Experiences with the GAEA Platform: Towards a country-scale Digital Twin for Climate Smart Agro-Forestry

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What GAEA is

GAEA is a geospatial analysis tool that consists of 27 geospatial and geo-analytics services which offer rich contextual information related to geospatial area of Cyprus.

All environmental services have been developed combining one or more of the following technologies:

- Satellite imagery analytics – earth observation
- Geospatial analysis
- Artificial intelligence techniques (computer vision, machine learning)

GAEA Environmental Services

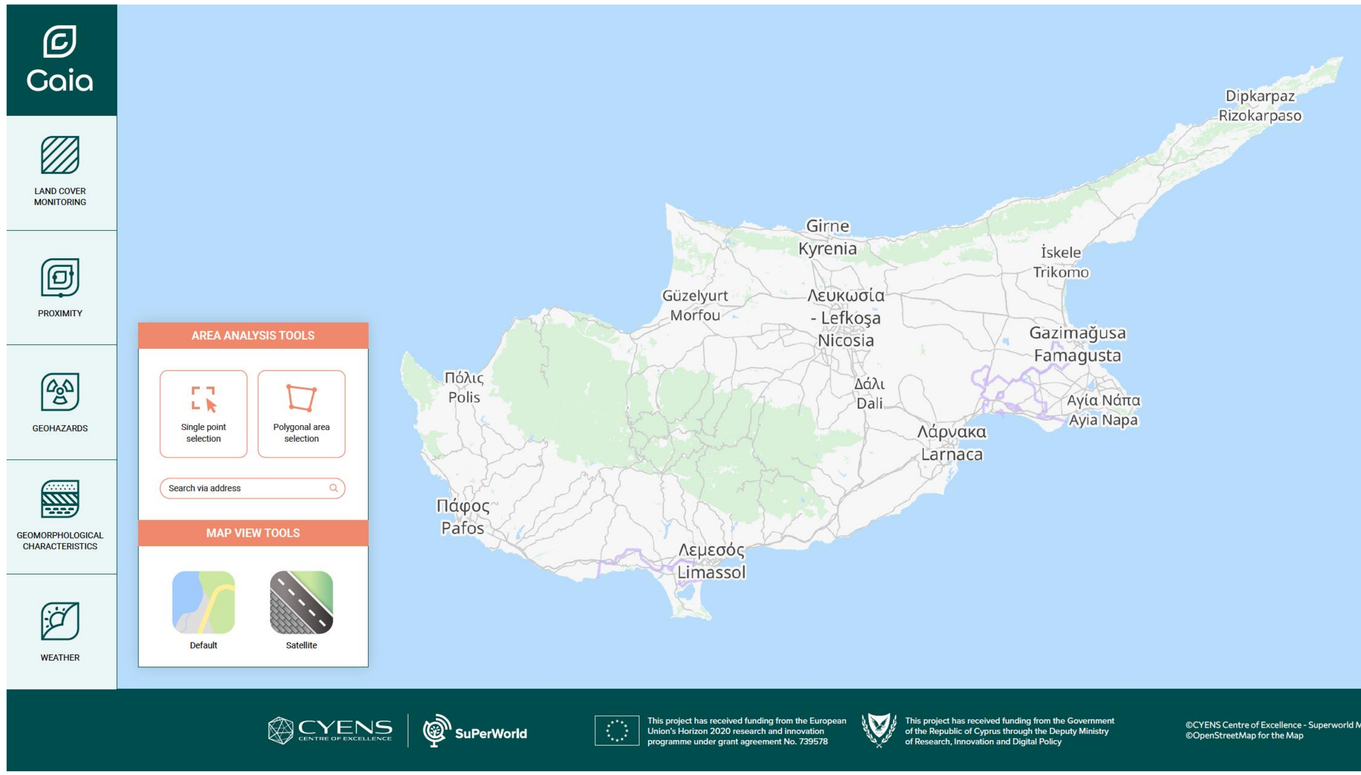
Land cover and use

Geomorphological characteristics

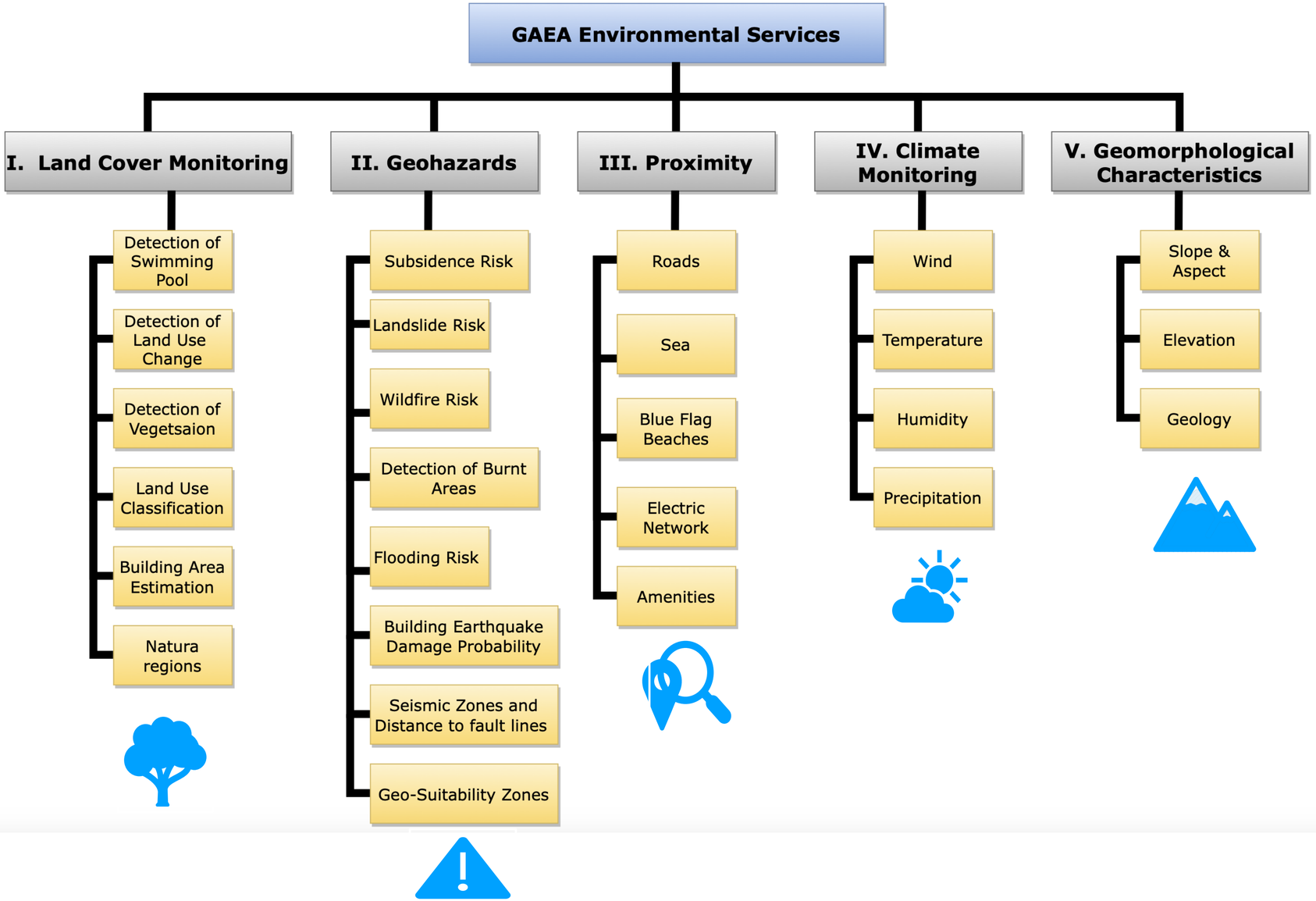
Distance to points of interest

Natural risks and geo-hazards

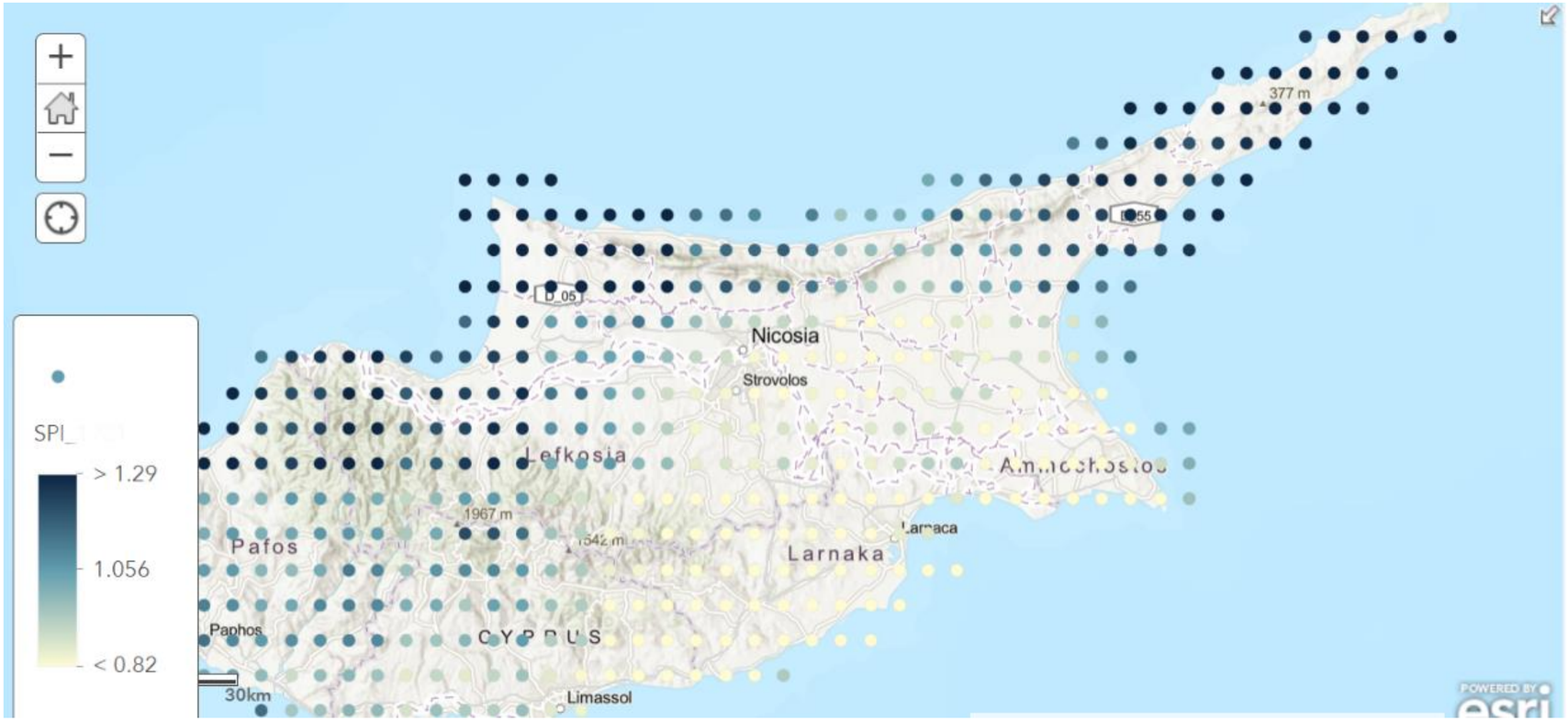
Weather/climate



GAEA Environmental Services



Geo-visualizations: Precipitation

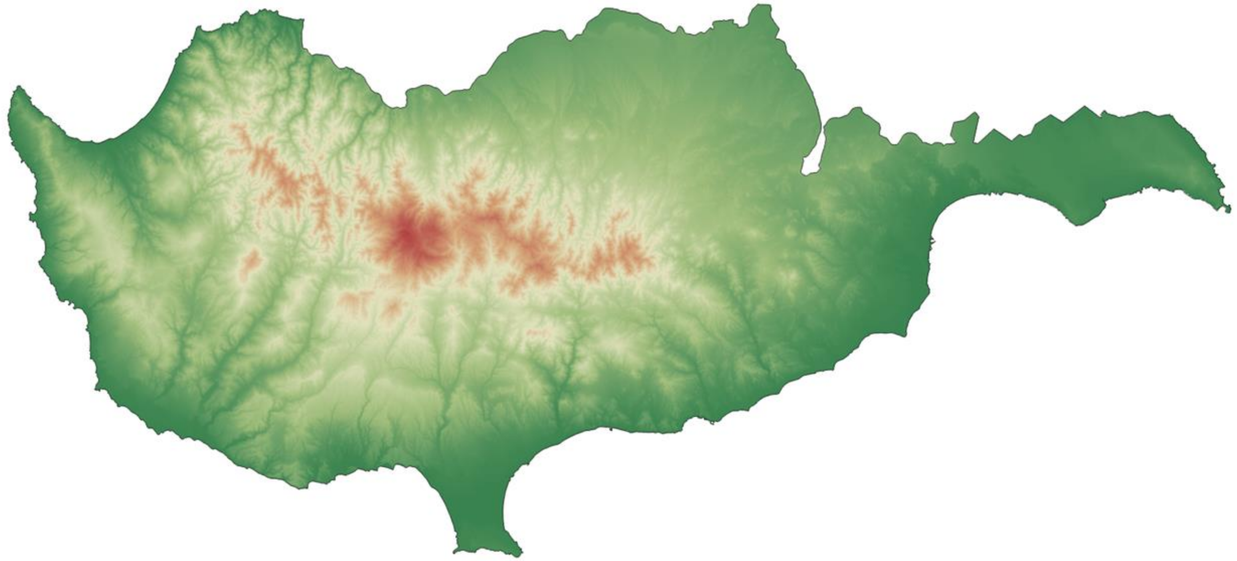


Source: 17 weather stations deployed around Cyprus by Dept. of Meteorology, taking measurements every 15 minutes (CSV files).

