Technical sheet

Policy
Europe: *RDPs (Pillar I and II); CAP; Reg. 1698/05 1974/06 (rural development)*
Austria, Hungary, Italy: *CAP GAEP Cross-Compliance Standards //CAP Rural Development Plans 2014-2020*
Italy: *Agricultural policy instruments; Regional RDP; Law n. 4/2011 National Integrated Production Quality System*
Campania Region: *Integrated Production Regulations of the Campania Region (Decree 29 29.02.2019) and Integrated Production Specification for the Viticulture*

First draft

TOOL VITICULTURE – *Territorial Scale: Regional*

WHY

The production of high-quality wines represents a major goal in this region. This requires viticulture planning and management to be optimized in agreement with the specific wine-growing terroir. This tool supports farmers in achieving this goal by providing detailed geospatial information about soil, topography, geology, climate and more generally about the landscape.

FOR WHOM

The Viticulture tool is designed to assist vine growers, consortia and wine cooperatives in operating a sustainable viticulture that is well adapted to the potential of their specific territories, including in connection with soil conservation.

HOW – if you want to select your *Region Of Interest* (ROI)[i]

The tool works over the regional scale and allows free selection of any region of interest (ROI) by following a very simple procedure:

Operational procedure

- By clicking on the "Draw (Polygon)" button on the top bar and drawing the desired area (ROI). It is also possible to assign it a name[ii].
- Using the "Save" button, the ROI is stored in the system memory and can be retrieved whenever necessary.

TOOL SUPPORT THE PLANNING OF YOUR VINEYARD

HOW – if you aim to "LABEL DESCRIBING YOUR VINEYARD"

Operational procedure

The "Support to the planning of your vineyard" tool can be selected from the toolbox on the right of the Graphic User Interface. Then, by clicking on the "Label describing your vineyard" icon and selecting your region of interest, a pdf file is created. This contains information about your ROI in terms of its geography, topography, climate, geology and soils. Besides this, are reported some environmental parameters of great importance for quality wine production, such as the Winkler index evaluated with both current climate data and climate change scenarios data.

The pdf file, named "PDF for a Label describing your vineyard", can be seen in/downloaded from the "Results" section by clicking on (i) the last operation and (ii) "Elaboration detail" (fig. 1).

What for

The information obtained provides support for the sustainable planning and management of vineyards in terms of issues such as the choice of grape varieties. The presence of potential climate change scenarios offers farmers the possibility to made long-term planning, especially if new plantation is planned.

HOW – if you aim to "VITICULTURAL ZONING" [iii]

Operational procedure

The "Support to the planning of your vineyard" tool can be selected from the toolbox on the right of the Graphic User Interface. Then, by clicking on the "Viticultural Zoning" icon and selecting your region of interest, a table with data and maps with geodatabase are created. These outputs contain information about your ROI in terms of its physical characteristics such as geography, topography, climate, geology, land morphology, soils, bioclimatic indexes, etc., referred to the "zones" within the ROI. Each zone has its peculiar sequence of features identifying them. (fig. 2)

The maps and table can be seen in/downloaded from the "Results" section by clicking on (i) the last operation and (ii) "Elaboration detail".

What for

The data produced are useful to identify and characterize each zone within the ROI in terms of Viticultural suitability.

TOOL SUPPORT THE PLANNING OF YOUR VINEYARD

HOW – if you aim to "SOLAR RADIATION" [iv]

Operational procedure

The "Support to the planning of your vineyard" tool can be selected from the toolbox on the right of the Graphic User Interface. After (i) clicking on the icon of the parameter to be analysed (i.e. solar radiation) and (ii) selecting your region of interest, the output will appear in the "Results" section. Here the user can choose to display the output data in a table format and/or as a map. Table and georeferenced map can be downloaded.

What for

Solar radiation is known to strongly affect grape quality, especially in terms of accumulation of antocians and polyphenols thus solar radiation strongly affect the grape oenological potential. Thus this information provides support for the sustainable planning and management of vineyards in terms of technical choice such as grape variety, type of training and pruning to optimize the solar radiation interception by of the vineyard.

