

# PERSISTENCE OF SCARIFICATION EFFECTS IN A SCOTS PINE STAND WITHIN THE SPANISH CENTRAL SYSTEM MOUNTAINS

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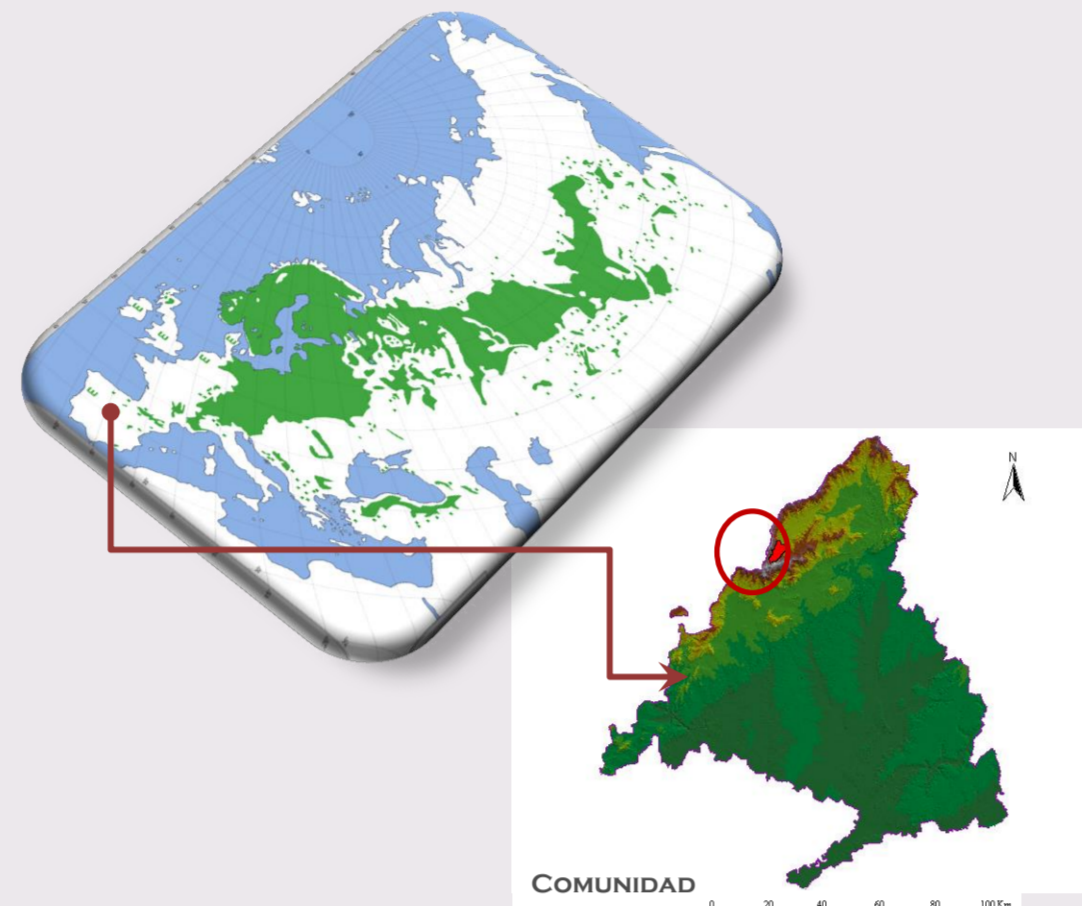
## The Stand



SCOTS PINE UNEVEN-AGED STAND at block level scale (variable age and size clumps aggregation) mixed with understorey Pyrenean oaks (*Quercus pyrenaica* Willd.) in lower areas.

Managed from 1957 for MULTIPLE ECOSYSTEM SERVICES: timber production, livestock, recreational use, wildlife & environmental conservation.

