CSIC / UMA

UC-FARM1-Water saving

26th InfoCom World Conference

Athens, Greece
12, November 2024

Presenter: Juan M Losada

6G-Path

Co-funded by the European Union

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01 Description and motivation

02 Scenarios for experimentation

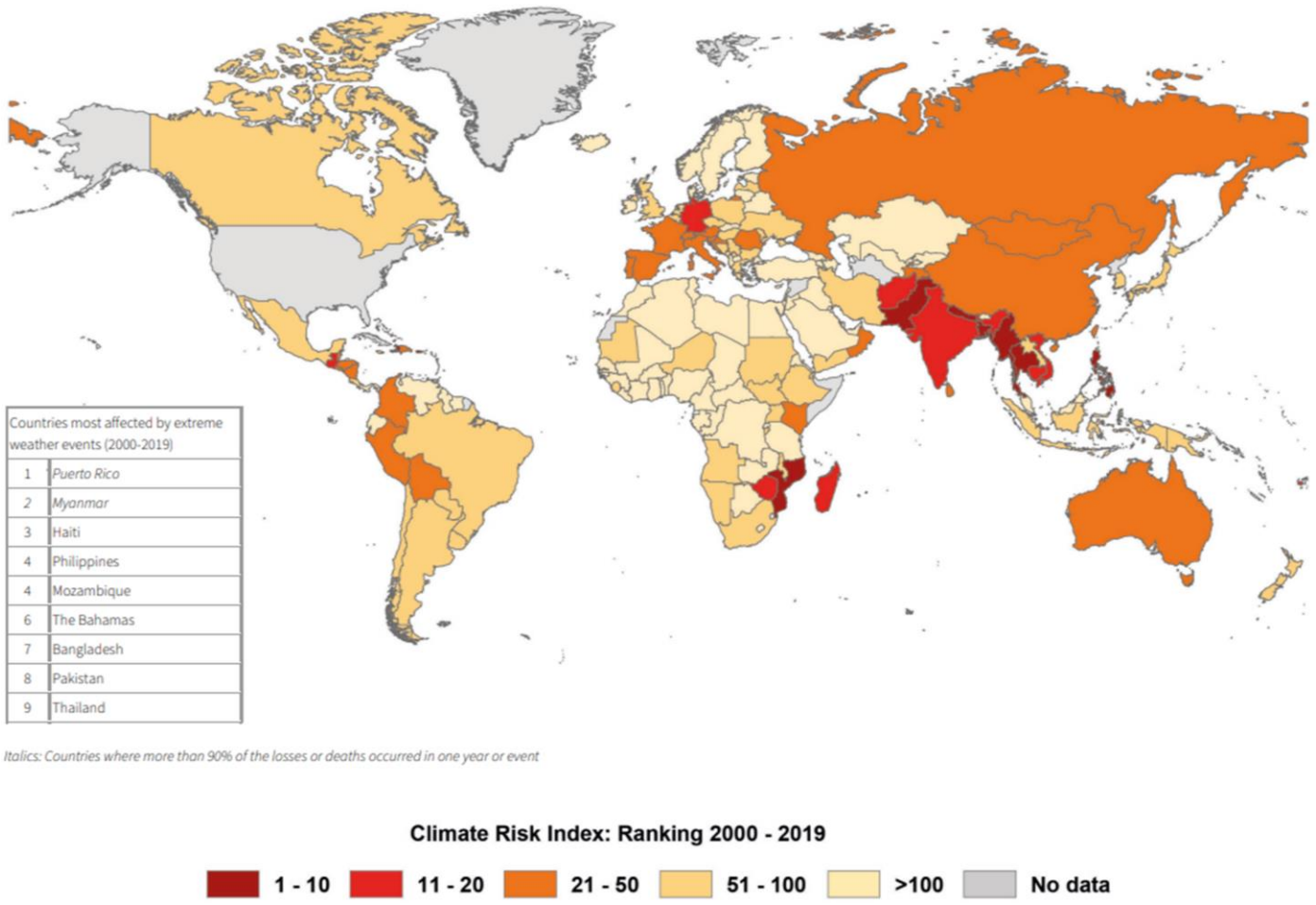
03 Use of 6G-advanced features

04 Validation: KPIs and KVIs

6G-Path

Figure 1: World Map of the Global Climate Risk Index 2000 – 2019

Source: Germanwatch and Munich Re NatCatSERVICE



Background

Climate change are acting as a driver for improving overall farming actions, not only by the direct impact it has on the **crops**, but also through the increasing regulations imposed on **farmers**.

