Development of forest management and planning tools with remote sensing: automatic tool for pest monitoring using multispectral data captured with drones, a case study

Photonics for Woodworking

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30th May 2022

CETEMAS
CENTRO TECNOLÓGICO FORESTAL Y DE LA MADERA

What is CETEMAS?

A private, not-for-profit organization. We help to generate knowledge to be applied in development and sustainable management, which is fundamental to society, industry and the environment.

1. Sustainable forestry production
2. Forest planning and organisation
3. Geomatics
4. Construction and sustainable materials
5. Bioproducts

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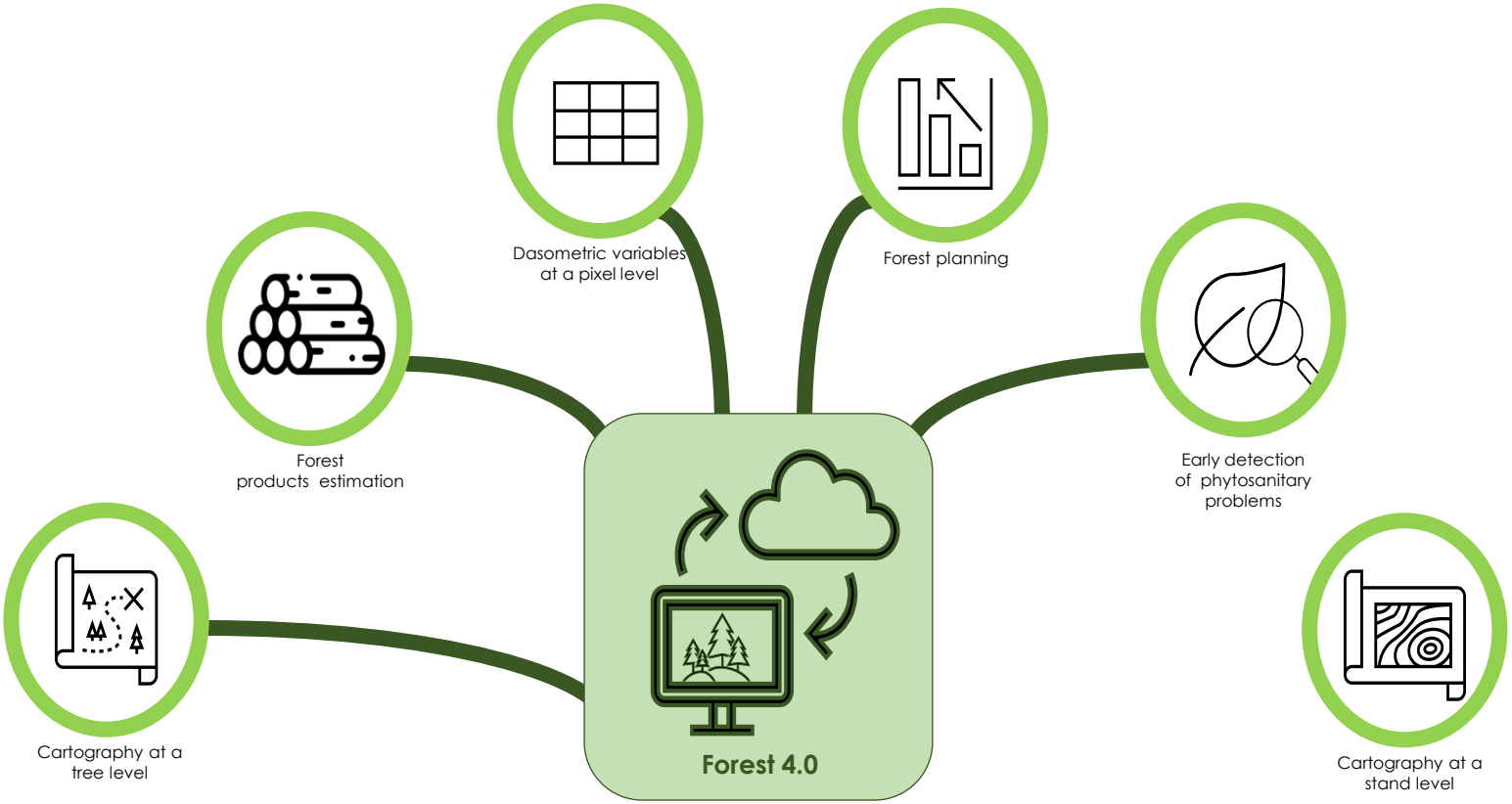
European digital strategy

