Estimation of the irrigation needs of the Franciacorta winegrowing area in northern Italy for the construction of a new collective irrigation network.

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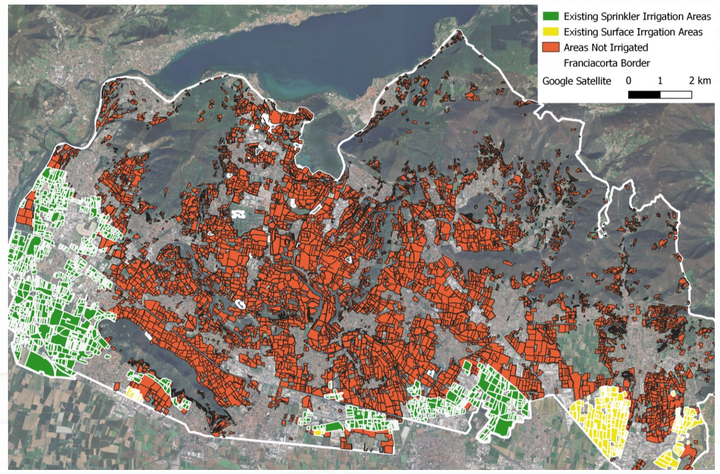
The study aims to quantify the irrigation requirements of currently non-irrigated areas in the Franciacorta region (6,700 ha, of which 3,350 ha of vineyards), to support the irrigation consortium Oglio-Mella in assessing the potential expansion of the pressurized irrigation network.

Although vineyards in this region have traditionally been cultivated without irrigation, climate change and evolving agronomic and environmental requirements are prompting an increasing number of farmers to adopt emergency irrigation measures. The lack of an irrigation service provided by the consortium led farmers to build private irrigation wells, resulting in the dangerous over-exploitation of groundwater resources.

To estimate the irrigation requirements of the non-irrigated areas in Franciacorta, the *IdrAgra* model, a fully distributed agro-hydrological simulation tool, was employed (**Fig. 1**). It computes the daily soil-crop water balance at the field scale and, providing both irrigation discharge rates and total irrigation volumes for either the entire study area or for specific sub-districts.



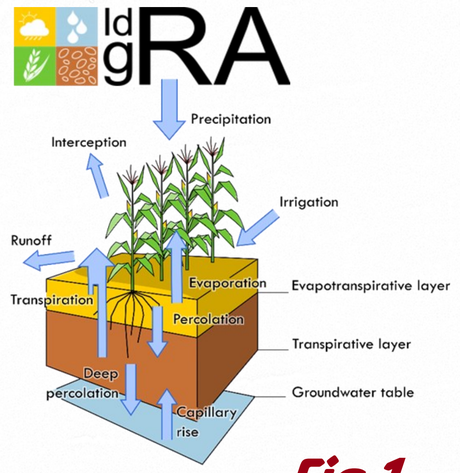
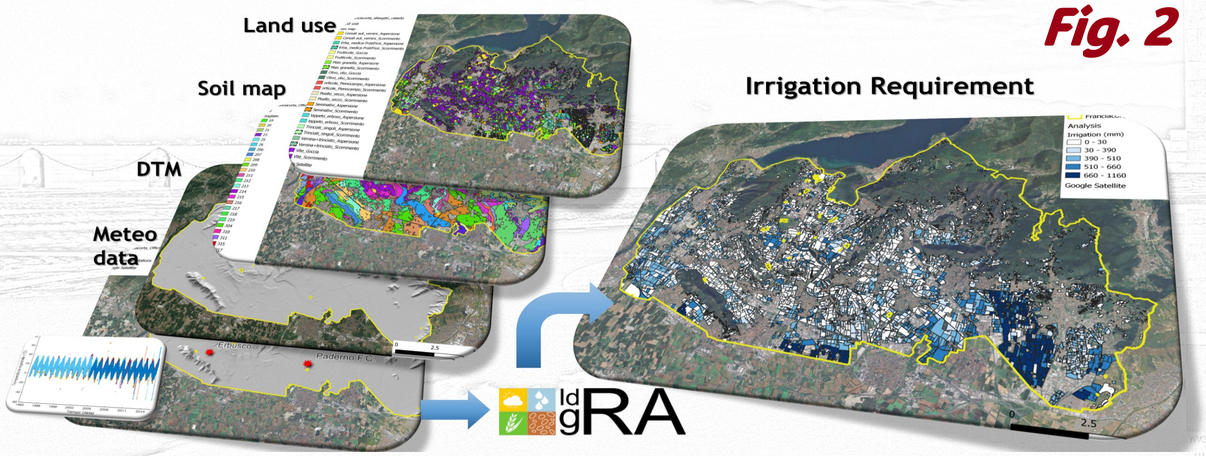


