XIV CONVEGNO NAZIONALE SULLA BIODIVERSITÀ
1ST INTERNATIONAL CONFERENCE ON MEDITERRANEAN BIODIVERSITY

A multidisciplinary approach for studying the invasion mechanisms of the alien tree species *Ailanthus altissima* (Mill.) Swingle

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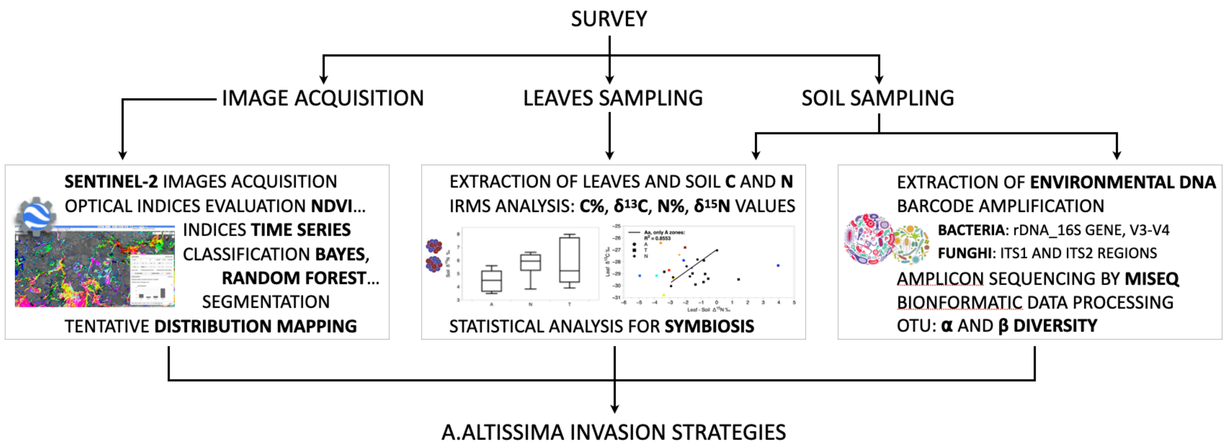
Ailanthus altissima is a fast growing invasive species, introduced in the second half of the 18th century, it is currently considered as one of the most invasive woody plants in Europe. This species shows a strong pioneering character, adapting to a wide range of urban, rural and forest ecosystems, especially in disturbed areas along roads; it has spread widely in temperate and Mediterranean regions of the world, threatens biodiversity through competition, population reduction and habitat modification. Within the frame of the CNR-funded USEit project, we used a multidisciplinary approach for investigating *A. altissima*: we selected several pilot experimental sites across central and southern Italy, with the following aims:

- Detecting and mapping the spatial distribution by GIS and remote sensing;
- Investigating the symbiotic relationships between *A. altissima* and associated mycorrhizae by means of stable isotopes techniques;
- Understanding the role of microbiomes in the Evolution of Increased Competitive Capacity (EICA) of *A. altissima* by metagenomic sequencing analysis of bacterial and fungal communities colonizing the root system.



