

Artificial Intelligence Applied to Soil Protection

Illegal Waste Detection - Change Detection - Water Pollution

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Part I

Illegal Landfill Waste Detection



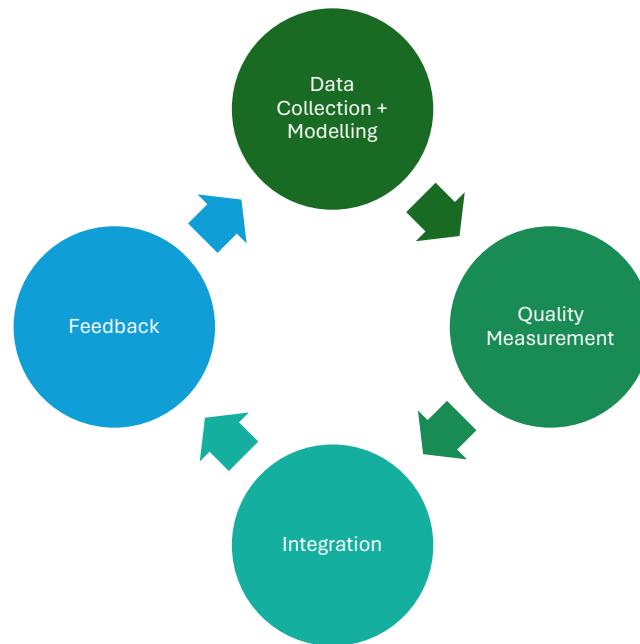


Motivations

- **Environmental Protection:** *pollution of soil, water and air.*
- **Economic Impacts:** *decreasing property values, deterring investment, incurring cleanup costs...*
- **Social Justice:** *disproportionately affect marginalized communities...*
- **Public Health:** *respiratory problems, waterborne illnesses...*
- **AI based monitoring**
 - AI models can provide support in automatic detection.
 - AI + experts in earth observation → more accurate and timely monitoring.
 - It helps in prioritize human in-person control.



Challenges



- **Data Collection**

AI models needs data to "learn" from

- *Frequently unknown information*
- Multispectral high-resolution images are costly

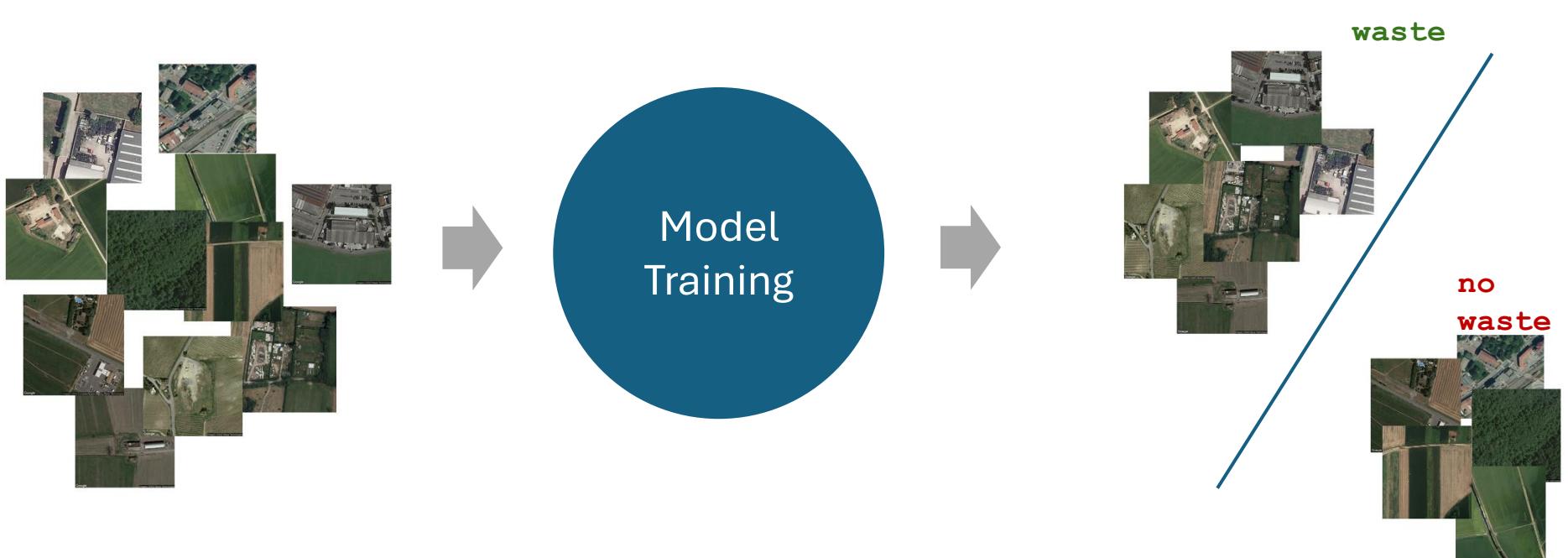
- **Collaborative Efforts**

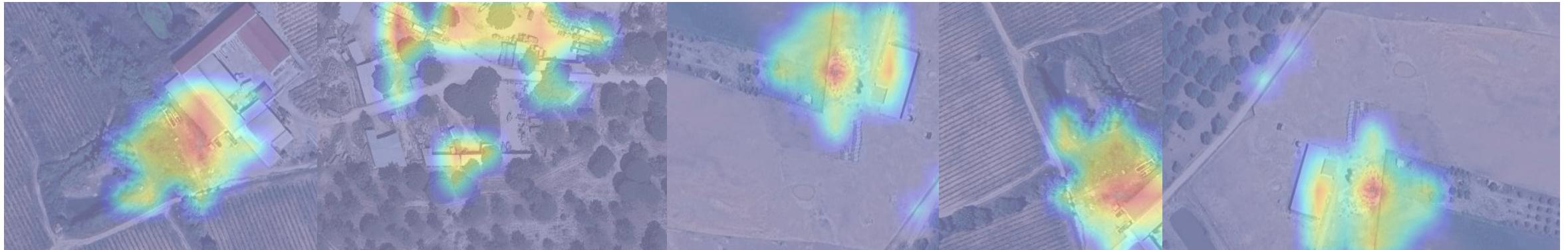
We need to foster collaboration among experts in:

