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A new modelling approach for the evaluation of the EU Rural Development Program's contribution to the reduction of water abstractions in agriculture

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Agriculture is an essential driving force in the management of water and has a central role in the EU's Rural Development Programme (RDP). A key role in safeguarding RDP efficiency has its evaluation based on specific Common Evaluation Questions (CEQ) and common impact indicators. The main indicator related to water, I.10 – "Water abstraction in agriculture", refers to the total volume of water applied to soils for irrigation purposes. According to the EU guidelines, the most appropriate relevant data source is the Eurostat Survey on Agricultural Production Methods; however, these data are available only for 2010. Furthermore, the original data sources used in many countries are unclear given the lack of related monitoring infrastructure. Accordingly, the use of models estimating the volume of water used in agriculture on the basis of farm structure survey data, annual crop statistics and meteorological data, seems to be the most suitable methodology fulfilling the evaluation quality criteria, at least in countries facing data scarcity.

In this study, the solution developed for the case of Greece is being presented. Greece, as many other southern EU countries, is characterized by very small farms, very high spatial and temporal variability, and acute data scarcity. To address these challenges, a specifically developed modelling approach, which is directly relevant to agricultural water policies evaluation based on multisource data, was applied. The proposed methodology is using an entirely spatially distributed, continuous hydrological model to provide gridded output of the hydrological balance components, plants water deficit, and irrigation water needs in a daily time step for the entire country. The model operates as an extension of ESRI ArcGIS. A special algorithm linking each farm's polygon (over 6,000,000 polygons) in the spatial database of the Integrated Administration and Control System (IACS) with the nearest grid cell of the model with the same crop and the same conditions was also developed. In this way, the developed approach provides very precise information at farm level to facilitate further analysis and the estimation of water abstractions in agriculture considering all the information included in the IACS database (e.g. irrigation system, water source, applied agri-environmental measures). Remote sensing data (Sentinel-Copernicus) and methods were also used for the validation of the crop patterns and of the irrigated fields in IACS database. The model was applied for 34 years reference period (1971-2004) using a different setup for each modelled scenario. In this way, the total water abstractions for each farm were estimated for the crop patterns and cultivation practices existing in the base year (2015) and in the evaluation year (2018)

for the reference meteorological conditions. The model is calibrated and validated using data from local water distribution authorities in order to improve the reliability of the results. The obtained results were analyzed to estimate the values of the impact indicators and answer to the CEQ.

The applied methodology produced valuable information concerning agricultural policies evaluation, and may additionally assist the evaluation of land use or climate variation impacts and adaptation and mitigation strategies.