



Satellite data and artificial intelligence contribution to a sustainable vegetation management system

THE CASE OF A24 (PORTUGAL)

IMAGINE
CREATE
ACHIEVE
a sustainable future





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INTRODUCTION

01.

Introduction



Vegetation management

Increase road users' safety and assets lifecycle

Comply with the Portuguese vegetation management law (mitigate fire risk)



Sustainability

Green spaces are very important to mitigate the environmental impact of a motorway



Goal

Adoption of a mixed vegetation management approach, based on periodic visual inspections and monitoring of various types, to create a more sustainable and efficient vegetation management



DESCRIPTION OF THE PROJECT

02.

Description of the project

A24 MOTORWAY LOCATION



A24 MOTORWAY (CONTRACT 2000-2030)

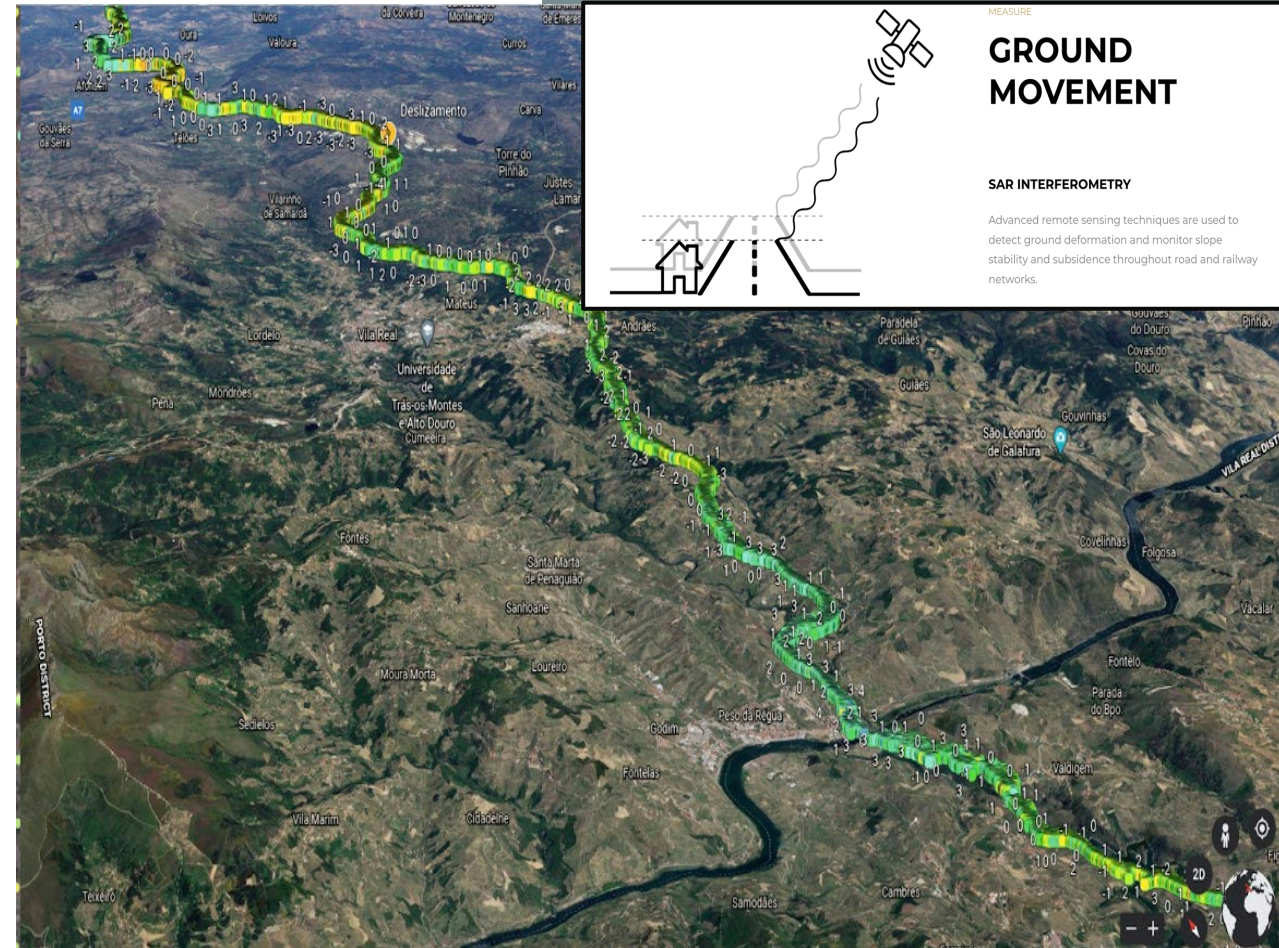
- ❖ 157 km, 2x2 lanes (mountainous motorway)
- ❖ 26 interchanges (3 for service areas)
- ❖ 70 viaducts / bridges
- ❖ 4 tunnels
- ❖ 145 retaining walls
- ❖ 86 reinforced slopes
- ❖ 1069 slopes
- ❖ 82 gantries
- ❖ 11 treatment basins
- ❖ > 7000 vertical signs