- *Earth observation*
- *Environmental crime*
- *AI*
- *Administration*

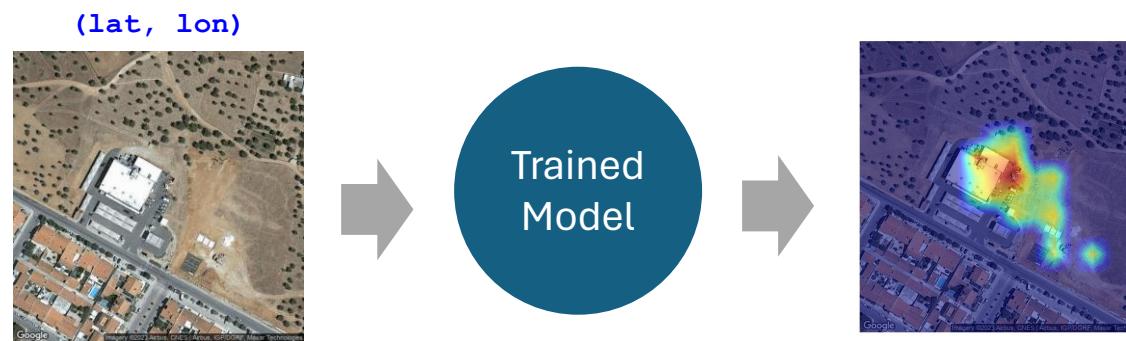


Image Classification





Waste Detection Process



1. Download
input image

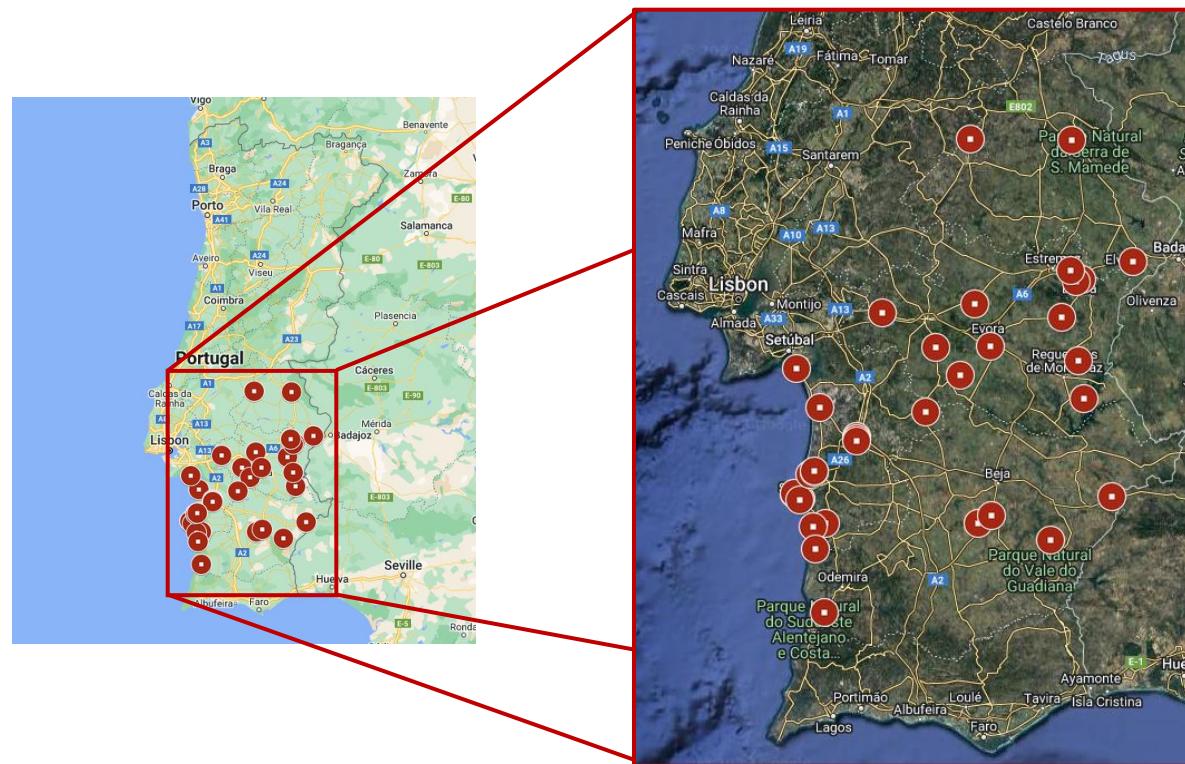
2. Model query

2. Result

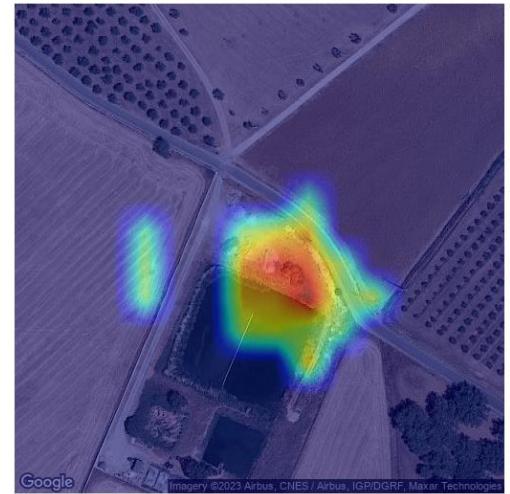
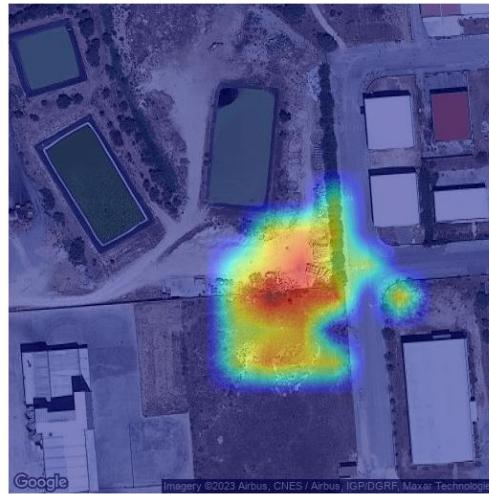