## The geographic Location



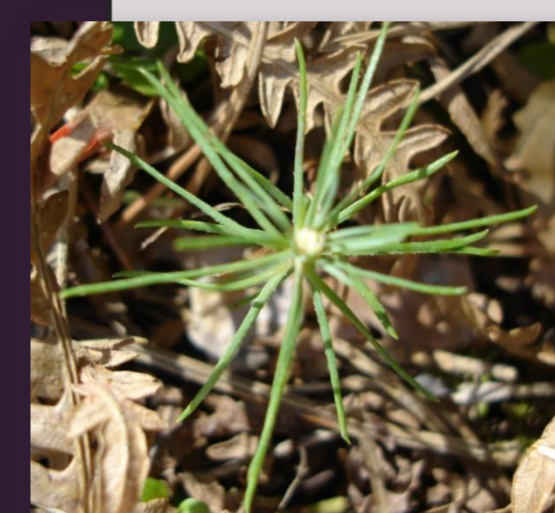
FAR SOUTHERN of species Range  
SPANISH Sistema Central: MEDITERRANEAN BASIN MOUNTAINS

MUCH MORE HEAT  
MUCH LESS SUMMER WATER

Height [1.260-2000 m]  
 $\bar{P}_{\text{annual}}=1115.8\text{mm}$   $\bar{P}_{\text{summer}}:95.3\text{mm}$   
 $\bar{T}_{\text{max-Aug}}=24.1^{\circ}\text{C}$   $\bar{T}_{\text{min-Jan}}:-4.6^{\circ}\text{C}$   
Soil water deficit:  
June-September

## The Problem...

DROUGHT as main abiotic limiting factor for seedling germination & establishment



## The Proposal...

Small-sized ground scarifications

Reduce weed competition

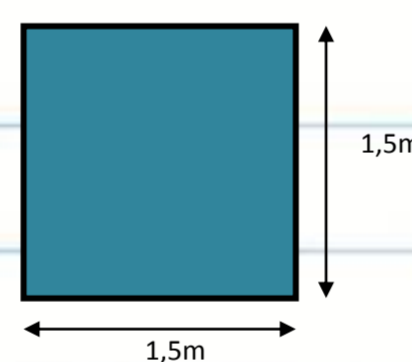
Loosen the soil

## The Question...

How long do the small-sized scarifications effects last within this environment?

## Sampling Design

198 plots [1.5x1.5m]  
(random selection within four 1 ha blocks)



### a) YEAR 0

#### MANUAL SCARIFICATION

- One plot out of four
- Full vegetation cover removal
- Soil ploughing: 15cm depth

