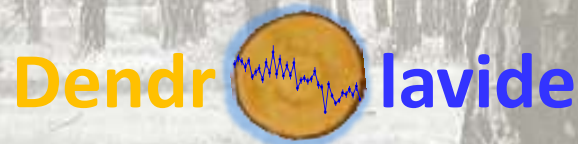


Vulnerabilidad de pino piñonero en la cuenca mediterránea

Raúl Sánchez-Salguero, Andrea Hevia

F.Natalini, A.DiFilippo, G.Piovesan, R.Calama, J.J.Camarero, M.Carrer, M.deLuis, F.Campelo, C.Nabais, A.Correia, G.Mazza, D.Sarris, S.Piraino, E.Gutierrez, V.Rozas, G.Battipaglia, V.de Micco, A.Balzano, F.Silla, A.Alla, E.Pasho, P.Ruiz-Benito, R.Alejano, J.Vazquez-Piqué



@dendrosur

rsanchez@upo.es

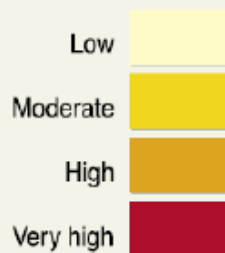


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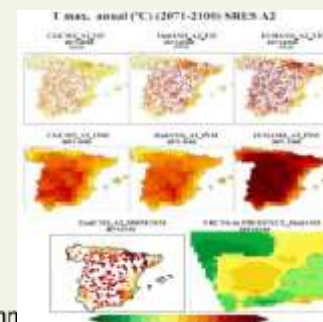
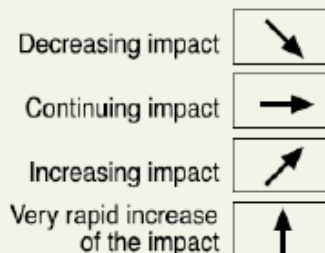
Vulnerabilidad climática en la region Mediterránea

| | | Habitat change | Climate change | Invasive species | Over-exploitation | Pollution (nitrogen, phosphorus) |
|---------|--------------------------------|----------------|----------------|------------------|-------------------|----------------------------------|
| Forest | Boreal | ↗ | ↑ | ↗ | → | ↑ |
| | Temperate | ↘ | ↑ | ↑ | → | ↑ |
| | Tropical | ↑ | ↑ | ↑ | ↗ | ↑ |
| Dryland | Temperate grassland | ↗ | ↑ | → | → | ↑ |
| | Mediterranean | ↗ | ↑ | ↑ | → | ↑ |
| | Tropical grassland and savanna | ↗ | ↑ | ↑ | ↘ | ↑ |
| | Desert | → | ↑ | → | → | ↑ |

Driver's impact on biodiversity over the last century



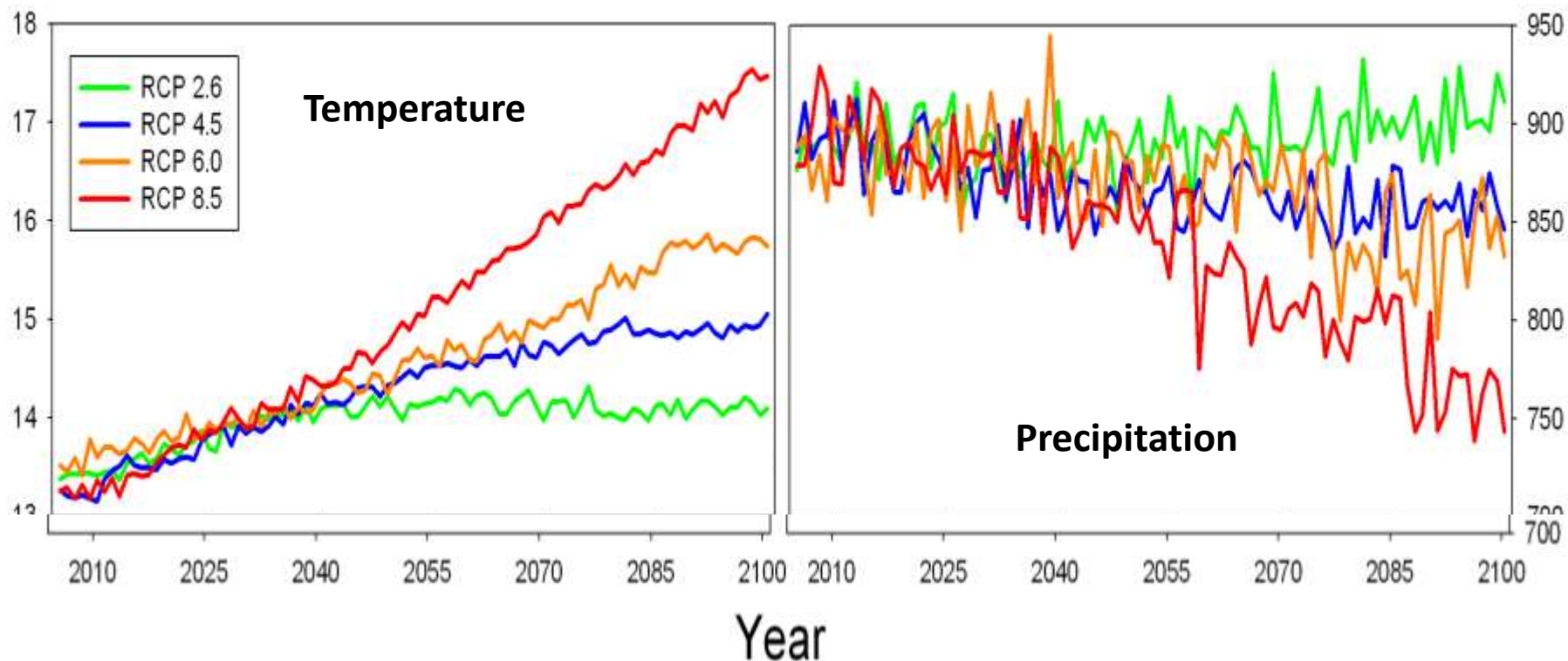
Driver's current trends







Source: Millenn

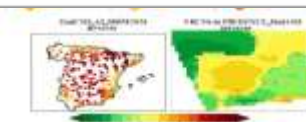
Vulnerabilidad climática en la region Mediterránea

Habitat change Climate change Invasive species Over-exploitation Pollution (nitrogen, phosphorus)

