Adaptive management of Mediterranean *Pinus halepensis* forests in the face of climate change

LIFE ADAPT-ALEPPO (LIFE20 CCA/ES/001809)

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1. PROJECT OVERVIEW

LIFE ADAPT-ALEPPO

GEOGRAPHIC SCOPE: Región de Murcia – Castilla La Mancha – Comunidad Valenciana – Cataluña – Aragón - Andalucía

BUDGET INFORMATION:

Total amount: 2.046.399 €

% Co-financing CE: : 1.433.268 € (54,99%)

DURATION: Start: 01/09/2021 - End: 31/08/2025

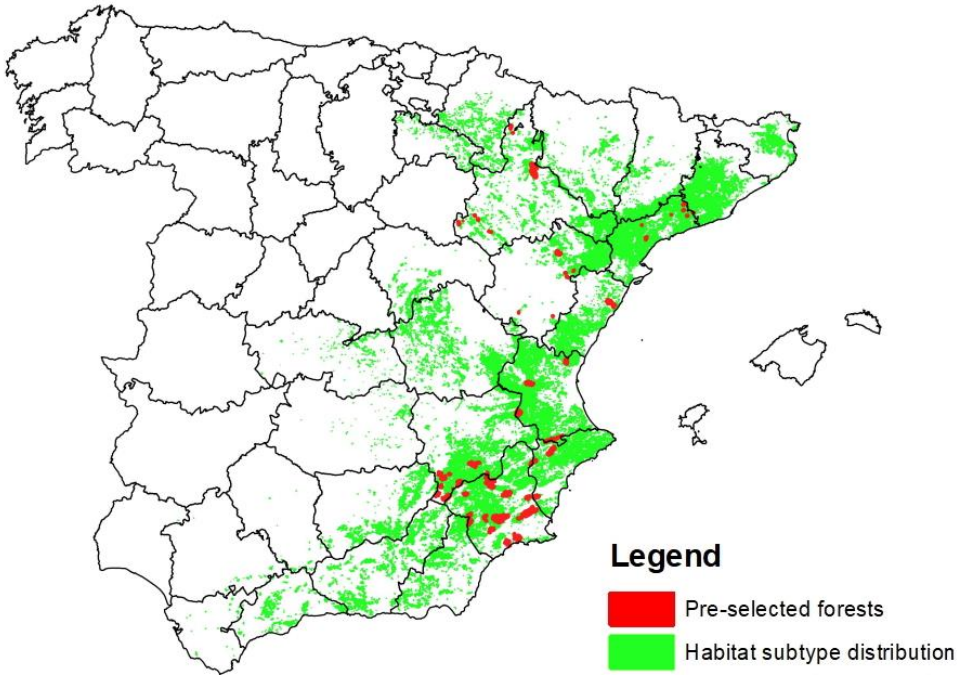
PROJECT PARTNERS:

Coordinator:

- Ingeniería del Entorno Natural (IDEN)

Partners:

- AGRESTA Sociedad Cooperativa (AGRESTA)
- Dirección General del Medio Natural de la CARM (DGMN)
- Universidad de Castilla-La Mancha (UCLM)
- Universitat Politécnica de Valencia (UPV)
- Universitat de Lleida (UdL)



Main objective

Its main objective is the development of new tools for the adaptation of Iberian Aleppo pine forests (subtype 42.841 of Habitat 9540 of the Habitats Directive, Annex I) to climate change, as well as their demonstrative application.

These tools will focus on:

- Early detection of decay processes
- Improving ecosystem resilience by increasing ecosystem vigour
- Capacity to adapt to climatic aridification
- Capacity to recover functions after natural disturbances.

Specific objectives

O1 - Develop a **habitat suitability map** and implement **a tool to detect decline processes** by remote sensing.

O2 - Implement and monitor **assisted migration actions** aimed at improving the capacity of the ecosystem to adapt to climatic aridification.

O3 - Implement and monitor **silvicultural treatments** aimed at **improving vitality** and reducing the effects of reduced water availability.

O4 - Implement and monitor **silvicultural treatments to improve structural** and floristic heterogeneity and increase the

O5 - Implement and monitor **adaptive management techniques to improve the resilience** and adaptive capacity of post-fire Aleppo pine regeneration.

O6 - Develop and transfer **management tools** to promote the integration of climate change adaptation into national and regional forest management regulations.

O7 - Develop monitoring tasks to evaluate the **success and impact** of the project.

O8 - **Transfer the implemented techniques and tools** to the main local and European Aleppo pine range stakeholders (Balearic, French and Italian), in order to improve the management and long-term conservation of the Aleppo pine habitat in Southern Europe.

