Assessment of crop water use and its sustainability in Sardinia region under Climate Change

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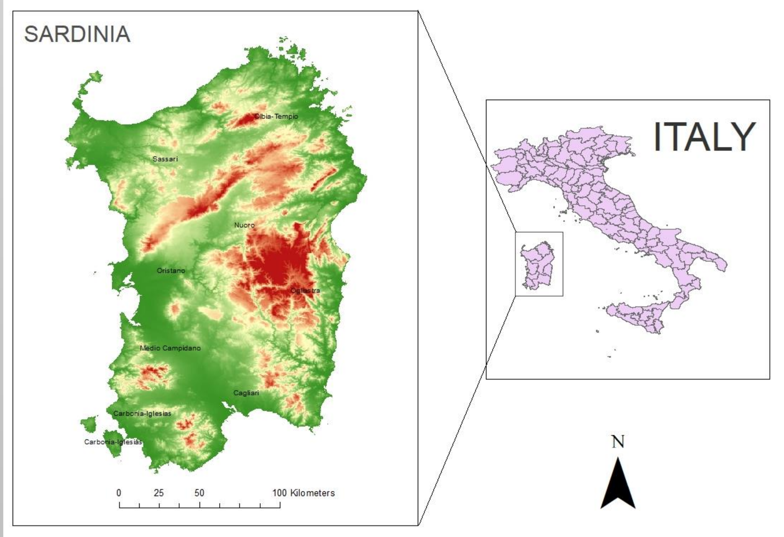
INTRODUCTION

Water allocation and management is one of the most pressing issues in the 21st century, due to limited water resources. The Mediterranean region has been identified as one of the main climate change hotspots, mainly due to water scarcity and high rates of human activities in coastal areas, especially agriculture and energy production.

In this scenario, the aim of the work is to model the water consumption for agriculture in a Mediterranean, in order to understand the water volumes needed for each crop in the current conditions and with future climate change-

RESEARCH SITE

Sardinia is the second largest island of the Mediterranean Sea. The agriculture of the region is mainly characterised on the cultivation of cereals, olives, vineyards, plus an important portion of land is dedicated to pastures for livestock. Sardinia is rich in terms of water basins and streams; however, the intensive agriculture is putting pressure to this resource which is supposed to become more scarce in the future



MATERIALS AND METHOD

SIMETAW# (Simulation of Evapotranspiration of Applied Water) is a daily crop-soil-water balance model developed to computes the daily reference, well-watered crop, and actual evapotranspiration (ETo, ETc, ETa), the evapotranspiration of applied water (ETaw), and an irrigation schedule for a specific site (Mancosu et al., 2016). SIMETAW# used a set of crop management, climatic and soil input data. This model runs on a R platform to allow crop water consumption and irrigation demand estimation (Masia et al., 2021). Furthermore, standardized FAO-56 Penman-Monteith equation was used to calculate the ETo

