Monitoring and predicting irrigation requirements of tree crops in Eastern Sicily as a tool for sustainability

Salvatore Pappalardo1, Enrico Antonio Chiaradia2, Giuseppe Longo-Minnolo3\*, Daniela Vanella1, Simona Consoli1

1Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), Università degli Studi di Catania, Via S. Sofia, 100, Catania 95123, Italy

2Department of Agricultural and Environmental Sciences, University of Milan, 20133, Milan, (Italy)

3International Doctorate in Agricultural, Food and Environmental Science - Di3A - University of Catania, Italy (corresponding author: giuseppe.longominnolo@phd.unict.it; +39 320 6960695)

**Keywords.** Random Forest, Water needs, FAO-56, QGIS, Sustainable irrigation management.

**Abstract.** In arid and semi-arid climates, improving the management of water resources through the use of innovative technologies is of primary importance to increase the productivity of the agricultural sector. Appropriate measures have been applied in Europe to limit water use to sustainable levels. In particular, the 6th Environmental Action Program (PAA, 1600/2002/EC) and the Water Framework Directive (WFD, 2000/60/EC) established the main political objectives about the use of water, to ensure a more sustainable environment and integrated approaches to water management. In Italy, the Ministry of Agricultural, Food, and Forestry Policies approved the Ministerial Decree of 31 July 2015 which obliges the Regions to monitor irrigated areas and volumes. The irrigated agriculture of southern Italy, often managed by the reclamation consortia, generally lacks the necessary information and tools which would allow to improve the water management and achieve the necessary sustainability of the system. In this context, the general objective of the study is to monitor the water needs of tree crops at the irrigation district level and to evaluate the reliability of the use of IdrAgra model for management purposes. IdrAgra is based on the FAO-56 double-crop coefficient approach, and it is easily accessible through the IdrAgraTools plugin in the QGIS framework.

The study concerned the “Quota 102.50” irrigation district (Eastern Sicily, Italy), for the reference period 2019-2020. First, a Random Forest (RF) classification was applied to map the main irrigated tree crops in the study area. The RF model was constructed using a monthly time stack of green (B2), red (B3), and near-infrared (B8) bands of 24 Sentinel-2 images and 503 ground truth sampling points.

Subsequently, the IdrAgra model was applied and the obtained irrigation requirements were compared with the volumes distributed by the reclamation consortium at each sub-district. The results showed the effectiveness of IdrAgra for monitoring water management in the context of tree crops and its use by reclamation consortia could allow improving the sustainable use of water resources.