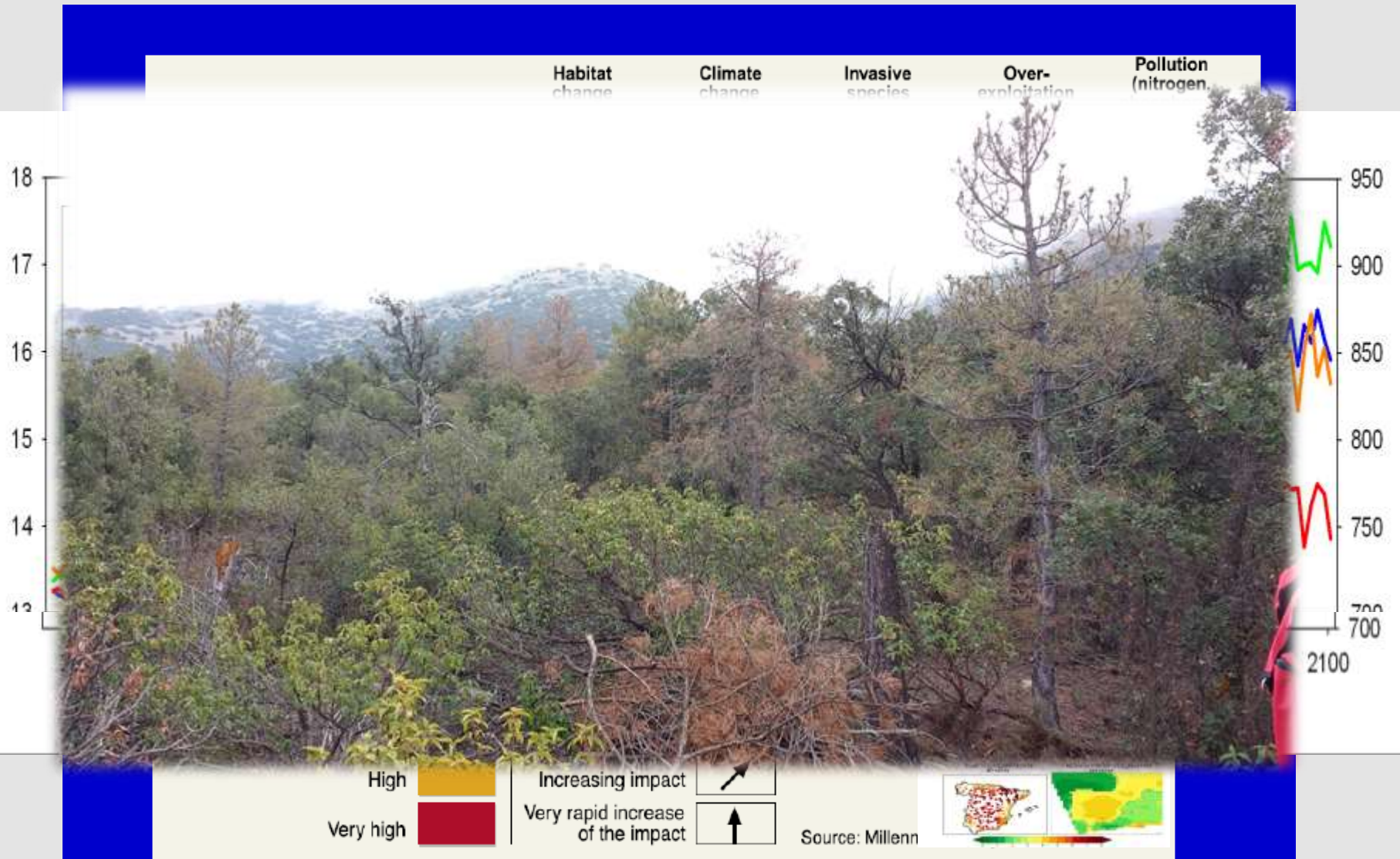


High  Increasing impact 
 Very high  Very rapid increase of the impact 

Source: Millenn

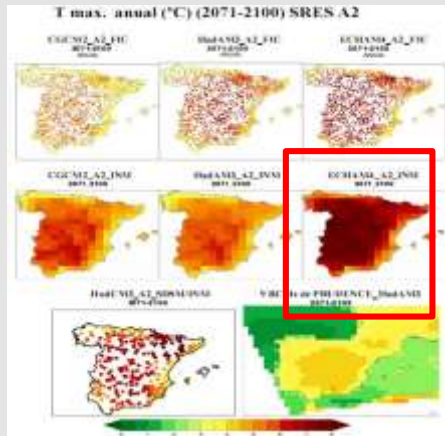


Vulnerabilidad climática en la region Mediterránea



MEA, 2005

Forest Stability? Climate Change



Incremento de
Temperaturas

Descenso de
precipitaciones

Incremento de
eventos
climáticos
extremos



Drought-prone areas



Rear-edges forests

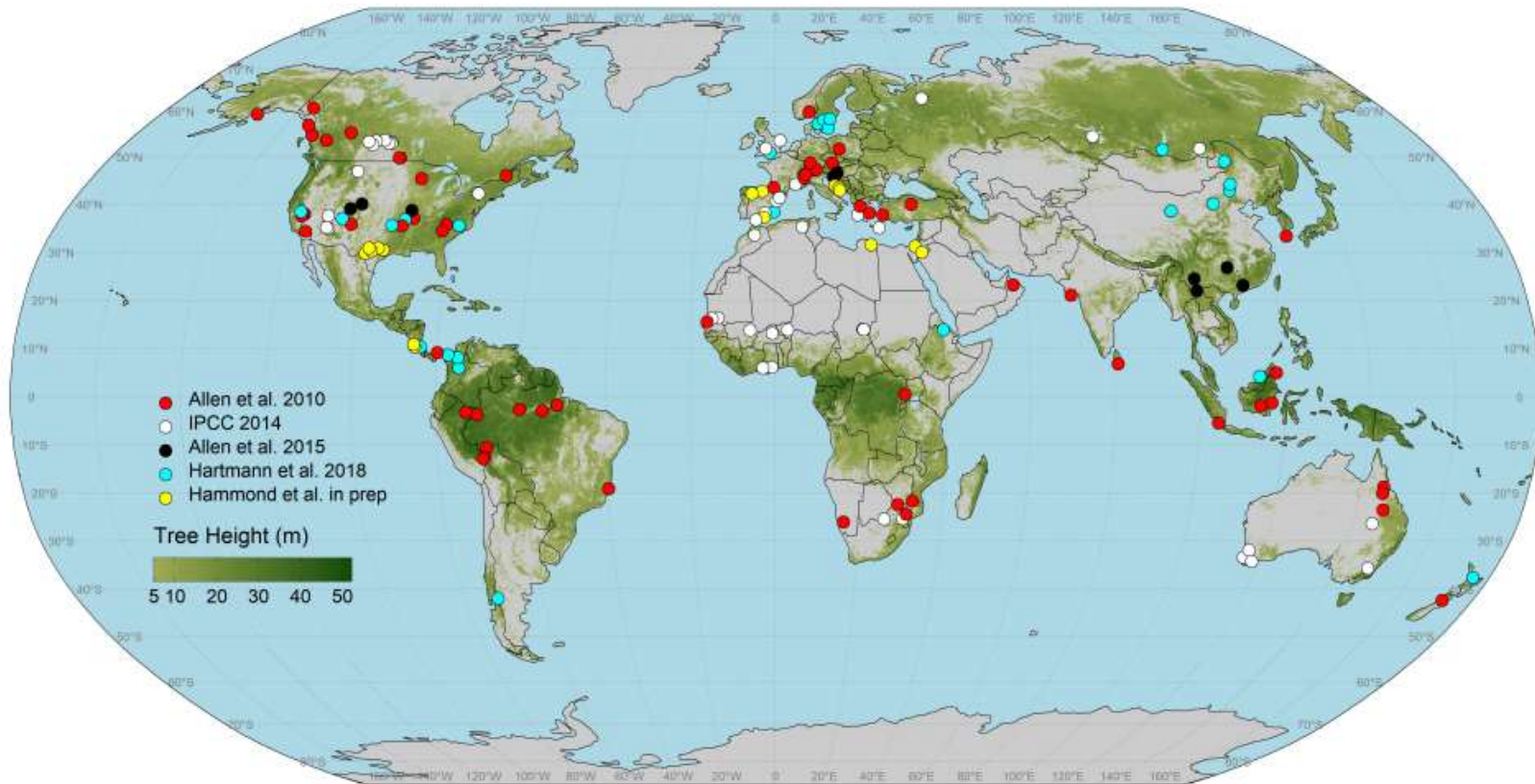
Abies alba & Pinus sylvestris
Pinus halepensis, Pinus nigra &
Pinus pinaster

Pinus pinea



Síntomas de vulnerabilidad y decaimiento

Alaska, yellow cedar



Mortality of *Homalium integrifolium* forest in central Chile following a severe drought in 2008-2009, northern Patagonia, Argentina (September 2009).



A dead tree stands through a clear of Alaska yellow cedar in the Seward National Forest where climate was ameliorated in the last half of the twentieth century (1980).