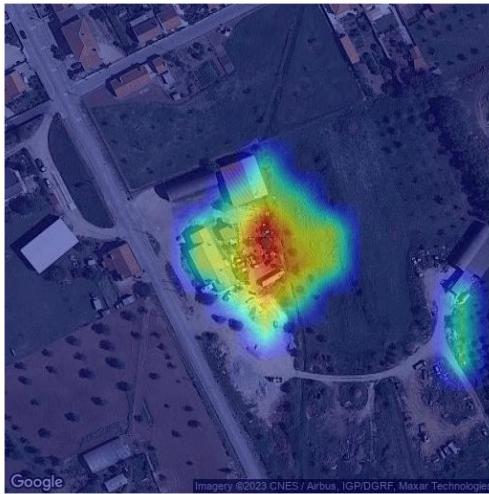
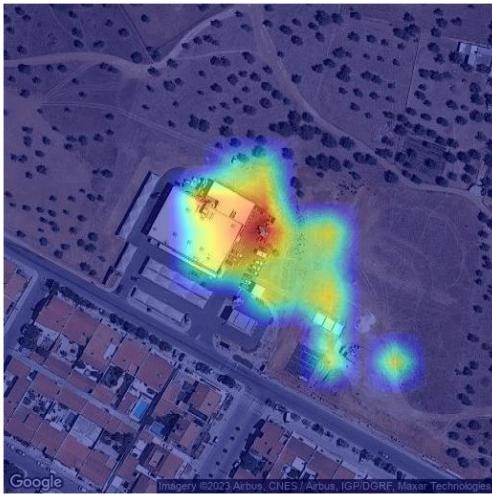




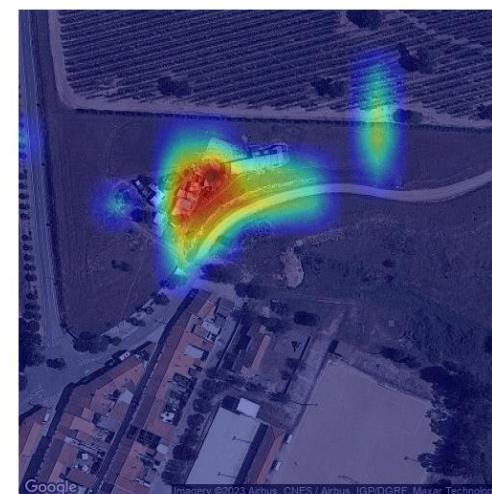
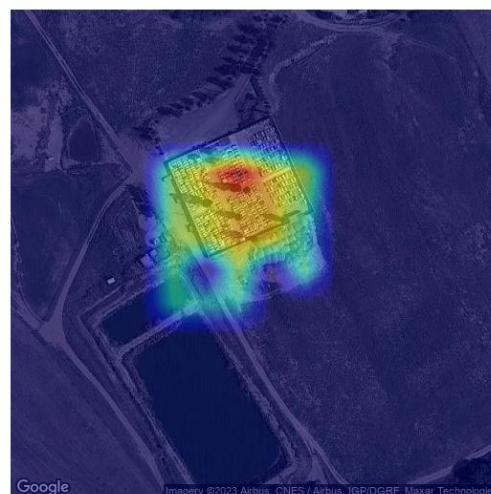
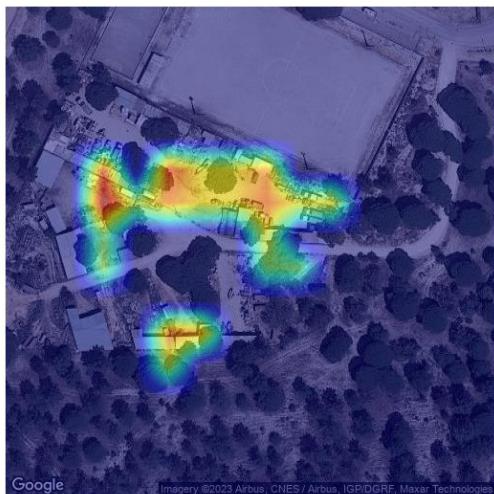
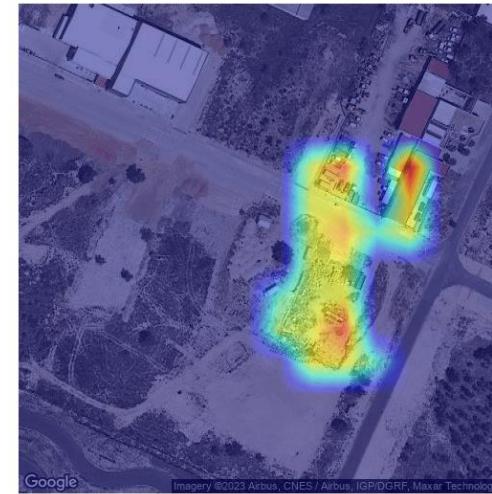
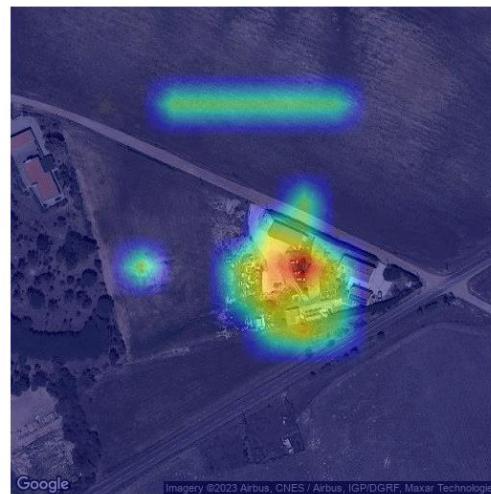
Waste Detection Examples