### b) YEAR 2

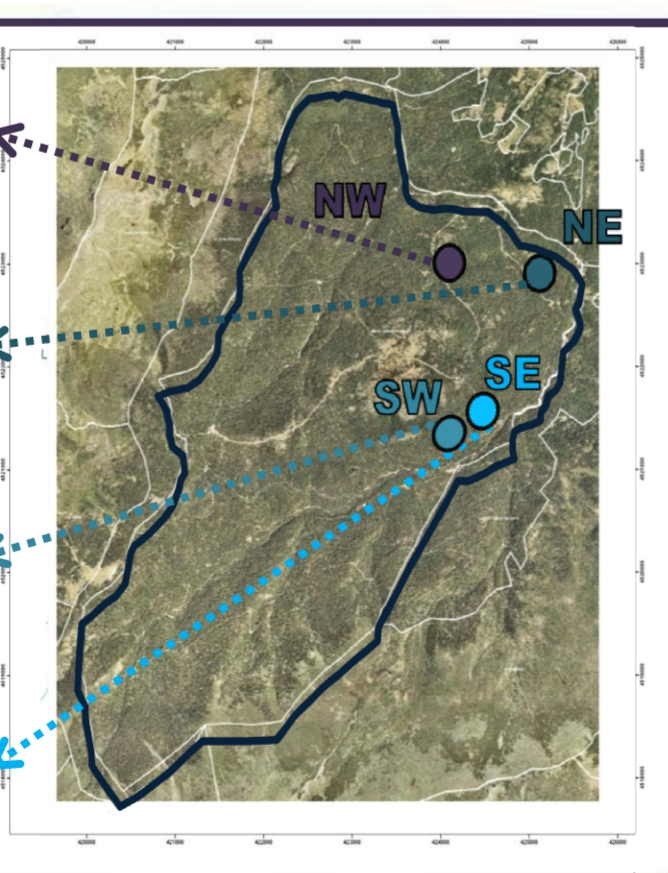
#### VEGETATION COVER CHECKING

- % Grass cover
- % Debris cover
- % Shrub cover

#### SOIL CHECKING

- Soil compaction: Penetration Resistance (0-10cm // 10-20cm)
- % Soil Moisture (TDR sensor)

Mean aspect (°)	268.3
Mean Height(m)	1441.4
Mean slope (%)	8.8
Mean aspect (°)	76.4
Mean Height(m)	1338.6
Mean slope (%)	9.9
Mean aspect (°)	174.8
Mean Height(m)	1526.7
Mean slope (%)	15.6
Mean aspect (°)	142.2
Mean Height(m)	1517.4
Mean slope (%)	18.6



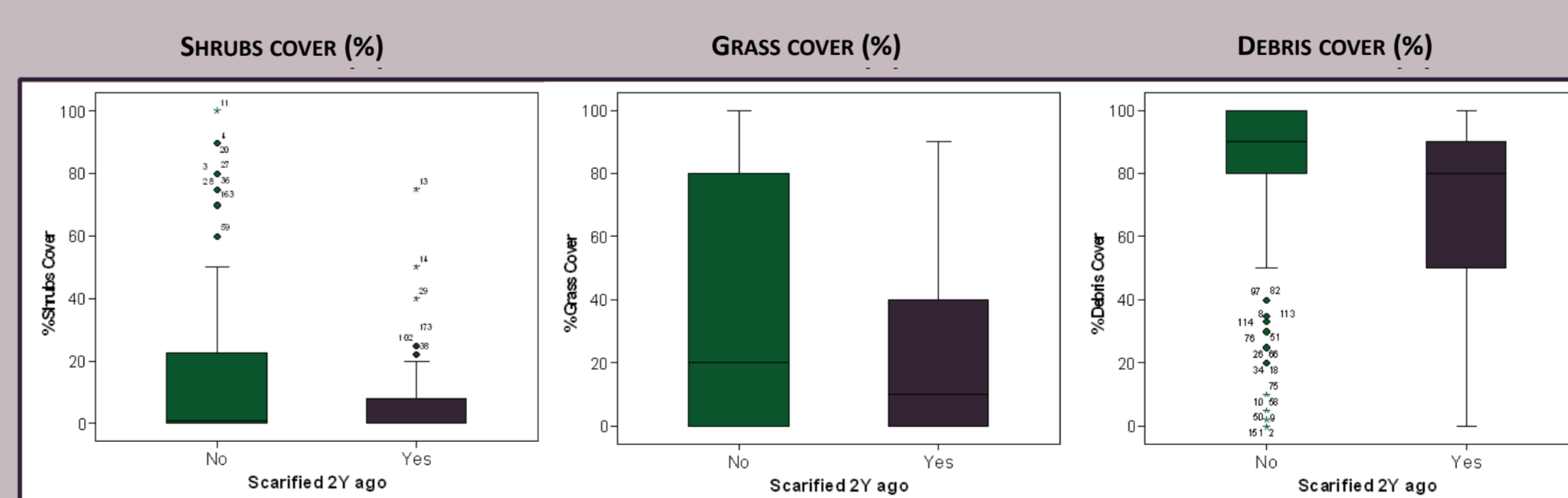
#### STAND DENSITY

- GAP fraction
- Basal Area (r=15m around every sampling point)

## Results

Two years after treatment...