Contents lists available at ScienceDirect
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 Journal homepage: www.elsevier.com/locate/foreco

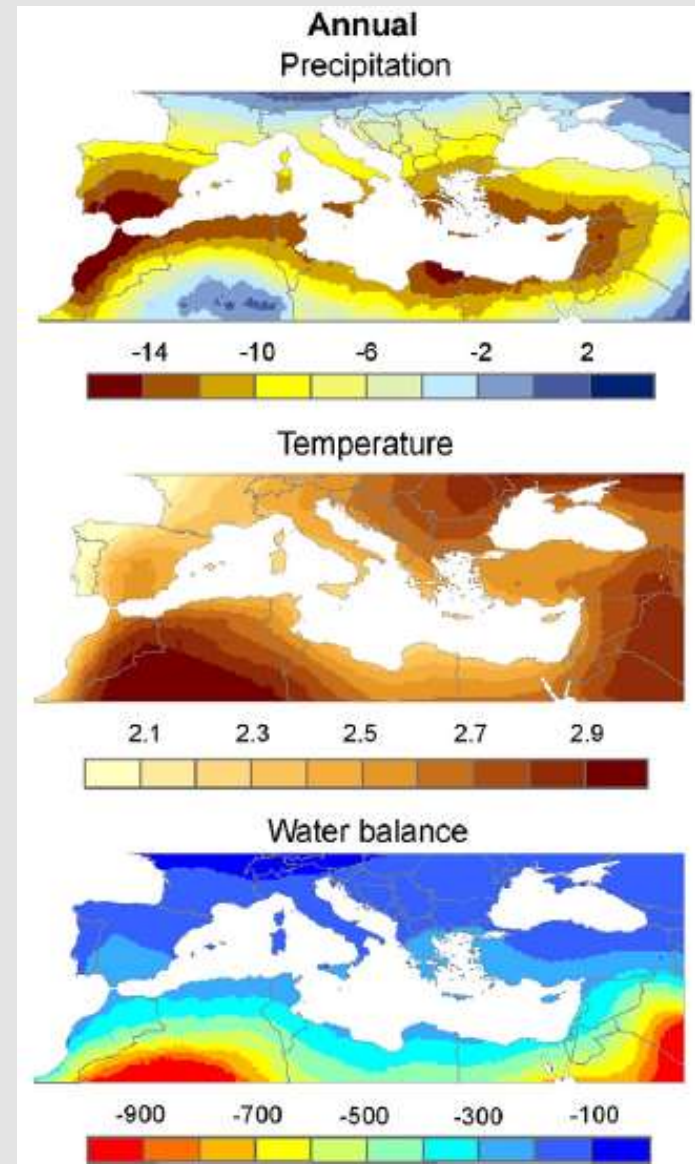
A global overview of drought and heat-induced tree mortality reveals emerging climate change risks for forests

Craig D. Allen^{a,*}, Alison K. Macalady^b, Haroun Chenououi^c, Dominique Bachelet^d, Nate McDowell^e, Michel Venetier^f, Thomas Kitzberger^g, Andreas Rigling^h, David D. Breshearsⁱ, E.L. (Ted) Hogg^j, Patrick González^k, Rod Fensham^l, Zhen Zhang^m, Jorge Castroⁿ, Natalia Demidova^o

*Corresponding author. E-mail: allen@alaska.edu

Vulnerabilidad climática en la region Mediterránea

Predicciones de cambio en la precipitación total anual, la temperatura y el balance hídrico predicho para la Región Mediterránea entre 2040 y 2070, comparado con el periodo 1960–1990.



Earth-Science Reviews
journal homepage: www.elsevier.com/locate/earscirev

Review
Mediterranean water resources in a global change scenario
José M. García-Ruiz^a, J. Ignacio López-Moreno^{a,b}, Sergio M. Vicente-Serrano^a, Teodoro Lasanta-Martínez^a, Santiago Beguería^b

^a Instituto Pirenaico de Ecología, CSIC, Campus de Aula Dei, 501, Avda. 13004, Zaragoza 50009, Spain
^b Estación Experimental de Aula Dei, CITA, Campus de Aula Dei, 501, Avda. 13004, Zaragoza 50009, Spain

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Water resources
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Mediterranean region
Hydrology of change

ABSTRACT
Mediterranean areas of both southern Europe and North Africa are subject to dramatic changes that will affect the sustainability, quantity, quality, and management of water resources. Most climate models forecast an increase in temperature and a decrease in precipitation at the end of the 21st century. This will enhance stress on natural forests and shrubs, and will result in more water consumption, evapotranspiration, and probably interception, which will affect the surface water balance and the partitioning of precipitation between evapotranspiration, runoff, and groundwater flow. As a consequence, soil water content will decline, saturation conditions will be increasingly rare and restricted to periods in winter and spring, and water accumulation as a result of rainfall will change, especially in the high mountain areas. Water land management will be characterized by forest and shrub expansion in most Mediterranean mountain areas, a consequence of land abandonment and grazing discontinuation, with increasing human pressure localized only in some places (the coast and around of valley floors), in the lowlands, particularly in the coastal fringe, increasing water demand will occur as a consequence of expansion of irrigated lands, as well as the growth of urban and industrial areas, and tourist resorts.

Future scenarios for water resources in the Mediterranean region suggest: (1) a progressive decline in the average streamflow (already observed in many rivers since the 1980s), including a decline in the frequency and magnitude of the most frequent floods due to the expansion of forests; (2) changes in regional river regime characteristics, including an earlier decline in flow from baseflow in spring, an intensification of low flows in summer, and more irregular discharges in winter; (3) changes in reservoir inputs and management, including lower available discharge from dams to meet the water demand from irrigated and urban areas. Most reservoirs in mountain areas will be subject to increasing water resource uncertainty, because of the reduced influence of snow accumulation and melting processes. Besides, reservoir capacity is likely to be reduced due to increasing sedimentation. In some cases, it is also envisaged to improve the safety control of floods, leading to a reduction in efficiency for agriculture. (4) hydrological and population changes in coastal areas, particularly in the delta zones, affected by water depletion, groundwater reduction, salt water water intrusion. These scenarios enhance the necessity of improving water management, water pricing and water recycling policies, in order to ensure water supply and to reduce tensions among regions and countries.

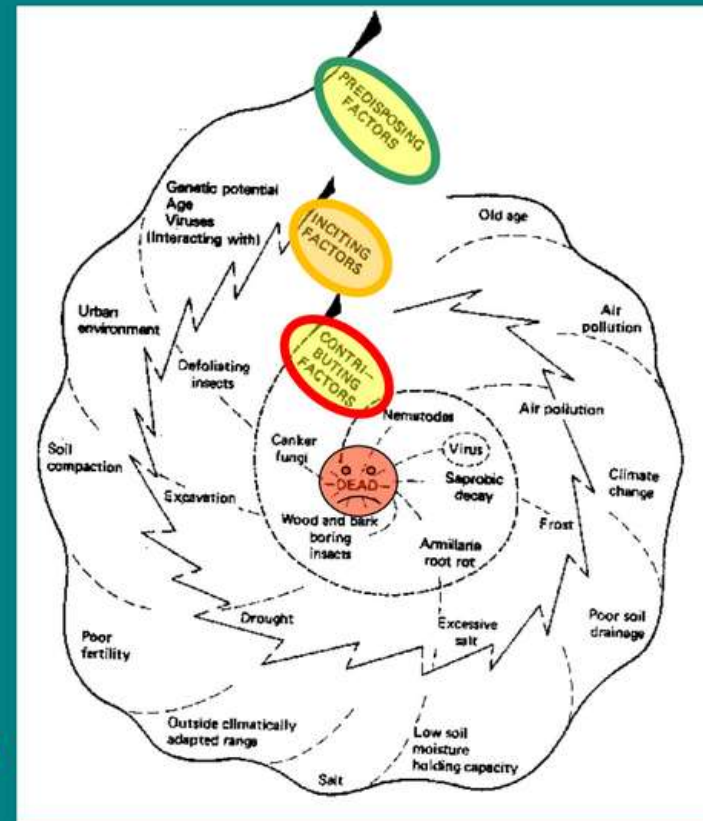
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Síntomas de vulnerabilidad y decaimiento

