

**LIFE[®]
VAIA**



International Oak Symposium



Science-based Management for Dynamic Oak Forests

USC
UNIVERSIDADE
DE SANTIAGO
DE COMPOSTELA

Land restoration after a big fire: evento and impact of forest fires: oaks versus pines

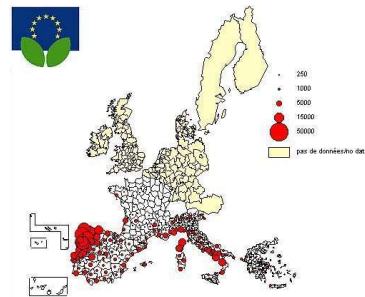
7-10 October 2024



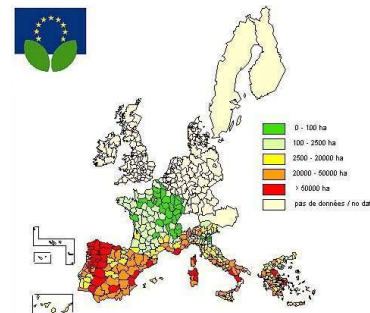


- **Introduction**
- Objective
- Methodology
 - Plantation
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Number of fires

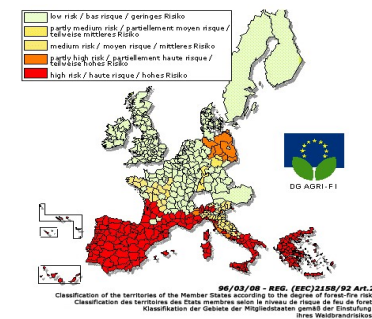


Burnt hectares



**Galicia is the most fired area of Europe.
45% of its land was fired in the last 10 years**

Fire Risk





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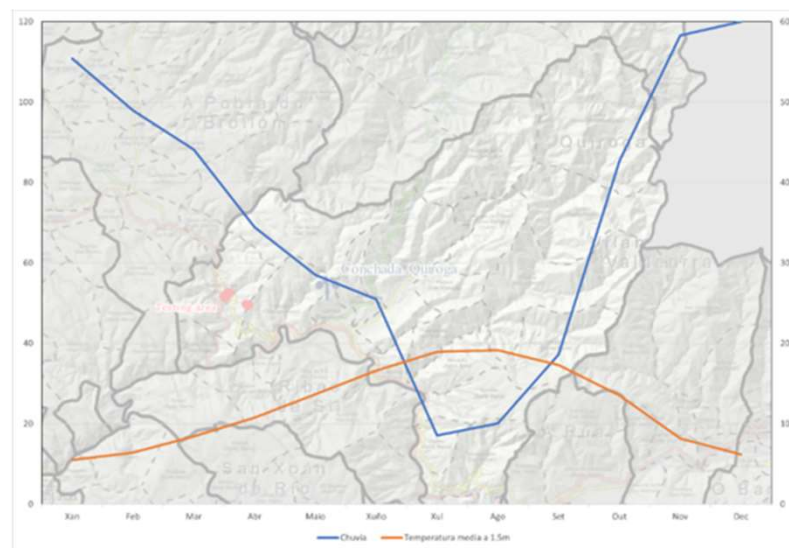
Science-based Management for Dynamic Oak Forests



Monte Virgen de los Remedios
(42.489141, -7.340093)

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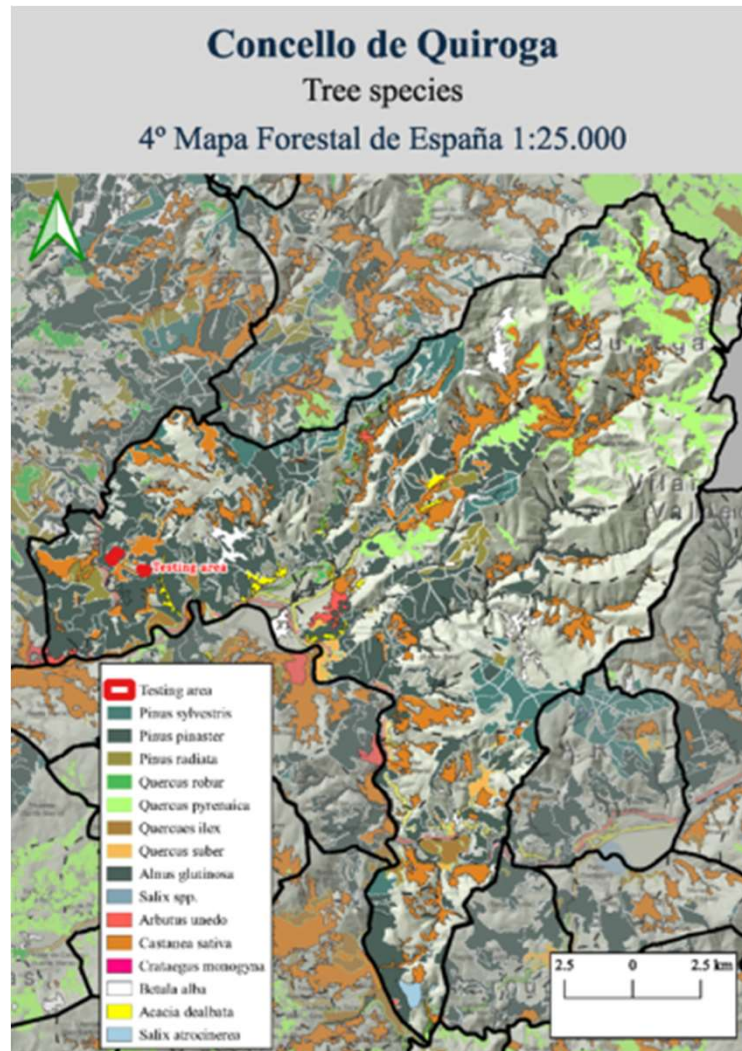