Expected results

Habitat vulnerability assessment through the development of suitability maps and the diagnosis of forest deterioration processes

Development of technical guidelines for adaptive forest management of Aleppo pine forests in the face of climate change

Implementation of 108 ha of demonstration plots and monitoring of these plots

Transfer and promotion of the use of these adaptive management tools and techniques to facilitate their use by forest owners and managers at local, regional and southern European level

Increase in the level of knowledge and awareness of the actors involved and the general public about the problem addressed and the solutions provided by the project

2. ACTIONS

Actions

A. Preparatory actions

A1. Previous experience, regulations and technical documentation

A2. Selection of plots and their characterisation.

C. Implementation actions

C1. Mapping of habitat suitability and development of a decay monitoring tool.

C2. Demonstrative implementation of assisted migration

C3. Demonstrative implementation of eco-hydrological based silvicultural modelling

C4. Demonstrative implementation of techniques for structural and floristic diversification.

C5. Demonstrative implementation of techniques for adaptive management of post-fire regeneration.

C6. Development of replication strategy and technical guidelines for the transfer of results.

D. Follow-up action

D1. Continuous monitoring of decay processes

D2. Monitoring of previous experiences

D3. Monitoring of demonstration actions

D4. Monitoring of project impacts on ecosystem services and socio-economic aspects

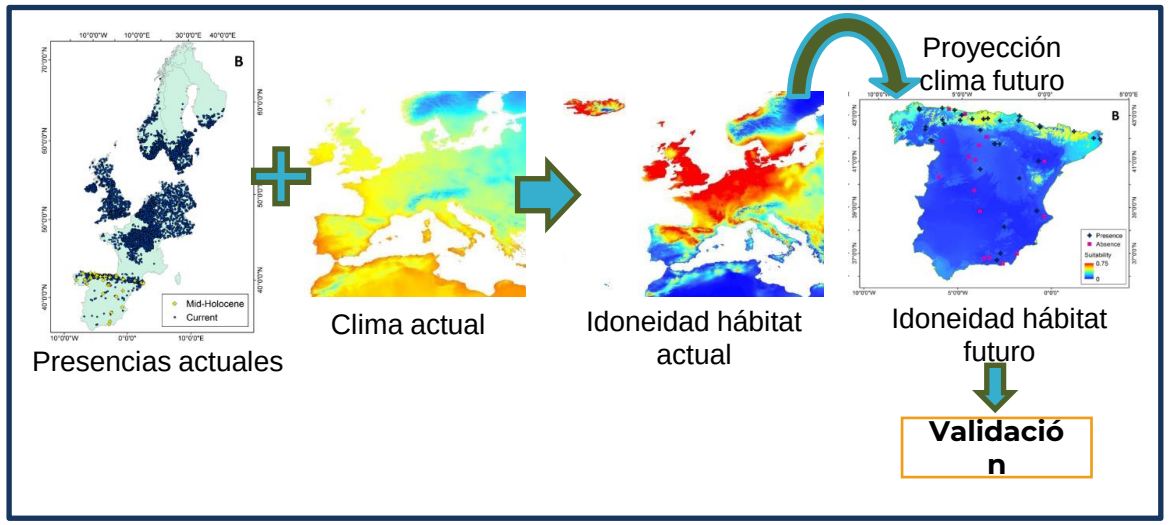
E. Dissemination actions

A1 y A2: Previous and newly implemented plots

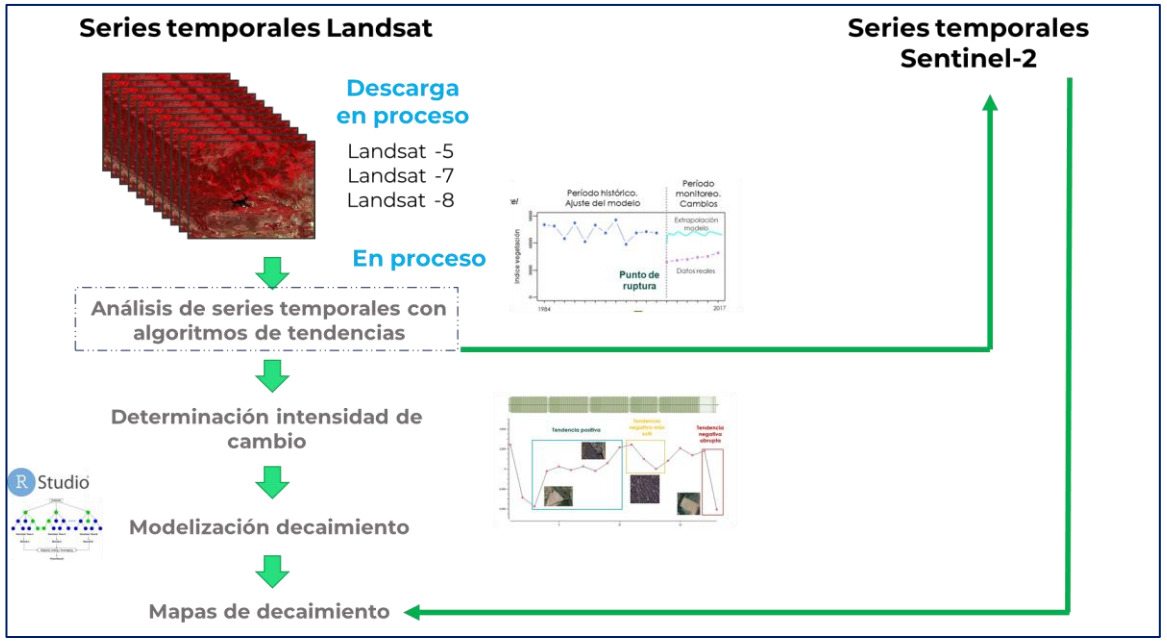
Type of action	Previous	New
C2. Assisted migration	6	12 (24 ha)
C3. Ecohydrological forestry	10	9 (18 ha)
C4. Structural and/or floristic diversification	16	12 (48 ha)
C5. Post-fire regeneration	23	9 (18 ha)
TOTAL	63	42