Fig.1

Fig. 2



The input data used for the model simulations (**Fig. 2**) included:

- Land use: spatial distribution of crops across the study area. For each crop, the model-required parameters were considered (i.e., leaf area index, rooting depth, basal crop coefficient, etc.);
- Soil map: spatial distribution of soils across the area and hydrological characteristics of representative soil profiles, derived from the available physical–chemical soil data and processed using pedo-transfer functions;
- Digital Terrain Model (DTM);
- Meteorological data: agro-meteorological time series from ARPA local stations, used to estimate evapotranspiration and rainfall inputs.

In addition, information on irrigation methods and districts and, as well as measured irrigation discharges where available, were used to parameterize and calibrate the model.

IdrAgra computes the hydrological balance on a daily basis. Irrigation discharge and volume estimates were then aggregated using an eight-day time step to reflect the consortium's irrigation rotation. To account for interannual variability, simulations were run over multiple years, with the final results reported considering at the 90th percentile, to provide a conservative reference for designing the collective irrigation network. Additionally, a medium-term future scenario was developed for the period 2035–2064, based on the 5th IPCC report (RCP 4.5), in order to assess how irrigation requirements might change in the context of projected climate conditions.

The results show that the discharge rate required to satisfy the peak irrigation demand did not change in the current and climate change scenarios (**Fig. 3**), whereas the total irrigation volume increased by around 35% in the latter, mainly due to the changes in rainfall distribution.

This study emphasizes the importance of collaboration between research institutions, irrigation consortia and regional authorities in addressing challenges related to water demand in the context of changing climate scenarios.

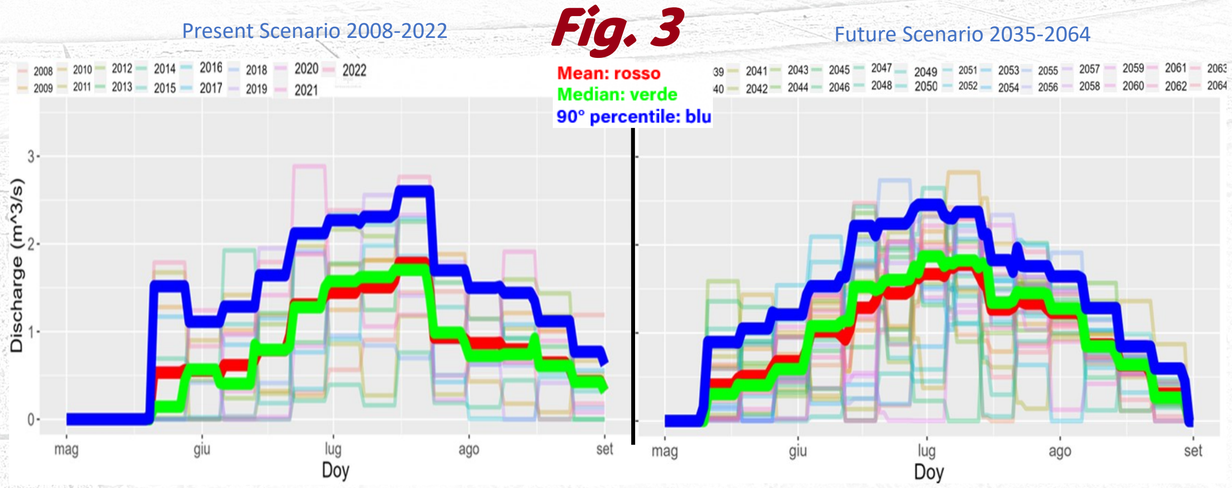


Fig. 3

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