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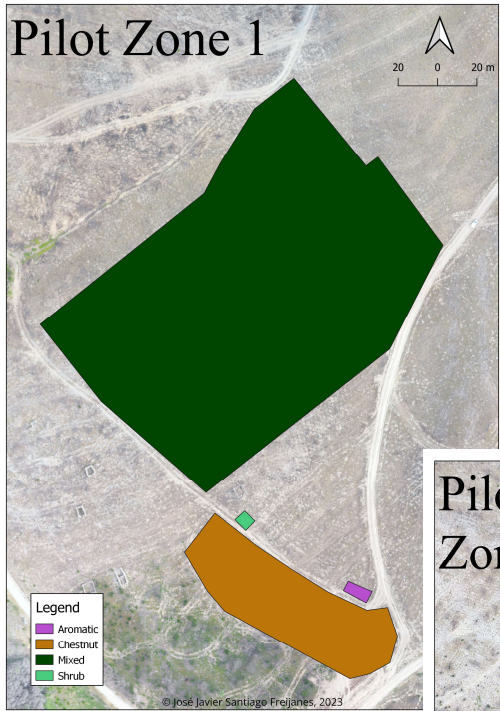
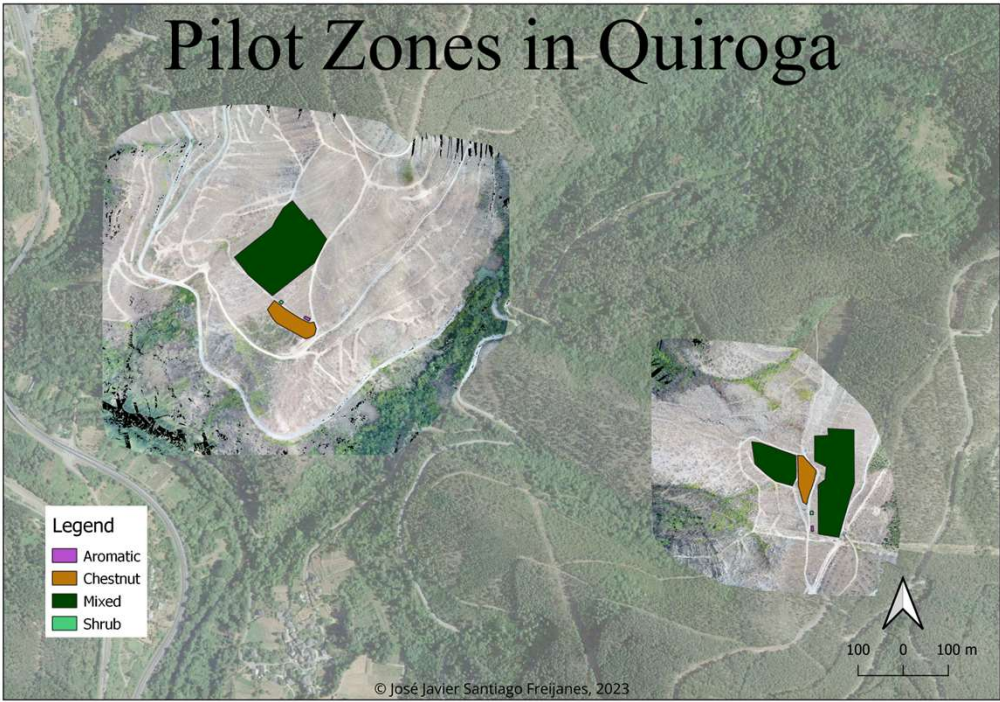


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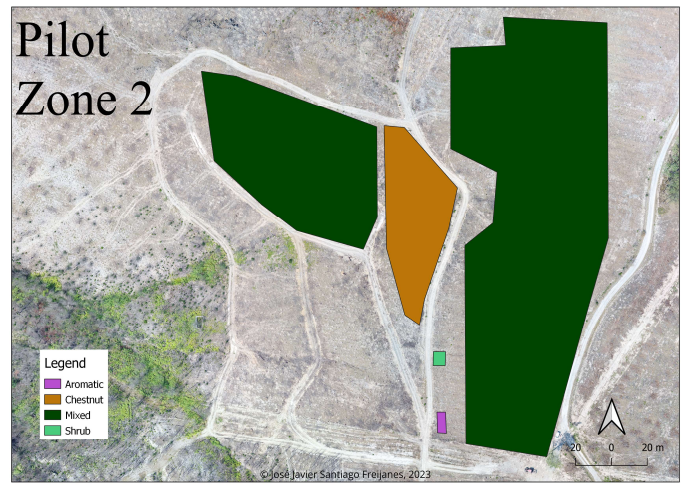


**Need to manage the landscape
with species less prone to fire in between
Fast growing tree species**

FINAL MAPS OF PILOT SITES



ID	Zone	Crop	AREA (m ²)
1_A	1	Aromatic	40.00
1_C	1	Chestnut	3344.95
1_M	1	Mixed	21803.28
1_S	1	Shrub	36.00
2_A	2	Aromatic	40.00
2_C	2	Chestnut	3052.48
2_M	2	Mixed	22503.99
2_S	2	Shrub	36.00
Z1	1	TOTAL	25224.2
Z2	2	TOTAL	25632.5