TOOL SUPPORT THE PLANNING OF YOUR VINEYARD

HOW – if you aim to select "BIOCLIMATIC INDEXES"

The tool allows the user to navigate - within the selected ROI – different maps of indexes relating to production of high-quality wines. The output is displayable directly as a map and/or as a table. The data obtained from this tool are important for vineyard planning. The following mapped indexes are available:

- Winkler index[v]
- Cool night index[vi]
- Huglin index[vii]
- Growing season precipitation
- Length of growing season

Operational procedure

After (i) clicking on the icon of the parameter to be analyzed and (ii) selecting the ROI, the output will appear in the "Results" section. Here the user can choose to display the output data in a table format and/or as a map. Table and georeferenced map can be downloaded.

What for

All the parameters that can be consulted by a viticulture expert who finds support for agronomic planning/management of the vineyard. This tool is especially designed to identify the spatial variability (map) of selected parameters, thus creating a geospatial knowledge set which will be very useful when choosing vine and rootstock varieties, planting layout and planning better management practices (e.g., potential pruning). Similarly, information on the Winkler index allow for better vineyard planning, including the choice of the vine variety, system of plating layout and potential pruning.

TOOL POTENTIAL RISK OF PLANT DISEASE

HOW – if you aim to know "BRANAS INDEX"[viii]

Operational procedure

By clicking on the "Potential risk of plant disease" icon, and then by selecting the "Branas index" tool, it is possible to visualize the output, as a map and/or as a table, directly in the "Results" section. Table and georeferenced map can be downloaded.

What for

The Branas index combines the effect of air humidity and temperature during the growing season to assess the risk of grapevine exposure to certain diseases, such as downy mildew; knowledge of geospatial distribution of the Branas index values allows more sustainable management of natural resources by the potential reduction of chemical control.

LIMITATIONS

The user should be aware that the following limits exist.

When drawing a region of interest, the users of LANDSUPPORT web platform must therefore be well aware of the limitation embedded in the different maps that they require for their specific application at specific scale. The system provides very reliable results only if used appropriately.

Climate data are obtained by COSMO-LEPS data (8 km spatial resolution). Therefore, the data obtained may be rather coarse when employed on the farm scale, especially in complex hilly landscapes (see technical sheet on agroclimate services).

The soil map along with other thematic layers, have inherit the limit (scale, n. observation etc.) of the original maps (see metadata on the platform). For instance, the reference soil against which the water stress is calculated may differ from a specific soil in a specific area because of local soil spatial variability.

FUTURE DEVELOPMENT

The following future developments are expected: (i) CRU polygons, (ii) viticulture management including remote sensing multitemporal images (e.g. Green Biomass from Sentinel 2 NDVI-like indicators) and estimation of potential

water stress, (iii) upload of soil data from any specific viticulture farm from Campania, (iv) additional development on enotourism.

[i] Special care is required when user draws/select the Region of Interest. In fact, LANDSUPPORT is a multi-scale decision support system. Each of the 15 available tools is designed for a specific application and for a specific scale. Furthermore, the databases using specific standards required for that specific scale. The users of LANDSUPPORT web platform must therefore be well aware of the limitation embedded in the different maps that they require for their specific application. The users must be expert on their specific problem and must understand if the input data offered by the platform are suitable for their problem. In light of the above, the system provides very reliable results only if used appropriately.

[ii] It is also possible: i) to draw a ROI with numerous polygons. In this case, it is possible to assign different values (e.g. numbers) to each of the drawn polygons; ii) upload single/multi polygons from GIS environment.

[iii] The "viticultural zoning" map represents a pre-processed thematic map resulted from GIS processing which merged data such as landscape morphology, geology, soils, physical landscape characteristics (i.e. slopes, aspect, etc.), bioclimatic indexes, etc. The map is composed of thousands of "zones" each of one has its peculiar sequence of identifying features.

[iv] *The annual solar radiation was calculated using a well established model, based on the landscape morphology based algorithm, applied in GIS environment. For further info: http://www.oliveoilpakistan.com/downloads/olive_oil_pakistan_monographs_light.pdf*

[v] The Winkler index is a bioclimatic and mono-parametric index, that supplies guidance on the thermal attitude of a specific territory towards the grapevine. It represents a thermal sum and is calculated using the lowest thermal threshold of the grapevine (10 Â° C) and the average air temperature in the period from April to October. For further info: http://en.wikipedia.org/wiki/Winkler_scale

Region/class	***°C units***	***General ripening capability and wine style***
Region Ia	*850–1111*	*Only very early ripening varieties achieve high quality, mostly hybrid grape varieties and some V. vinifera.*
Region Ib	*1111–1389*	*Only early ripening varieties achieve high quality, some hybrid grape varieties but mostly V. vinifera.*
Region II	*1389–1667*	*Early and mid-season table wine varieties will produce good quality wines.*
Region III	*1668–1944*	*Favorable for high production of standard to good quality table wines.*
Region IV	*1945–2222*	*Favorable for high production, but acceptable table wine quality at best.*
Region V	*2223–2700*	*Typically only suitable for extremely high production, fair quality table wine or table grape varieties destined for early season consumption are grown.*

[vi] The Cool Night Index was created to study nocturnal conditions of grapes ripening according to the different wine-making regions (Tonietto, 1999; Tonietto et Carbonneau, 2004). By convention, this index is also called nycthermal index and is equivalent in the North Hemisphere to the minimum temperature of the harvest month which is most of the time September.

