Remote Sensing for Agricultural Water Demand

Descriptive Summary

The main challenges faced by this demonstrator were related to human resources. Given the competitive market within the IT industry it proved to be difficult to find people to work on the front end of the online tool.

The demonstrator collected ground-truth data, where different plots of land were checked to see the crops being grown and irrigation practices in some pilot sites to be able to train the model. The expected outcome of this project is to provide a new approach towards the management of agricultural water demand. This shall be achieved through the development of an online based tool which makes use of multi-platform satellite imagery, particularly from the ESA Copernicus program and PlanetScope which will assist in the development of insights into this dynamic and strategic sector by all relevant stakeholders.

Background

This project is crucial for developing an innovative approach to agricultural water management, which promises a wide range of benefits. By enabling regulators in the water and agricultural sectors to assess water use for irrigation, it will help identify areas where water is being overused. In such cases, regulators will offer support services to operators to help reduce water consumption. This measure plays a vital role in addressing the agricultural sector’s water demands and is a key part of Malta’s drought management plans.

The results of this demonstrator can become a valuable decision-making tool. A deeper understanding of water use within the agricultural sector will assist in shaping better water policies. Earth Observation data, combined with other agricultural data, will also provide insights into current practices, which can support more informed decisions about funding allocation and the management of EU subsidies. In addition, the data can be used to offer tailored advice to farmers on irrigation practices and crop water use, helping them adopt more efficient methods. Furthermore, this approach can improve the effectiveness of field inspections by providing regulators with more accurate and actionable information.

Ultimately, this initiative has the potential to transform agricultural water management in Malta, making it both more efficient and sustainable. It combines regulatory oversight with practical support, encouraging better water use practices while ensuring that misuse is

addressed. By leveraging advanced data analytics, the approach supports informed decision-making across policy, funding, farming practices, and inspections. This will help promote more sustainable agricultural practices and ensure the more efficient use of water resources in the sector.

It is also known that the agricultural sector may not be as water efficient with certain crops. This has also been proved, through other projects where monitoring of the unsaturated zone is being done, where the agricultural sector may be overwatering their crops. This is the main challenge that this demonstrator is trying to address. By having a better estimate of water demand, then agricultural water use could be more efficient. This would also lead to better results in the Energy-Food Nexus.