Description of the project

- ❖ Previous successful experience with satellite data:

Natural hazards risk management in highways with satellite data

- ❖ A24 motorway project started in 2019 and keeps on going
- ❖ Already started to be used along motorways all over the world

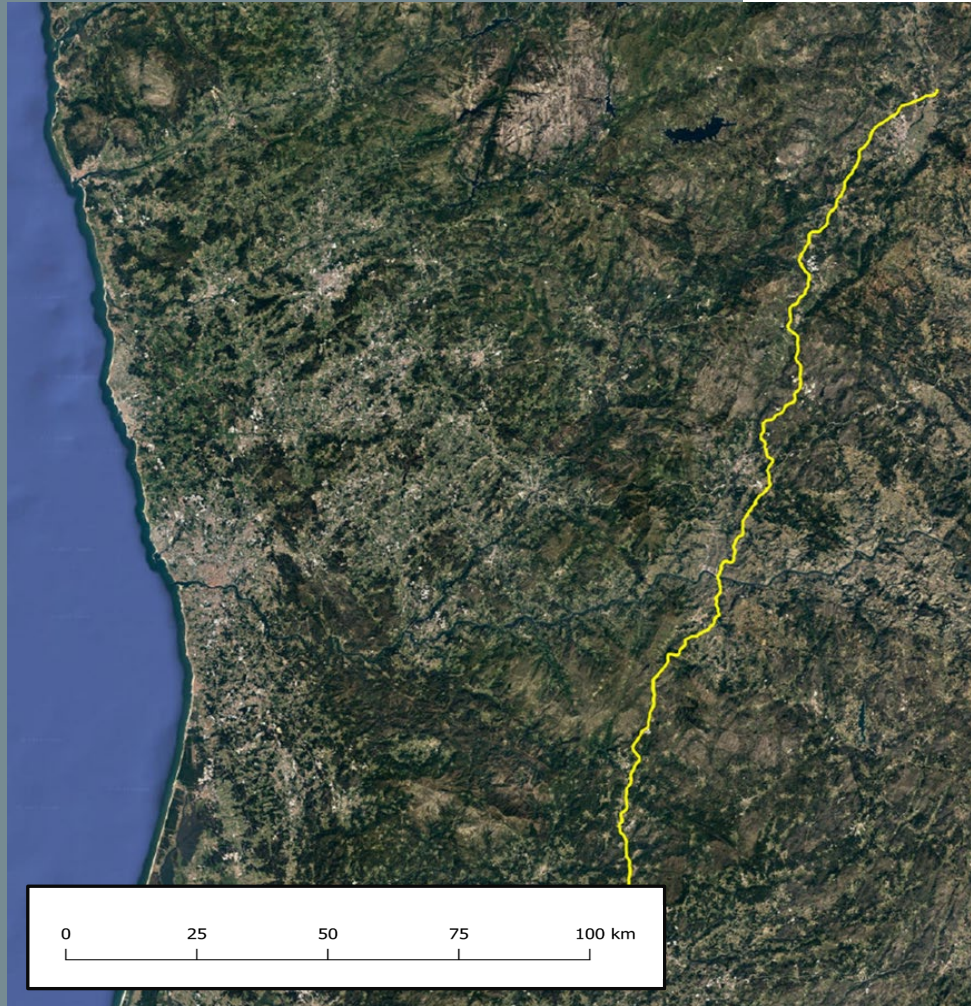




IMPLEMENTATION

03.