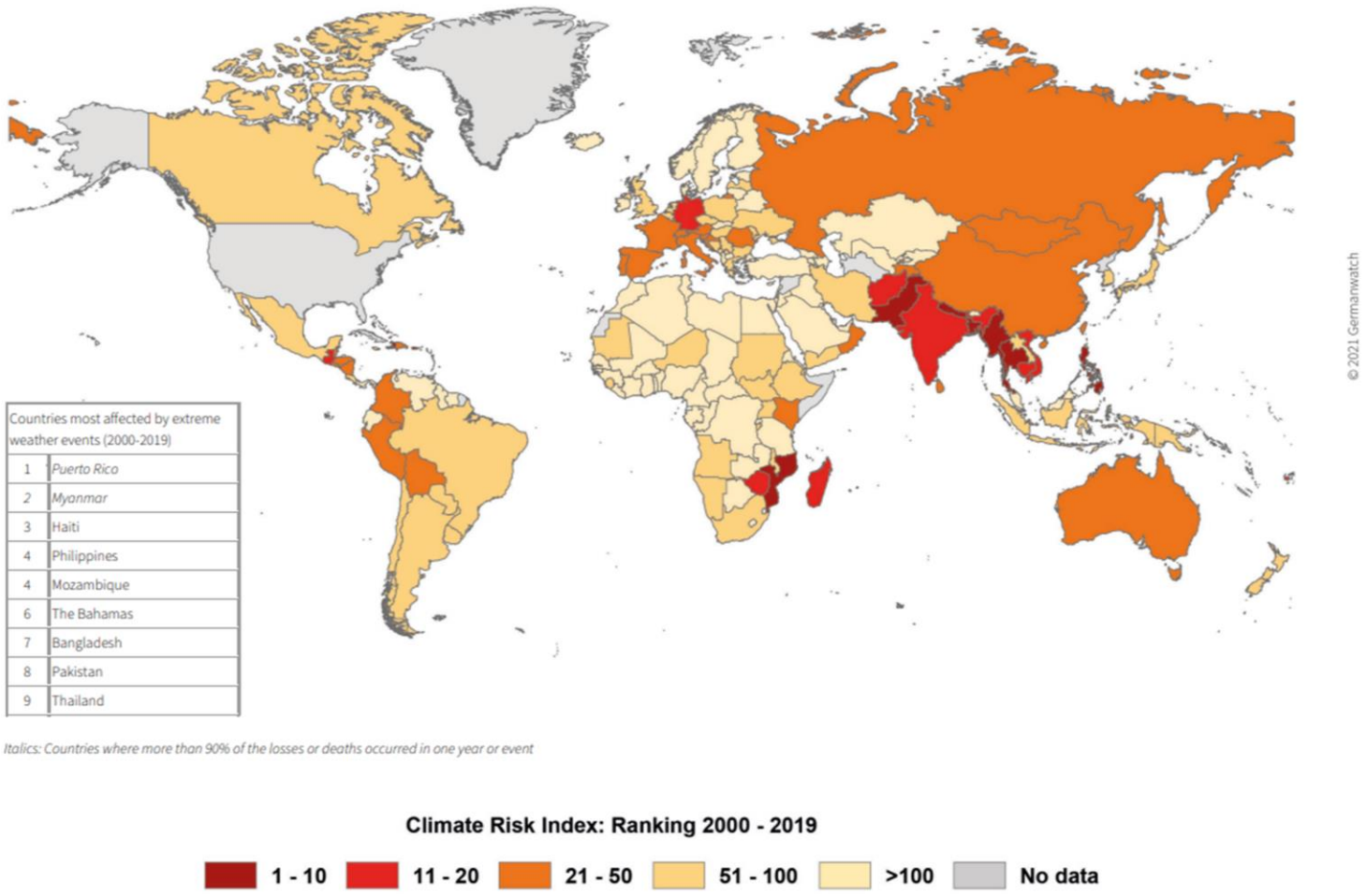
Innovation and intelligence to crops management will increase its effectiveness, reducing the consumed resources while also increasing the cost effectiveness of operations.

The **Mediterranean basin** in highly susceptible to the harmful effects of climate change, such as water scarcity. In particular, the coastal regions of Málaga and Granada are the main producers of **subtropical fruit crops**, such as avocado, the most important in terms of productivity. The lack of available **water for irrigation** it threatening this production, and a handful of studies have explored the effects of climate change in this crop.

The use case objective is to focus on the development and provision of guaranteed products and services for the agricultural sector, in this case, ensuring water saving according to the phenological stages of the crop and taking advantage of the pilot facilities to optimize and validate the final product. All this will lead to efficient and intelligent irrigation. Large volumes of **video and images in real-time require the use of 6G technology** with lower latency and reliability.

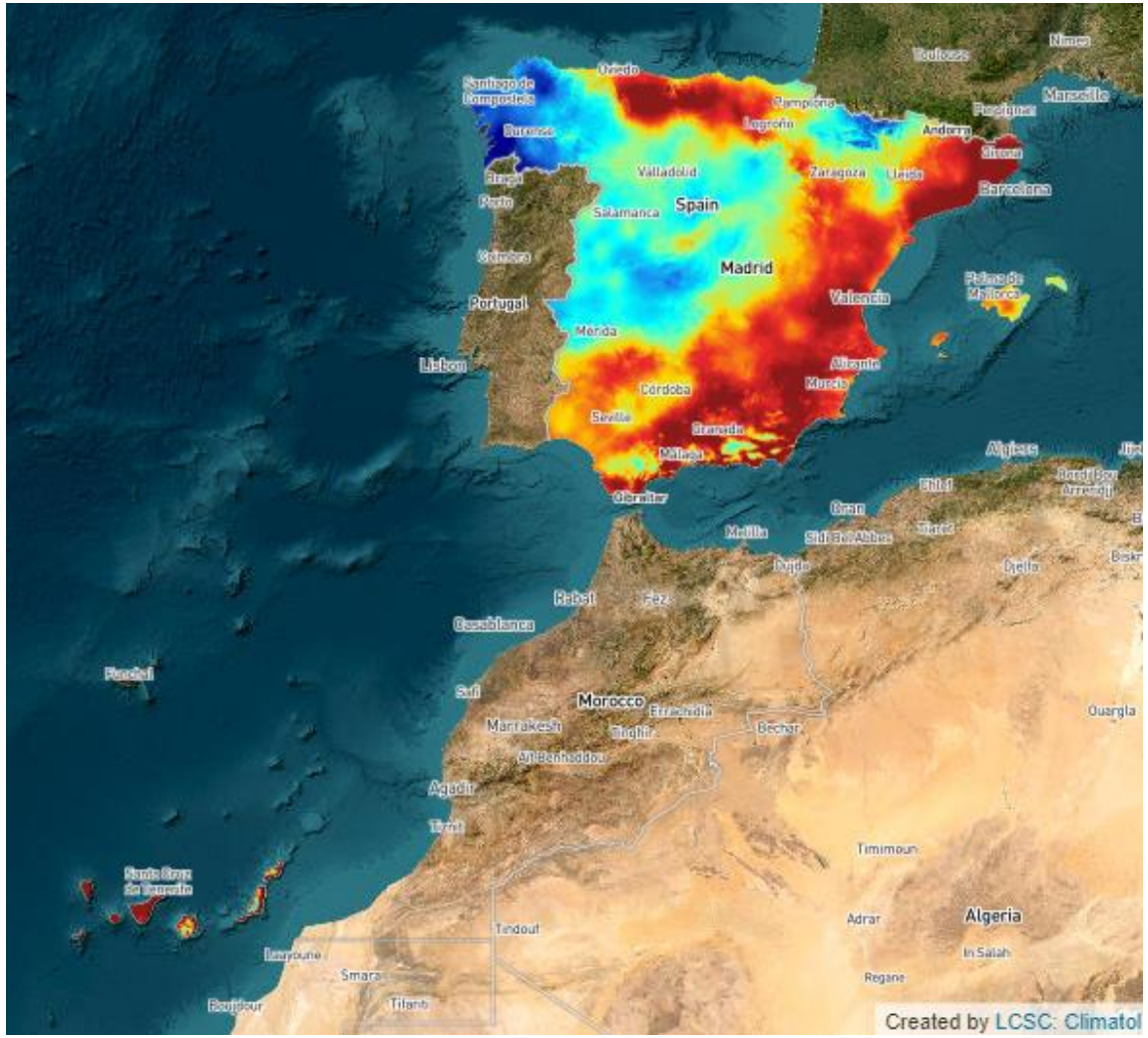
Figure 1: World Map of the Global Climate Risk Index 2000 – 1999