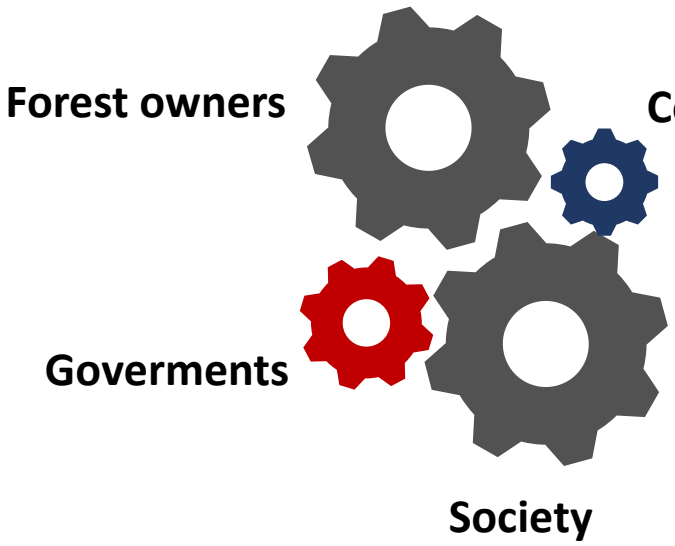
Digital technologies are crucial for the EU to become climate neutral by 2050, the goal set in the European Green Deal.

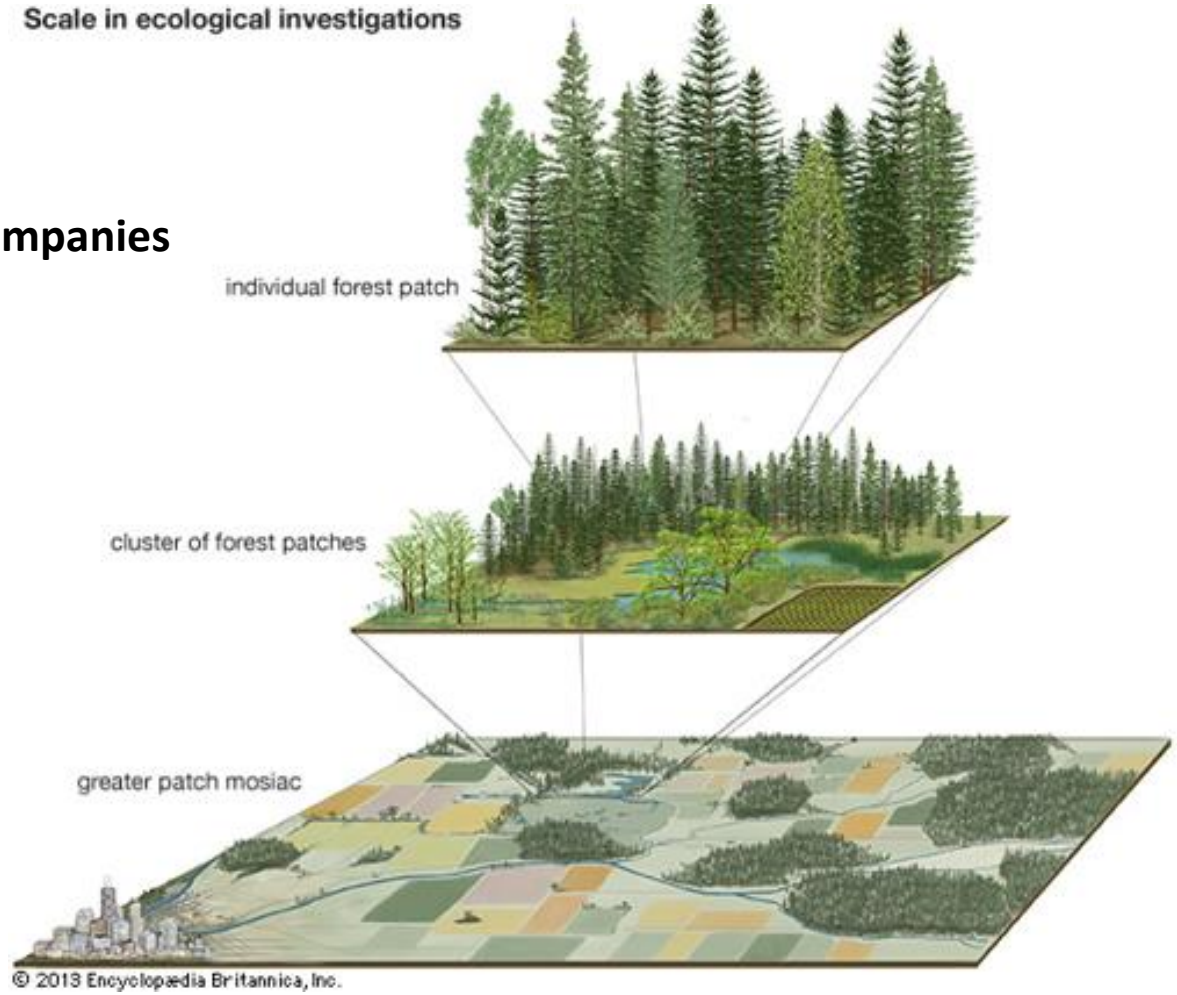
✓ Take advantage of AI, 5G, cloud and edge computing and IoT (Internet of Things)