Waste Detection Examples

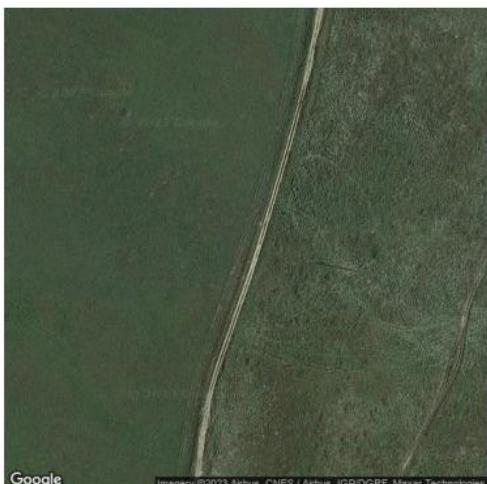
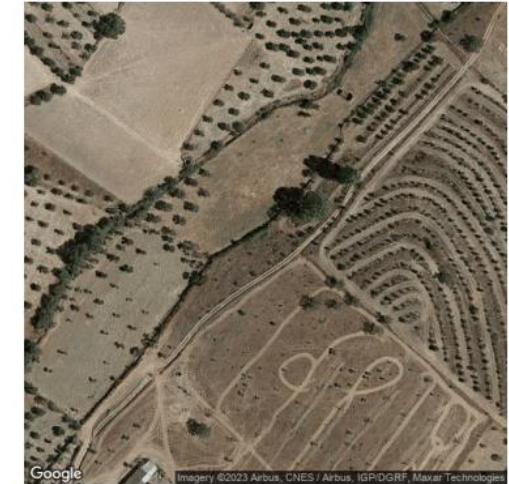


Waste Detection Examples



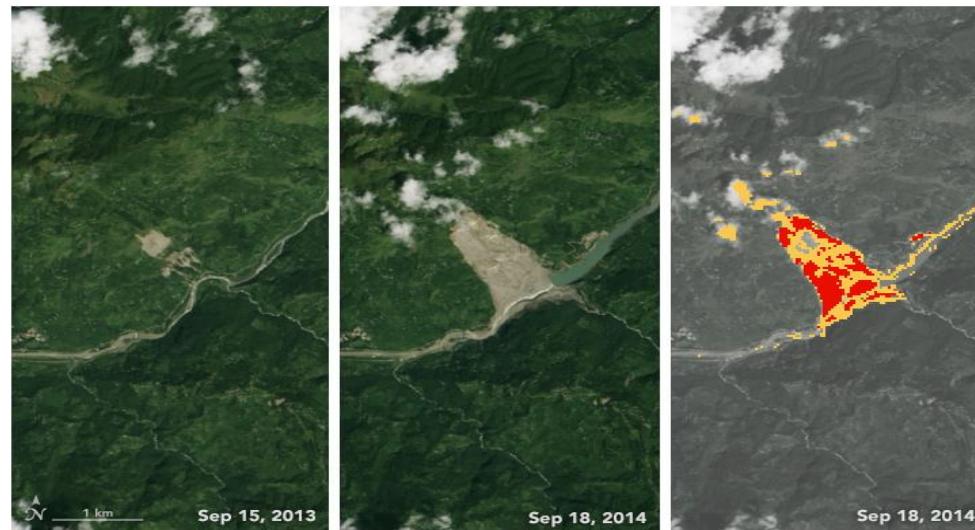
Waste Detection Examples

For some image there is **not waste detected**.