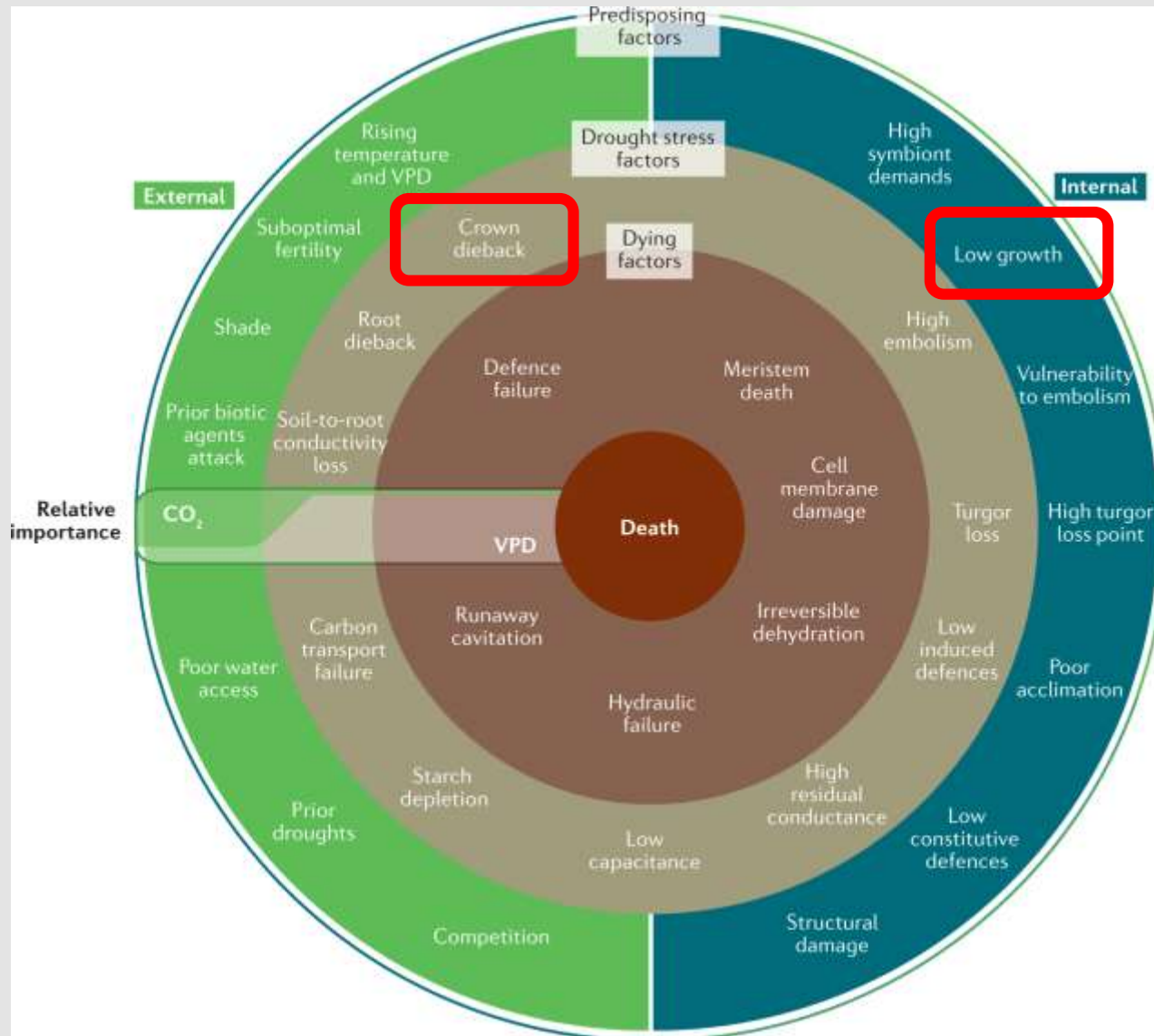
Manion (1991) conceptual model.

Decline is caused by interacting abiotic and biotic factors (decline disease spiral) classified in three groups:

- **PREDISPOSING** factors: long-term drivers (climate, site, soil, age, genetic pool, historical use). Reduce tree vigor.
- **INCITING** factors: short-term stressors (reduce C storage, enhance branch mortality and cause defoliation) such as droughts, frosts, insects, mechanical damages.
- **CONTRIBUTING** factors: opportunistic (secondary) organisms which contribute to kill the already weakened tree (e.g., root fungi, scolytids, etc.).



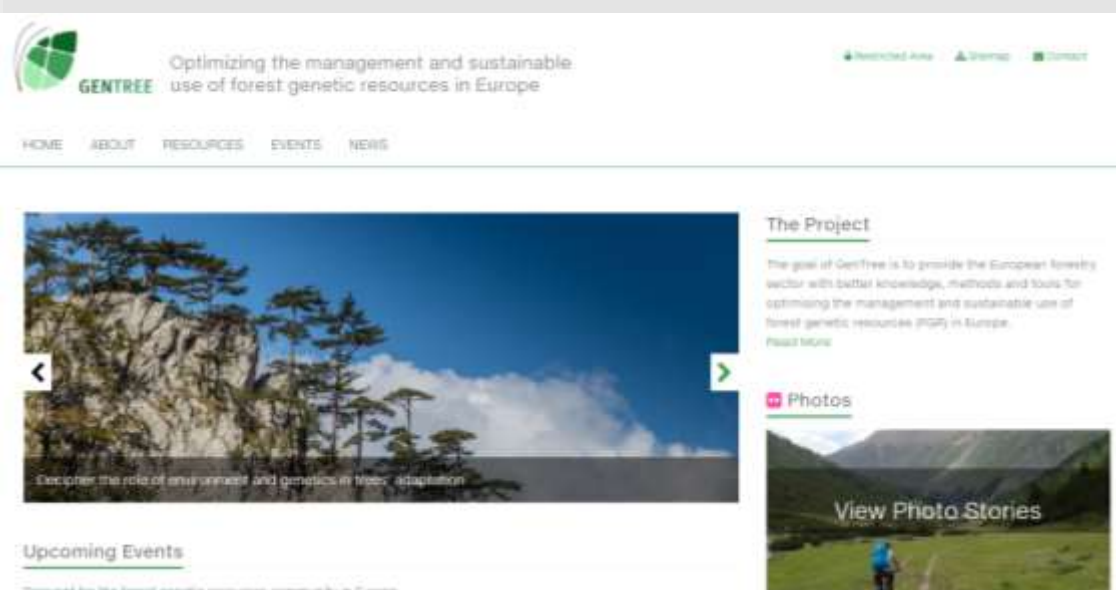
Síntomas de vulnerabilidad y decaimiento



Síntomas de vulnerabilidad y decaimiento



Regiones de procedencia geográfica



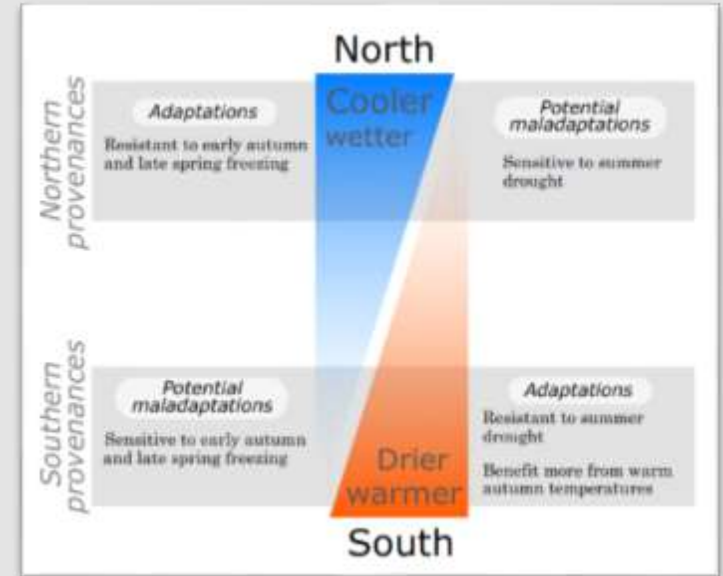
GENTREE Optimizing the management and sustainable use of forest genetic resources in Europe