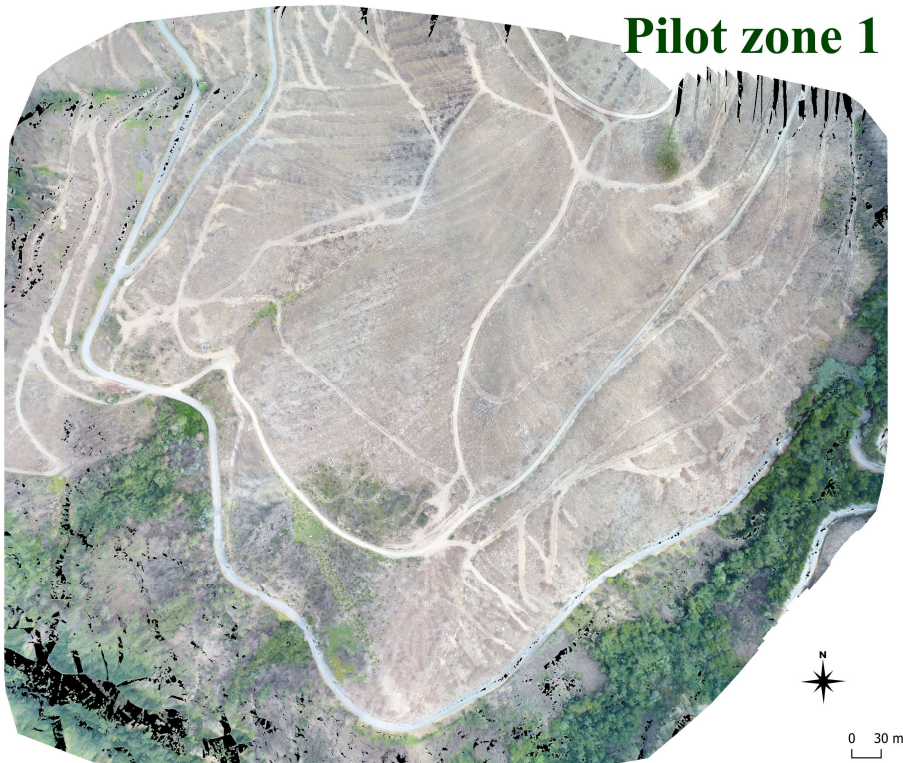


50856.72 ha without the Pinus pinaster regeneration study

AUGUST 2022 and FEBRUARY 2024

DRONE FLIGHTS (August 2022)

Pilot zone 1



© José Javier Santiago Freijanes 2023



0 30 m

Pilot zone 2



0 30 m

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- **Objective**

- Determine the best species to restore soils
- Determine the historical impact of broadleaves and conifers on soil characteristics

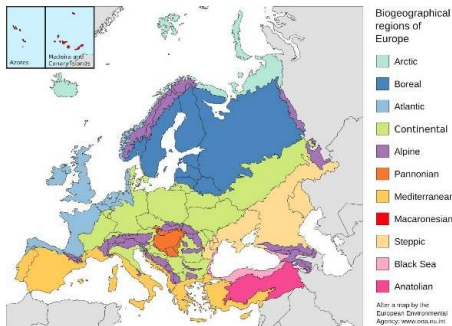


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GALICIA (NW SPAIN)

Monte Virgen de los Remedios
(42.489141, -7.340093)



Forest fire in 2021:

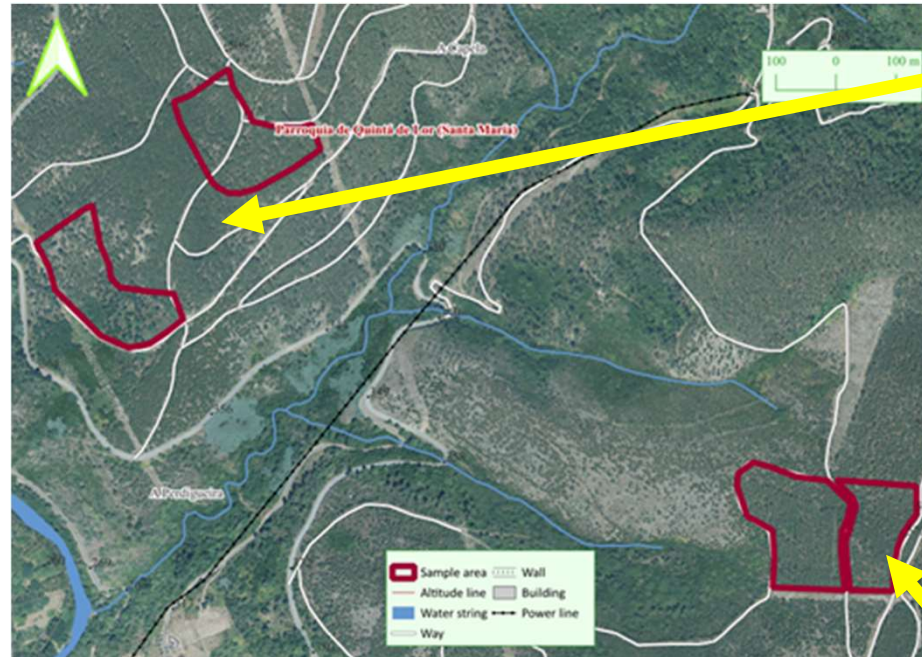
1.792 ha were destroyed, 909.1 ha within the municipality in two days