Implementation : overview



OBJECTIVE:

- ❖ Use satellite data and artificial intelligence to contribute to a sustainable vegetation management system

DATA:


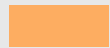

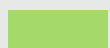

- ❖ 7 High resolution satellite images
- ❖ (Pleiades – 50 cm)
- ❖ Historical data

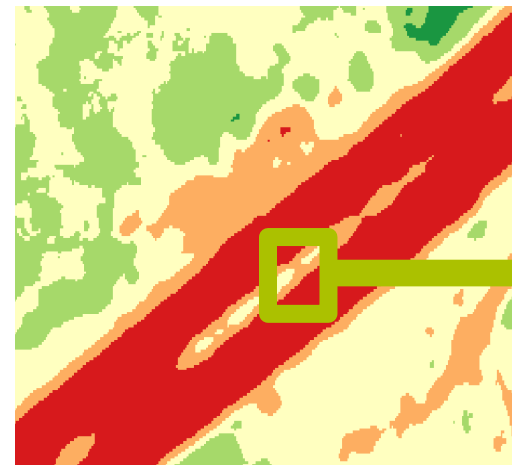


Implementation

Normalized Difference Vegetation Index (NDVI): quantify the amount of chlorophyll, which is the element responsible for the green of the vegetation



Vegetation Index	
	Very low vitality (built up area)
	Low vitality
	Medium vitality
	High vitality
	Very high vitality





Implementation

Tree detection with Artificial Intelligence (AI): high accuracy definition of polygons encircling the trees



Thanks to the high accuracy of the model, it is possible to observe trees thru red polygons encircling the trees