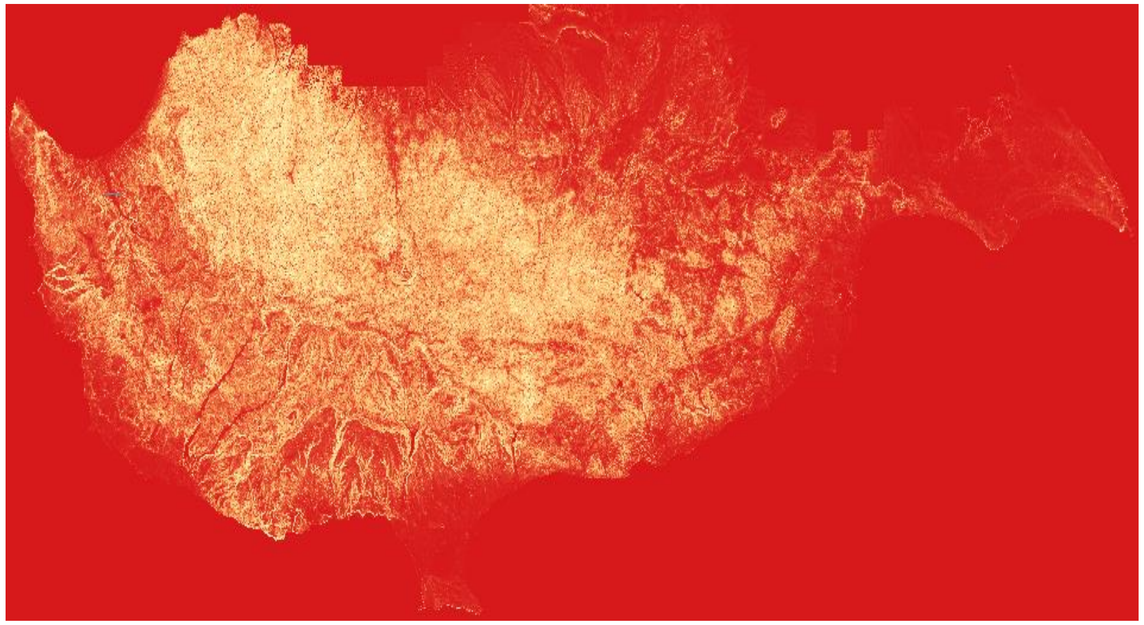
ΤΜΗΜΑ ΜΕΤΕΩΡΟΛΟΓΙΑΣ

Geo-visualizations: Geomorphology

Elevation

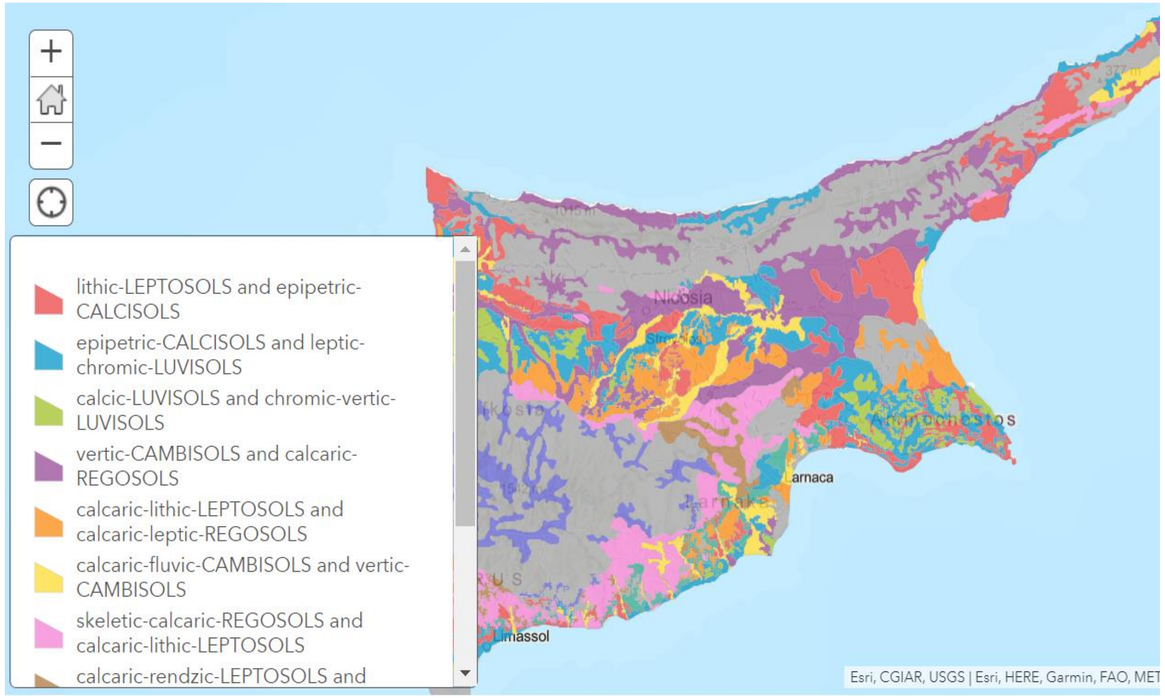


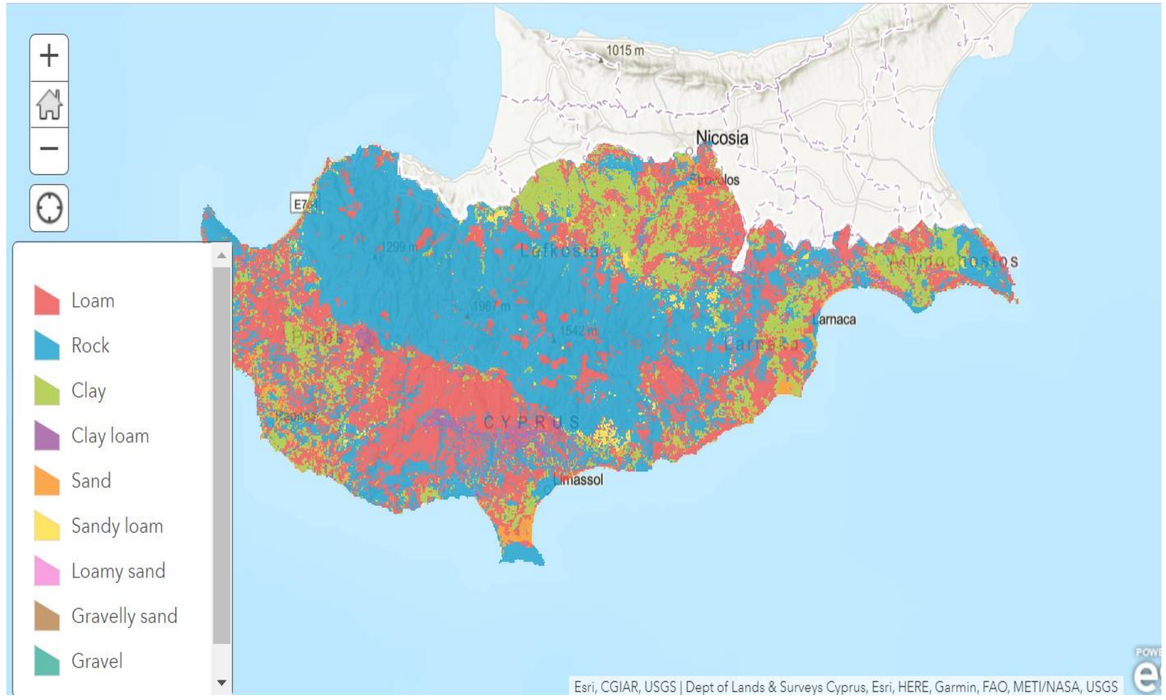
Slope



Source: Dept. of Geological Surveys (GIS Layer)

