Project **ID 230716** : **“USE OF NEW TECHNOLOGIES FOR DETECTION EARLY DAMAGES IN OLIVE”**.

General objective of the project

Identify environmental, physiological and nutritional variables in olive groves that correlate with the data obtained through satellite/drone images, with the aim of establishing a series of indices or factors that allow detecting risk areas for the appearance of repilo and/or nutritional deficiencies in olive grove

Specific Project Objectives

- Check through a historical record those areas most susceptible to the presence of repilo and collect meteorological data to establish study areas of interest.
- Obtain humidity and temperature records by placing sensors in the different selected study areas, and thereby establish a classification of possible incidence of repilo.
- **Estimate the general condition of the trees using images (NDVI) obtained by satellite**, and study their possible relationship with the recorded humidity and temperature variables.
- Generate infection prediction models from the processing of historical satellite images and climatic data acquired from selected farms.

METHODOLOGY

Selection of the satellite image provider.

First, a search and comparison of various providers of historical multispectral satellite images was carried out. For this purpose, the Sentinel Hub platform was used, a satellite image distribution and analysis service that provides access to data from the main providers.

Finally, it was decided to use the data provided by the PlanetScope satellite constellation. PlanetScope data are an excellent source for monitoring vegetation over time due to the temporal coverage it offers and its spatial resolution. The main characteristics of PlanetScope can be consulted in **Table 1**.

Tabla 1: Características de PlanetScope

Característica	Información
Resolución espacial	3 m/px
Bandas	Azul, rojo, verde y NIR
Tiempo de revisión	1 día
Cobertura espacial	Global

METHODOLOGY

Downloading the images

First, the area of interest (AOI) was defined, that is, the geographical extent from which data is to be obtained. To carry out this work, two areas of interest were defined within the study plot: A first area (AOI 1) composed of trees in which TREATMENT 1 was applied (Image 1) and a second area (AOI 2) composed by trees in which TREATMENT 2 was applied (Image 2). Both areas have an approximate area of 1 hectare.

Image 1: AOI composed of trees treated with TREATMENT 1

Image 2: AOI composed of trees treated with TREATMENT 2

METHODOLOGY

Processing

The Normalized Difference Vegetation Index (NDVI) is one of the most widely used vegetation indices. It measures the greenness and mass density of vegetation and is used to estimate the health status of plants. NDVI can be calculated from multispectral images using the following formula: $NDVI = \frac{NIR-RED}{NIR+RED}$

The range of NDVI values is defined by values ranging from -1 to 1. Negative NDVI values correspond to areas with water or clouds. Values close to zero (-0.1 to 0.1) generally correspond to arid areas of rock, sand, or snow. Low and positive values represent areas with sparse vegetation (approximately 0.2 to 0.4), while high values indicate a higher density of green leaves (values close to 1).

In carrying out this study, for each of the multispectral images obtained, the NDVI image has been calculated through algebraic operations between the different spectral bands. As a result, an image is obtained in which each pixel represents an NDVI value. The Matlab code to carry out this processing is as follows:

```
function [ndvi] = calcNDVI(nir,red)

    nir = double(nir);
    red = double(red);

    ndvi = (nir-red)./(nir+red);

end
```

RESULTS

Image 4 shows a graph in which the average NDVI value of each image has been represented against time for both AOIs. For a clearer representation, it has been decided to use data every 10 days. As can be seen, the average NDVI value for both areas of interest is very similar between the months of January and April. However, between the months of May and August it can be seen how the average NDVI value of the AOI 2 is slightly higher. This may be because the treatments applied at AOI 2 are more effective, thus causing a greater drop of diseased leaves in the treated trees, thus increasing the NDVI value.