C1. Mapping of habitat suitability and development of tool for monitoring decay processes

Habitat suitability mapping process:



Basis of the decay detection and monitoring tool:



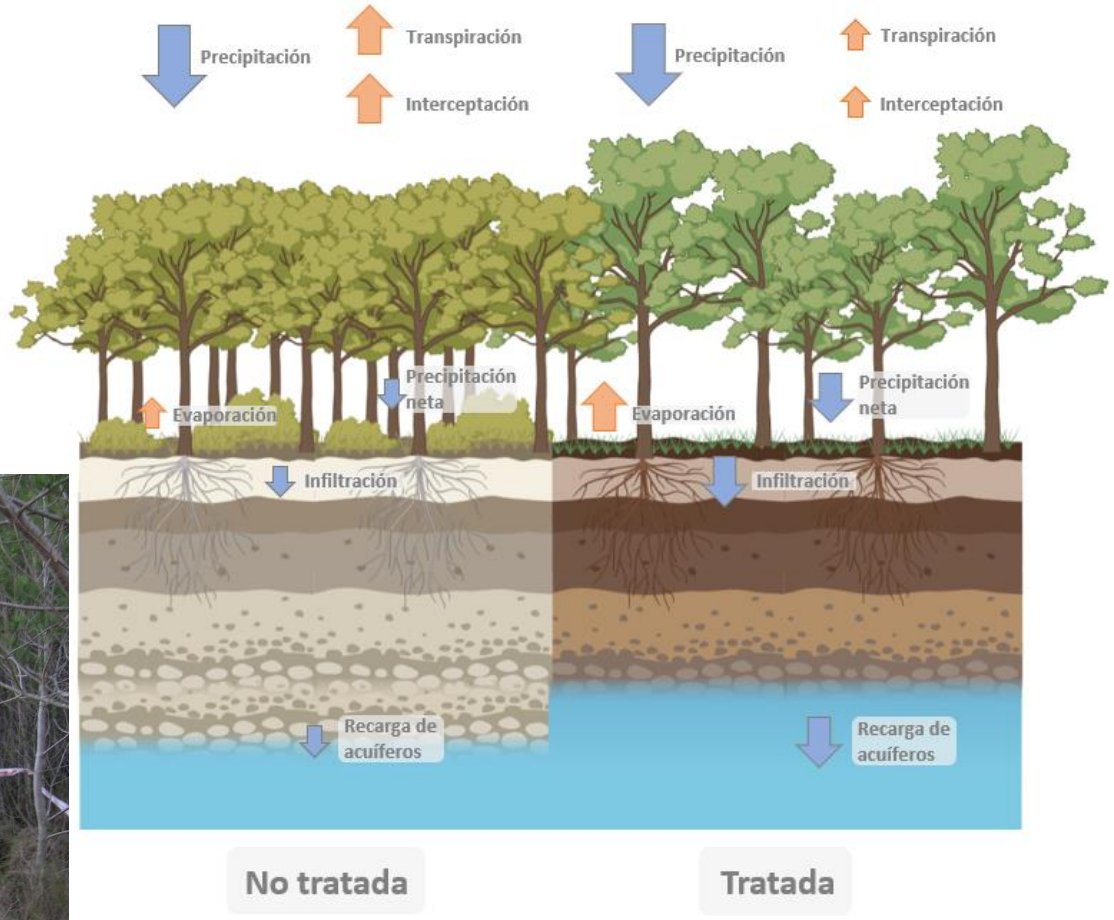
C2. Demonstrative implementation of assisted migration

Assisted migration involves changing the specific or genetic composition of a population, seeking to replace (or complement) poorly adapted species or populations with species or genotypes better adapted to expected future climatic conditions. It consists of using different origins of Aleppo pines to analyse their response to climate.