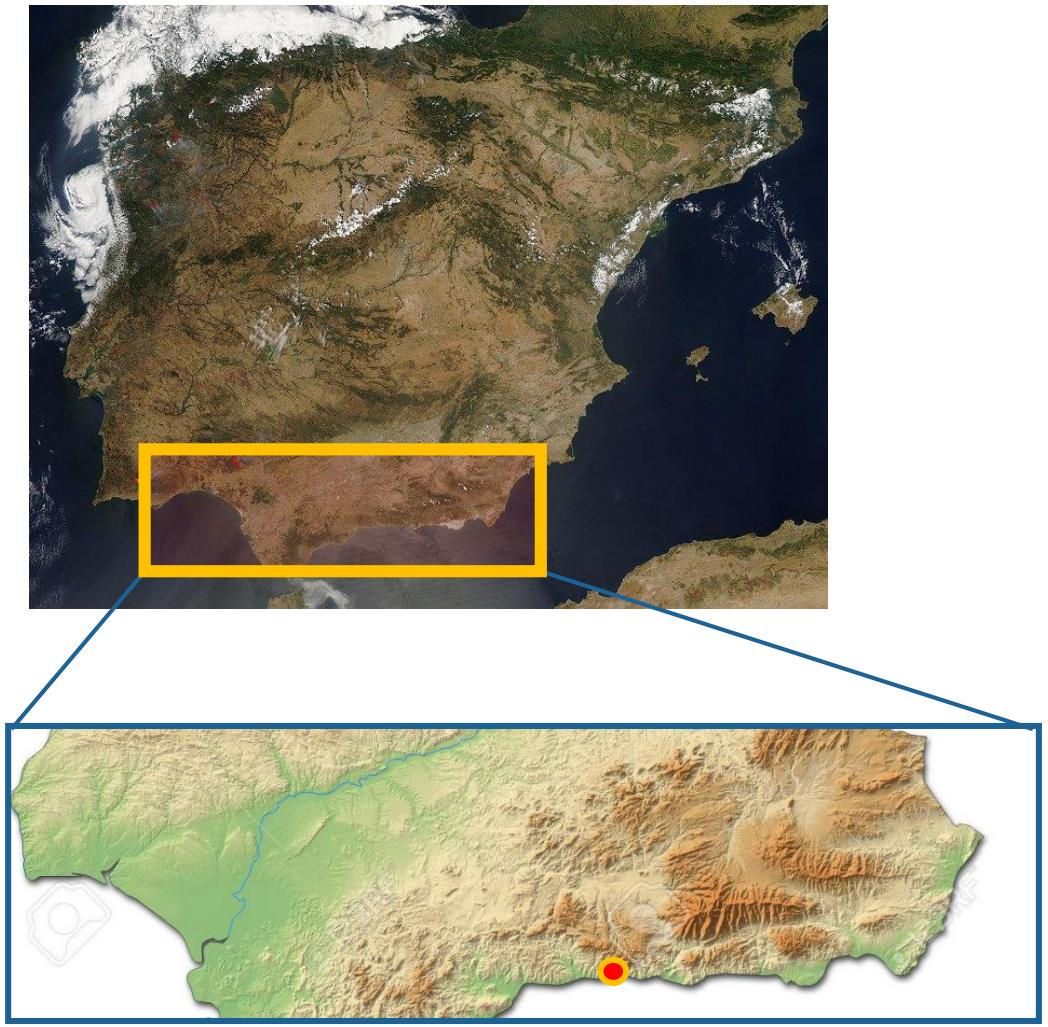
Source: Germanwatch and Munich Re NatCatSERVICE



Key Pain Points

- Irrigation of crops uses approximately 70% of available freshwater worldwide. **Real-time decisions to optimize water use** are limited by the difficulty in obtaining and analyzing sufficient data quickly.
- The access of producers to tools that improve decisions on irrigation would result in significant **savings in the amount of water used for fruticulture**
- Decisions on irrigation are usually made at the orchard level from a qualitative perspective since there is a limitation in the collection and analysis of data at the single tree/plant level. The combination of **a significant amount of data at the single tree level together with its rapid flow and analysis may enable preventive actions to optimize irrigation**.
- Irrigation needs in accordance with the **phenology of plants** is a novel approach for fruit trees, given the lack of seasonal information of most crops. Combining irrigation experiments with phenophases at the orchard level will be crucial to optimize product quality and more efficient use of resources.