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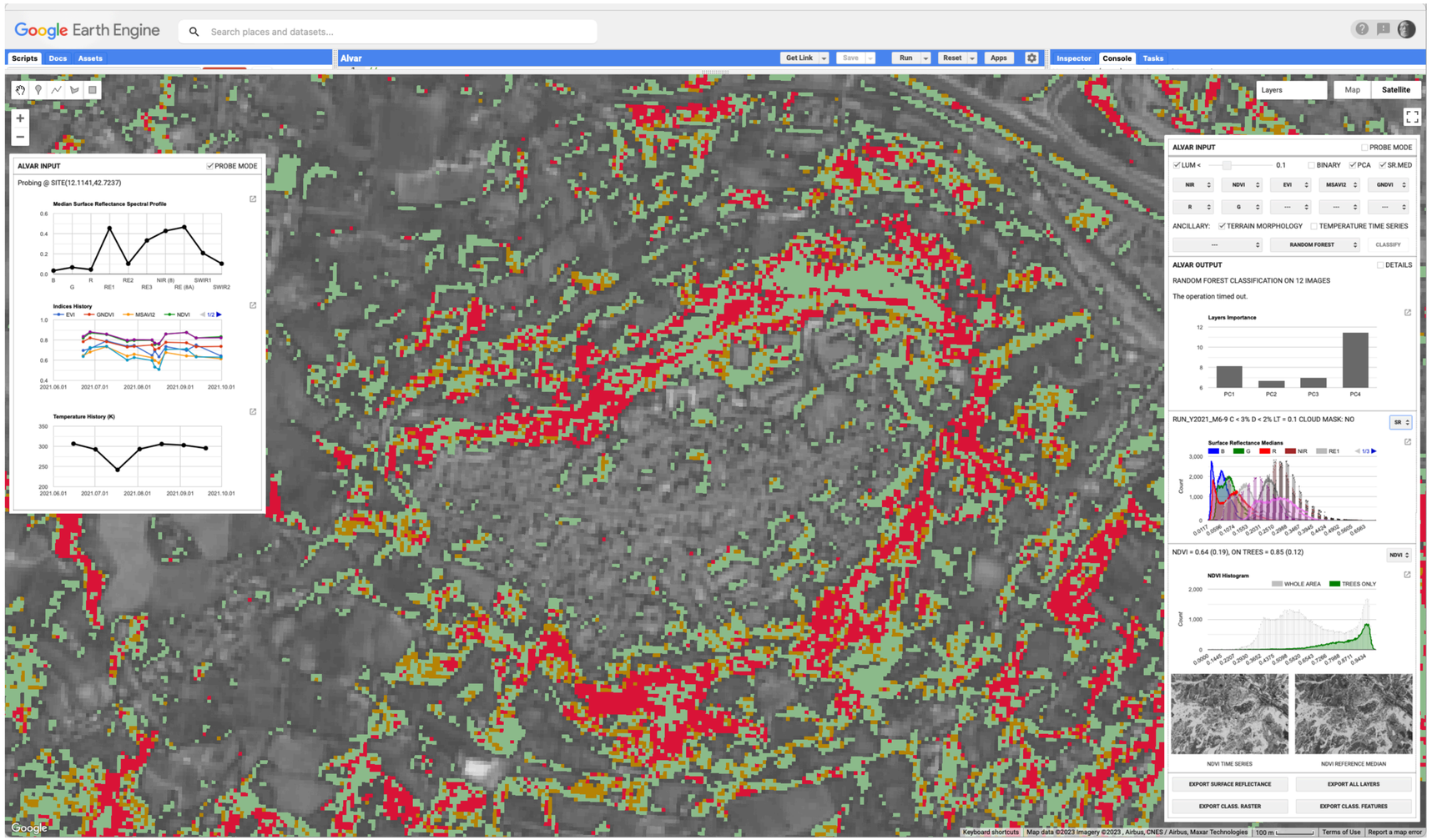
Detecting and mapping the spatial distribution of Ailanthus altissima by remote sensing

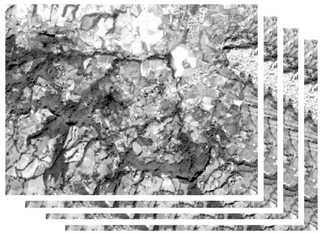
INPUT

Remote data: Copernicus Sentinel-2 10m ground resolution optical data

Survey - Ground truth: Training and control points

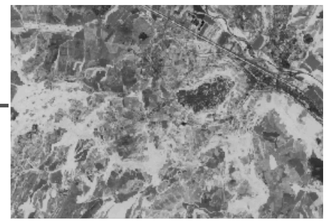


Open code available @ https://code.earthengine.google.com/?accept_repo=users/ciolfis/Lecce2023 - Alvar javascript file