Application : Deforestation example



7th Feb 23

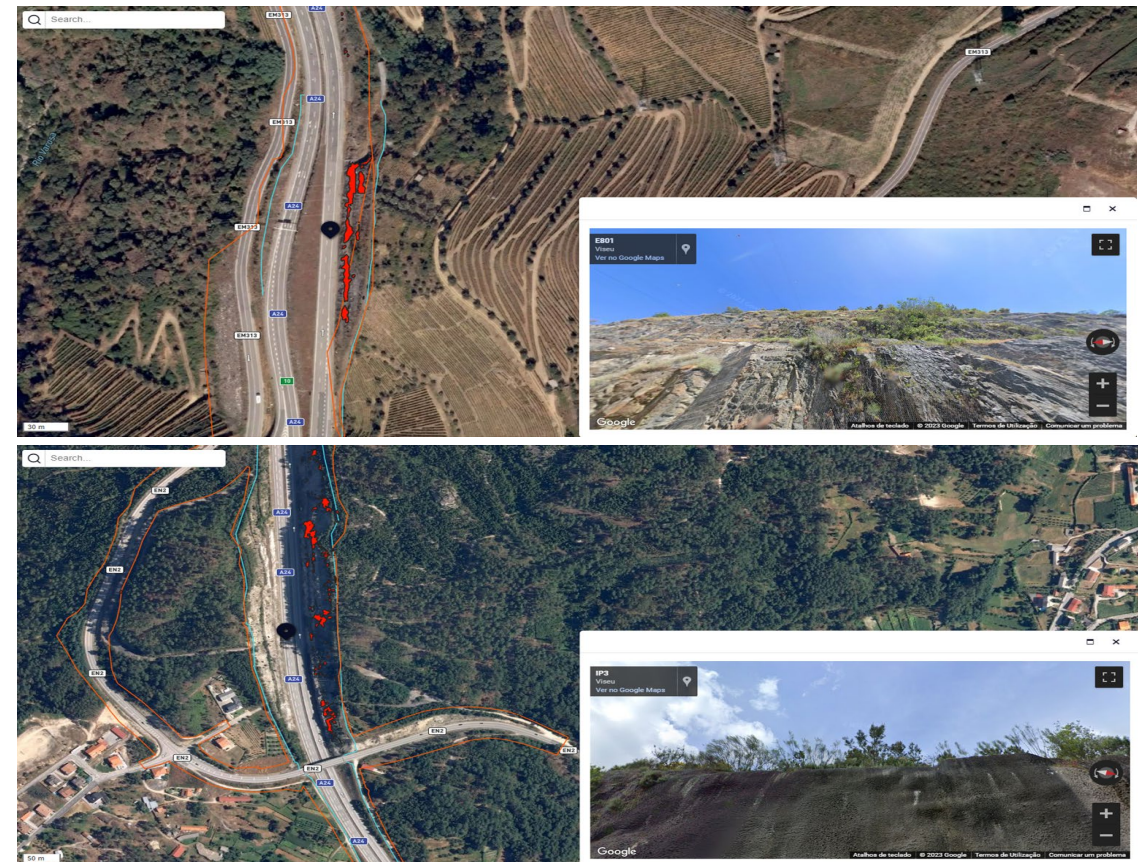


28th May 23

Implementation



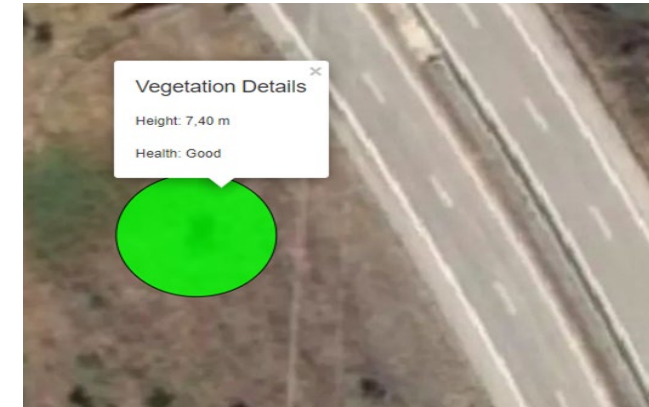