The **Pilot Areas** has above 1 sq km (130 ha), including the **Pilot Sites** and the **Cultivation Areas**

BEFORE THE FOREST FIRE

- Conifers (*Pinus pinaster*)
- Shrubs (*Arbutus unedo*, *Ulex gallii*, *Erica arborea*, *Erica australis*, *Cytisus multiflorus* and *Genista florida*)
- Herbaceous species (*Pteridium aquilinum*)
- High proportion of the soil was covered by pine needles



Pilot 1:
Low latitude, larger soil depth

Pilot 2:
High latitude, low soil depth



Monte Virgen de los Remedios





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Arbutus unedo



Mixed Forest
Soil Samples: pH, CEC





Topsoil
30 cm

Organic
Subsoil

Mineral
Subsoil

Unfertilized Grazed Permanent Grassland



Fertilized Mowed Permanent Grassland



Heathland



Pinus pinaster



Pinus radiata





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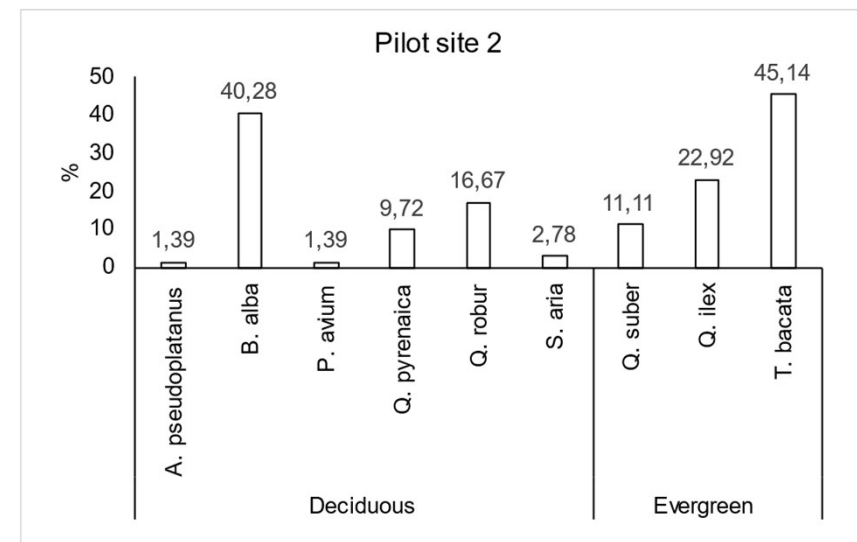
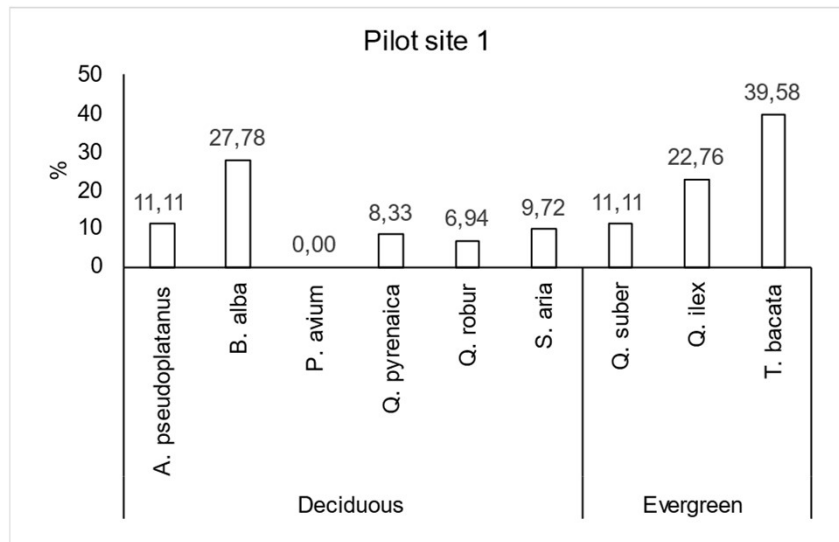
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8000 plants per ha-1

Pinus pinaster natural regeneration is a success



% death trees



Lowland



Highland

Pilot area 1: *Quercus robur* (Qr) < *Q. pyrenaica* (Qp) < *Q. suber* (Qs) < *Q. ilex* (Qi)

Pilot área 2: *Q. pyrenaica* (Qp) < *Q. suber* (Qs) < *Quercus robur* (Qr) <ns *Q. ilex* (Qi)

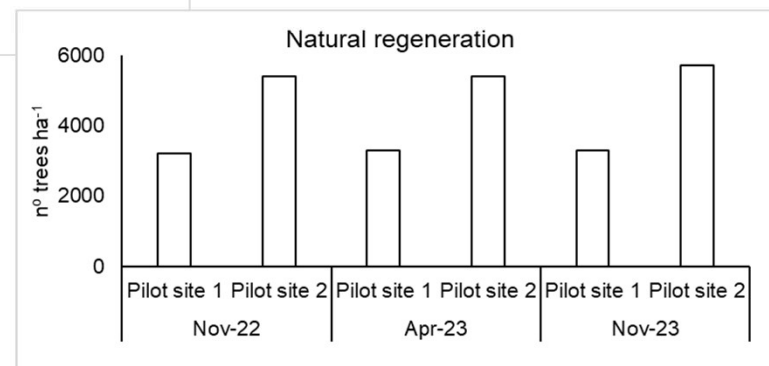
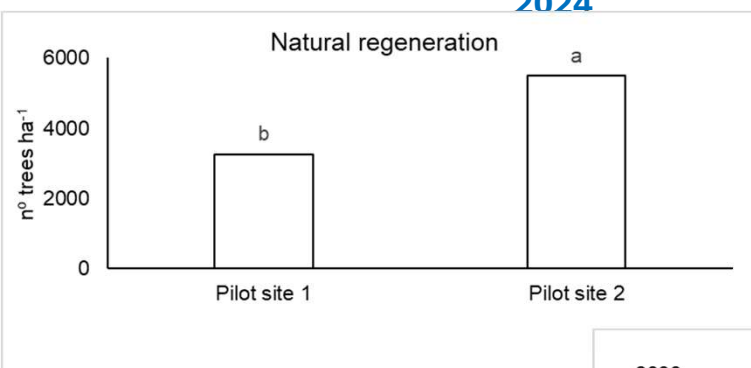
RESULTS: NATURAL REGENERATION