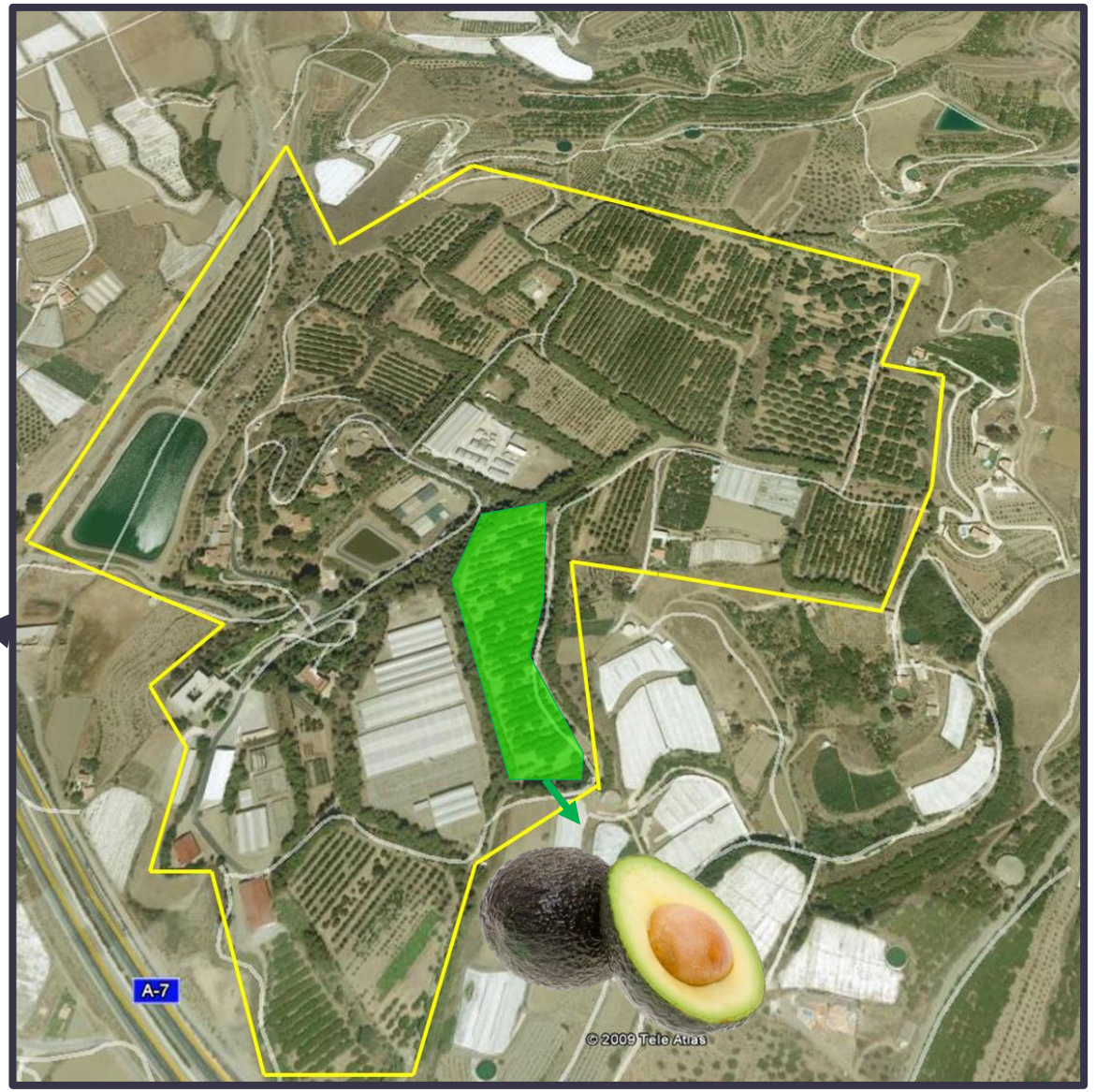




Mapa: monitordesequia.csic.es, datos: SPEI


IHSM
CSIC
Consejo Superior de Investigaciones Científicas
IHSM
IHSM


IHSM
CSIC
Marenga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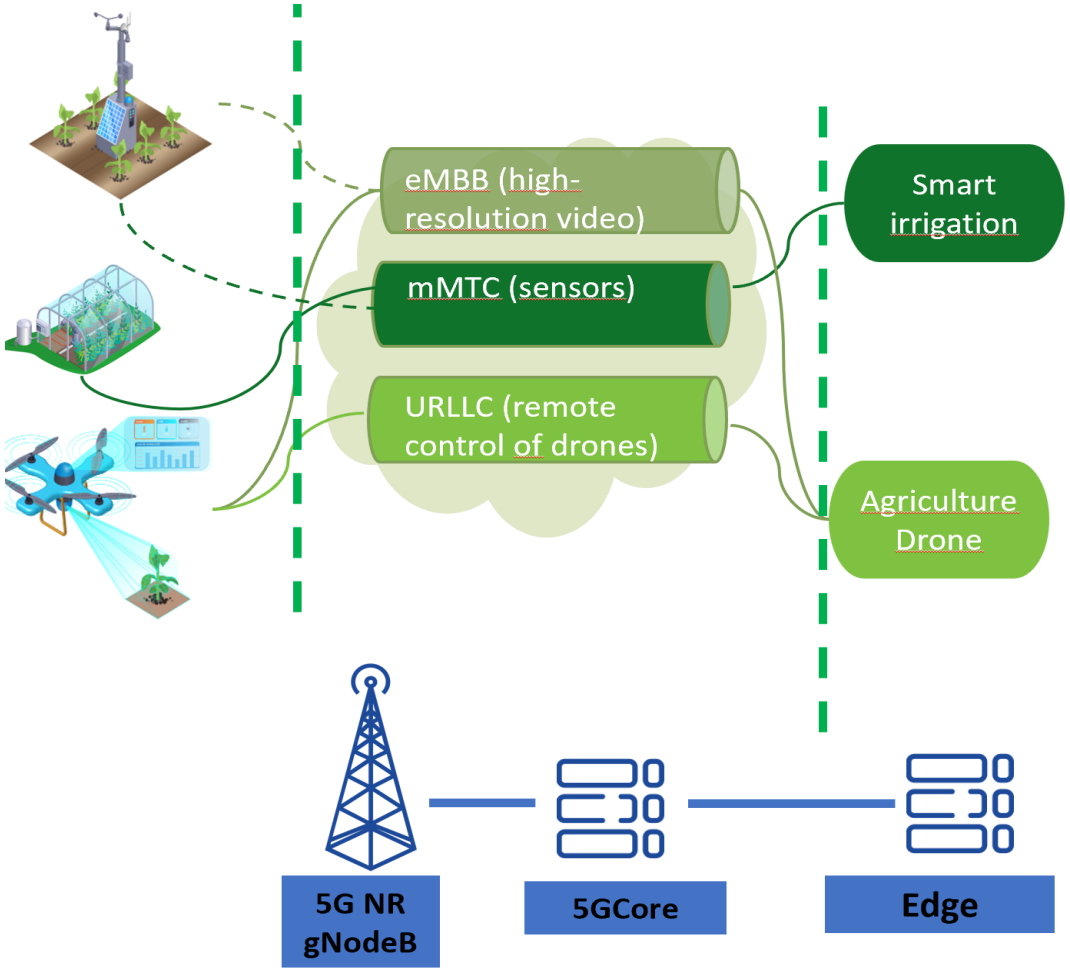
eMBB (high-resolution video)
mMTC (sensors)
URLLC (remote control of drones)
Smart irrigation
Agriculture Drone
5G NR gNodeB
5GCore
Edge