Selection of locations → Design of the action → Selection of provenances for each stand → Seed collection and plant production → Planting

C3. Demonstrative implementation of ecohydrological-based silvicultural modelling

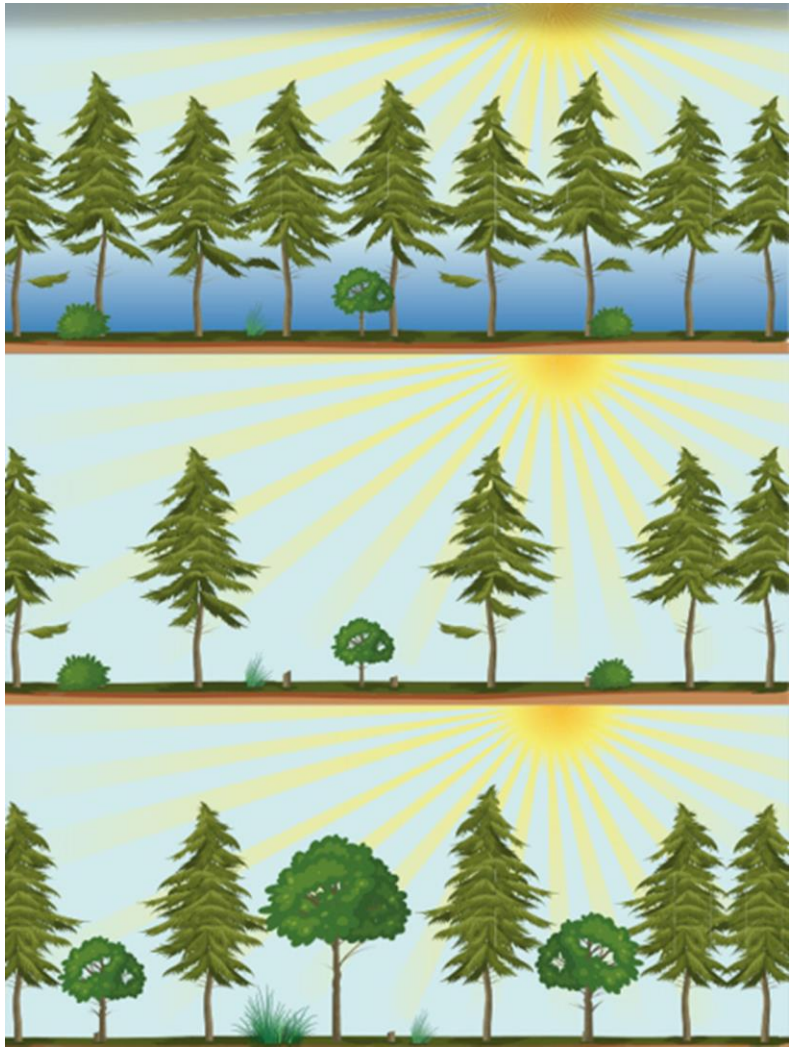
Ecohydrological treatments or ecohydrological silviculture aim to reduce tree density based on forest-water relations, i.e. their objective is to manipulate and optimise forest-water interactions through forest management considering an ecosystem-based approach. Specifically, by moderately reducing the number of trees, the amount of water available in the system increases, which improves the water status of the system. Even in areas where rainfall is high, it favours the recharge of aquifers.



C4. Demonstrative implementation of techniques for structural and floristic diversification