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The Project
The goal of GenTree is to provide the European forestry sector with better knowledge, methods and tools for optimizing the management and sustainable use of forest genetic resources (FGR) in Europe.
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[View Photo Stories](#)

Upcoming Events



New Phytologist

Full paper | [Open Access](#)

Tree rings provide a new class of phenotypes for genetic associations that foster insights into adaptation of conifers to climate change

Johann M. Housset, Simon Nadeau, Nathalie Isabel, Claire Depardieu, Isabelle Duchesne, Patrick Lenz, Martin P. Girardin

First published: 04 January 2018 | <https://doi.org/10.1111/nph.14968> | Cited by: 3

MOLECULAR ECOLOGY

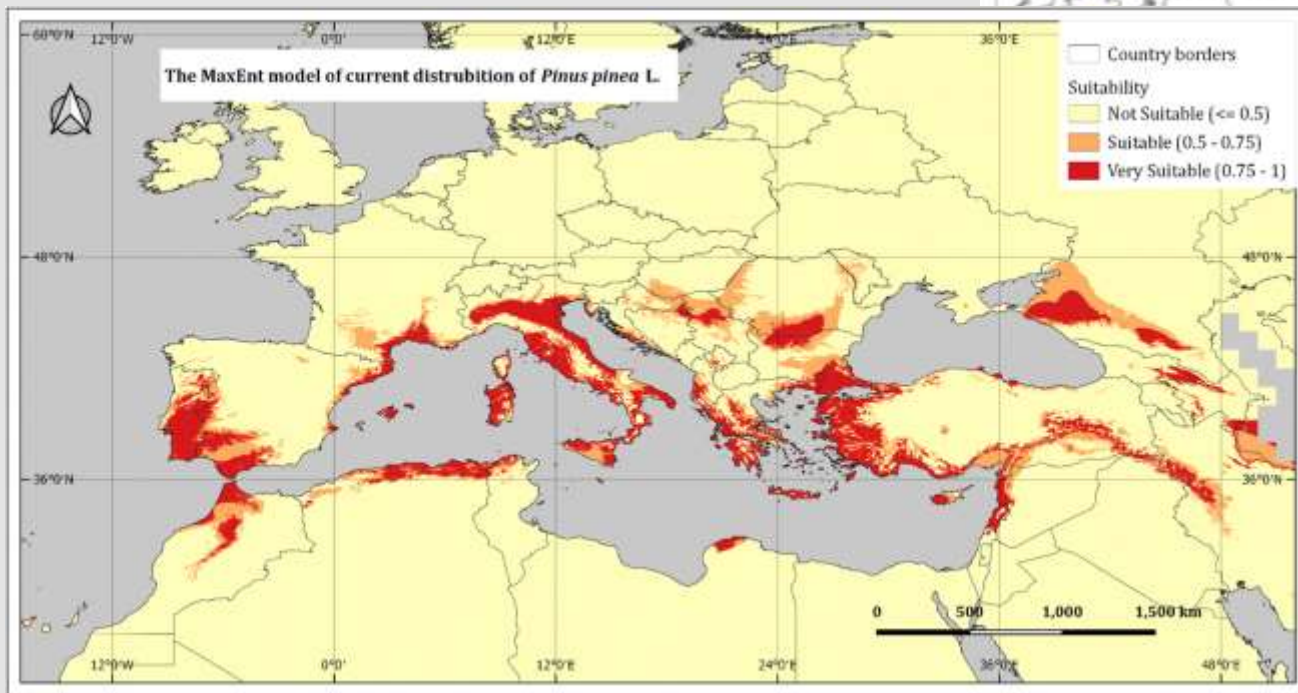
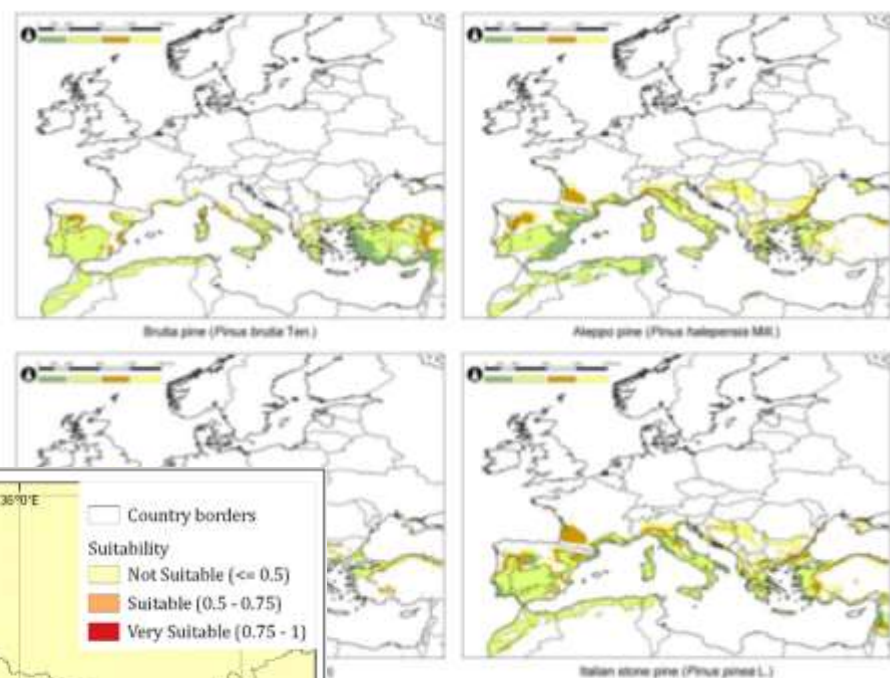
ORIGINAL ARTICLE

Linking dendroecology and association genetics in natural populations: Stress responses archived in tree rings associate with SNP genotypes in silver fir (*Abies alba* Mill.)

€ Heer, D. Behringer, A. Piermattei, C. Bässler, R. Brandl, B. Fady, H. Jehl, S. Liepelt, S. Lorch, A. Plotti, S.G. Vendramin, M. Weller, B. Ziegenhagen, U. Büntgen, L. Ogennoorth

First published: 14 February 2018 | <https://doi.org/10.1111/mec.14538>

Regiones de procedencia geográfica



¿Sólo espacio?