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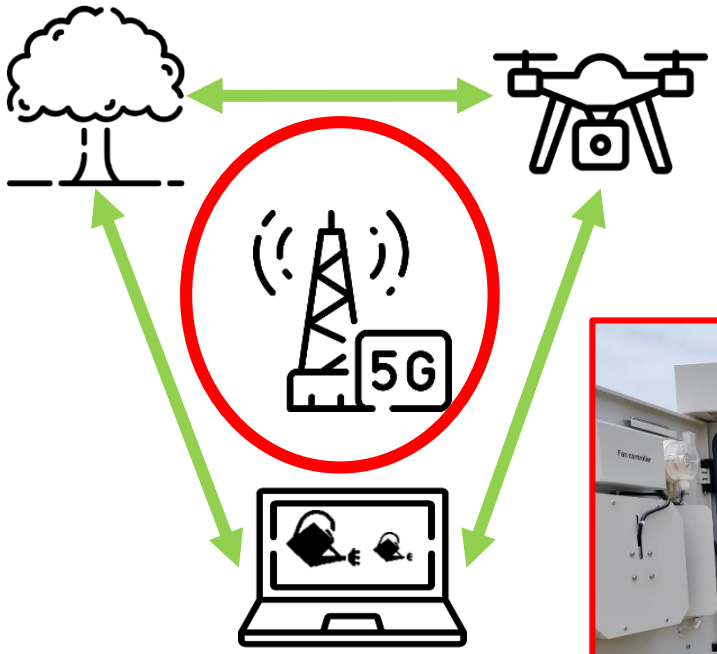
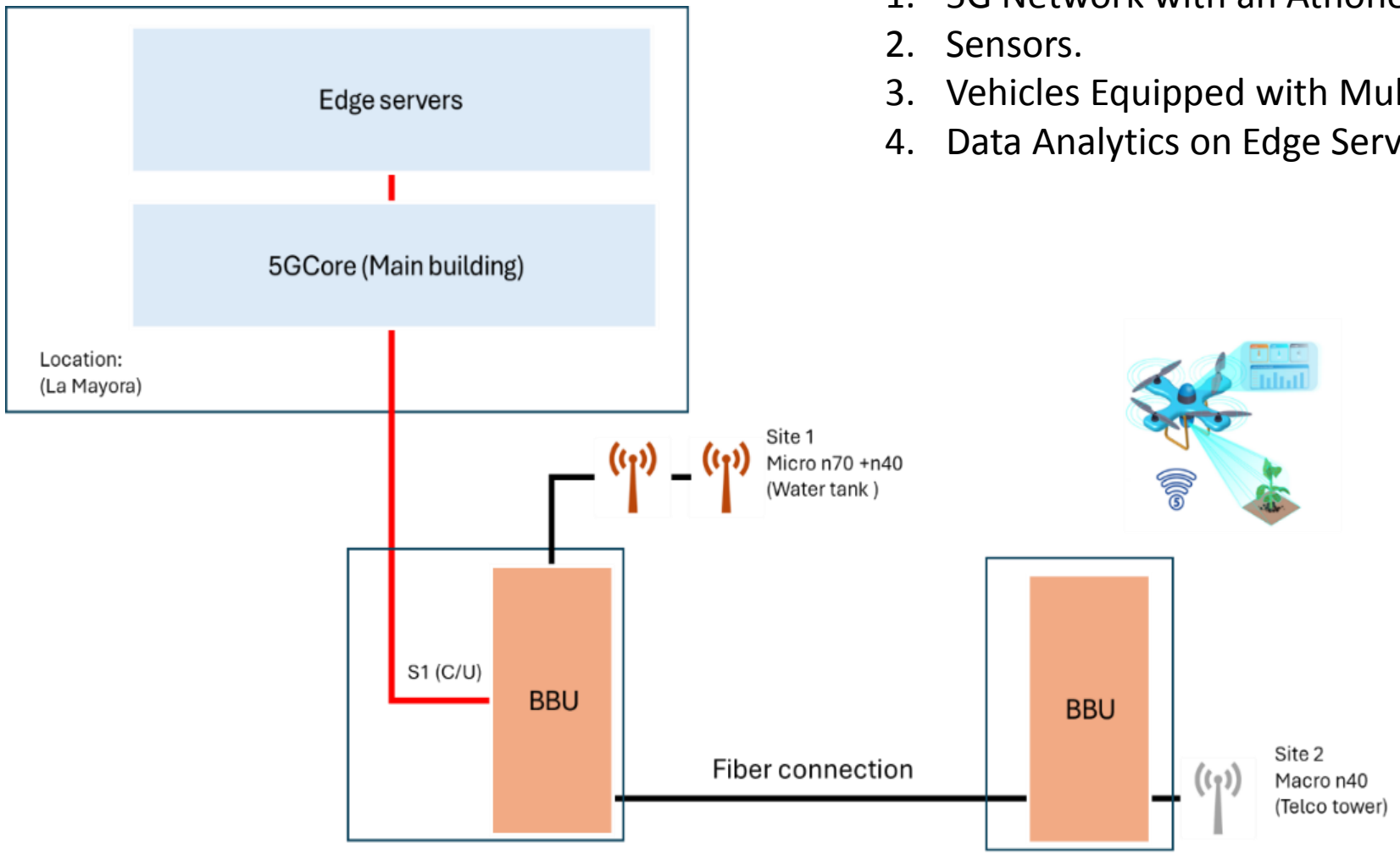
Create a private 5G network in the field



High level topology



KEY COMPONENTS

1. 5G Network with an Athonet 5GCore and Edge Computing
2. Sensors.
3. Vehicles Equipped with Multispectral Cameras.
4. Data Analytics on Edge Servers

