characterise each PDO, which is currently only available in the regulatory documents of each wine PDO and not as a harmonised dataset.

Here, we describe how we created the first geospatial inventory of regulatory information for the 1177 PDO areas registered in Europe, giving insights into its structure and potential uses.

Building the inventory

We collected, standardised and spatialised a set of regulatory information using the legal documents included in the EU geographical indication register eAmbrosia⁵ and aggregated it in a harmonised dataset. We collected only regulatory information that was available for all considered countries and could be standardised among all PDO areas (see Table 1 for a description of some of the selected regulatory information). For this reason, we had to exclude information that was not consistently reported, such as the training system, chemical

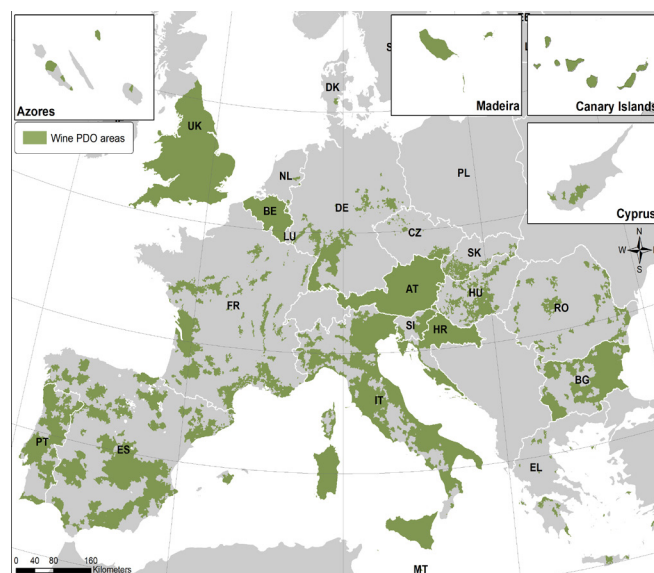


FIGURE 1. Wine PDO areas included in the inventory, based on the municipality boundaries from Eurogeographic (© EuroGeographics 2022).

TABLE 1. Selected regulatory information included in the inventory.

Information	Contents
Name	Official name of the PDO
Wine products	Types of wine products authorised for production, following the definition of Regulation (EU) No 1308/2013
Vine varieties	List of the vine varieties authorised for PDO wines production; varieties have been standardised based on OIV nomenclature
Yield	Maximum yield allowed, expressed in hl or kg/ha
Planting density	Minimum planting density allowed, expressed in n° of stocks/ha
Irrigation	Possibility to use irrigation, expressed as yes or no
Municipalities	List of the municipalities included in the PDO
Link to regulatory documents	Web link to the eAmbrosia page containing the regulatory documents of the PDO

composition of wines, or alcoholic content, although potentially useful for developing adaptation strategies; e.g., to climate change. The regulatory specifications were then spatialised using the boundaries of the municipalities included in each PDO (Figure 1).

Inventory structure and potential uses

We developed a freely available geospatial inventory for all the 1177 wine PDO areas in the EU (as of 4 November 2021) that contains a set of regulatory information that can be used by researchers and decision makers. A comprehensive description of the dataset is available in Candiago *et al.*, 2022⁶. The database is freely available online⁷ as a set of three files that contain: (1) the geographical boundaries of each PDO, (2) the related regulatory information summarised at the PDO level, and (3) the regulatory information summarised by category of wine product. Using the provided datasets, it is possible to visualise and analyse the main characteristics of European wine PDO regions (Figure 2, 3).

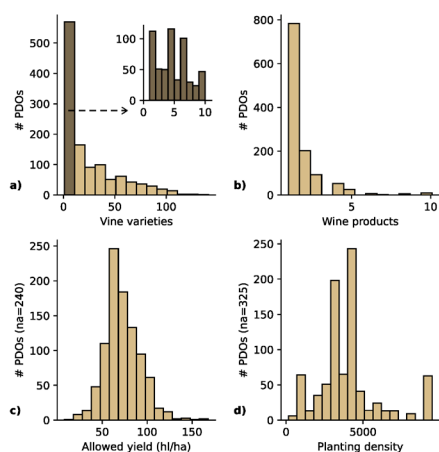


FIGURE 2. Histograms representing the variability in the (a) number of authorised varieties (with a focus on PDOs that authorise 1 to 10 cultivars), (b) wine products, (c) allowed yield, and (d) planting density in the PDOs included in the inventory.

This dataset is particularly useful for researchers and decision makers in the field of viticulture. For example, information about planting density and yield can be used by researchers to run crop models calibrated based on the characteristics of each PDO and assess the specific impacts of climate change in a region². The comparison of the characteristics of different PDOs, that must always be carried out

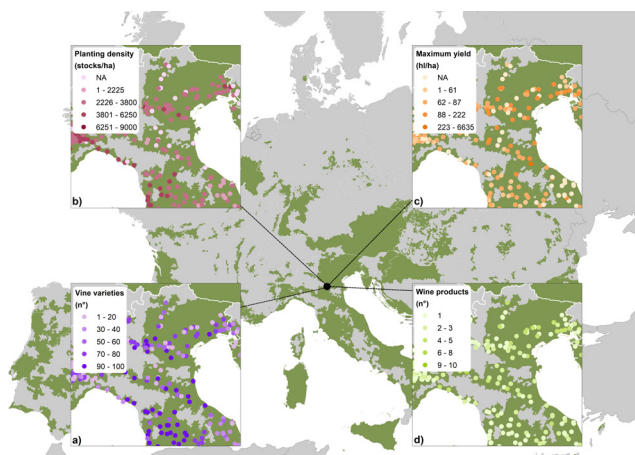


FIGURE 3. Map showing a set of selected key variables included in the inventory for the area of north-eastern Italy. a) Vine varieties, b) planting density, c) maximum yield, and d) wine products. Points on the maps represent the centroids of the PDOs.

considering each PDO's contextual specificity, can give insights into adaptation strategies that include the introduction of new vine cultivars suitable for producing high quality products, or the authorisation of irrigation in specific areas⁶. Analysing the contents of PDO documents can also improve our understanding of the critical factors that determine the sustainability and reputation of PDO regions, for example showing that there is a need to pursue more environmental regulations.

Concluding remarks

Regulatory information on wine PDO products have never been summarised in a unique spatial database. Here, we provide the first freely available geospatial inventory of PDO regulatory information at the European level. This dataset will allow the comparison of information among different wine PDOs, enabling researchers and decision makers to analyse specific characteristics of each PDO region. This will facilitate the development of tailored adaptation strategies in the face of the current global drivers of change. ■

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