Vulnerability of wells supplying drinking water and use of pesticides in wine-growing areas: the Treviso province case study

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Evidence of pesticides leaching due to intense rainfall events was found in two wellhead protection areas (WHPAs) located in the wine-growing areas of the Veneto piedmont area, in Italy. In this territory, the extensive agricultural activities related to the Prosecco production are developed often using pesticides-based vine protection practices. In the same area, numerous wells extract from the phreatic aquifers the drinking water needs of most of the province of Treviso, rising concern on the possibility of groundwater contamination from pesticides and risks for human health. Further experimental surveys – infiltration tests and soil samplings – were developed in the same WHPAs to study the spatial variability of the chemical-physical properties of the soil governing the pesticides leaching. The experimental data collected on areas of 2 hectares comprising both vineyards and non-agricultural areas, highlighted a larger variability of the soil properties inside the vineyards. Moreover, soil infiltration capacity, assumed in our case as the main property governing the pesticide leaching capacity, showed values up to one order of magnitude higher within the areas destined to wine-growing activities than the non-agricultural ones. This information, obtained at the local and at the field scale, were included in a geospatial analysis related to the distribution of vine-specific pesticides at the scale of the Treviso province, to obtain a vulnerability map for all the wells located in area. The geospatial analysis, developed in a geographical information system (GIS), is based on the sale data of pesticides for agricultural activities - also referred to as plant protection products (PPPs) – registered in the province in the period 2012-2019. The units of PPPs (kilograms or liters) collected at the municipal scale (the province of Treviso counts 94 municipalities) were analyzed by: i) identification of the vine-specific products based on the local guidelines for the vine-protection practices, ii) hazard classification of the vine-specific PPPs based on the CLP pictograms and statements (Classification, Labelling and Packaging Regulation, EC/1272/2008). This information, combined with the extension of the wine-growing areas from land use geographical data (Corine Land Cover 2018), allowed to outline, by assuming the use of the PPP in the municipality of sale, a map showing the hazard level of the wine-growing areas. The geospatial analysis based on the level of superimposition obtained between the extension of the wellhead protection areas and the wine-growing areas, led to a vulnerability map for wells. The map, resulting from the definition in different scenarios of the WHPAs extensions based on a geometrical criterion and the PPPs-based hazard of the vineyards, gives a clear picture of the wells that require PPPs-specific actions to minimize the risk for the quality of the water supplied for human consumption.