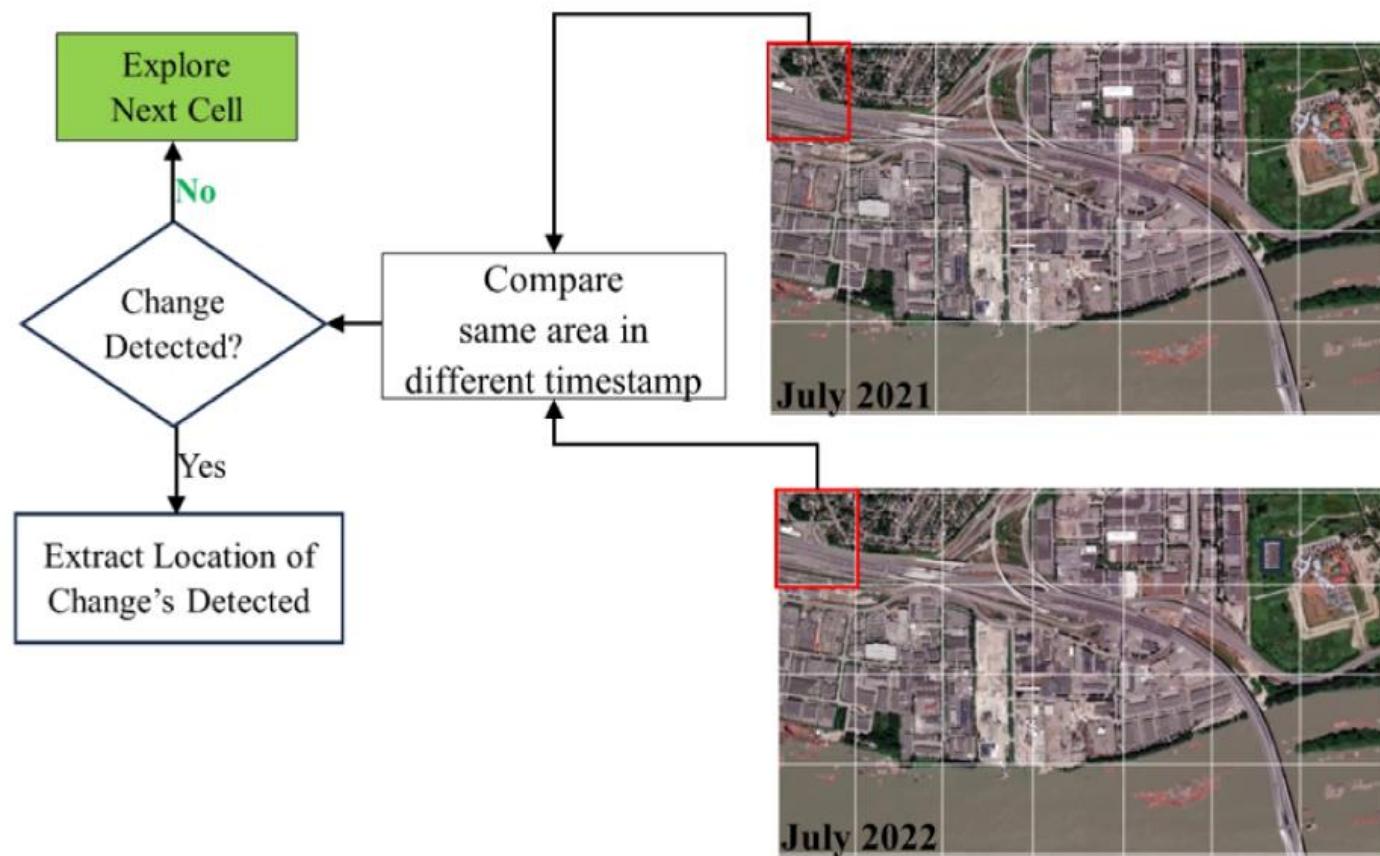


Part II

Automated Land Change Detection



Automated Land Change Detection



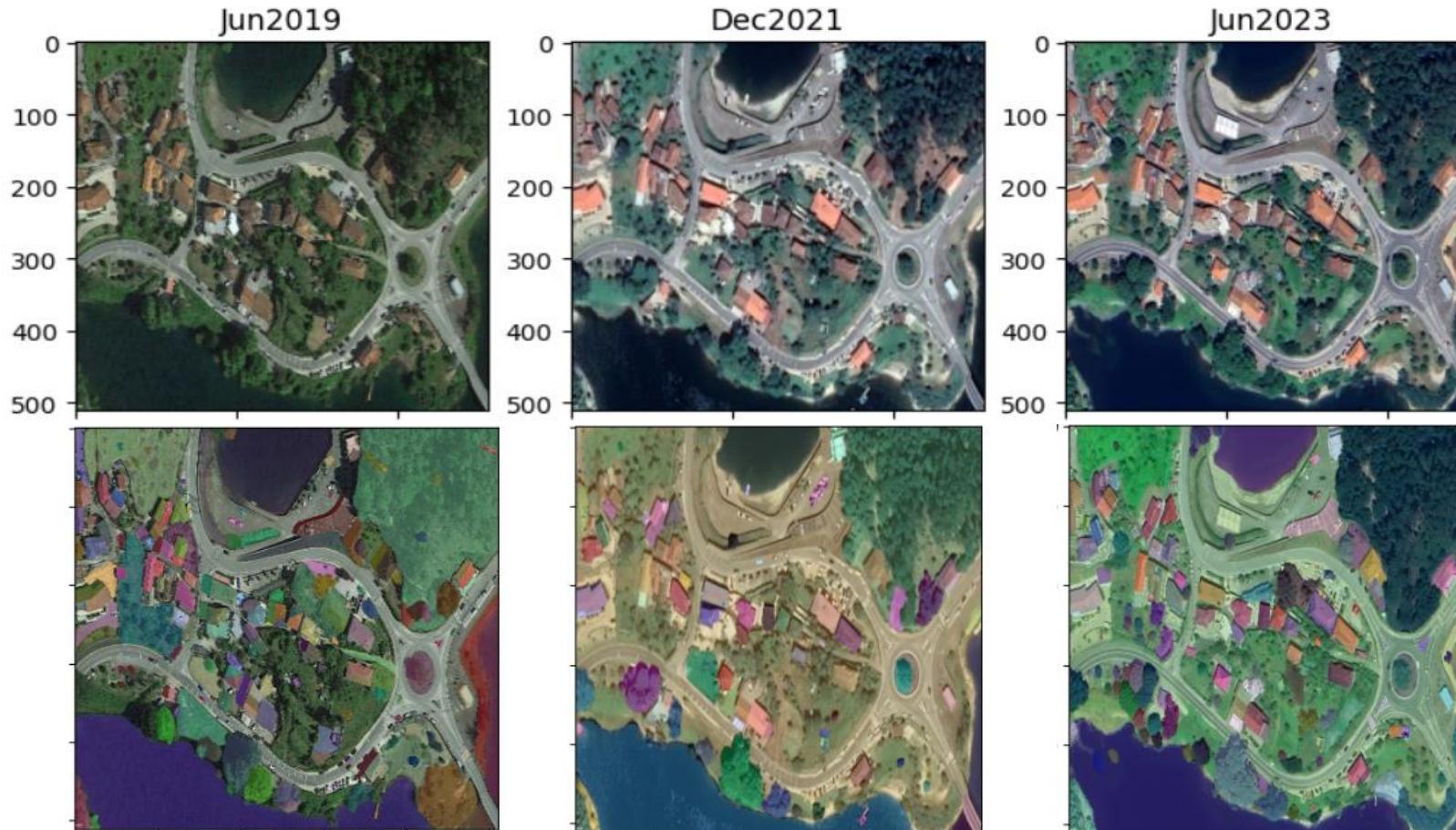
Case Study



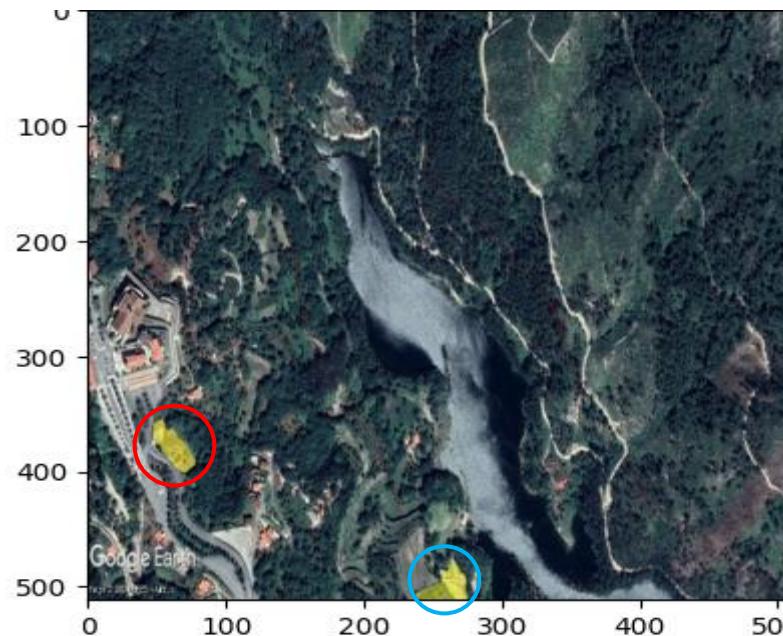