Use of 6G-advanced features

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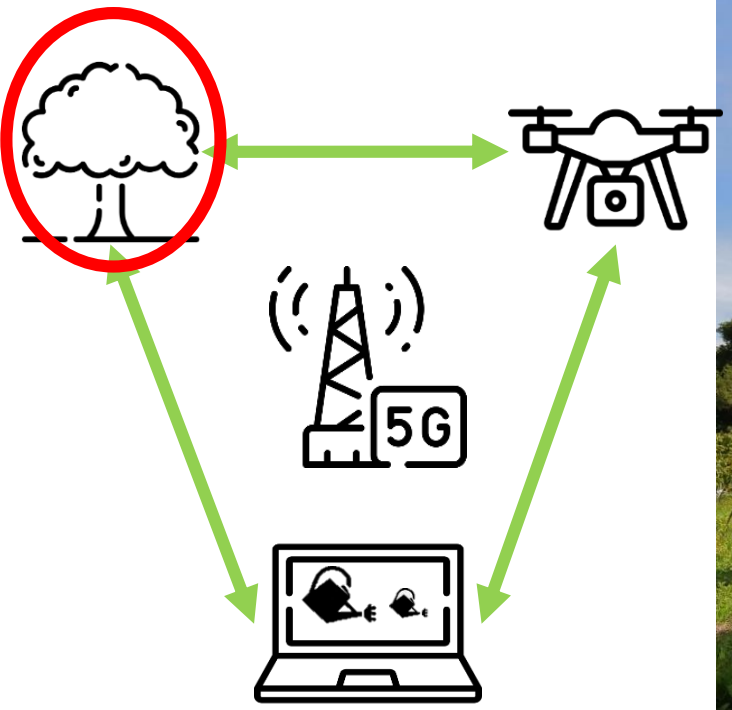
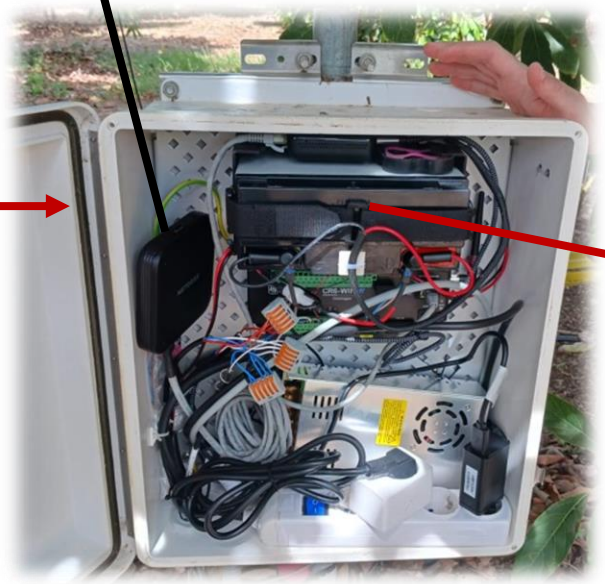


Core 5G

Server UMA
Edif. Ada Byron



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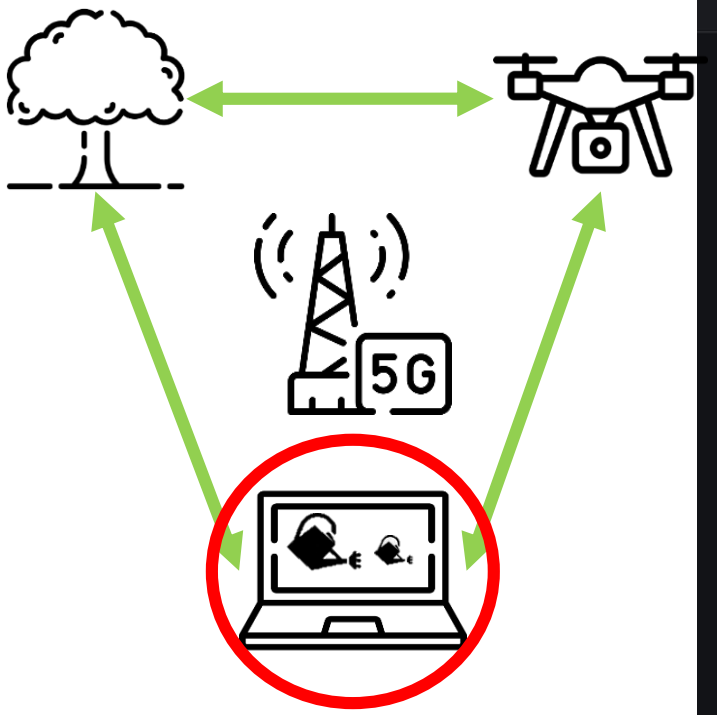

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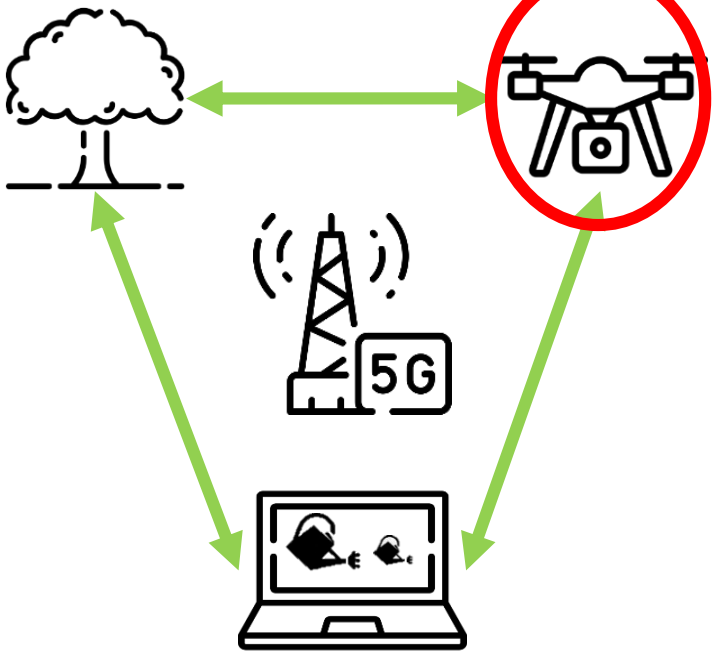