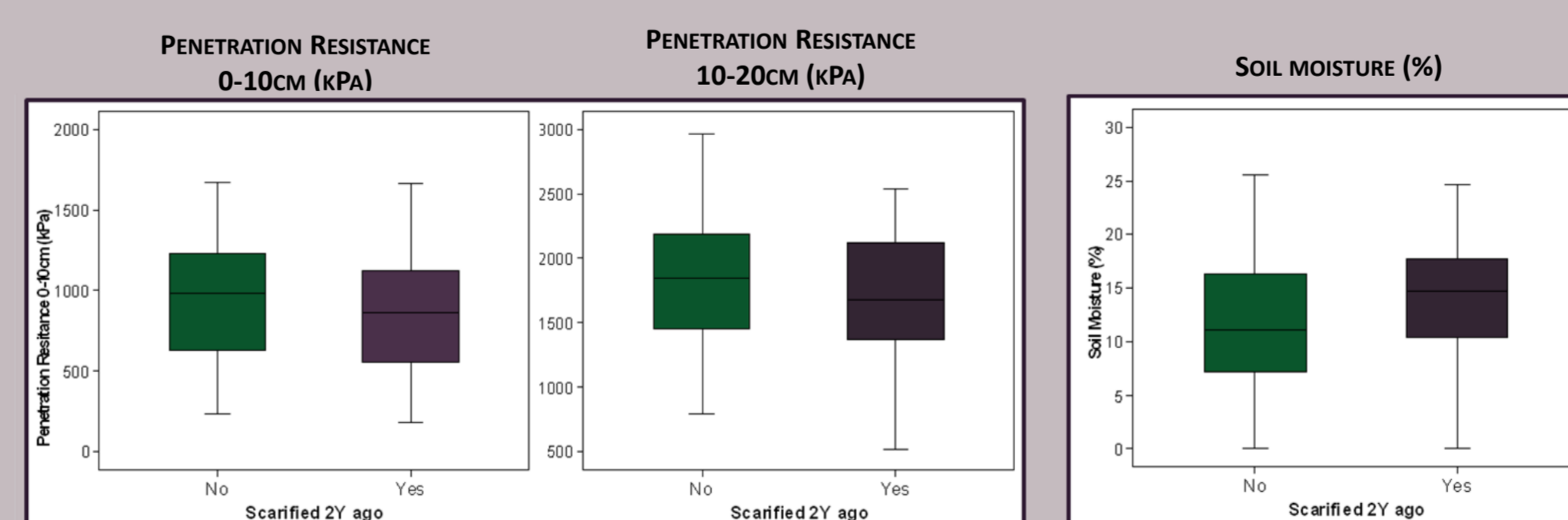
### VEGETATION COVER



Scarified plots recovered > 50% of the non scarified original cover levels:

- Debris ⇒ 87%
- Grass ⇒ 64%
- Shrubs ⇒ 58%

### SOIL



- Compaction level: NO SIGNIFICANT DIFFERENCES between treated and non-treated plots

- Soil moisture: SLIGHT INCREASE (+1,9%, p-value=0,08) in treated plots

### STAND DENSITY

	Basal Area (m <sup>2</sup> /ha)	Canopy cover (1-GAP fraction z= 139°)	Canopy closure (1- GAP fraction z=90°)
PR <sub>0-10cm</sub>	-0.459(**)	-0.581(**)	-0.385(**)
PR <sub>10-20cm</sub>	-0.311(*)	-0.419(**)	-0.437(**)
% Moisture	-0.367(**)	-0.540(**)	-0.375(**)
%Grass	-0.385(**)	-0.484(**)	-0.401(**)
%Shrubs	-0.178	-0.233	0.019
%Debris	0.721(**)	0.762(**)	0.800(**)

\*\* p-value< 0.01 \* p-value<0.05

- Stand density SIGNIFICANTLY INFLUENCED RESTORATION of both soil & vegetation excepting % shrubs.

- Best stand parameter explaining recovery: % Canopy cover over the sampling plot (1-GAP139°)

## Conclusions

- Pre-tillage soil conditions are quickly recovered after scarification when treatment is applied in plots this small (1,5x1,5m).
- Time available is too short for seedling to benefit from soil de-compaction.
- Stand density should be considered when evaluating scarification effects persistence.