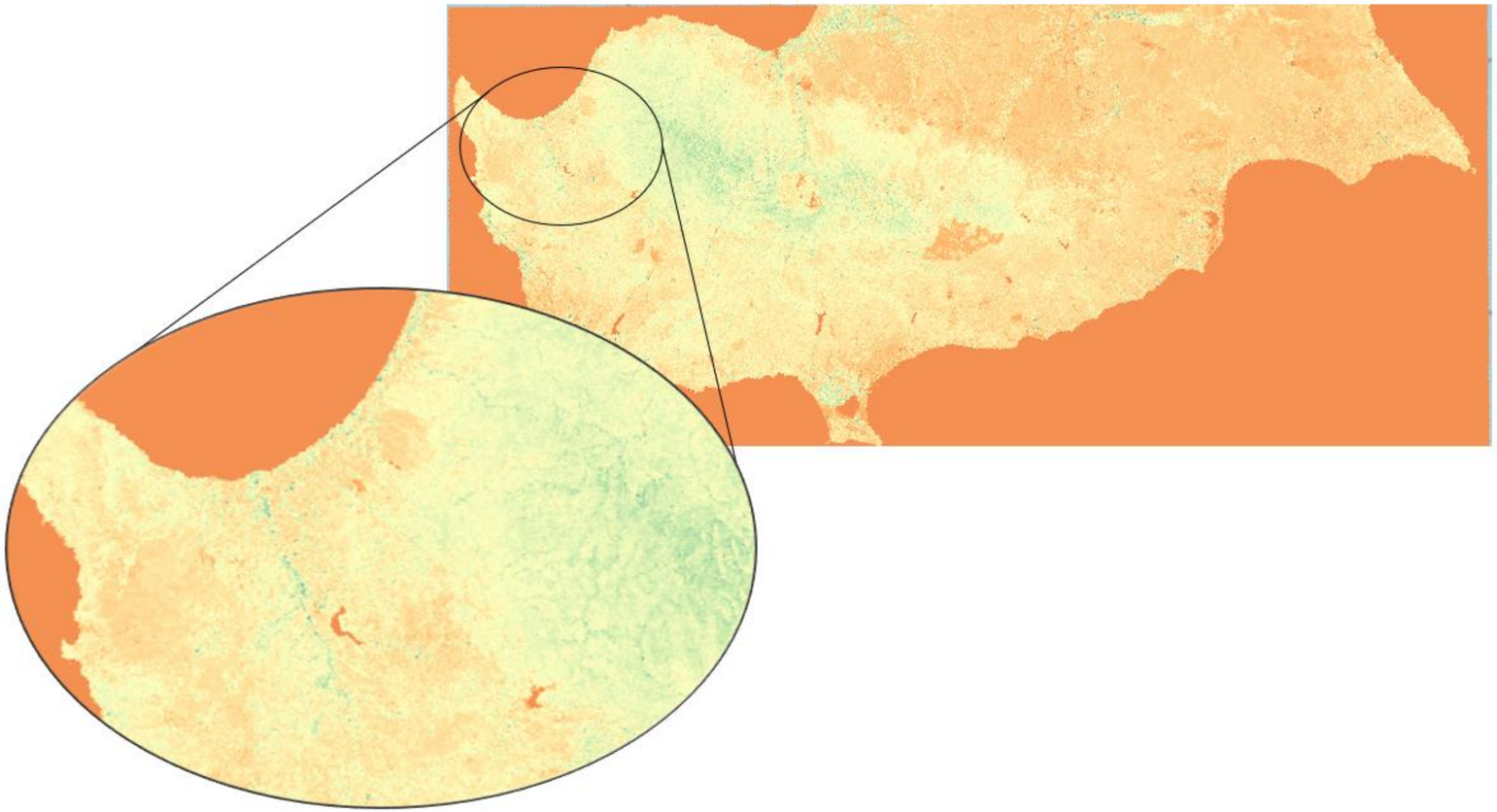
Geo-visualizations: Soil type and texture





Source: Dept. of Geological Surveys (GIS Layer)

Geo-visualizations: Vegetation

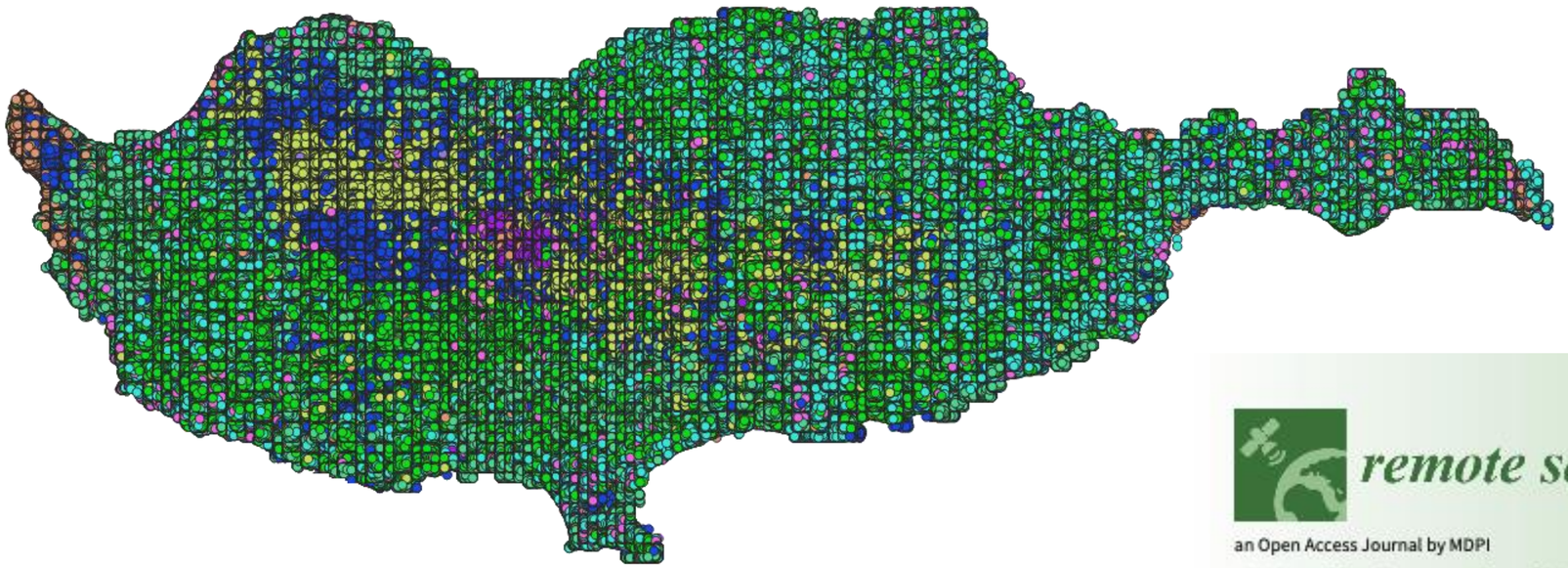


Source: PlanetScope satellite imagery and NDVI index

planet.