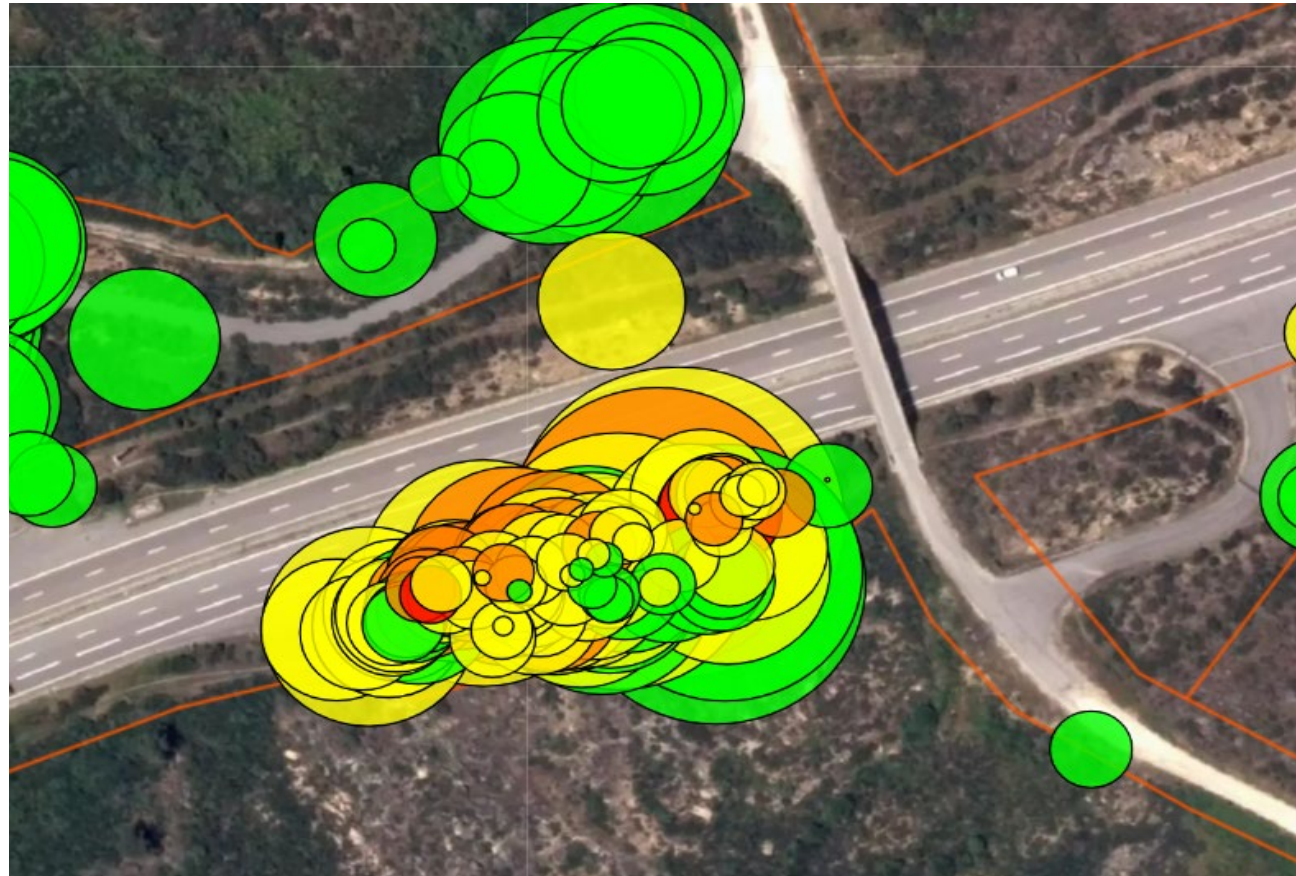
Dead trees detection: the correlation between NDVI and tree detection makes it possible to detect dead trees