EVALUATION OF NATURAL REGENERATION:

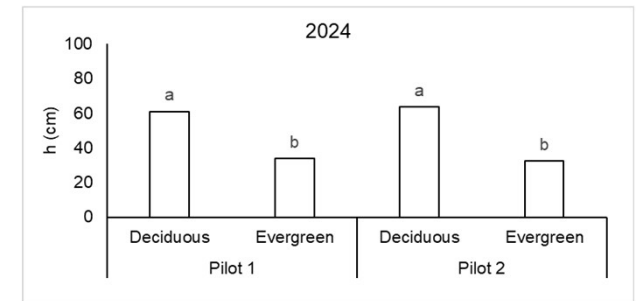
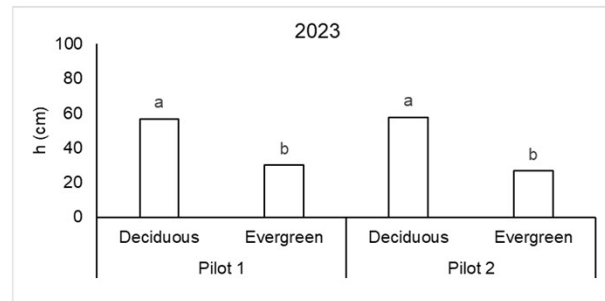
November 2022, April-May 2023, November 2023 and March

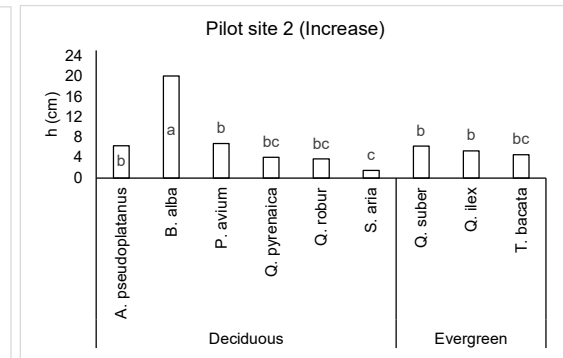
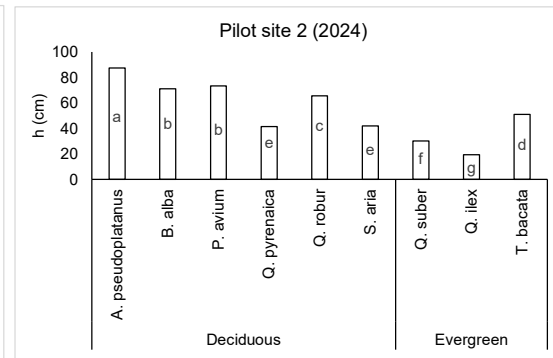
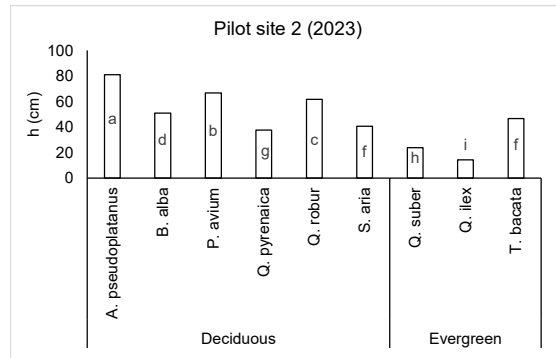
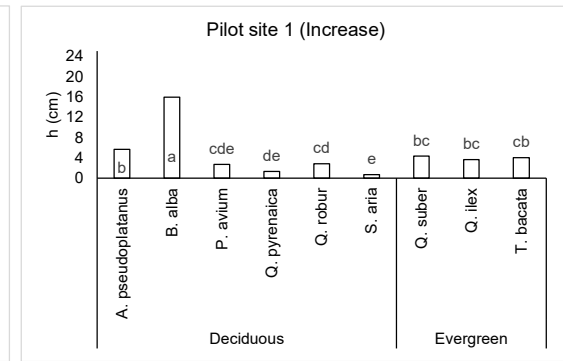
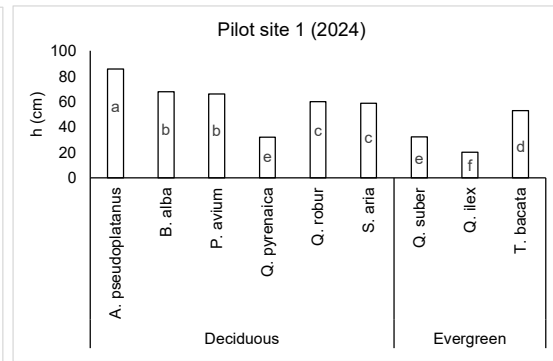
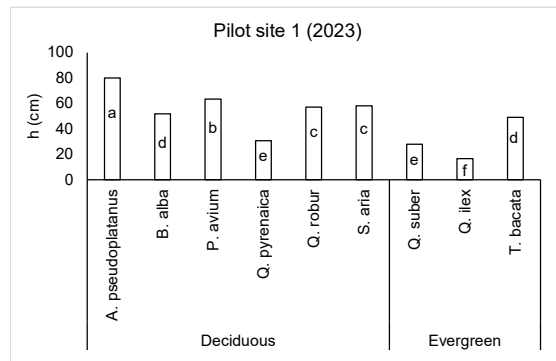
2024