Table I. Cool Night Index categories (adapted from Tonietto, 1999)

Characteristics	Ranks	Values	Examples
Warm nights	CI1	CI>18°C	Marsala (Italy), Nabeul (Tunisia)
Temperate nights	CI2	14°C<CI≤18°C	Madrid (Spain), Montpellier (France)
Cool nights	CI3	12°C<CI≤14°C	Porto (Portugal), Carcassonne (France)
Very cool nights	CI4	CI≤12°C	Freiburg (Germany), Napa (USA)

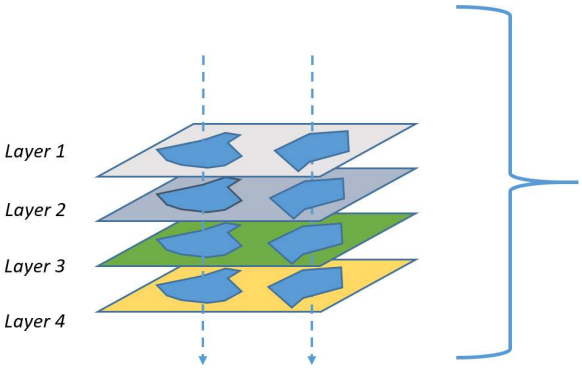
The nocturnal coolness is an important factor during the grapes ripening period; the Cool Night Index of Tonietto is based on the relationships between cool temperatures and the biosynthesis of aromatic compounds during the ripening period, within the 30 days before harvest.

[vii] *In Huglin index the temperature sum over the temperature threshold of 10 °C is calculated and then summed for all days from beginning of April to end of September. The calculation uses both the daily average temperatures and the maximum temperatures and slightly modifies the calculated total according to latitude. Each grape variety needs a certain amount of heat in order to be cultivated successfully in the long term in a given area. For further info:* http://en.wikipedia.org/wiki/Huglin_index

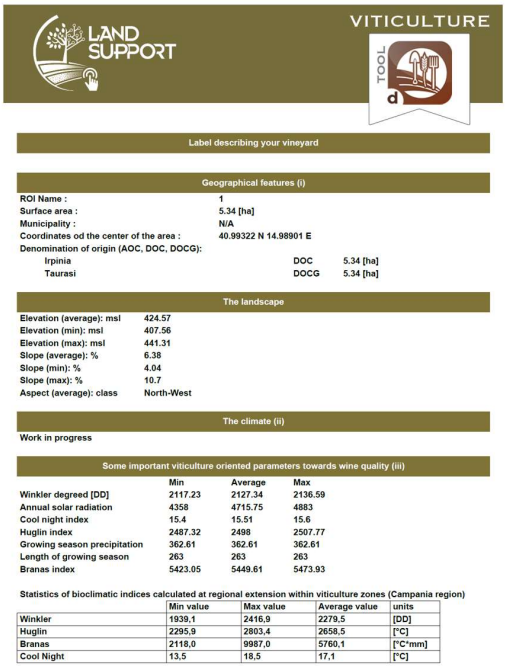
Huglin Index values	Varieties of grapes
1600	Pinot Blanc, Gamay, Gewurtztraminer
1700	Pinot Noir, Chardonnay, Riesling, Sylvaner, Sauvignon
1800	Cabernet Franc
1900	Cabernet Sauvignon, Chenin Blanc, Merlot, Sémillon, Italian Riesling
2000	Ugni Blanc
2100	Cinsaut, Grenache, Syrah
2200	Carignan
2300	Aramon

[viii] *The Branas index is the product of the monthly average temperature for the total rainfall, limited to the period in which the vine is in development (1st April-30th September semester). The index aims to represent the strength of the probable virulence of Downy mildew (Plasmopara Viticola), closely linked to the value of precipitation.*

$$\mathbf{BI} = \sum \mathrm{T}_{\mathrm{med}} \times P$$



ROI selected for statistics



LAND SUPPORT

VITICULTURE TOOL

Label describing your vineyard

Geographical features (i)