Geo-visualizations: Trees’ classification

Trees’ classification



- Cedrus Brevifolia
- Ceratonio Rhammonion
- Juniperus
- Leaved-Fruit Bearing
- Olives
- Pine (Pinus Brutia)
- Pine (Pinus Nigra)
- Quercus Alnifolia
- Vine

Source: CAPO Archives and field observations from Dept. of Forestry

ΚΥΠΡΙΑΚΟΣ ΟΡΓΑΝΙΣΜΟΣ ΑΓΡΟΤΙΚΩΝ ΠΛΗΡΩΜΩΝ
CYPRUS AGRICULTURAL PAYMENTS ORGANISATION

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DEPARTMENT OF FORESTS

remote sensing

an Open Access Journal by MDPI

A Weakly Supervised Multimodal Deep Learning Approach for Large-Scale Tree Classification: A Case Study in Cyprus

Arslan Amin; Andreas Kamilaris; Savvas Karatsiolis

Remote Sens. **2024**, Volume 16, Issue 23, 4611

Geo-visualizations: Tree counting

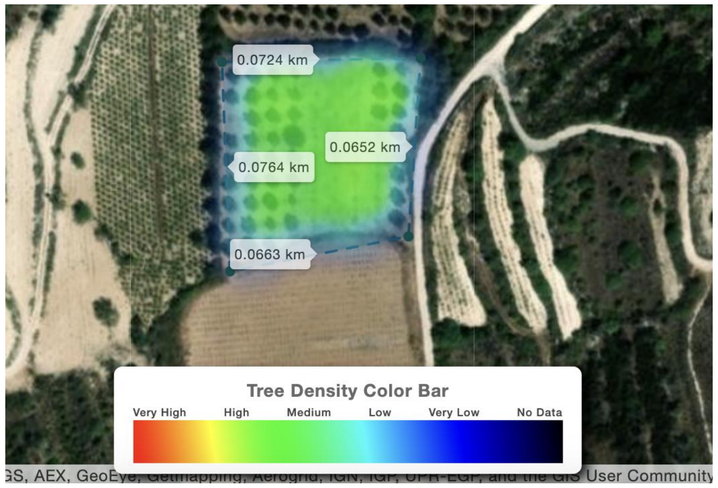
Polygon selected inside GAEA

Tree Coverage within the Polygon	
Overall Tree Count	58
Tree Density Per Square Meter	1.16%

Heatmap

EMPOWERED BY PERIOPSIS

AI model output



Geo-visualization inside GAEA

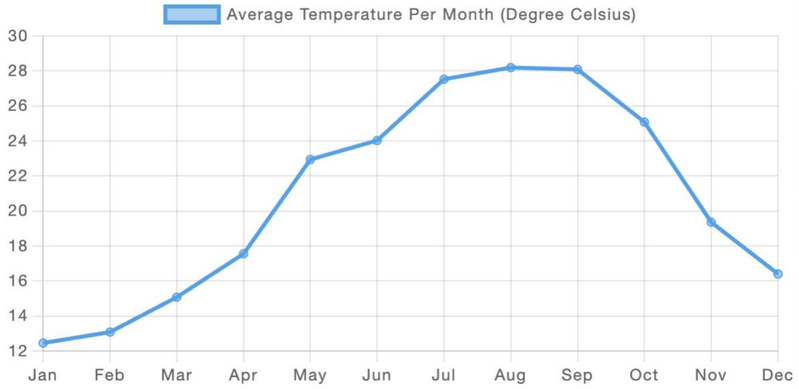
Geo-visualizations: Climatic conditions

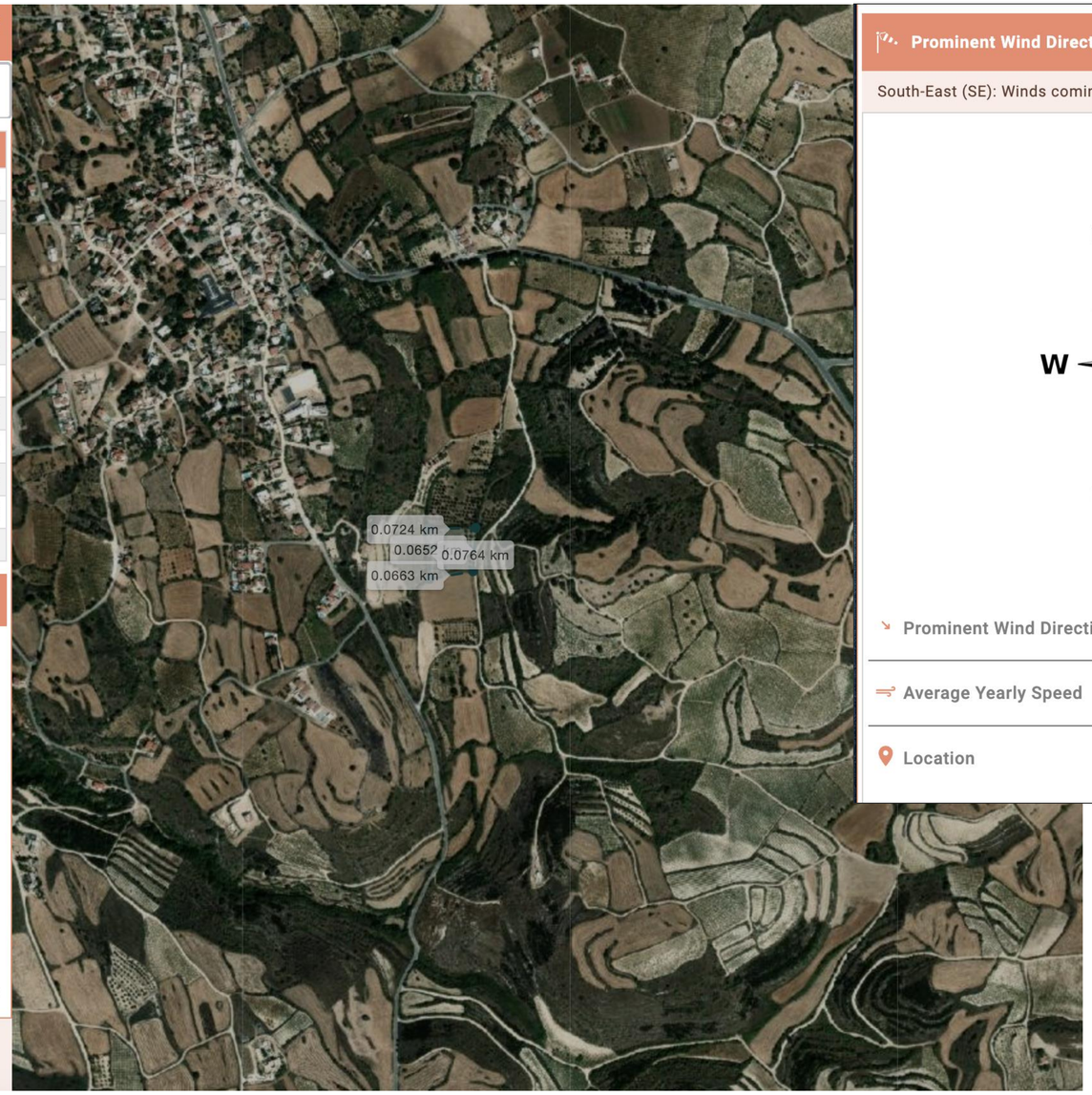
Temperature Result | Polygon Service

AREA ANALYSIS | STATISTICS

Month	Average Temperature
January	12.46
February	13.09
March	15.08
April	17.56
May	22.94
June	24.03
July	27.53
August	28.19
September	28.09
October	25.08
November	19.36
December	16.41