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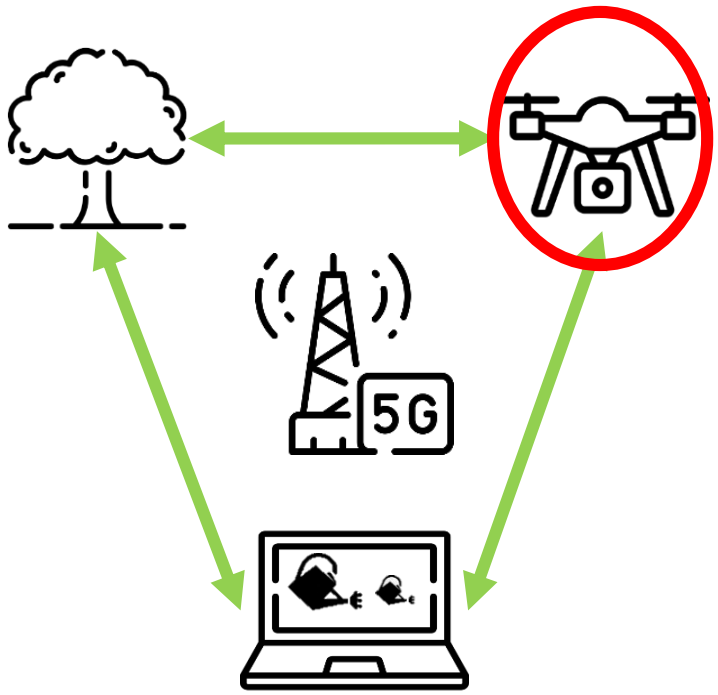

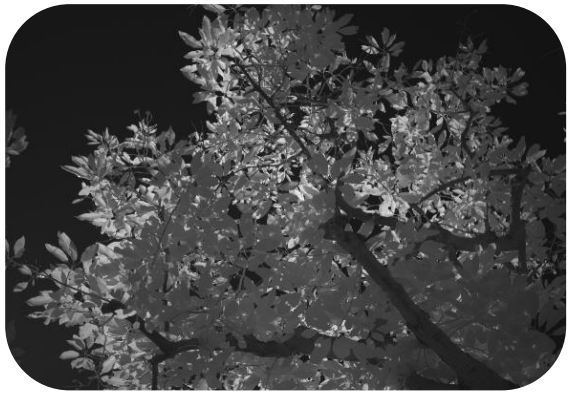

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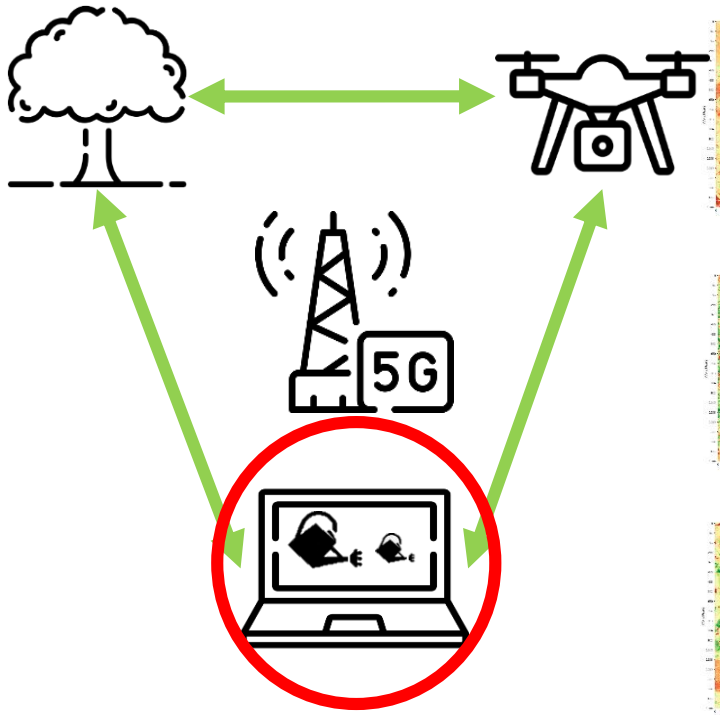