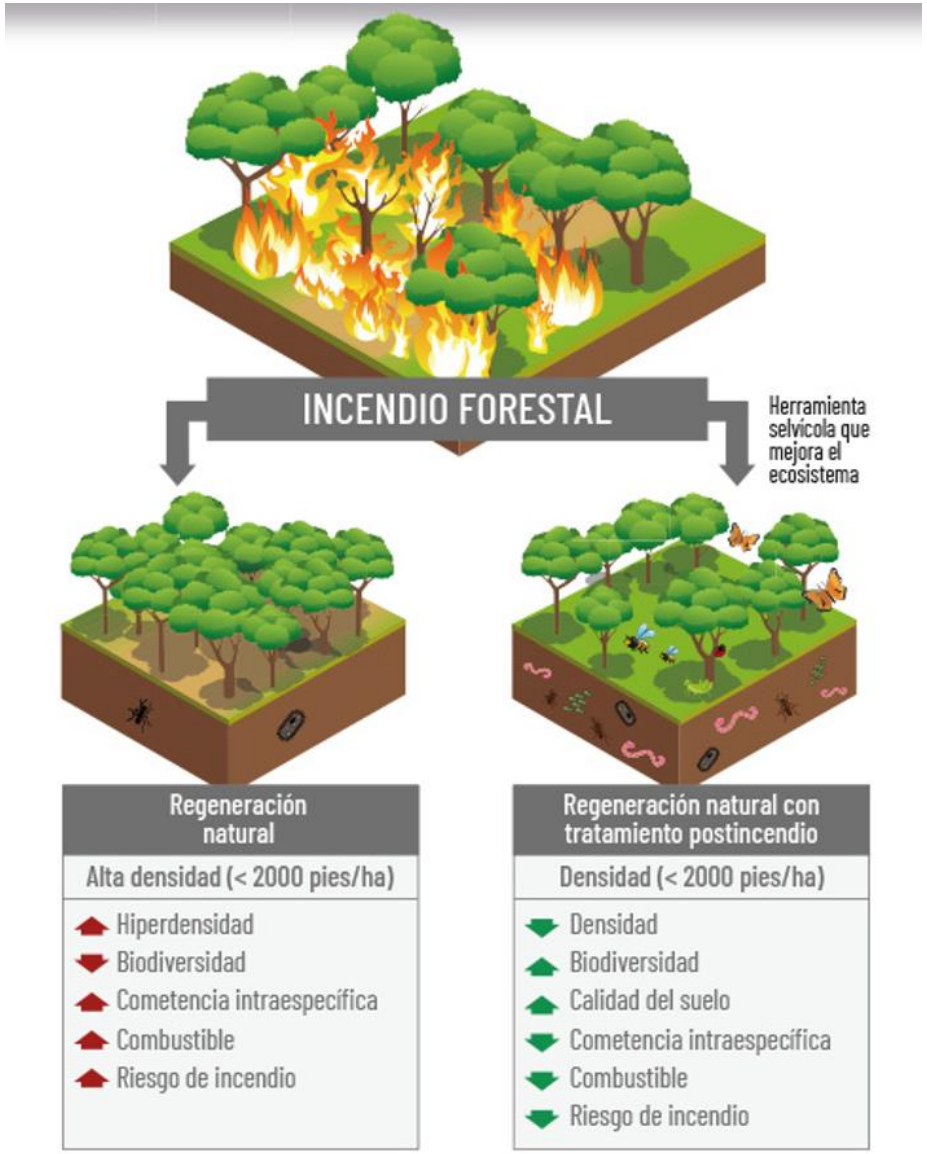
Aleppo pine forests with fairly homogeneous dominant floor structures - often reforestation, although not essential - and in which there is some presence in the undergrowth of interesting tree or arborescent species, especially Quercus and Juniperus (although also Sorbus, Prunus, etc.).

- Replacement of pine by another species with the ability to establish dominance (increasing diversity at landscape scale).
- Transformation of the stand into a mixed stand of two or more species.
- Maintenance of pine as the dominant species, favouring the accessory presence of companion species.



C5. Demonstrative implementation of techniques for adaptive management of post-fire regeneration.

The aim is to implement silvicultural actions in high-density Aleppo pine forests affected by large forest fires, to improve the resilience of regeneration against new disturbances, as well as its adaptive capacity to a scenario of climatic aridification. Intraspecific and interspecific competition will be reduced, favouring the diversification of stands from early stages of development. Thinning of more than 80% will be carried out.