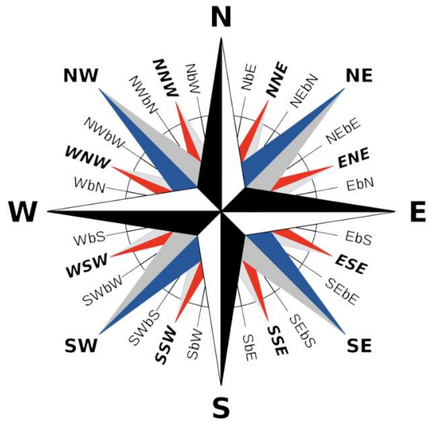
Monthly Temperature Averages Line Chart





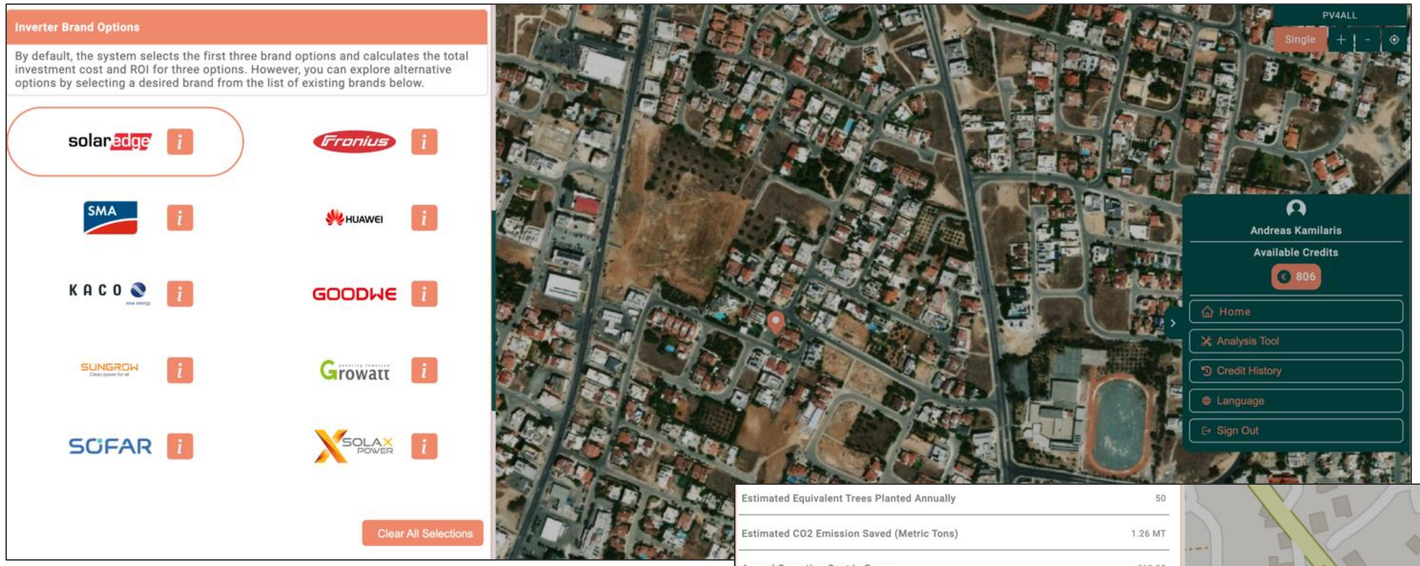
Prominent Wind Direction : South East (SE)

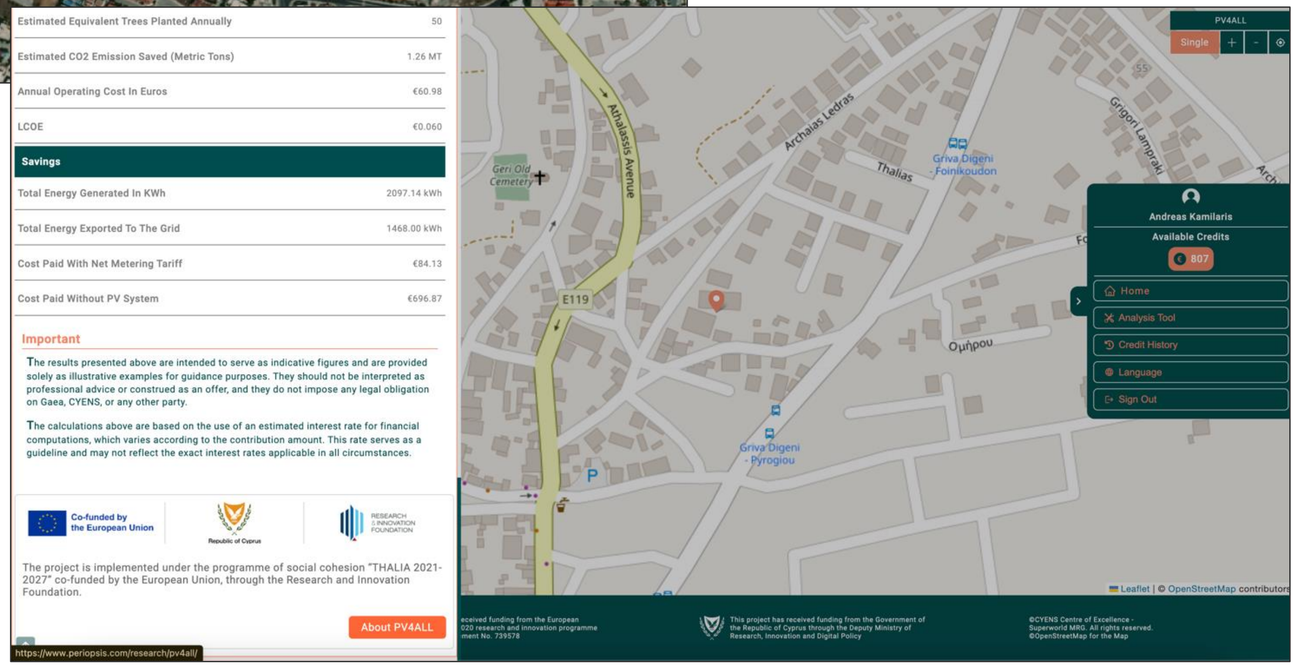
South-East (SE): Winds coming from the southeast and moving toward the northwest.