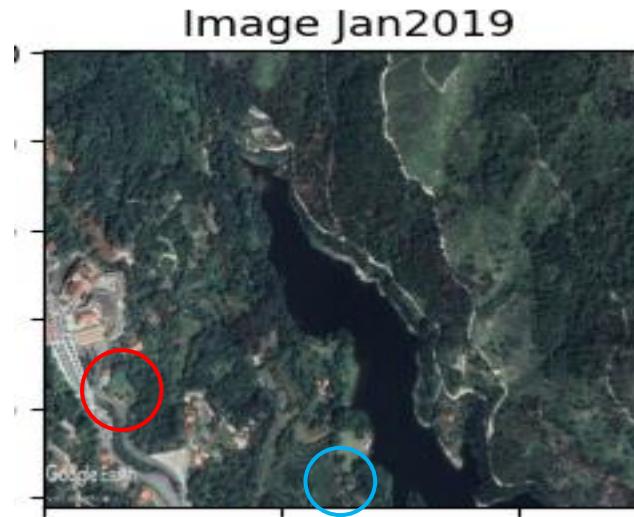
Segmentation for Change Detection

Reference Image: Captured in 2019

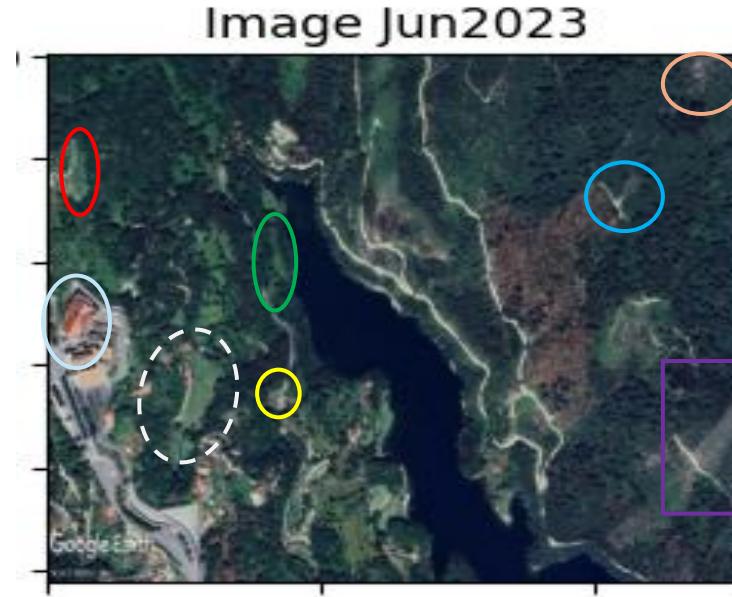
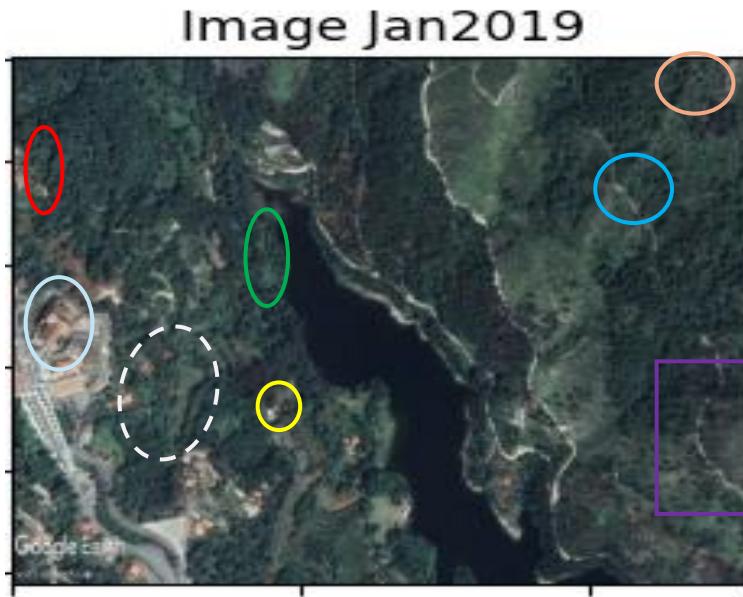
Images Under Evaluation: 2019 vs. 2021 and 2019 vs. 2023