RESULTS: TREE GROWTH

At the beginning of 2023 and 2024





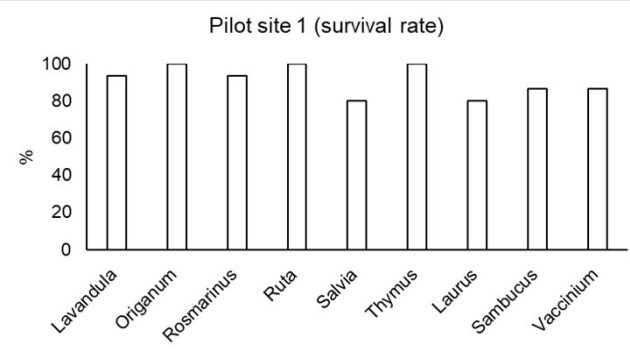
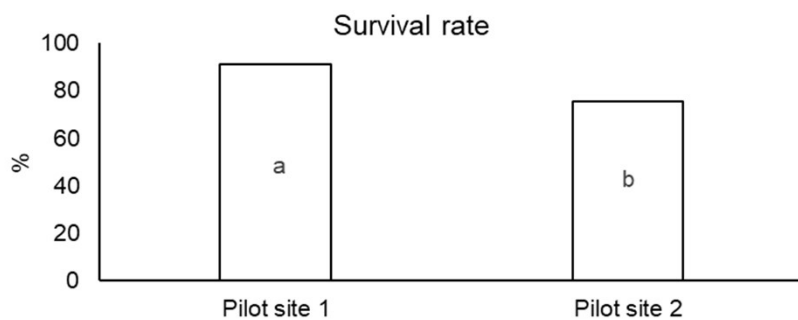
Height: *Quercus robur* (Qr) > *Q pyrenaica* (Qp) > *Q. suber* (Qs) > *Q. ilex* (Qi)

Growth increment: *Q pyrenacia* < *Q. robur*, *Q. suber* and *Q. Ilex*

Pilot area 2 > Pilot area 1

RESULTS: MEDICINAL AND AROMATIC PLANTS (SURVIVAL RATE)