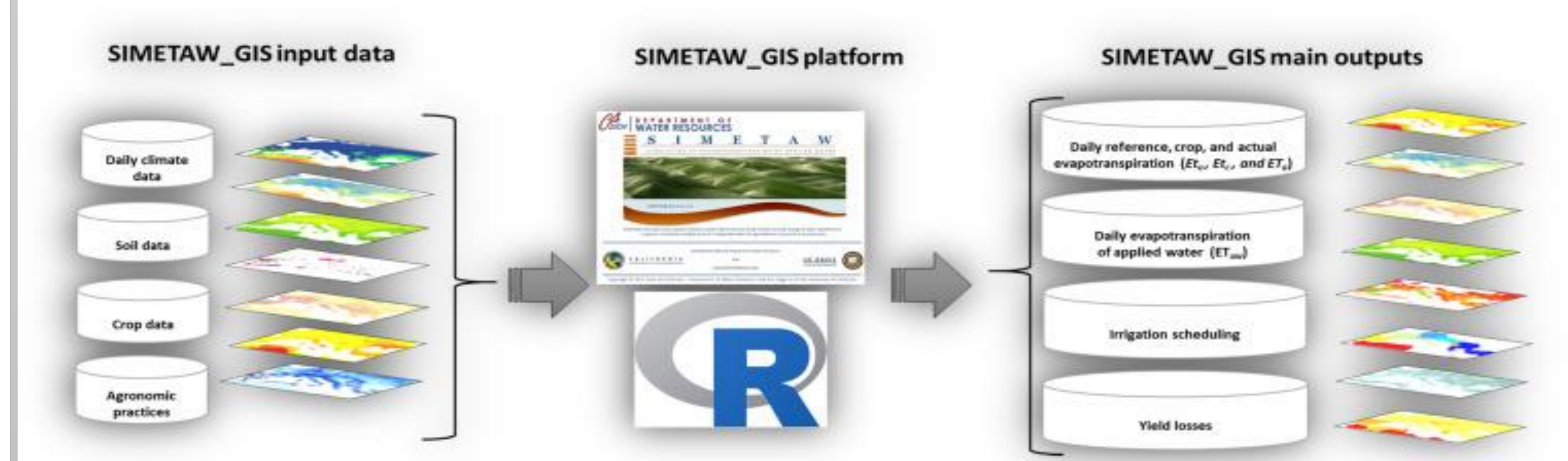


Figure 1. Design of SIMETAW_GIS Platform (Masia et al., 2021)

Data of historical and future periods (respectively 1976-2005 and 2036-2065) using the set of five General Circulation Models downscaled with Regional Circulation were processed. Cordex climate data were downloaded with a spatial resolution of 0.11 degrees (~11 km) and a daily temporal scale

RESULTS

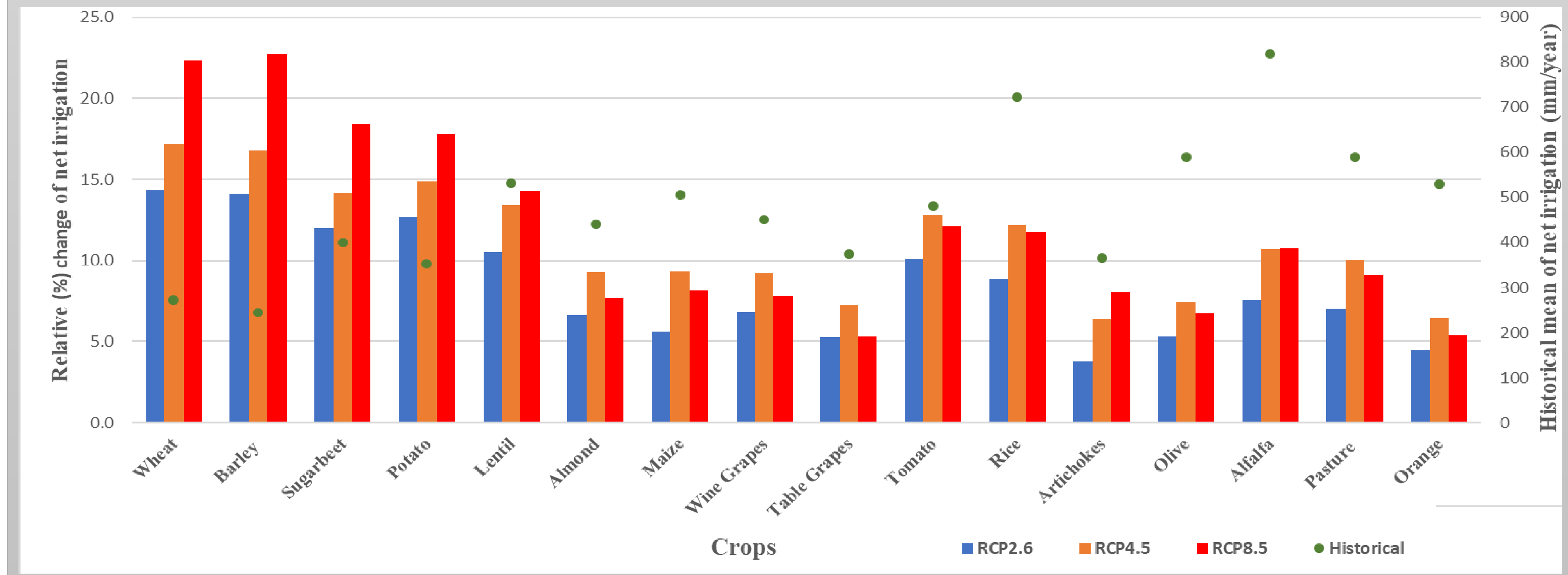


Figure 2. Comparison between the historical mean (green dots) and relative percentage change of net irrigation requirement for the future scenarios (RCP2.6, RCP4.5, RCP8.5).