Trilho de São Bento 60, 4845-023 Rio Caldo



Trilho de São Bento 60, 4845-023 Rio Caldo



Rua Quatro 110, 4845-020 Rio Caldo

Image Jun2019



Image Jan2020

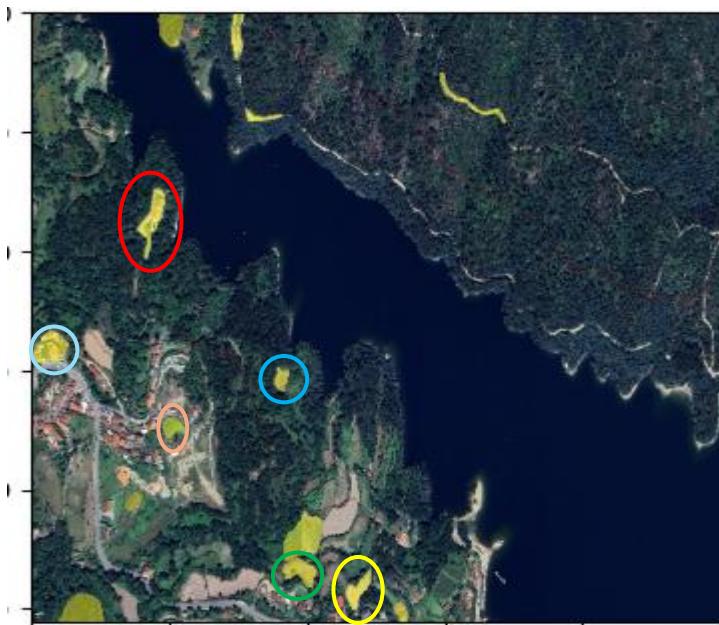


Rua Quatro 110, 4845-020 Rio Caldo

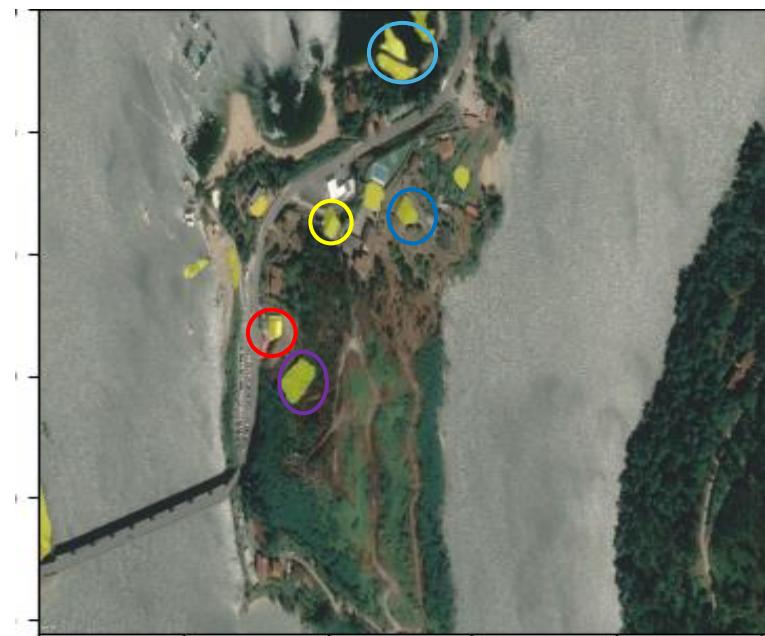
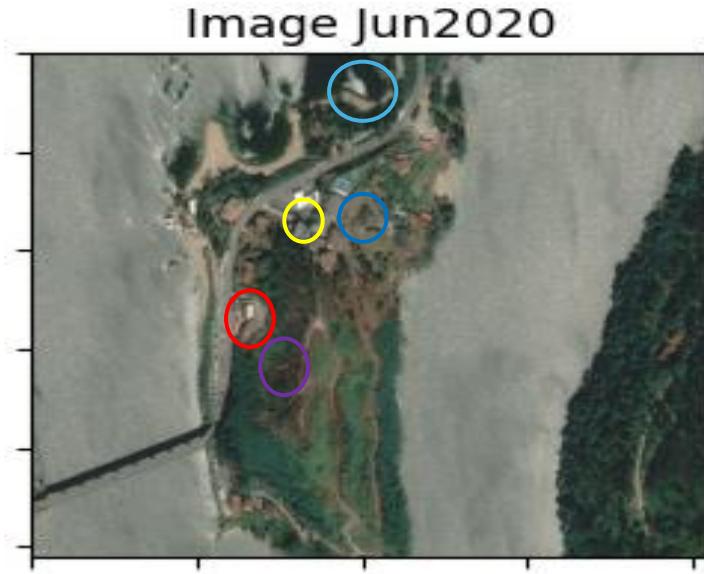
Image Jun2019



Image Jun2023



Parque Nacional da Peneda-Gerês, 4845-062 Gerês

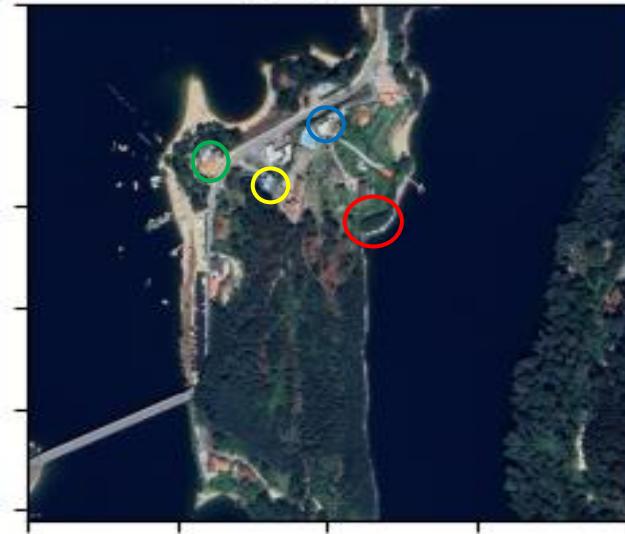


Parque Nacional da Peneda-Gerês, 4845-062 Gerês

Image Jan2019



Image Jun2023



Paredes, 4845-024 Rio Caldo (41.67608099, -8.18218883)

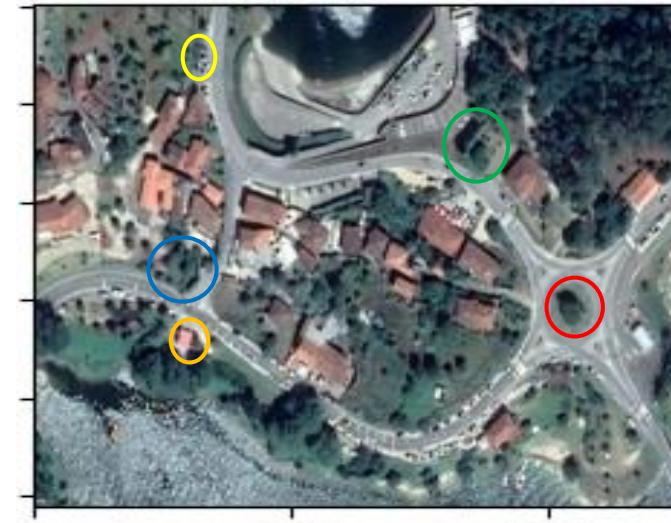


Image Jun2020with unmatched segments



Paredes, 4845-024 Rio Caldo (41.67608099, -8.18218883)