May 2023





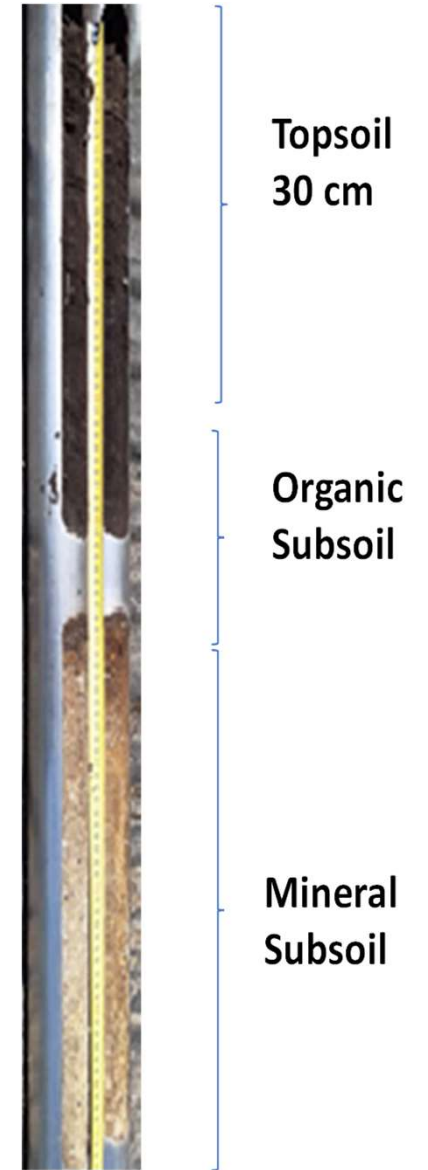
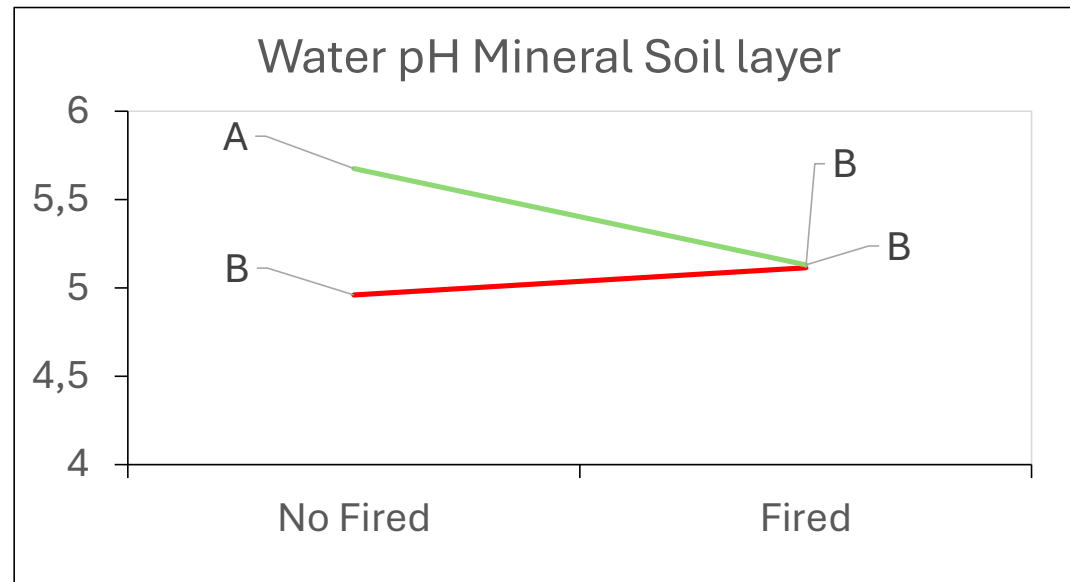
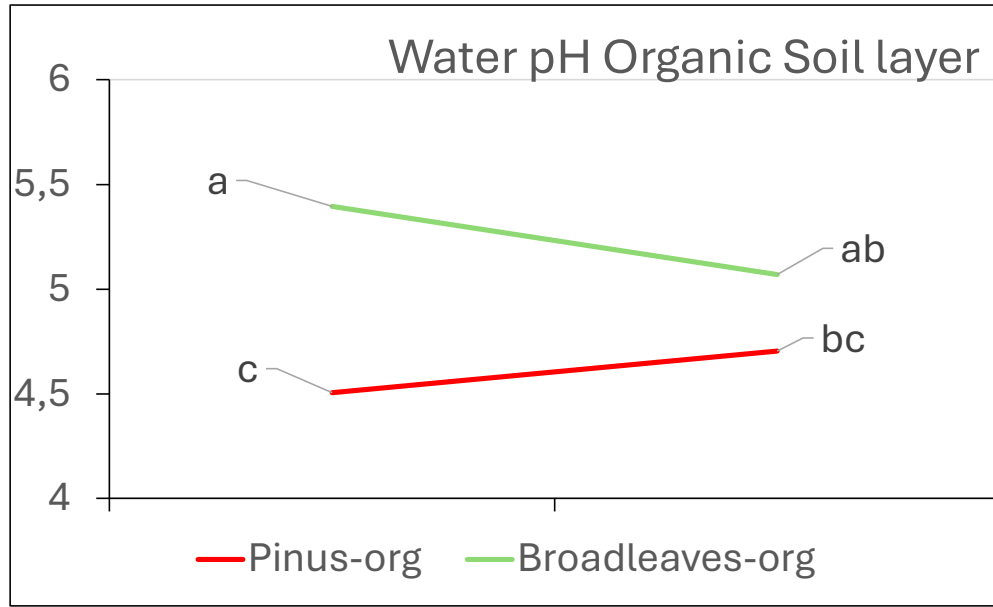
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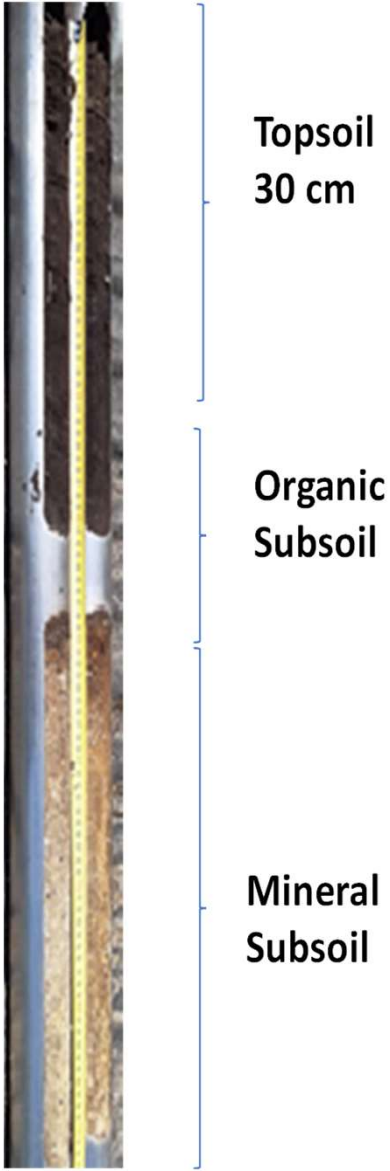
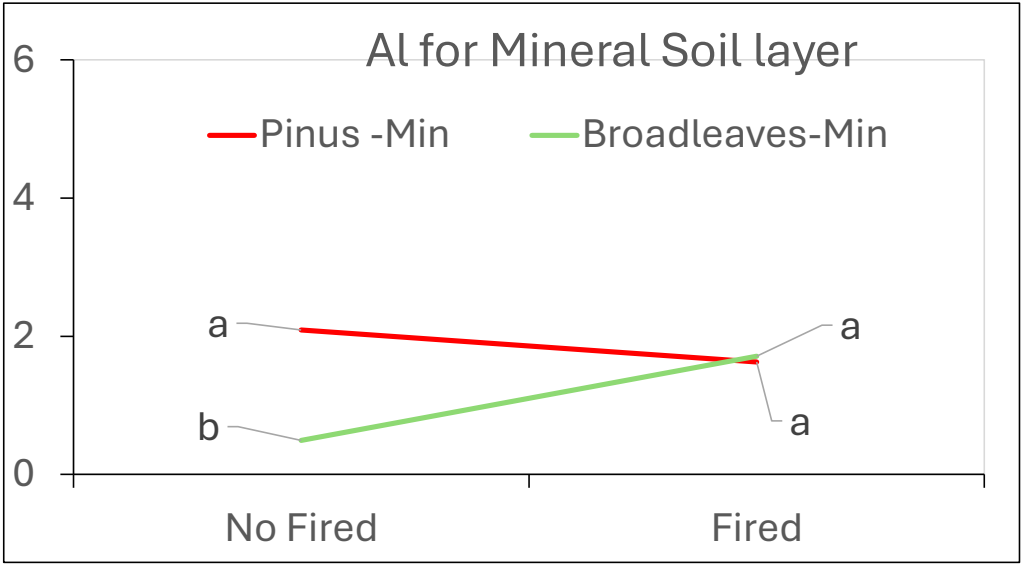
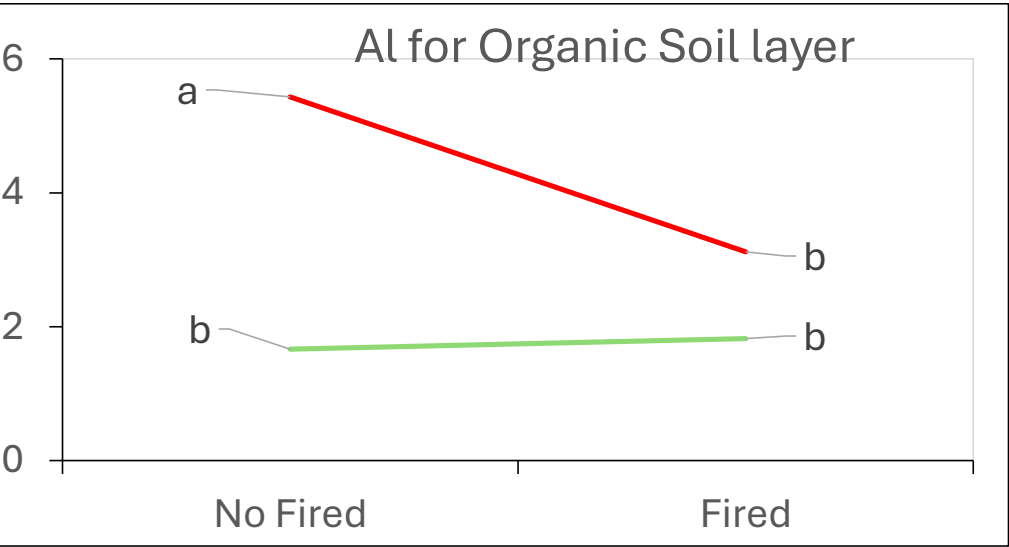
5 months after fire