El árbol como termómetro del Cambio Climático

Dendrocronología



The past is the key for the future

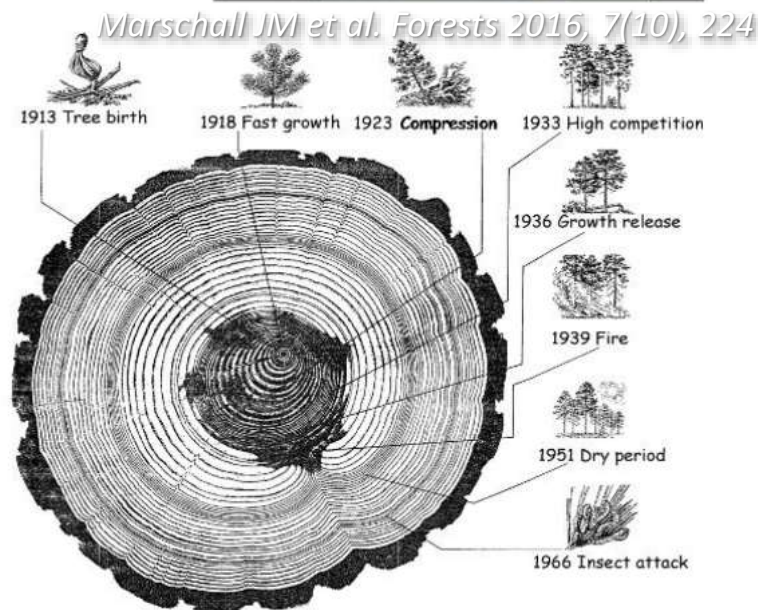
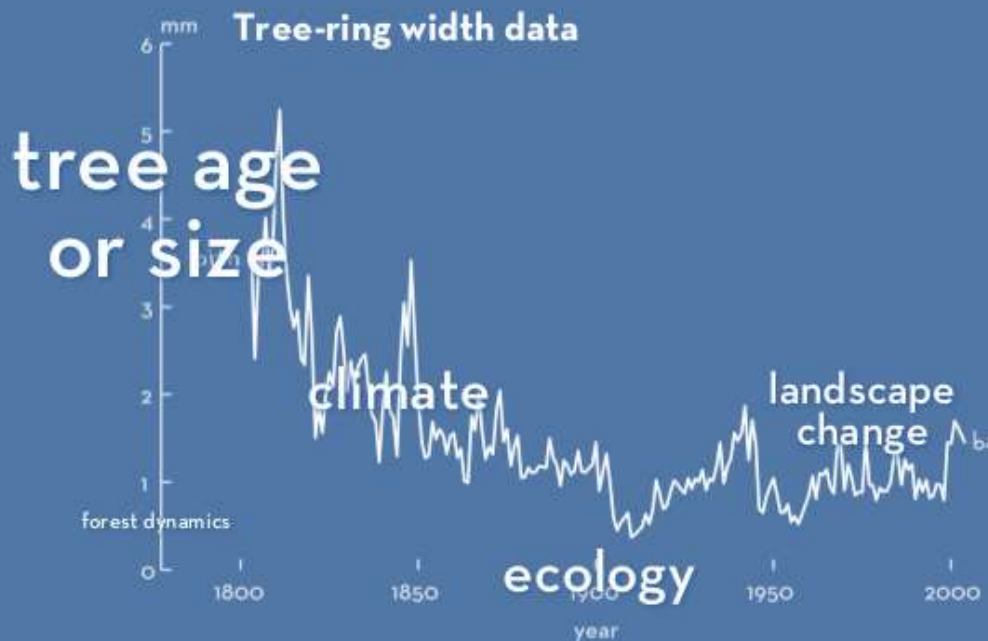


¿Máquina del tiempo?

Crecimiento ~Edad

+ Factores (clima, dinámica forestal, perturbaciones, etc.)

INCENDIOS FORESTALES



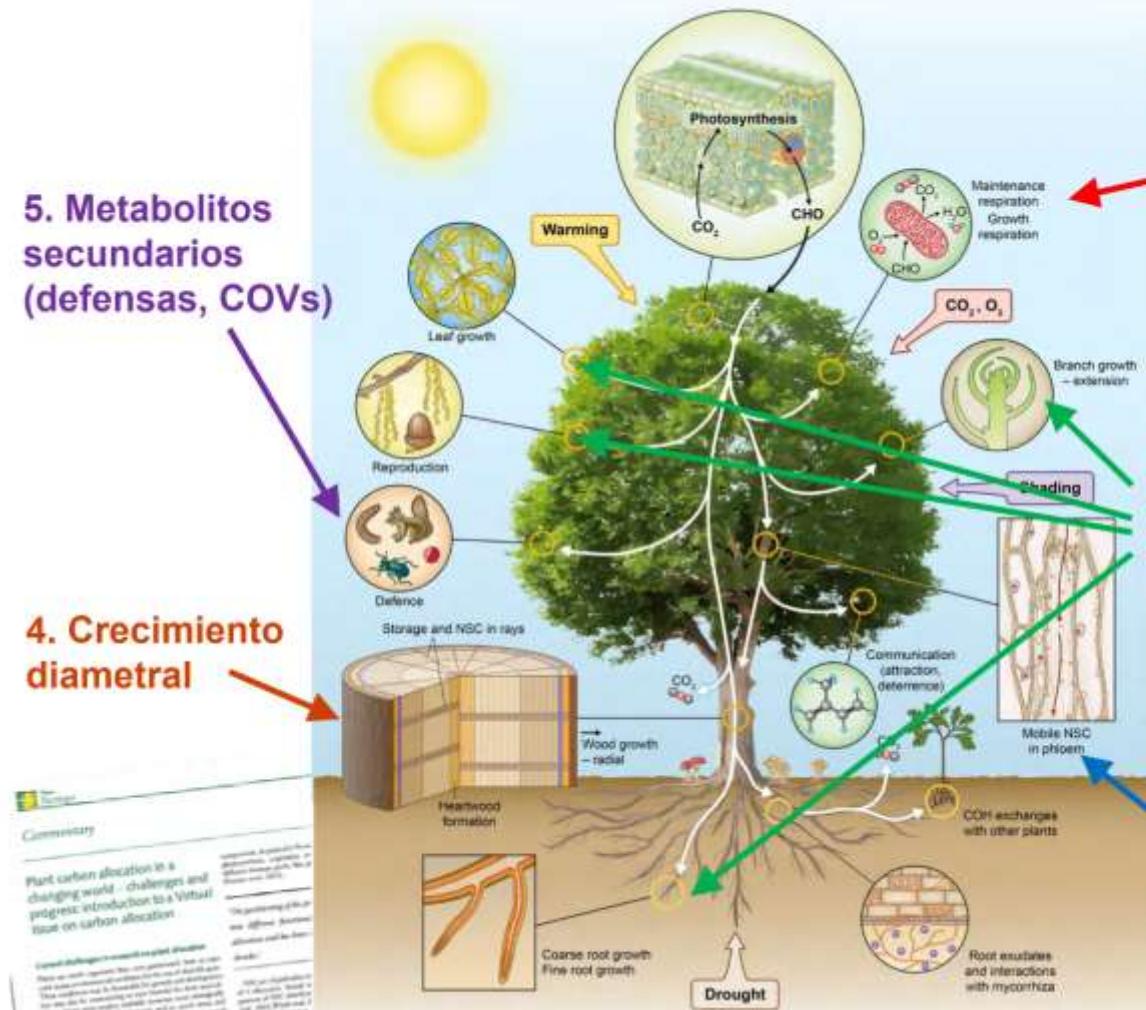
5. Metabolitos secundarios (defensas, COVs)

4. Crecimiento diametral

1. Respiración de mantenimiento

2. Crecimiento elongación de ramas y raíces; hojas; frutos.

3. Carbohidratos no estructurales (reserva).

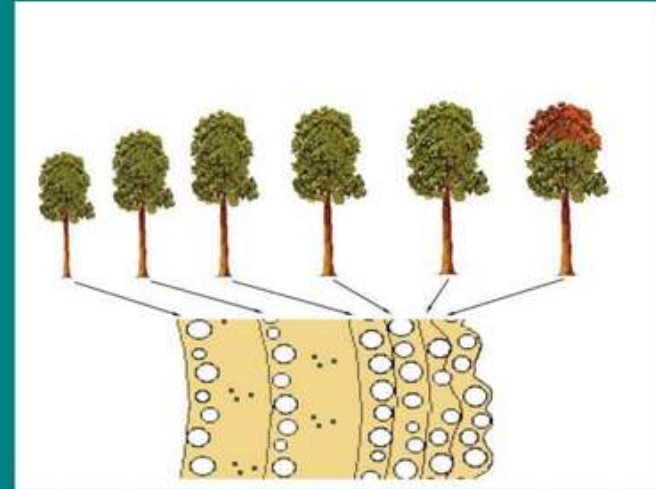
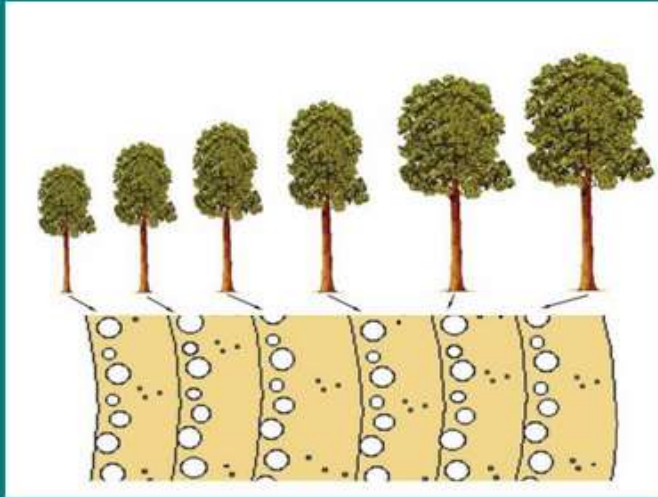