✓ Support automated and connected transport



Forest management and planning tools: the data revolution





Sensors at CETEMAS

We integrate data from different types of sensors into our solutions: satellites, drones, ground sensors (IoT), LiDAR, thermal, multispectral…

Drones

Satellites

LiDAR

TLS

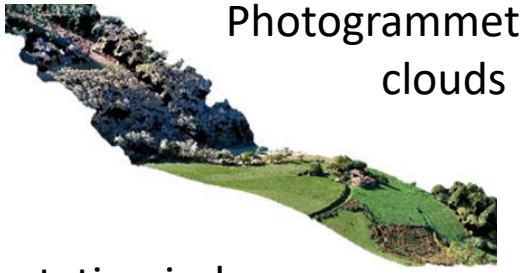
Multispectral

Thermal

Main lines of work/research

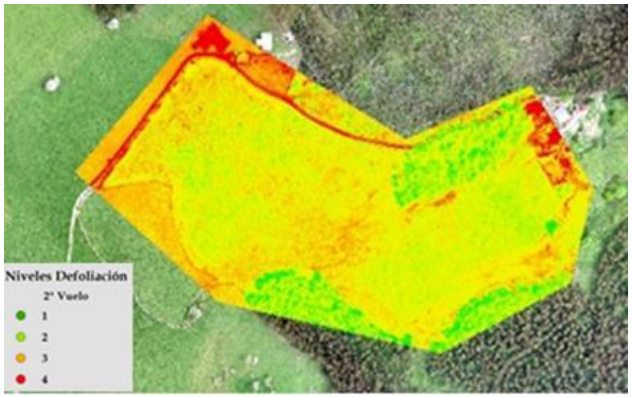
PHOTOGRAMETRY

Orthomosaics



Photogrammetric point clouds

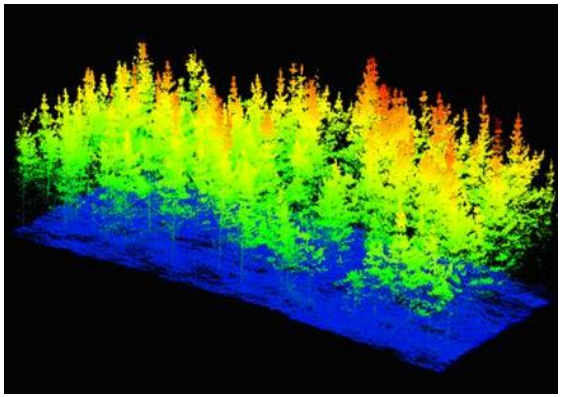
Vegetation index maps

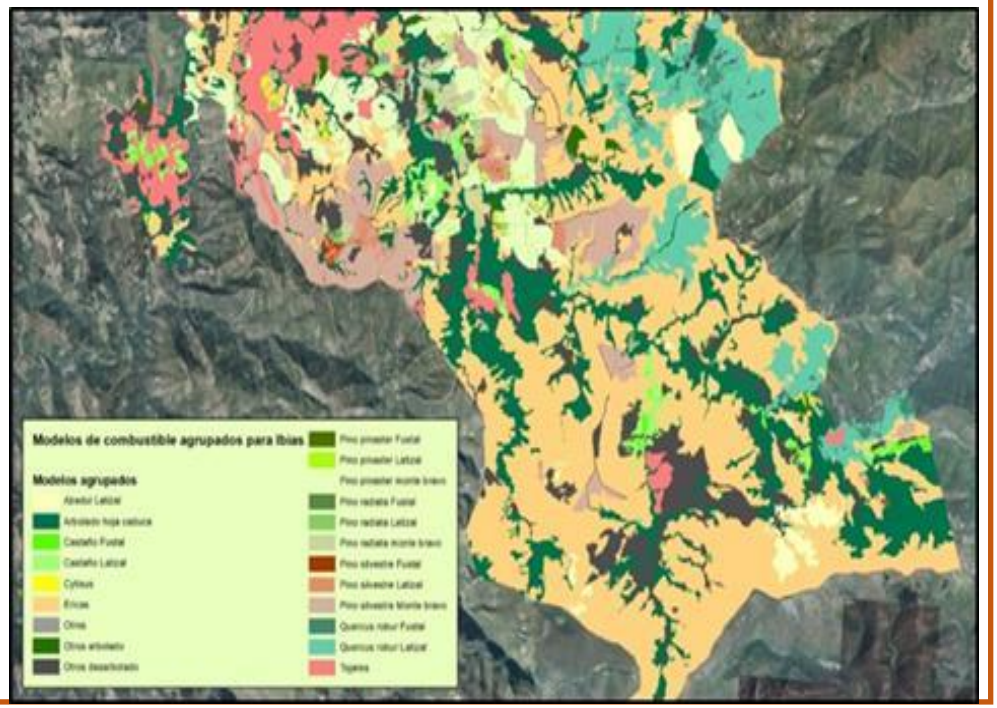


LiDAR

Estimation of forest variables

- Trees height
- Wood volume
- Fire fuel maps





Example: Automatic tool for tree decay monitoring

