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## **Utilizing GIS tools to analyze viticultural choices under climate change scenario in North-East of Italy**

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Vineyard areas are constantly decreasing in Italy as well as in Europe. North-eastern regions in Italy are showing an opposite trend, steadily expanding with increased winegrowing areas. In viticulture and wine production, climate is arguably the most critical aspect in ripening fruit to achieve optimum characteristics to produce a given wine style. According to WMO and IPCC, climate is changing and the world is experiencing unprecedented climate extremes. Despite recent zoning aimed at defining key factors in determining the suitability of a given region for specific varieties and wine types, the expansion of viticulture in North East of Italy has led to some irrational planting choices about row orientation, dimensions, and slope. Under these conditions, the consequences of some extreme weather events may be more severe.

The main objective of this study was to verify whether row orientation, aspect, and slope of vineyards, in combination with climate conditions, may affect yield and fruit quality.

An area localized in the Northern Italy was analyzed, taking advantage of QGIS tools. The investigated parameters included: row orientation, slope, area, age of plantation, aspect ratio and distance between rows. Such variables have been combined with management information (planting distances, scion/rootstock combination, use of irrigation) and environmental information (yearly weather conditions).

Data resulting from GIS analysis, vineyard management and environmental information have been correlated with 10-years yield and must quality parameters. Furthermore, satellite imagery from sample vineyards were collected and investigated in order to analyze the responses of the plants to different weather conditions.

The results of the analysis highlighted how the mean slope of investigated vineyards is in general ranging between 1 and 3 degrees, with a prevalent Southern exposure. Rows do not exhibit a dominant orientation, mainly due to the following reasons:

- the reduced dimensions available for vine cultivation, especially in hilly areas, where the vineyards are planted along contours, in order to limit erosion
- the need for mechanisation, which calls for longer rather than larger rows.

The results enabled to create a connection between row orientation, climate and soil conditions, and grapevine yield and quality responses to be considered as a guide for future planting choices more suitable to the restrictions imposed by increasing extreme weather events.