Prominent Wind Direction	South East (SE)
Average Yearly Speed	9 Knots
Location	Akoursos, Δήμος Ακάμα, Paphos District, Cyprus

Application: PV4ALL

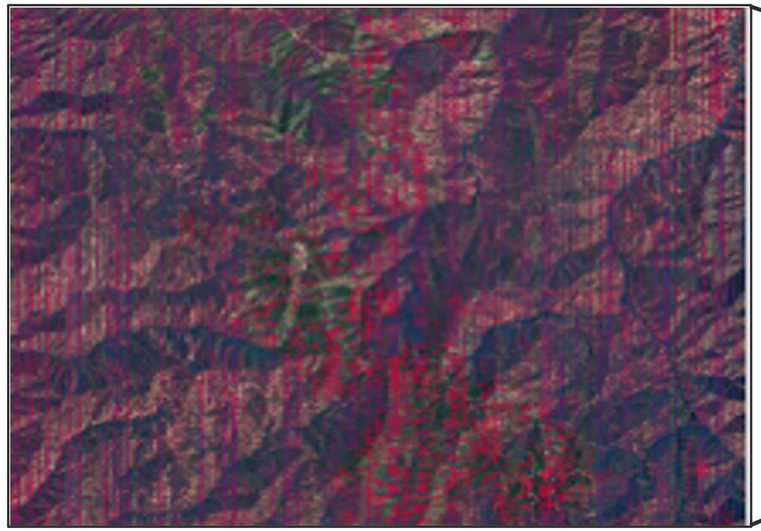


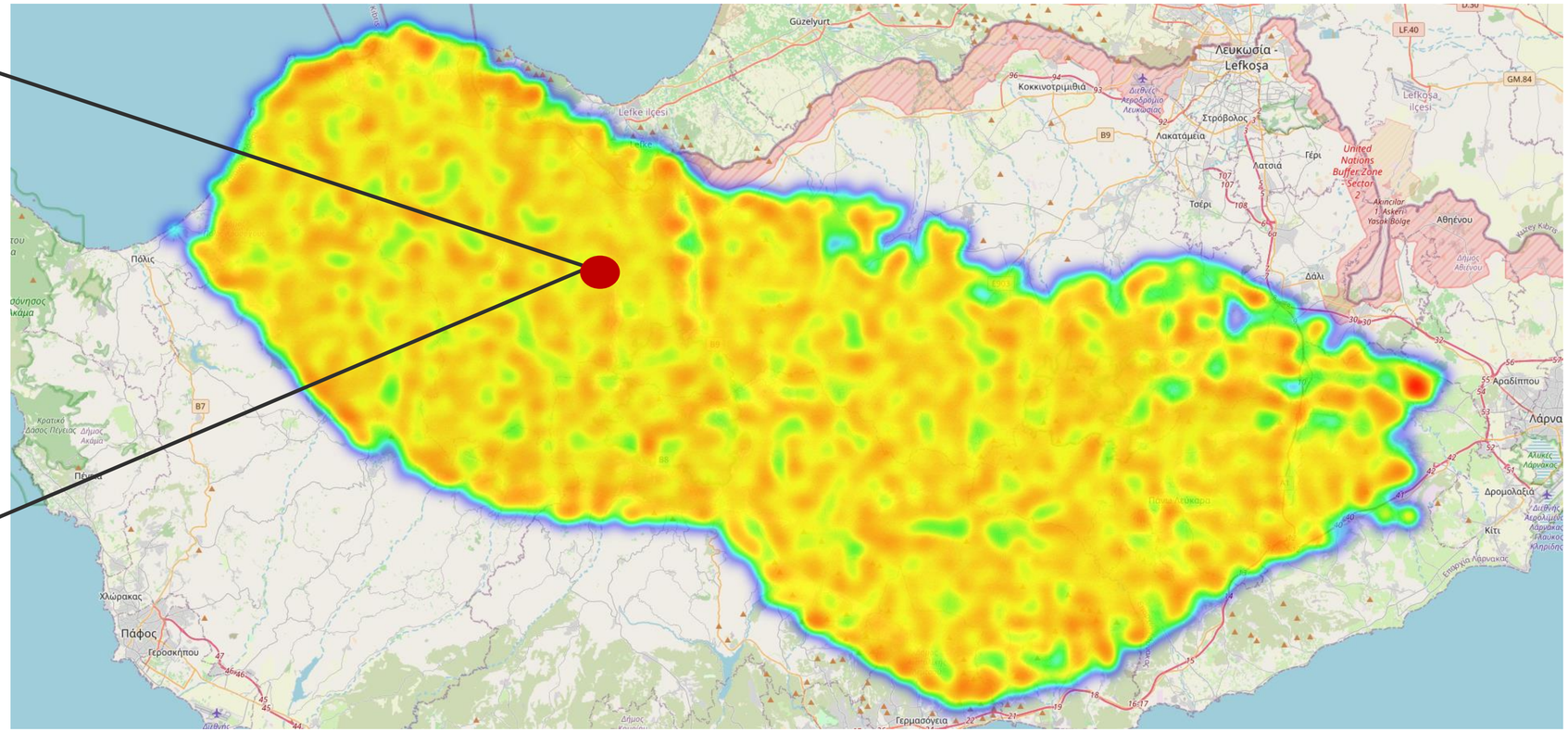


Application: Forests' health from satellite imagery

FORWARDS

EDUCYPRUS-CSF

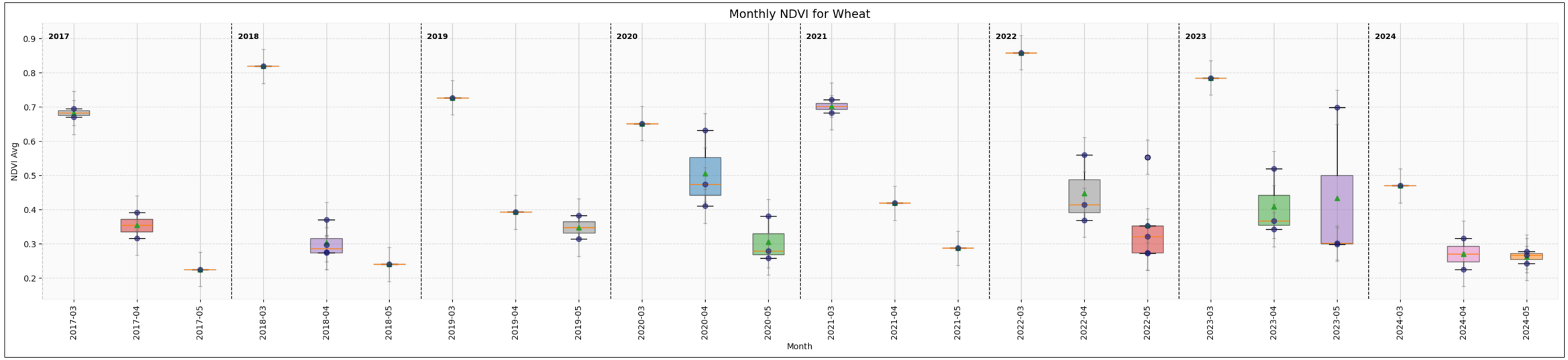




Drought stressed canopy in an area expanding from Frodisia to Cedar Calley and ending towards Milikouri, and then between Chionistra and Amiantos Asbestos mine area. (NDWI Index)