Terra IV project: to design, develop and put into operation a solution for forest management and control based on the data captured by airborne sensors mounted on UAVs.

Unión Europea
XUNTA DE GALICIA
FONDO EUROPEO DE DESARROLLO REGIONAL (FEDER)
Una manera de hacer Europa
Civil UAVs Initiative
MINISTERIO DE CIENCIA E INNOVACIÓN
GOBIERNO DE ESPAÑA
CETEMAS
coteso
USC
3edata

Module 3

- Forest pest detection
- Pest treatment with UAVs

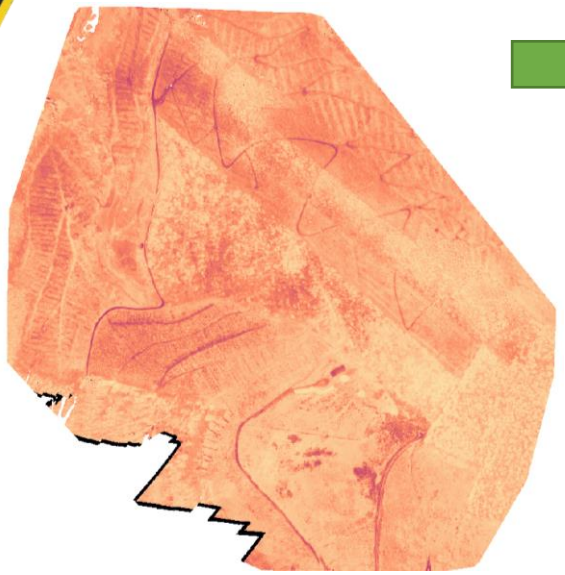
What causes tree decay?

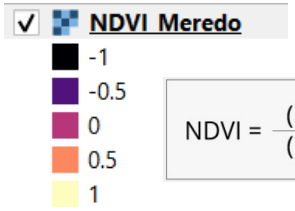
Fungal diseases (*Lecanosticta acicola*, *Dothistroma septosporum* and *Dothistroma pini*)

What was the objective of the tool?

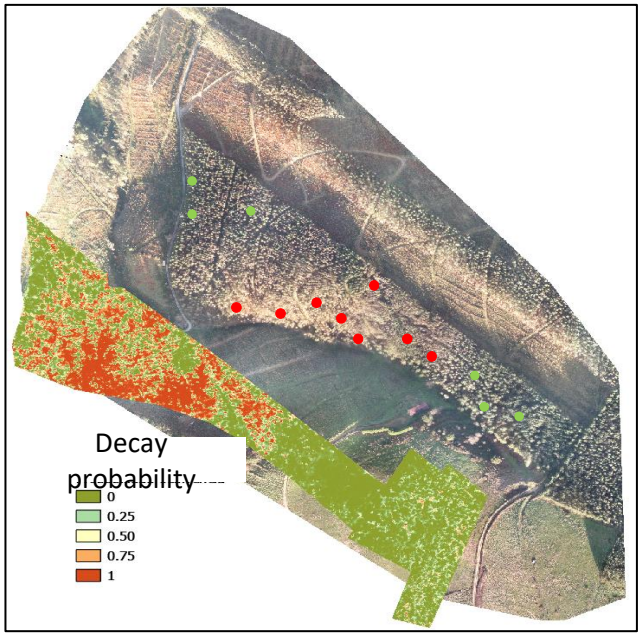
To convert a vegetation index map into a decay probability map for Brown spot needle blight and integrate it into a cartographic management tool