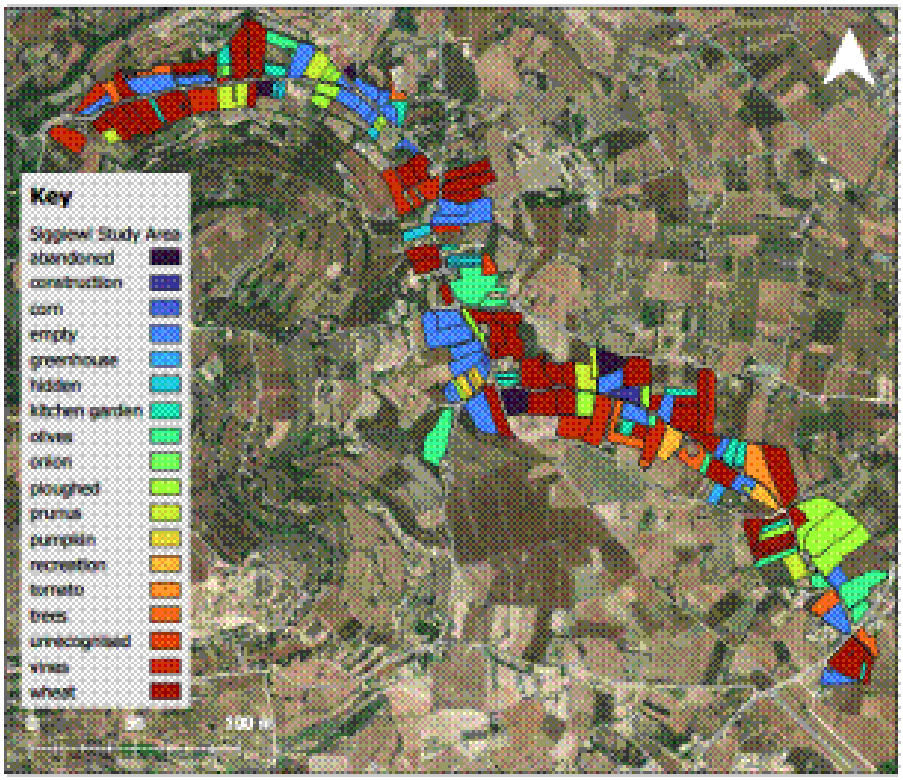
Aims and Goals

The demonstrator targets the Water-Energy-Food Nexus, through the various processes that the demonstrator is finding. The demonstrator aims to understand the best irrigation practices for crops through the use of satellite imagery and modelling. By tackling this one would be reducing the amount of water being used for irrigation as well as the energy needed to transport and supply water. Discussions were carried out with the relevant government entities, where the data and initial results were shared. Through this, the government entities responsible of the agricultural sector can implement changes related to water allocation and education for more water resilient crops and efficient irrigation methods.

The implementation of the project began in 2020 and should be finalised by end of 2025. The operation of the online tool will be maintained by the Energy & Water Agency. Short term goals included the ground truthing exercise where a number of pilot sites were surveyed to see the changes in parcels, crops being grown and irrigation practices. other short-term goals included the development of the super resolution of the satellite imagery. Long-term goals include a model that will predict the crop type being grown through the satellite imagery, and this will be combined in an online tool that is accessible by farmers, where they can see how much irrigation they should need given the climatic conditions.

Actions taken

The main technical system created through this demonstrator is an online tool for the management of water in the agricultural sector. The platform should have a continuous visualisation and access to evapotranspiration information with very basic functionality. Further data will be integrated, and the model will be further trained. The tool will have visualisation customisability, insights and analytics at different time scales both numerical and spatial, and the ability to download products and data. This operational tool can be used by relevant stakeholders in the public and academic sectors.



The design and development of the online model entailed the participation of over 10 persons. This included the persons that were collecting the ground truth data, and development of the algorithm for the super-resolved satellite images, and then the development of the online tool and the integration of all. During all of this, consultation was done with relevant authorities and farmers. The demonstrator started with the collection of ground truth data and in parallel working on the super resolution of the satellite imagery. The training of the model then followed with the use of the ground-truth data based on the super-resolved images. The tool was then developed which combines all the previous actions, as well as other weather and agronomic data. Proper use of this tool would allow for better use of water, energy which would result in a better crop.

Main Achievement to date

The demonstrator links up with the following dimension of the nexus:

Water: With the use of the platform, better irrigation practices would be adopted by the agricultural community. Such practices would also lead to reduction in extraction and movement of water.

Energy: If less water is needed to be moved and abstracted then less energy would be utilised by vehicles and pumps.

Food: Improvement of the agricultural produce would be seen through the improved irrigation practices, wherever farmers would take up the information hat is being given by the platform.

The project is still under implementation and the above outlined key parameters will form part of the validation of the model and online platform. The demonstrator is a first-of-its-

kind in Malta and its outcomes will be used to inform future agricultural water policy development relating to a better understanding of the water use characteristics of the agricultural sector. The demonstrator would also provide capacity-building as advice to farmers on irrigation practice and crop water use characteristics.

Partners
University of Malta (UoM)

Lessons, replicability and scalability potential

The demonstrator already covers up the whole country, however, with better ground truth data in different areas the model could be further trained and therefore, the result of the platform would be more accurate. This demonstrator also has good potential for replicability in other countries, as all that would need to change is the focus area of the satellite imagery, parcels, and the addition of different ground truth data.

The main outcome is that any ground truth data that is available and validated should be made available for the model to be optimal. It might also not be as easy for the agricultural community to take on new irrigation practices, and this is why consultation is crucial throughout the whole process of the development and implementation. Such a demonstrator could also be applied in other countries or islands with similar climates as those found in Malta. Understanding the crops being grown and their water requirements could help any country be more water efficient. Furthermore, the model could be applied elsewhere, as it is only the location and the training data that would need to be changed.

Affiliation
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Environmental
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Social
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Technological
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Nexus Dimensions
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