

## MESO-SCALE GEOSTATISTICAL ANALYSIS: A METHOD FOR IMPROVING EXPERIMENTAL DESIGN

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### Abstract:

#### Context and purpose of the study –

The growing region of Barolo DOCG certified wines is topographically complex. The region is famous for this complexity and for the associated terroir driven Nebbiolo grapes and wines derived distinctly from this varietal. Although it is recognized that the Barolo area is unusual topographically and it is assumed that this unusual topography lends to the inherit terroir, the specifics of this relationship are less well defined. Evaluating regional terroir with macro-scale climatic behavioural assumptions may lead to incorrect evaluations of climate behaviour at the meso-scale. Utilizing open-source weather station data and incorporating geostatistical processes to do analysis of the meso-scale climate relationship with local topography can help to more clearly understand behaviour in a meso-scale setting and also aid in honing experimental design targeted at better understanding of variation in berry traits.

**Material and methods** – Climate related indices (monthly average minimum and maximum temperatures, Huglin Index and diurnal range) were calculated using data from 45 open-source weather stations within a 40 km radius of the center of the Barolo DOCG growing region. Topographical traits (Elevation, Aspect, Slope, Latitude) for the same region were extracted from a digital elevation model with a 10 m resolution. Linear regression models were developed between the dependent variables (climate indices) and the independent variables (topographical traits). Unexpected relationships between elevation and climate were observed from this statistical.

With this finding, field research for the following year was designed with elevation incorporated as an independent variable to attempt to determine the impact on berry developmental characteristics as well as differences in anthocyanins and flavonols based on elevation. Three vineyard sites were identified that had different elevations (approximately 230, 360 and 410 m).

**Results** – Linear regression analysis showed negative relationships between maximum monthly temperature and elevation as well as between the Huglin Index and elevation. No relationship was established between elevation and minimum monthly temperature (generally considered to be the night temperature) in all growing season months (April to October). Due to the lack of a relationship between minimum temperature and elevation, it was found that diurnal range (DR) in the greater 40 km<sup>2</sup> region has a negative relationship with elevation. It was further noted that within the immediate Barolo region, 7 weather stations suggested a parabolic relationship between maximum temperature, diurnal range and elevation.

This result was confirmed at the field scale where the highest vineyard was found to have a higher night temperature and lower day temperature thus resulting in a smaller diurnal range than the other two vineyards. Preliminary berry characteristic results suggest a significant difference between vineyards that can at least partly be associated with elevation.

**Keywords:** Nebbiolo, terroir zoning, diurnal range, elevation.