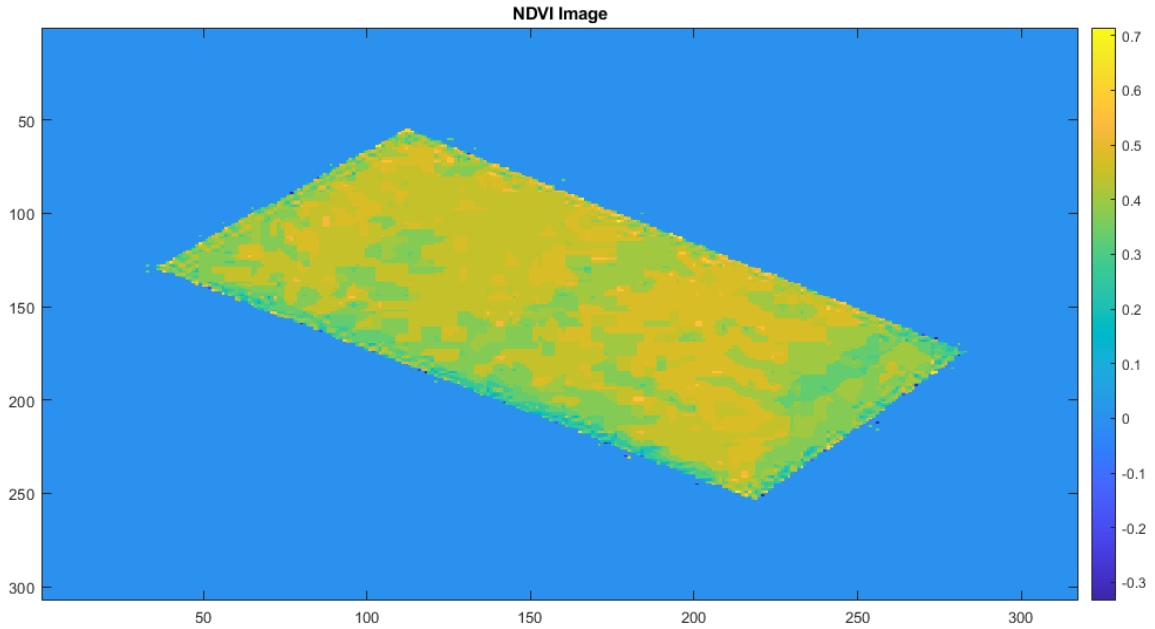

Imagen 3: NDVI image

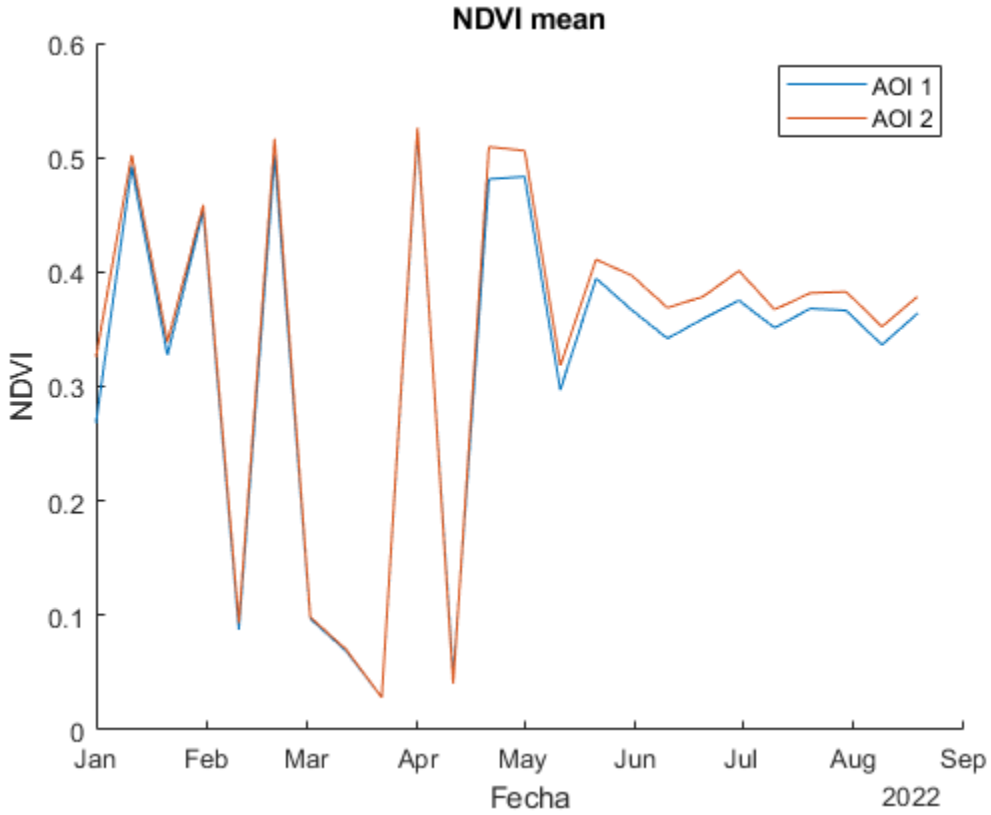

Imagen 4: NDVI medio