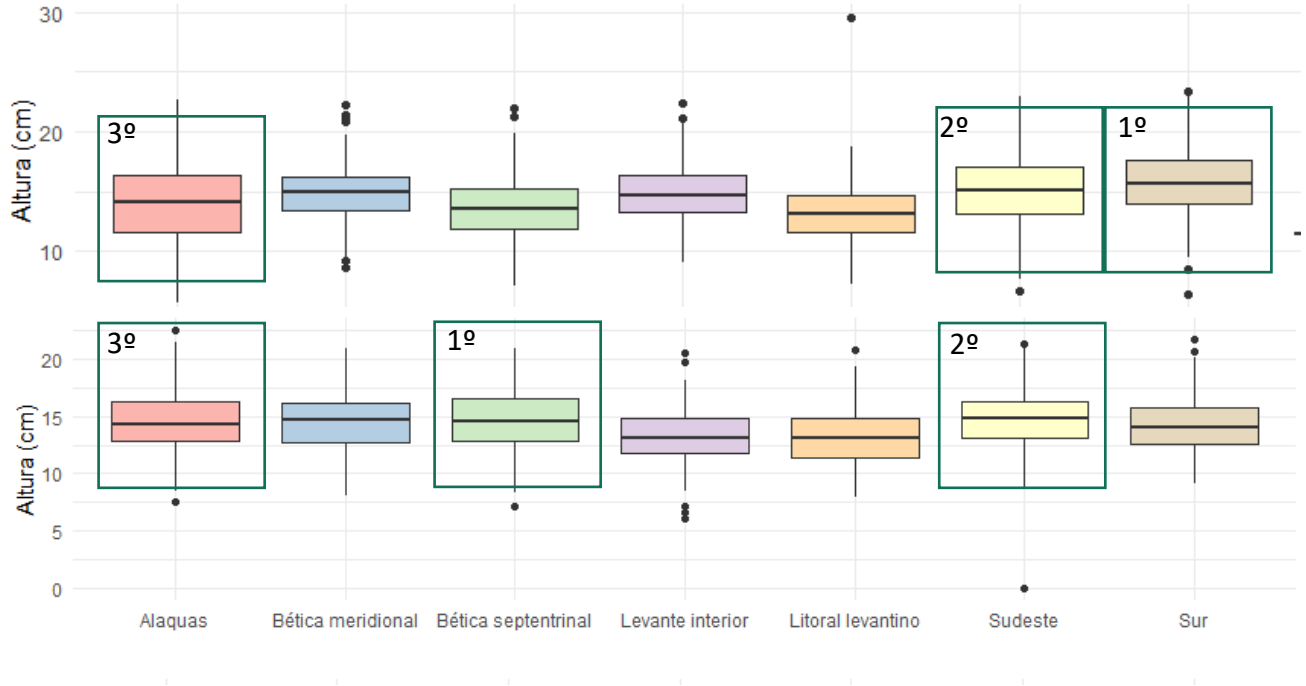
3. Focusing on...

Assisted migration in Valencia

Cortes de Pallas (700 m)

Pedralba (300 m)

+ Andilla (1300 m)



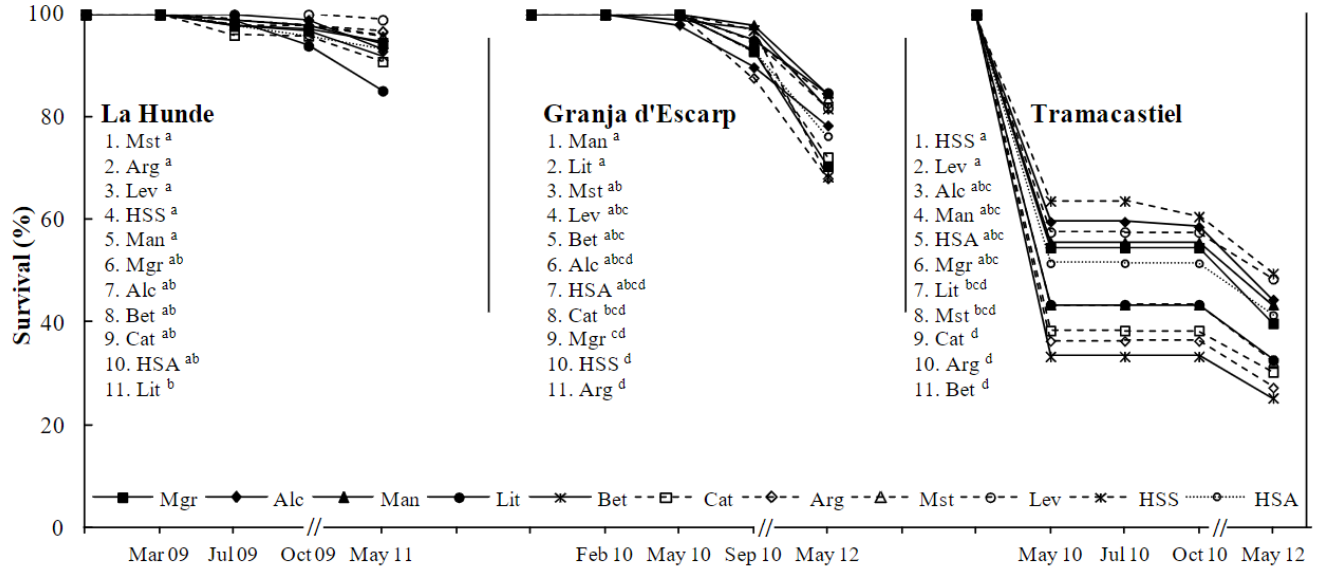
Data for the February/March 2023 measurement

Assisted migration: Measurement previous plots.