ROI Name :	1		
Surface area :	5.34 [ha]		
Municipality :	N/A		
Coordinates od the center of the area :	40.99322 N 14.98901 E		
Denomination of origin (AOC, DOC, DOCG):			
Irpinia		DOC	5.34 [ha]
Taurasi		DOCG	5.34 [ha]

The landscape

Elevation (average): msl	424.57
Elevation (min): msl	407.56
Elevation (max): msl	441.31
Slope (average): %	6.38
Slope (min): %	4.04
Slope (max): %	10.7
Aspect (average): class	North-West

The climate (ii)

Work in progress

Some important viticulture oriented parameters towards wine quality (iii)

	Min	Average	Max
Winkler degreed [DD]	2117.23	2127.34	2136.59
Annual solar radiation	4358	4715.75	4883
Cool night index	15.4	15.51	15.6
Huglin index	2487.32	2498	2507.77
Growing season precipitation	362.61	362.61	362.61
Length of growing season	263	263	263
Branas index	5423.05	5449.61	5473.93

Statistics of bioclimatic indices calculated at regional extension within viticulture zones (Campania region)

	Min value	Max value	Average value	units
Winkler	1939,1	2416,9	2279,5	[DD]
Huglin	2295,9	2803,4	2658,5	[°C]
Branas	2118,0	9987,0	5760,1	[°C*mm]
Cool Night	13,5	18,5	17,1	[°C]

PDF document (on the-fly)

Fig 1: Landsupport generates on the-fly PDF documents by operating spatial statistics over user selected ROI

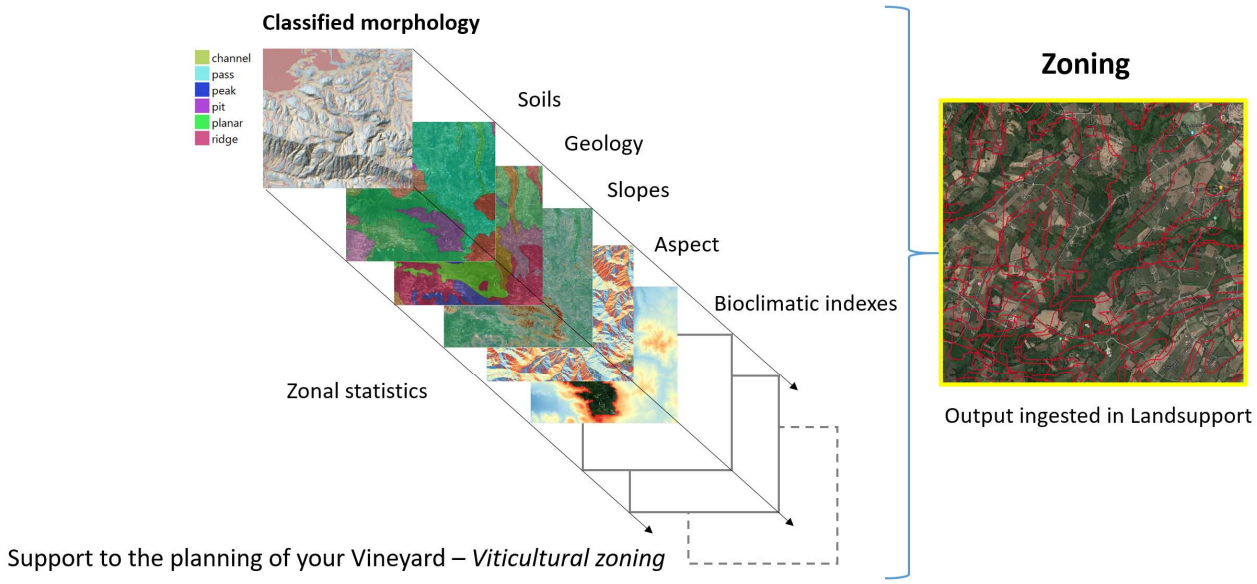


Fig.2: Landsupport ingested a pre-processed thematic map (viticultural zoning) resulted from GIS processing which merged data such as landscape morphology, geology, soils, physical landscape charachteristics (i.e. slopes, aspect, etc.), bioclimatic indexes, etc. The map is composed of thousands of "zones" and each zone has its peculiar sequence of features identifying them.