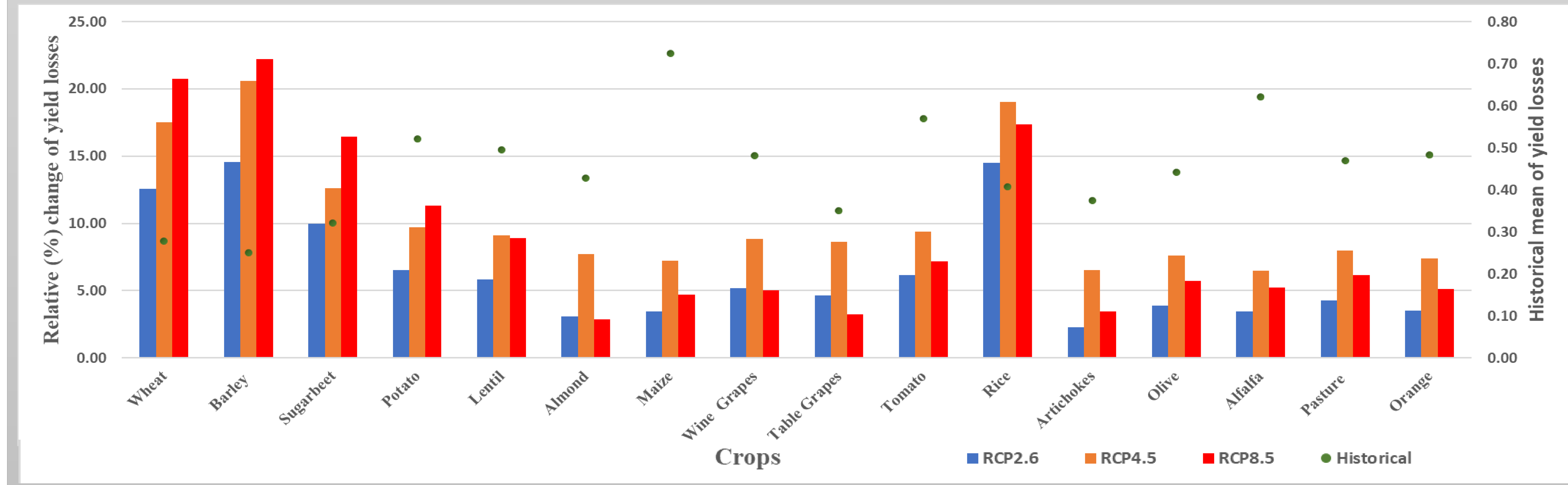


Figure 3. Historical mean (green dots) and relative percentage change of yield losses under RCP2.6, RCP4.5 and RCP8.5.

Such high-resolution simulations provide us detailed information at different spatial scales for decision making process. The simulated irrigation requirements are projected to rise under future climate scenarios, results in reduction of crop yield. Results of the SIMETAW# model, show the impact of climate change on Sardinia region, suggesting that availability of high resolution of environmental and climate data could support detailed understanding of plant-soil-atmosphere processes, the impact of climate change on crops, and subsequent needs of crops and adaptation choices.

CONCLUSION

To overcome the impact of climate change on agriculture, adaptive strategies should be developed, supported, and implemented. Optimal irrigation practices are pivotal to increase the adaptive capacity of a system to cope with climate change and make the agricultural production sustainable.

ACKNOWLEDGEMENTS

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REFERENCES

1) Mancosu, N., Spano, D., Orang, M., Sarreshteh, S., & Snyder, R. L. (2016). SIMETAW# - A model for agricultural water demand planning. *Water Resources Management*, *30*(2), 541–557.
2) Masia, S., Trabucco, A., Spano, D., Snyder, R.L., Sušnik, J. and Marras, S., 2021. A modelling platform for climate change impact on local and regional crop water requirements. Agricultural Water Management, 255, p.107005.

Contact for Discussion