Image Jun2018



Image Jun2023



Part III

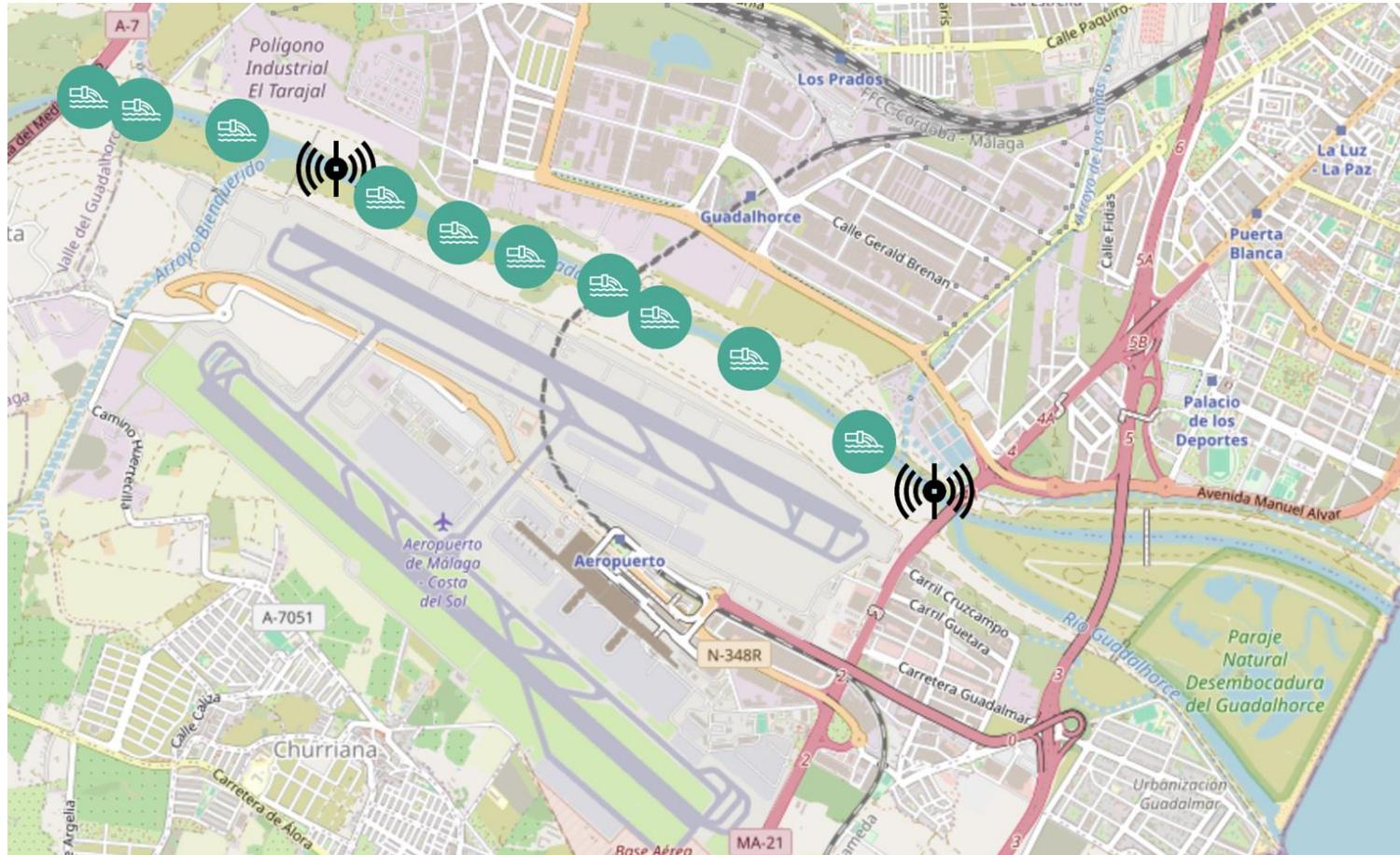
Water Pollution: Sources Identification



Rio Guadalhorce, Málaga

#Sensors: 2

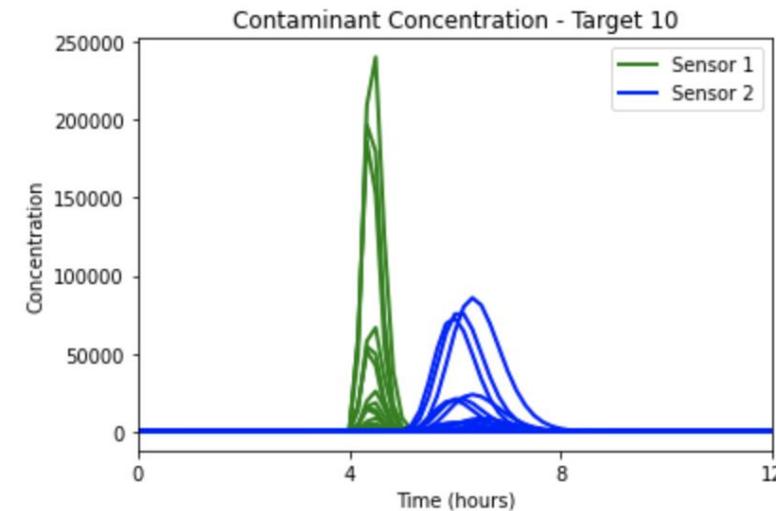
#Possible places of discharge pollutants: 10



Simulations carried out using PySWMM by **Centro Tecnológico da Água Cetaqua**.

Scenarios:

- Different initial concentrations of pollutants.
- Approximately 1000 simulations for each discharge point.
- The data simulates records, with intervals of 10 minutes, over 26 hours, monitoring the concentration of pollutants and the flow of the river in two different locations in the river where the installation of sensors is planned.





Thanks for your attention!
Questions?



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<https://emeritusproject.eu>