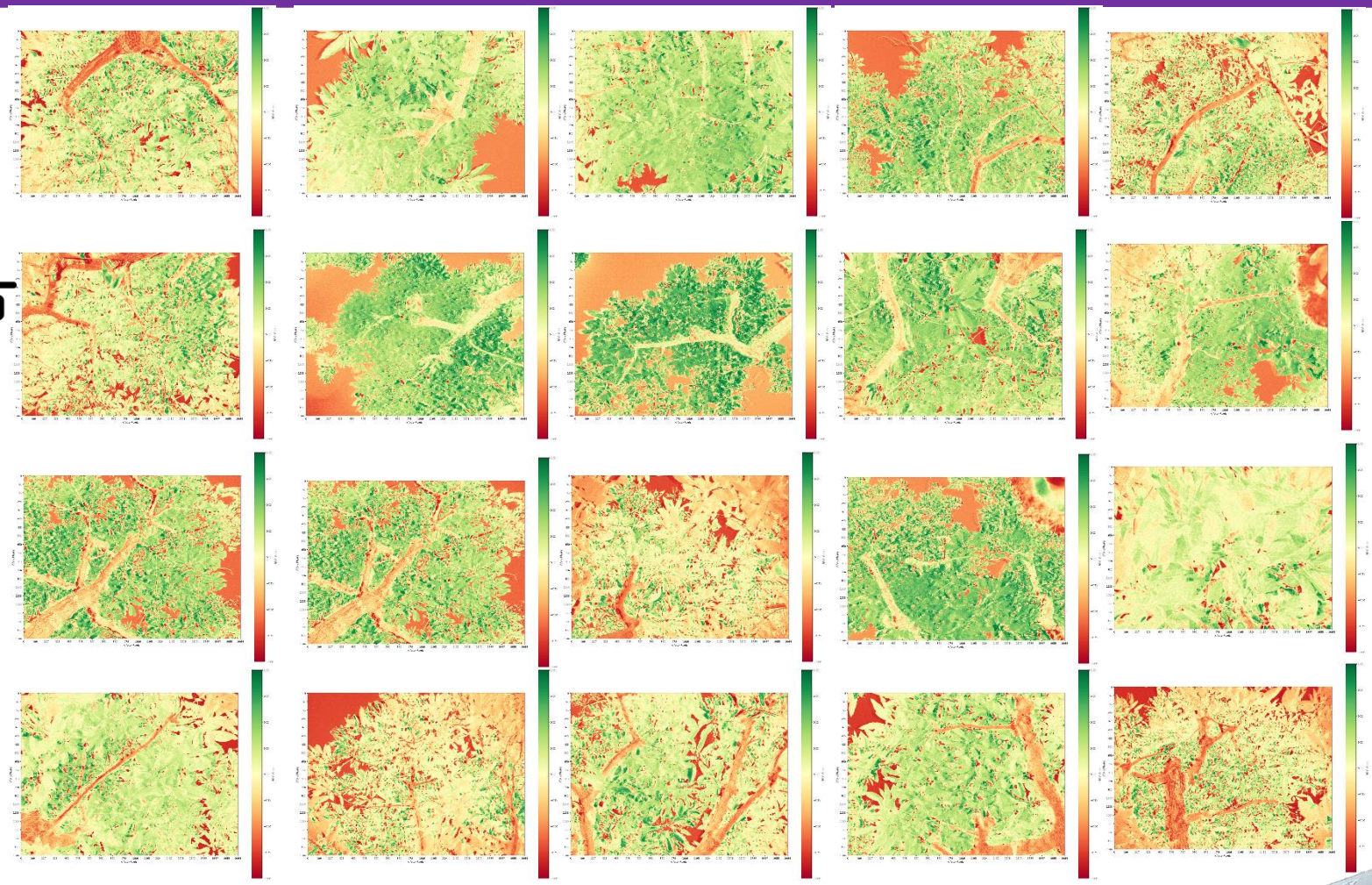

Validation: KVIs

Use Case KVIs

Sub-scenario	KVI name	Description	Objective
Social	Increase the presence of technology in the agricultural sector	Development of applications and automation of irrigation would reduce time consuming activities	To promote the engagement of young growers in agriculture
Social	Profitable technology in rural areas	The results of the application of 5G-6G might be convincing for small growers living in rural areas to make investments	To convince small growers of the profitability of using 5G-6G in their orchards
Social	Policy engagement	Policies on environmental protection and counteracting the effects of climate change	
Economic	Cost Savings (KPI from the perspective of operation)	Reduction in water use and resource inputs (the stakeholders would benefit from cost reductions)	(>10%) compared to the previous period or baseline
Economic	Increase in yield Predictive yield	Crop yield quality increase resulting from timely interventions Personnel cost reductions	(>20 indicators) collected and processed at the single tree/plant level (baseline: qualitative analysis at the orchard level).
Economic	Energy intensity of agriculture	Increases in Agricultural production but reduction in energy consumption	Delta between costs saved from using intelligent water saving processes and the overhead in terms of compute and network costs in operating such processes (>5%).
Economic	Inferencing accuracy and interpretability	AI-models accuracy (and additional AI metrics)	predicting the correct irrigation decisions and the usage of explainable AI techniques when compared to SoA algorithms (+5%) and no AI

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Showcases

Show our Use case to visits from private companies and Universities	Sharing knowledge and Foster collaborations at the international level	Show the deployment of our use case and the data generated in reat time.	June 2024: 15 persons visiting from KEYSIGHT Co. And the University of Malasya

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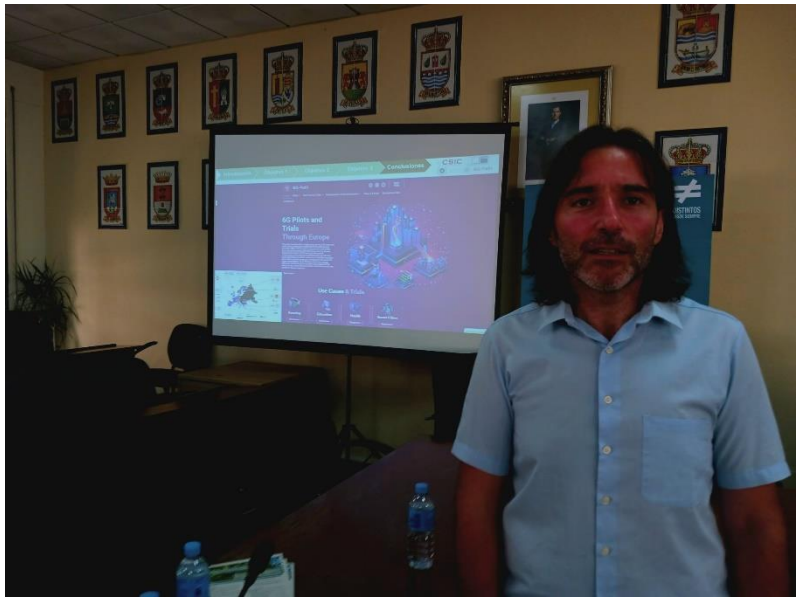

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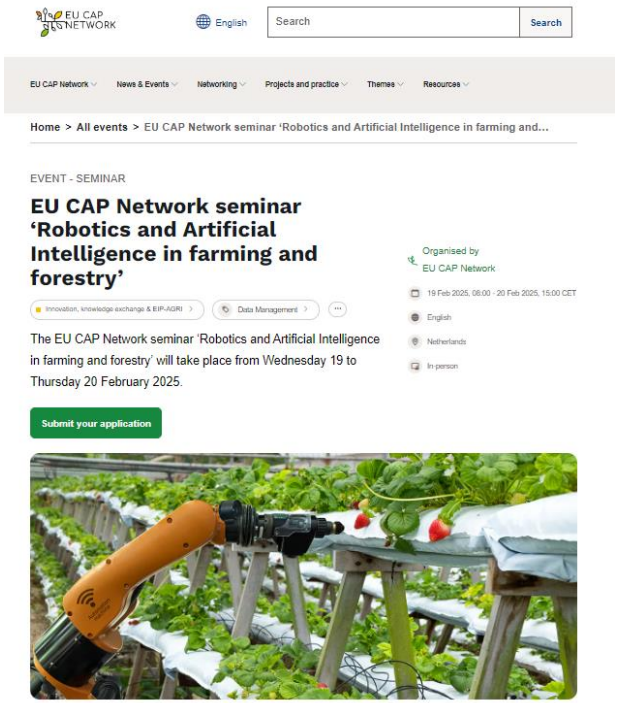
Academic	Share these results to the Academic sector	Sharing knowledge and Foster collaborations in Academy	Discuss with scientific peers on the possibilities to deploy these infrastructures in other scenarios	June 2024: Cristina Ferrer presented this work at the Fruit Tree Symposium in the Canary Islands

Validation: KVIs

..stay tunned for 2025

February

Spring/Summer



Thank you for you attention!

Company Name
CSIC/UMA

Presenter & position
Juan M Losada. Tenured researcher

Email
juan.losada@csic.es

Company website
www.ihsm.uma-csic.es

6G-Path

Co-funded by the European Union

6GSNS

6G-PATH project has received funding from the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101139172.