Granja d’Escarp

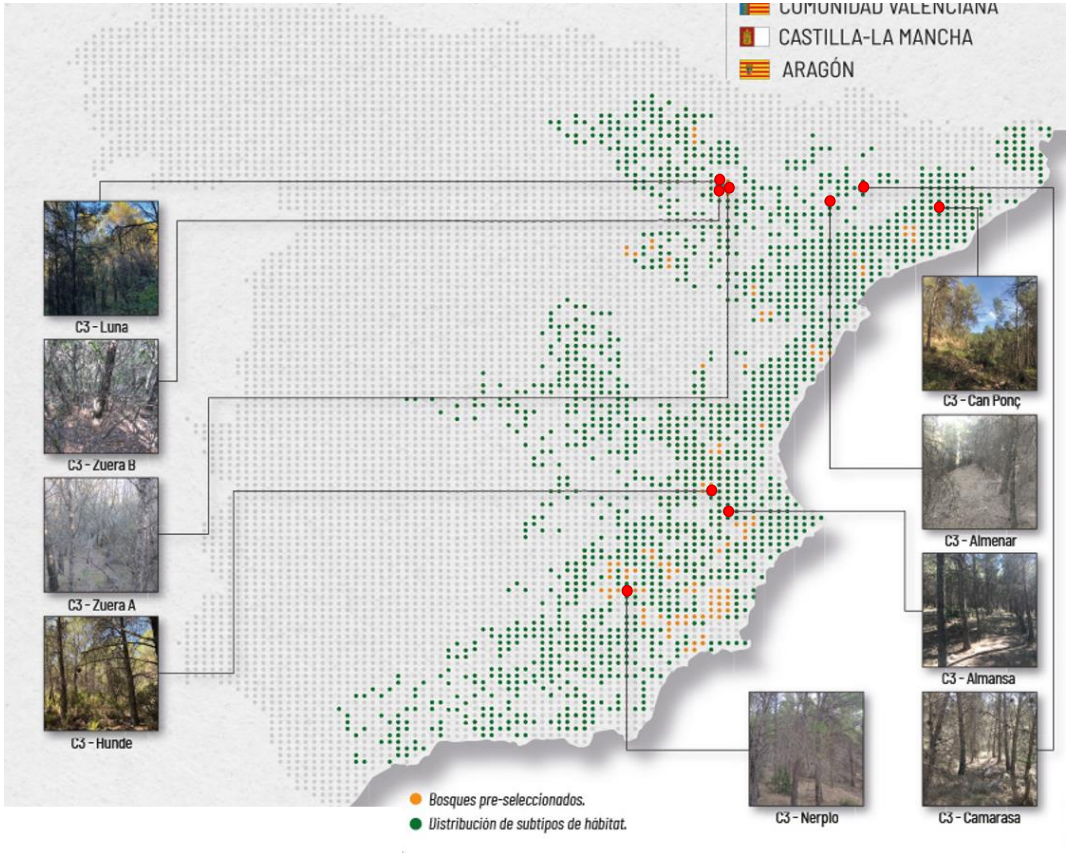
La Hunde

Seed source[(class)]	ID		
H.S. Alaquàs[3]	HSA	H.S. El Serranillo[3]	HSS
Litoral levantino[1]	Lit	Levante Interior[1]	Lev
Cataluña[2]*	Cat	Maestrazgo-Los Serranos[1]	Mst
Los Monegros-Depresión Ebro[1]	Mgr	Bética septentrional/sur[1]	Bet
Ibérico Aragonés[1]	Arg	La Mancha[1]	Man
		Alcarria[1]	Alc



Ecohydrology-based silvicultural

CCAA	Rodal	Responsable	Superficie
Aragón	Zuera A	UPV	2
	Zuera B	UPV	2
	Luna	UPV	8
Castilla La Mancha	Nerpio	AGRESTA (UCLM)	3
	Almansa	AGRESTA (UCLM)	3
Cataluña	Almenar	UDL	3
	Camarasa	UDL	3
	Can Ponç	UDL	2
Valencia	Ayora	UPV	4
		9 rodales	**30 ha**