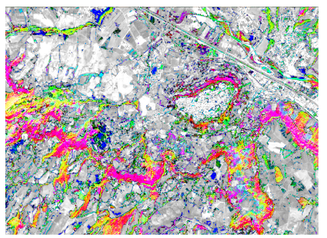
Sentinel-2 Surface Reflectance Series

Cloud Computing — No local image storage needed



Optical Indices Time Series

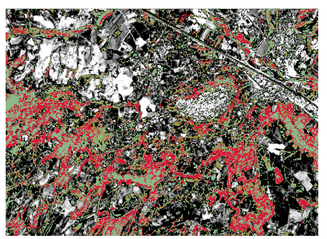
Classification is performed on indices or principal components



Principal Component Analysis

Google Earth Engine Classification Algorithms
Random Forest, Maxent, Bayes…
Segmentation and vectorialisation

OUTPUT



Classification

Investigating the invasion strategies of Ailanthus altissima by stable isotopes and metabarcoding analysis

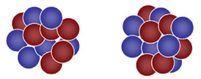
INPUT

Leaves sampling — stable isotopes

Rhizosphere sampling — genetics and isotopes

Spatial Sampling: **A** Ailanthus only
T Transition zone — **N** Only other species

Carbon and Nitrogen Stable Isotopes



DNA Metabarcoding Analysis

Extraction of Environmental DNA

Barcode Amplification

Bacteria: rDNA_165 gene V3-V4
Fungi: ITS1 and ITS2 regions

Miseq Amplicon Seqencing

DADA2

ASV Sequences

SILVA Ribosomal RNA Database

UNITE ITS Database

Taxonomy

R DataProcessing — Vegan & Phyloseq

OUTPUT

α Diversity — β Diversity

DADA2 Processing

Read 1 | Read 2

Primer Removal

Quality Filter

Error Model Read 1 | Error Model Read 2

Dereplication | Dereplication

ASV Interference Read 1 | ASV Interference Read 2

Pair Merging

ASV Filtering

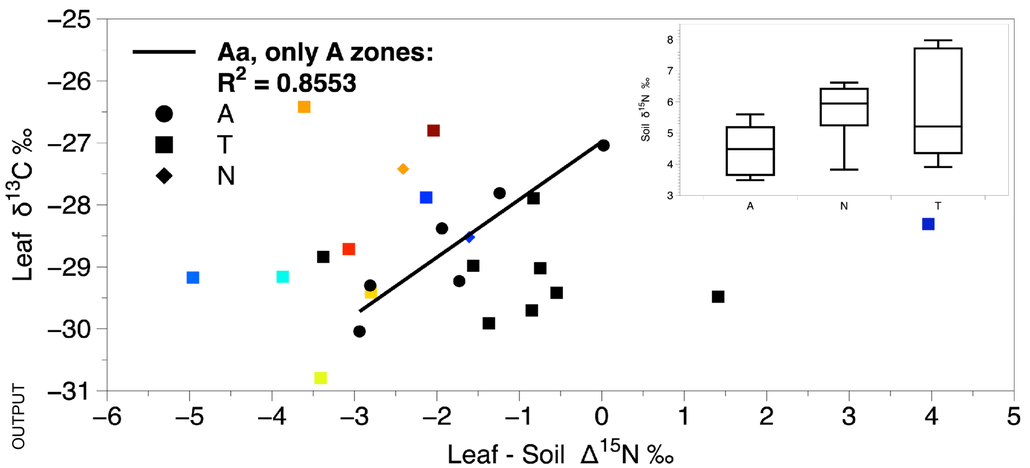
Chimera Removal

Extraction of Leaves and Soil **C** and **N**, **C%** and **N%** Evaluation

IRMS Analysis: **$\delta^{13}C$** and **$\delta^{15}N$** Relative Abundances

Fractionation Analysis: Leaves - Soil **$\Delta^{13}C$** and **$\Delta^{15}N$**

Seeking for **Mycorrhizal Symbiosis** through Statistical Matching



While suggesting different microbiological effects at the rhizosphere interface, the diversity in soil-leaf ^{15}N discrimination is also positively related to leaf $\delta^{13}C$, further suggesting that an enhanced ^{15}N depletion in leaves could correspond to a favorable photosynthesis performance in *A. altissima.*