Implementation

Tree height, fall radius and vitality: detecting tree height from shadow using AI and trigonometry formulas






Vitality Index	
	Dead
	Low vitality
	Medium vitality
	High vitality
	Fall radius

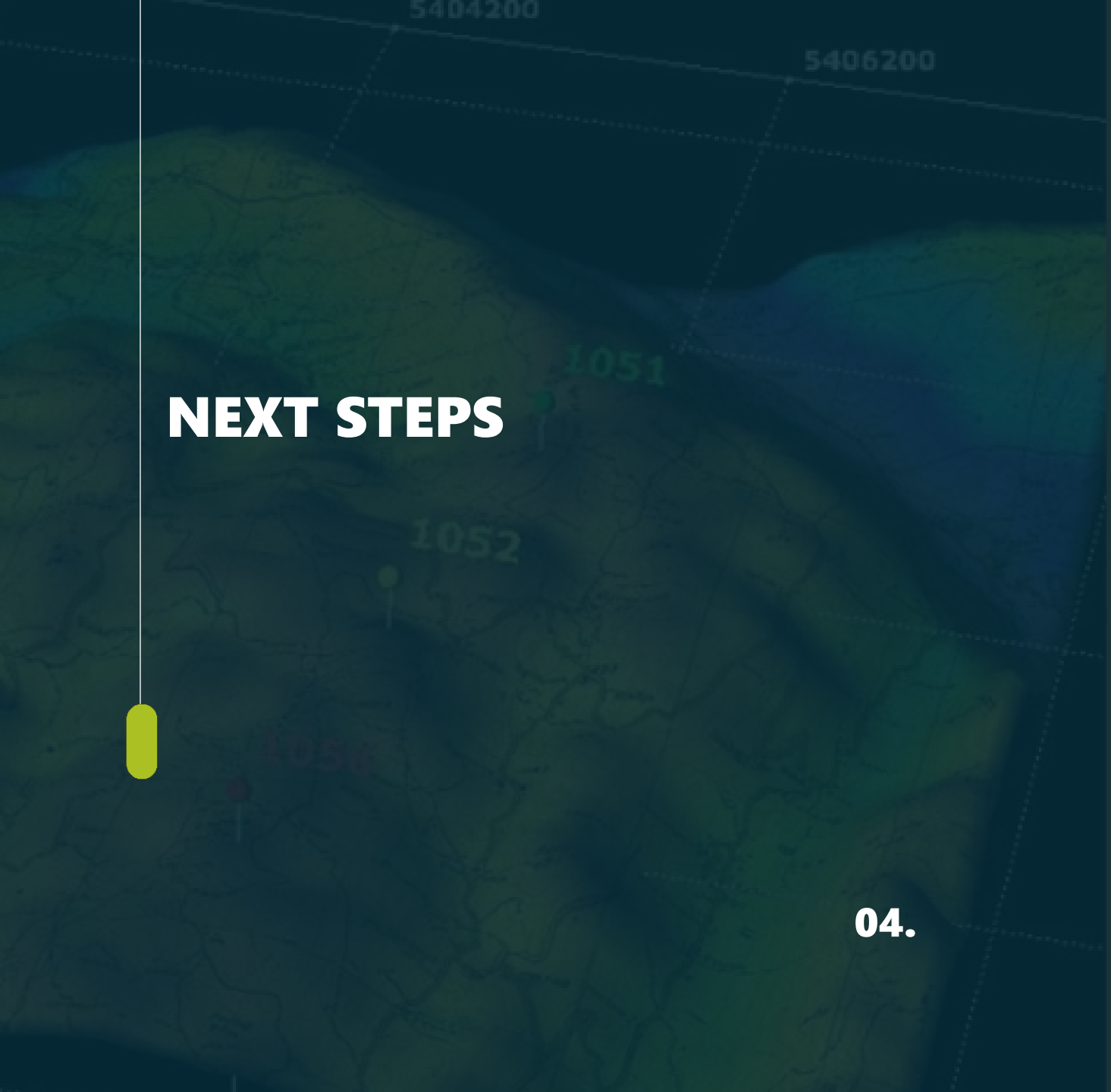
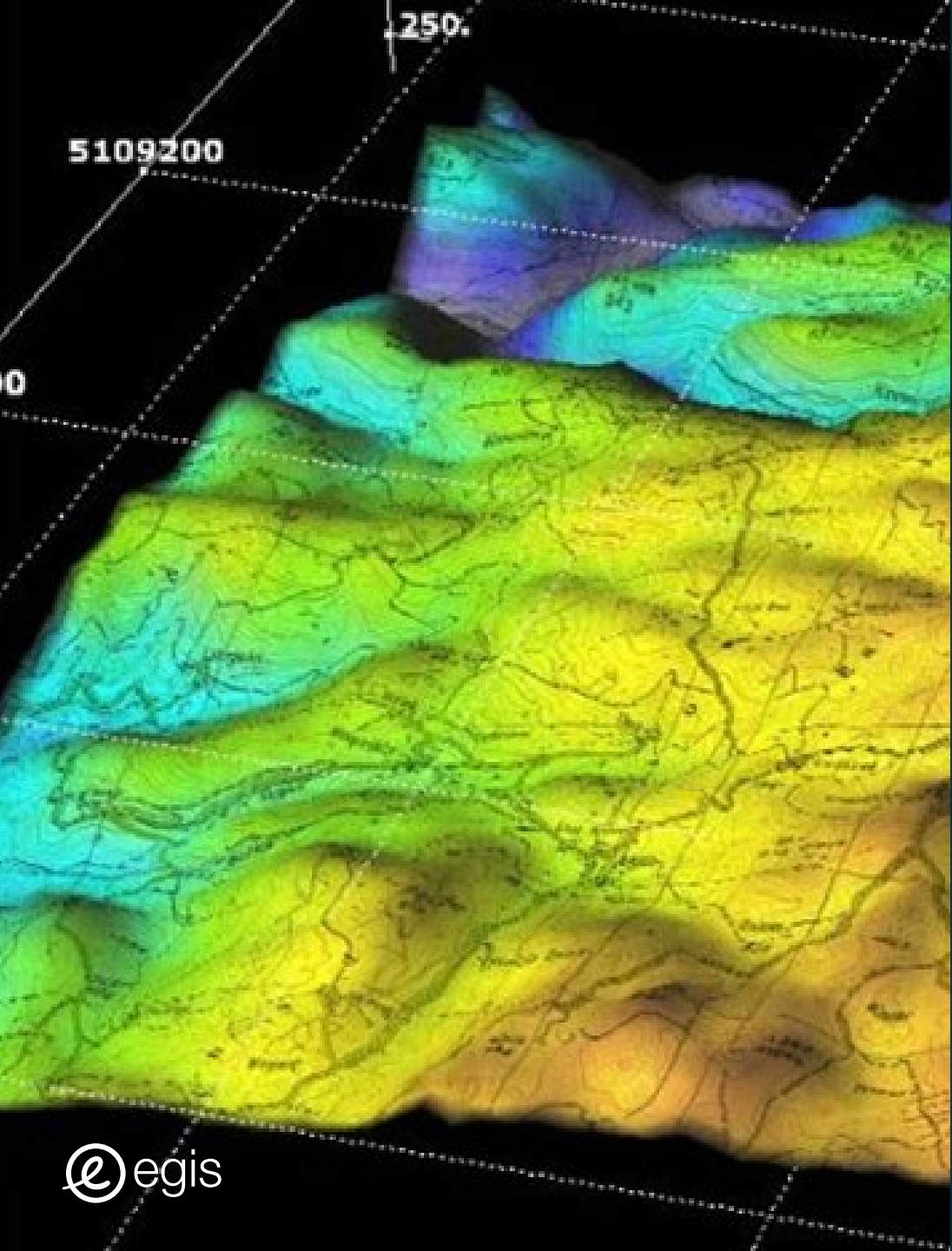