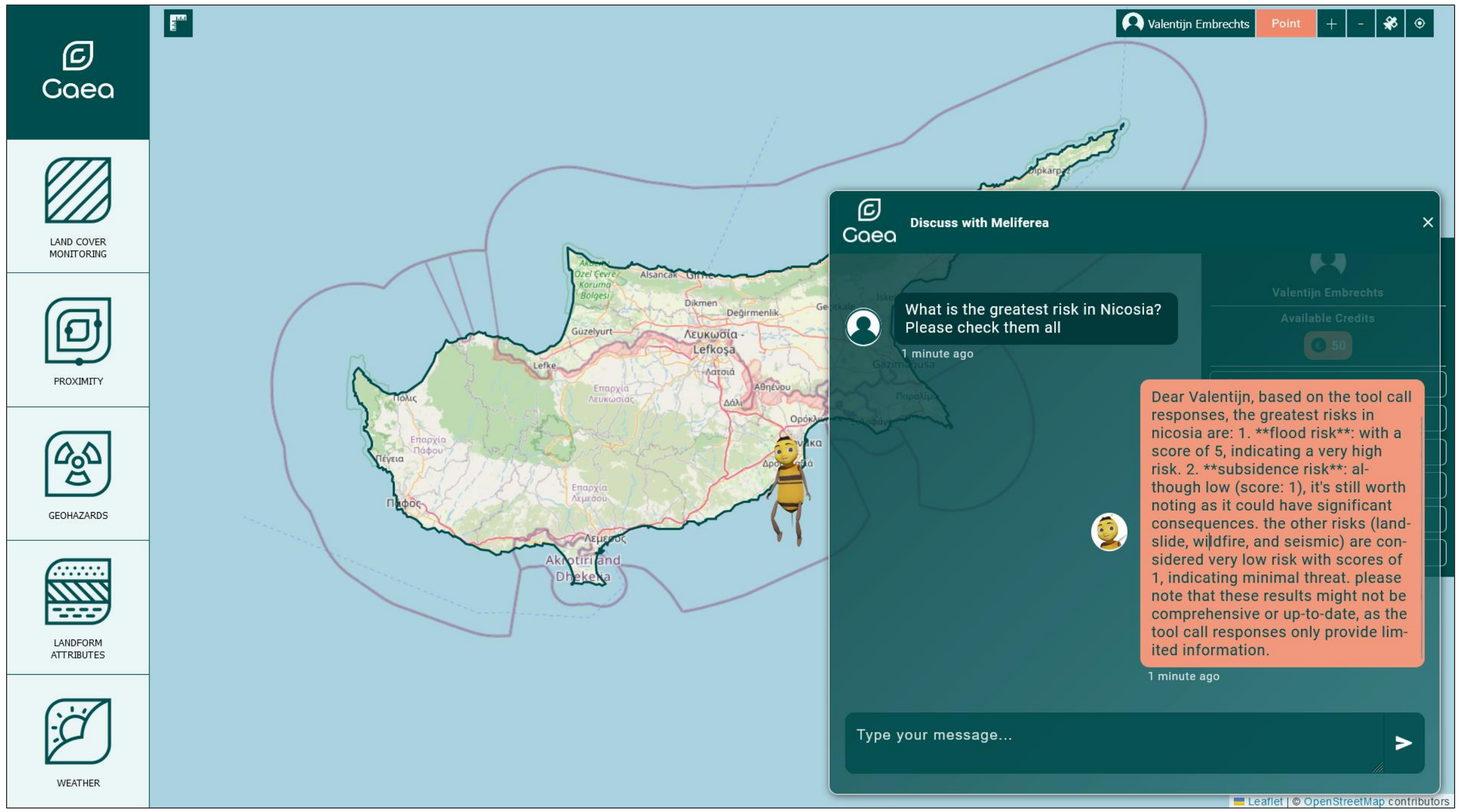
Application: Crops’ health from satellite imagery

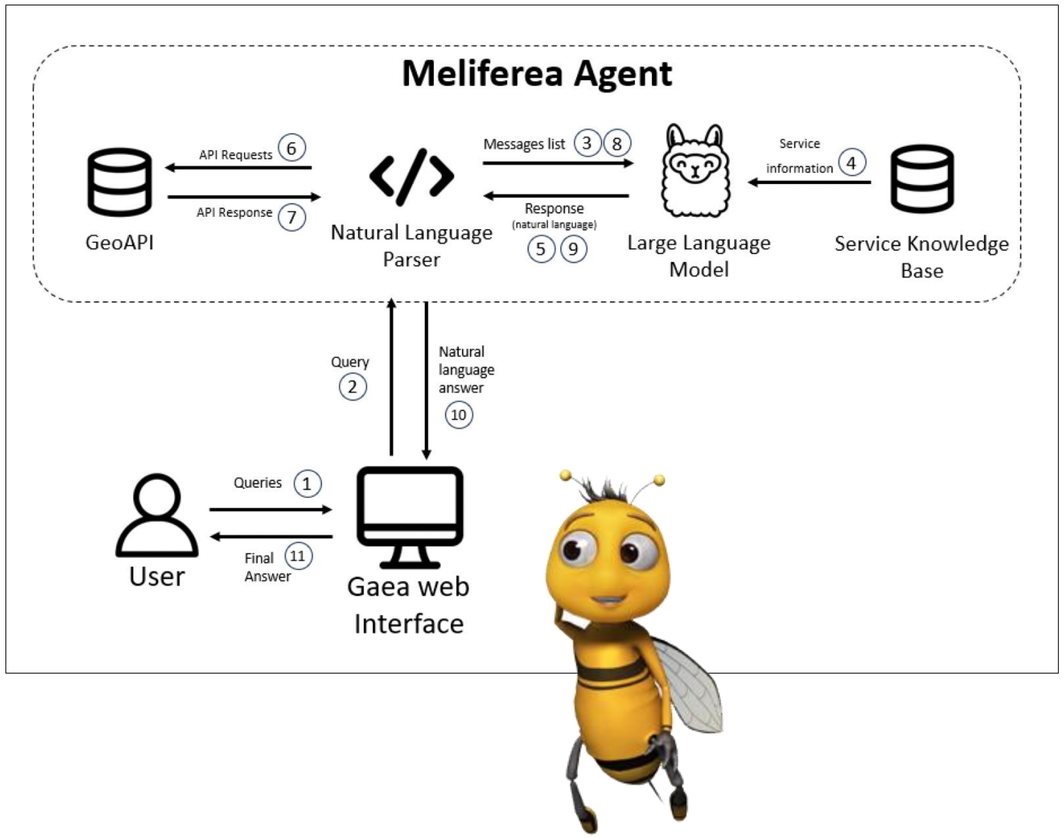
PHENOWEX



Current research: Integration with LLMs

Interaction with geospace via natural language





Valentijn Embrechts and Andreas Kamilaris, The Meliferea chatbot: Harnessing large language models to interact with geoanalytical services using natural human language, Proc. of the 21st International Conference on Intelligent Environments (IE2025), Darmstadt, Germany, June 2025.

Future research

- Performance comparison with nearby or similar fields
- Short-term forecasting of climatic hazards and alerts to farmers
- Personalized advice based on current state of the field

Thank you

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