Commentary

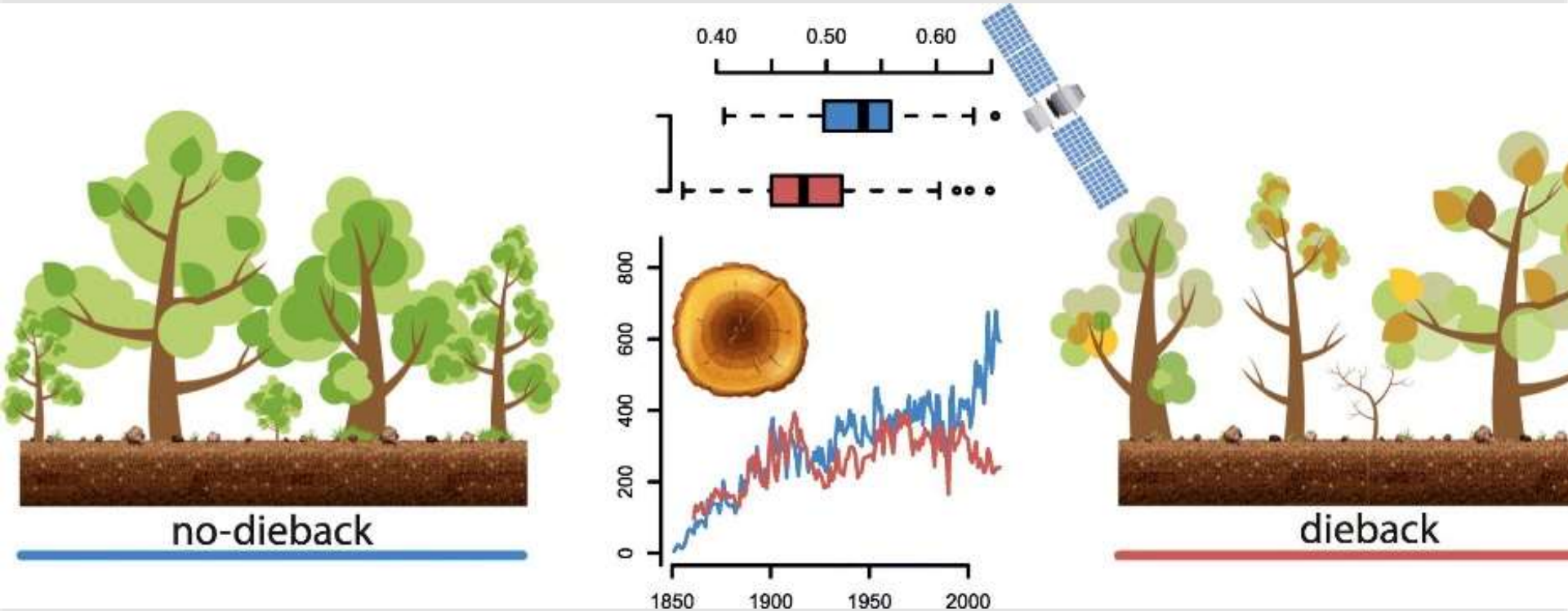
Plant carbon allocation is a changing world - challenges and progress: introduction to a Virtual Issue on carbon allocation

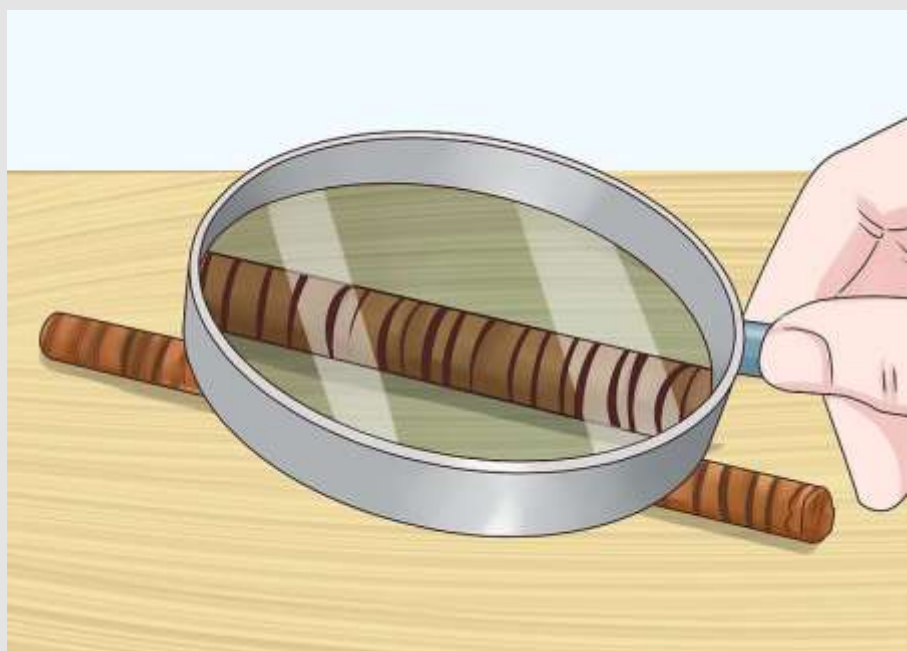
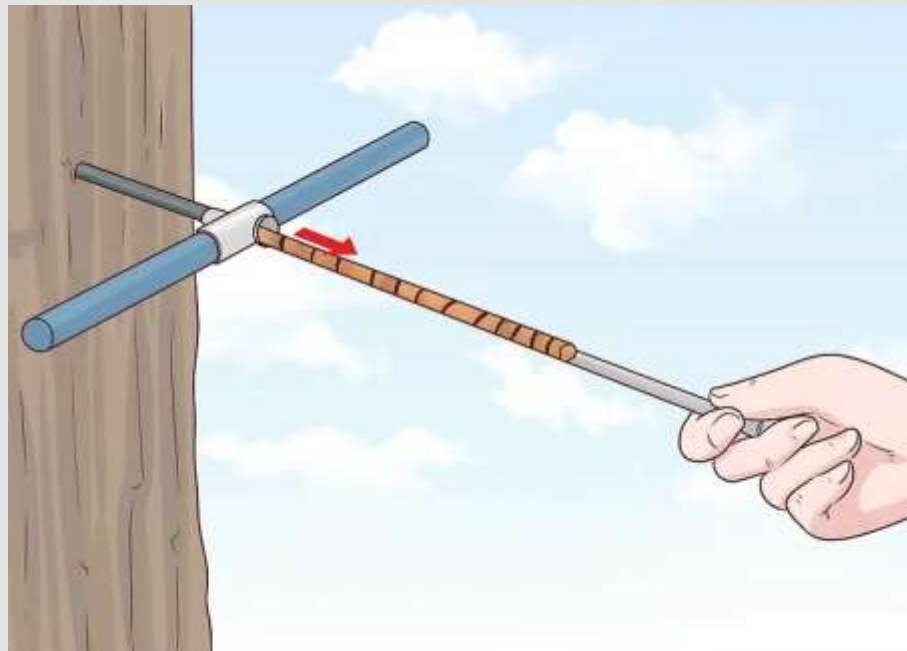
Commentary: Challenges in research on plant allocation
Plant carbon allocation is a complex process that involves the distribution of photosynthetic products to various parts of the plant. This process is influenced by many factors, including environmental conditions, plant growth stage, and plant species. The Virtual Issue on carbon allocation provides a comprehensive overview of the current state of research on this topic and highlights the challenges and progress in this field.