How?





$$NDVI = \frac{(NIR - RED)}{(NIR + RED)}$$



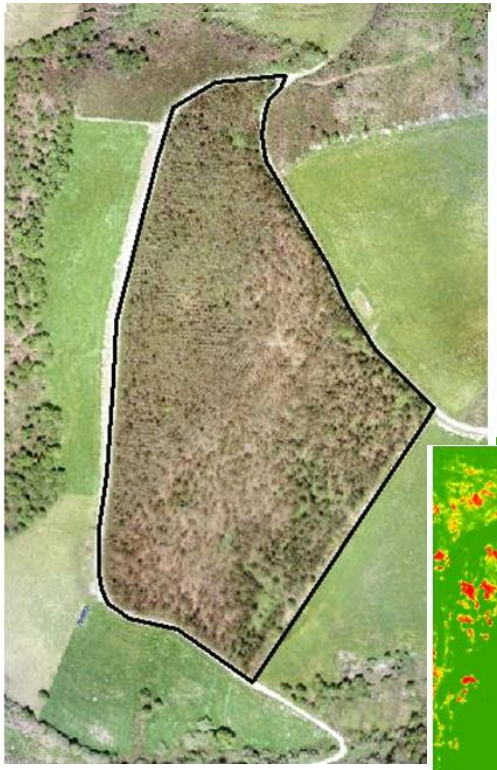
$$p = \frac{e^{19{,}809 - 30{,}568 \cdot NDVI}}{1 + e^{19{,}809 - 30{,}568 \cdot NDVI}}$$

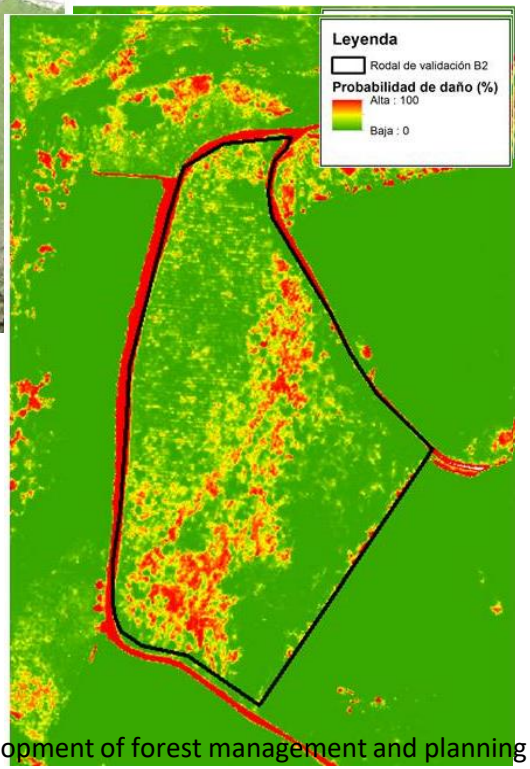
Healthy vegetation samples

Unhealthy vegetation samples

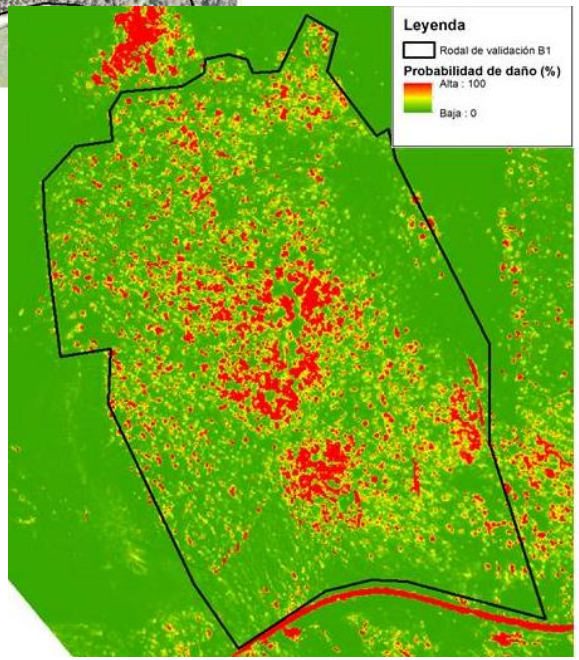
How did the tool perform in other areas?

Validation area 1





Validation area 2



The next challenges

- Improving the current tool by capturing more data from decaying trees so more samples are available to feed it.
- Introducing data captured with a thermal sensor in the model
- Calibrating the model to use it with satellite images (Scalable)
- Incorporating new models for different pests and species

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