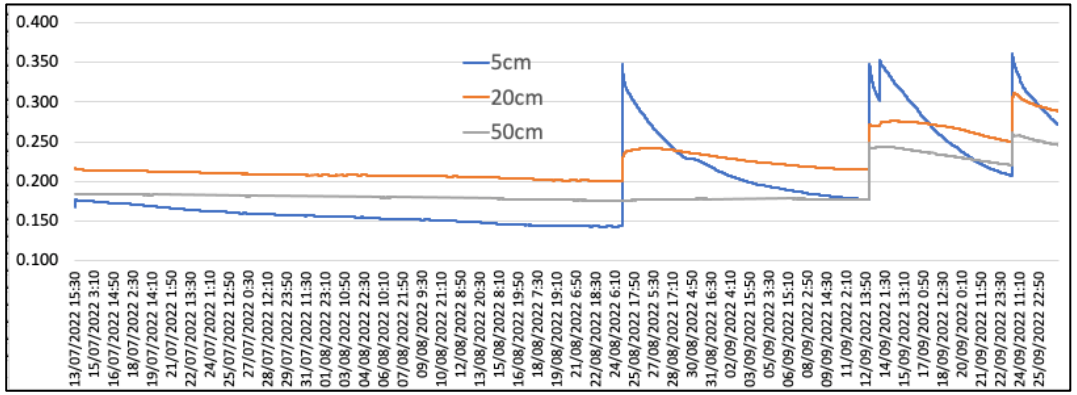
Agua para el bosque

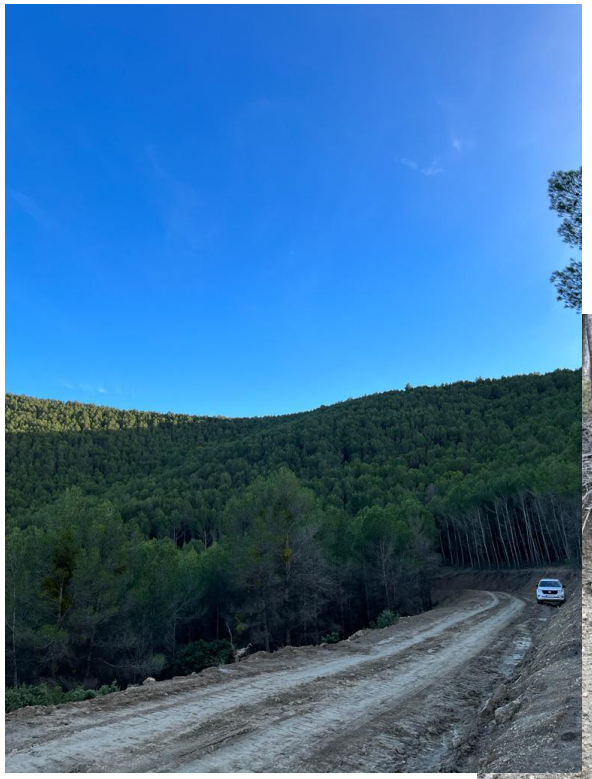
Agua para el hombre

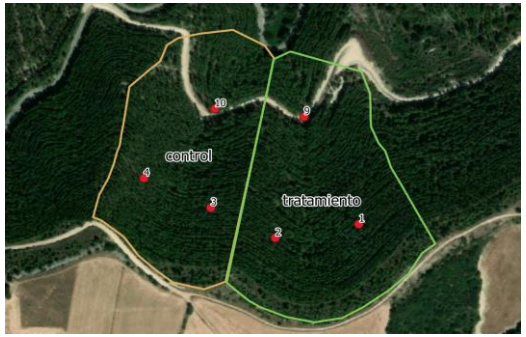
Ecohydrology-based silvicultural

The UPV is responsible for the Sierra de Luna, Zuera A and Zuera B (Aragon) and La Hunde (Valencia) stands. They are currently being executed with the exception of La Hunde.

The Sierra de Luna stand is particularly interesting because it has two paired basins: one control and the other treated. Before treatment started, soil moisture sensors and piezometric tubes were installed to measure surface and deep water, so future comparisons will be more robust.



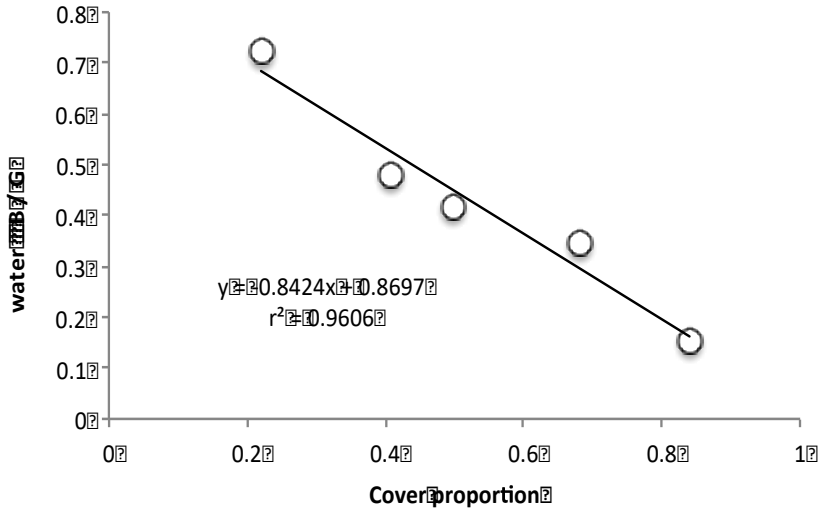




Ecohydrology-based silvicultural

Previous experience: Thinning of different intensities at La Hunde

Tratamiento claras	FCC (%)	Densidad (pies ha^{-1})
Control (C)	84	1489
Intensidad baja (L)	68	744
Intensidad Media (M)	50	478
Intensidad Alta (H)	22	178
Intdad. alta + 10 años (H98)	41	155



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Thank you!