Implementation

Vegetation intensity per km: Identify the primary vegetation type adjacent to the road at each kilometer



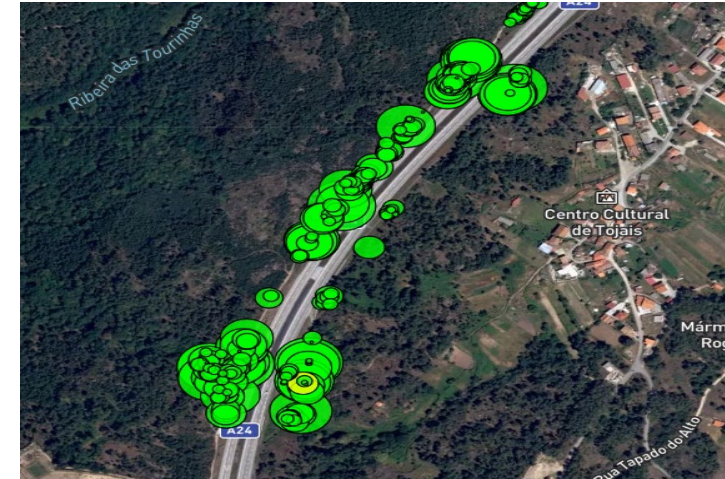
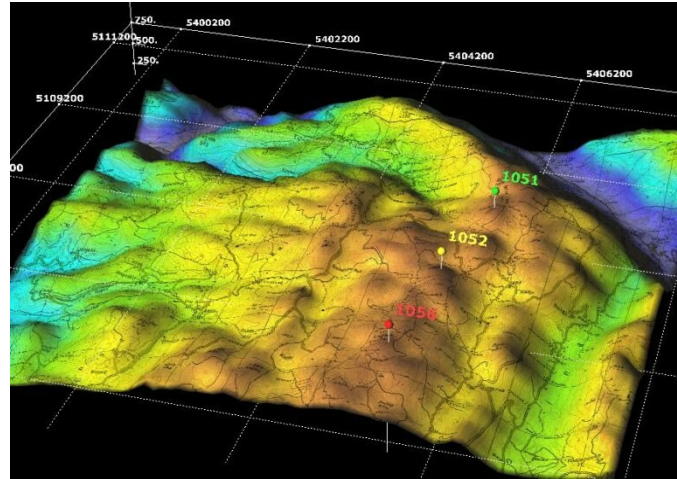
Vegetation intensity per km	
	Level 1 - Mostly covered by bare soil
	Level 2 - Mostly covered by ground vegetation / bush
	Level 3 - Mostly covered by trees



NEXT STEPS

Next Steps

- ❖ **Improving accuracy** for calculating **tree height** by adding **digital terrain model**