15 months after fire







WORKS TO BE DONE

- ✓ Monitoring:

 - Tree growth

 - Production of aromatic and medicinal plants

- ✓ Successive drone flights

- ✓ Biodiversity monitoring



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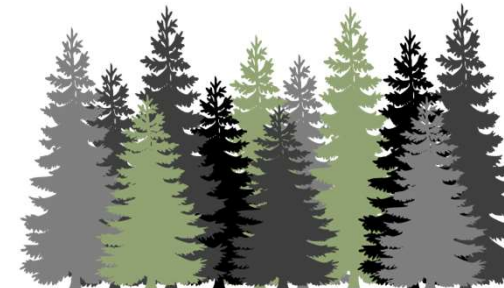
Conclusiones

Restaurar suelos incendiados entraña una gran dificultad

Las especies arbóreas presentan un elevado grado de tasa de mortalidad, pero las que quedan sobreviven

Las plantas medicinales tienen una mayor capacidad de establecimiento pero su crecimiento es pobre

Se precisa de más años para evaluar el efecto de los tratamientos evaluados





CONCLUSIONS

- *Pinus pinaster* natural regeneration was excellent after fire but should be under control to avoid future forest fires
- Atlantic oaks had a reduced seedlings death than Mediterranean oaks
- Lowlands reduced seedling death compared with highlands
- Atlantic *Quercus* had a higher height than Mediterranean oaks
- *Q. pirenaica* has a higher height increment than the other Mediterranean and Atlantic oaks
- Growth was better in highlands than in lowlands in spite of the high seedlings death rate of the highlands.
- The soil has memory: after fire, the resilience and recovery of the vegetation is better in former broadleaves than pinus areas

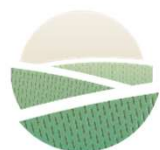


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GOFORREST



DIGIT-RANGELANDS

Oper8

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PYRICLABS

FORADVICE

SUS-SOIL



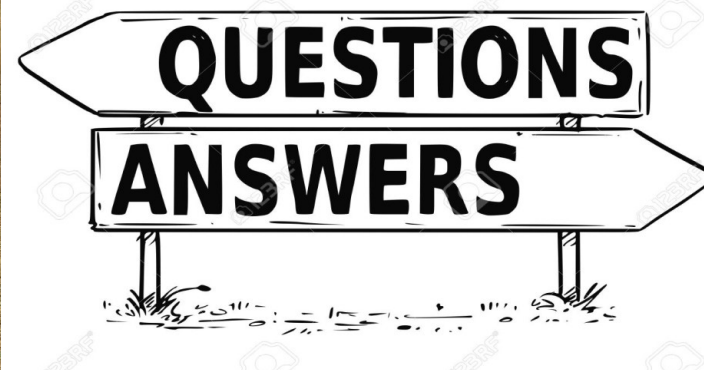
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THANK YOU!



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