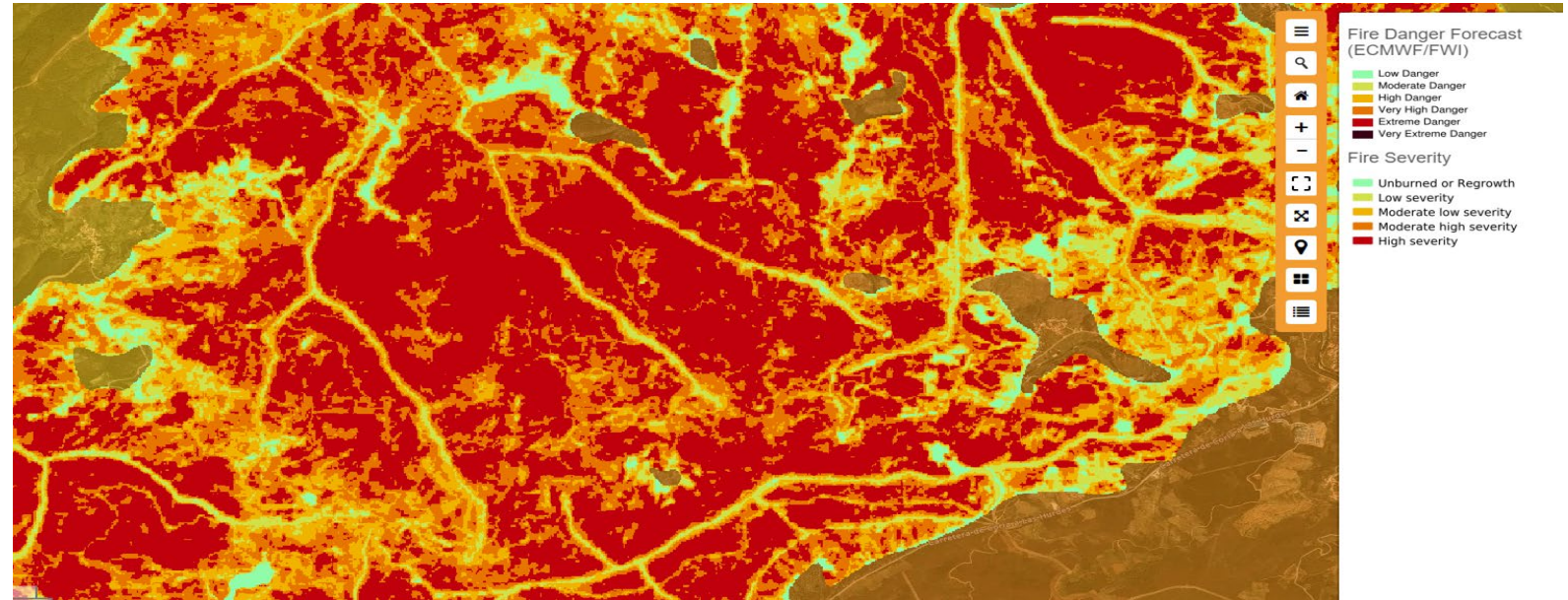


- ❖ **Detecting invasive species** (e.g., Acacia trees)

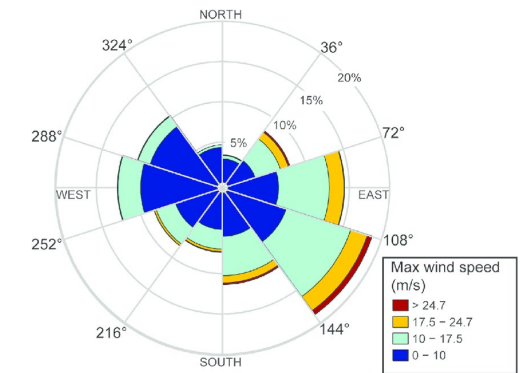
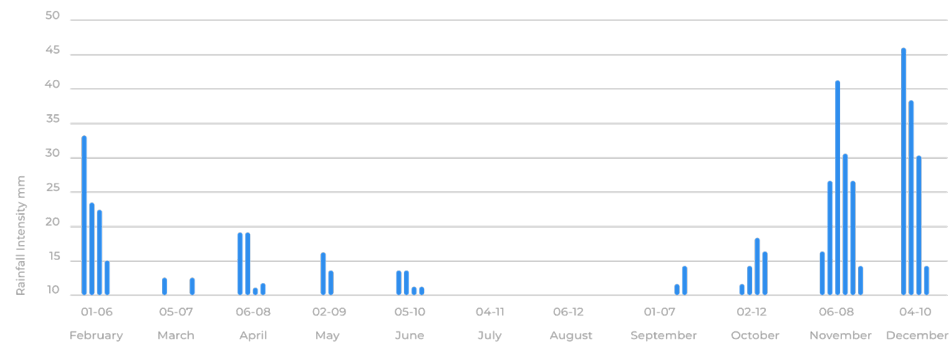


Next Steps

❖ **Generate** highly accurate **map** depicting **Fire Risk hazards**



❖ Adding **precipitation** (estimate **vegetation growth**) & **wind** (estimate the probability of **tree fall** and its **impact area**) data



About Egis

IMAGINE
CREATE
ACHIEVE

a sustainable future

Egis is an international player active in the consulting, construction engineering and mobility service sectors.

We design and operate intelligent infrastructure and buildings capable of responding to the climate emergency and helping to achieve more balanced, sustainable and resilient territorial development.

With operations in 120 countries, Egis places the expertise of its 18,000 employees at the disposal of its clients and develops cutting-edge innovation accessible to all projects. Through its wide-ranging fields of activity, Egis is a central player in the collective organisation of society and the living environment of citizens all over the world.



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