El decaimiento del bosque suele estar relacionado con una reducción paulatina del crecimiento



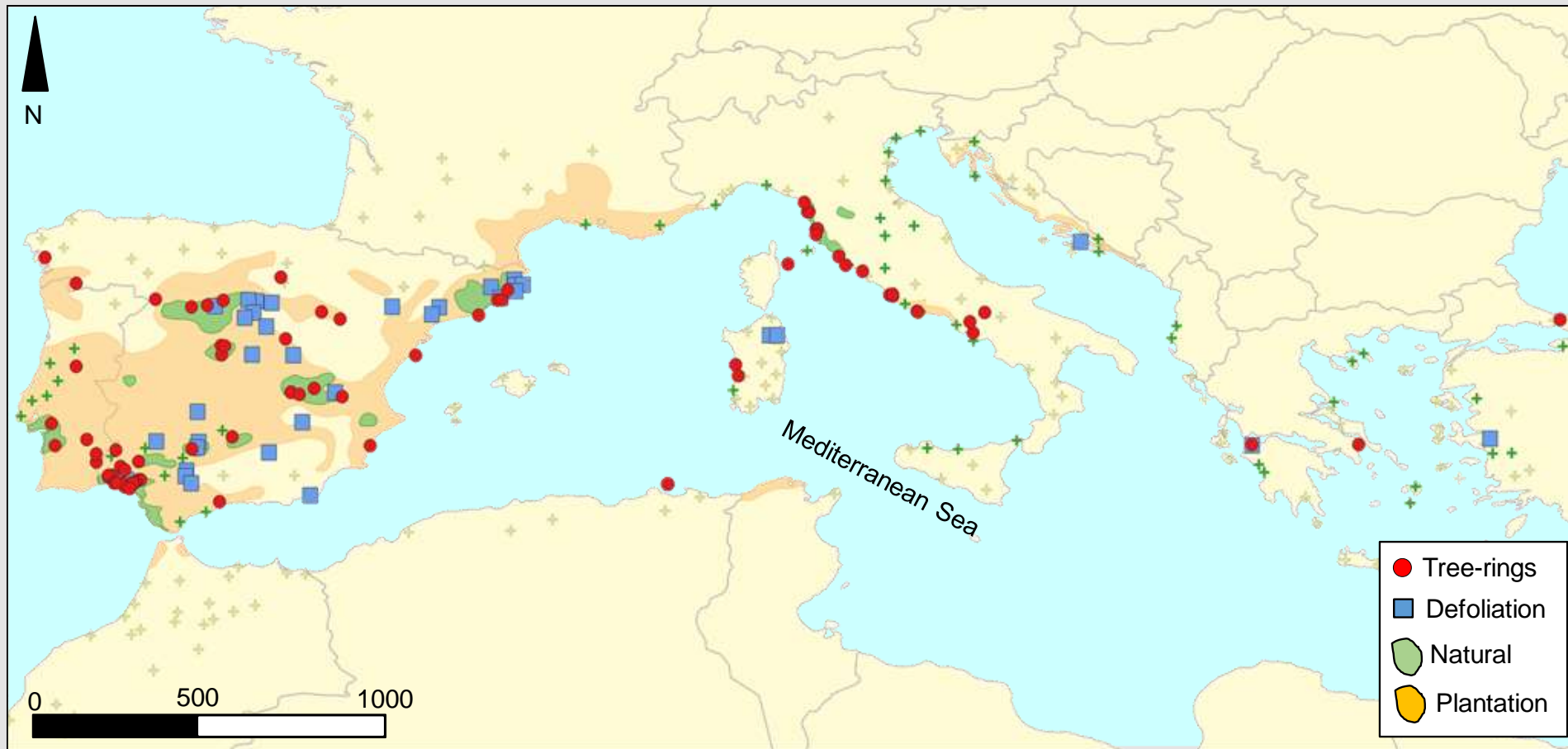
El decaimiento del bosque suele estar relacionado con una reducción paulatina del crecimiento



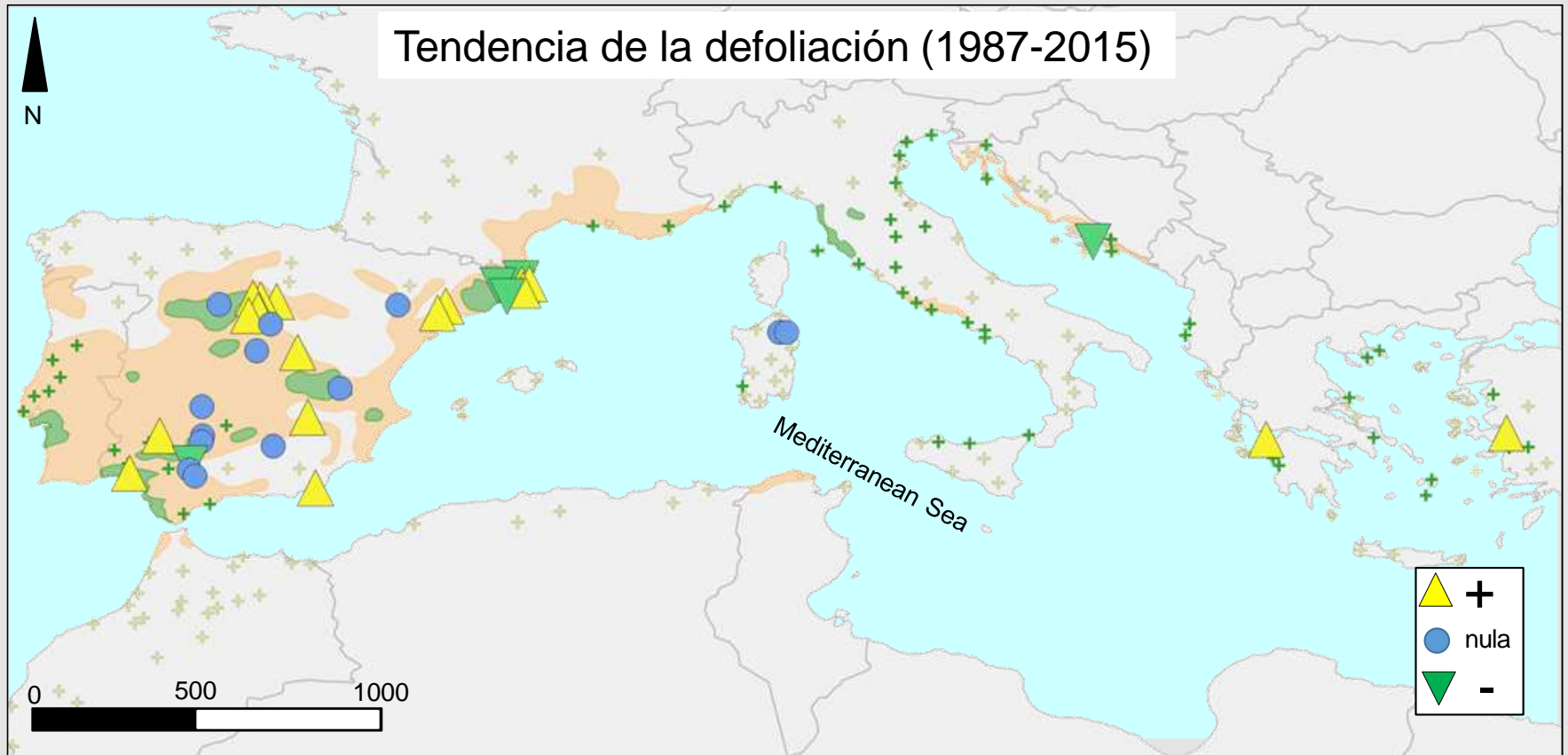


Trabajo de campo (muestreo dendrocronológico)

120 parcelas con datos dendrocronológicos (>3500 árboles)
35 parcelas con defoliación y mortalidad (> 550 árboles)



Tendencias de la defoliación



Aumento en repoblaciones principalmente

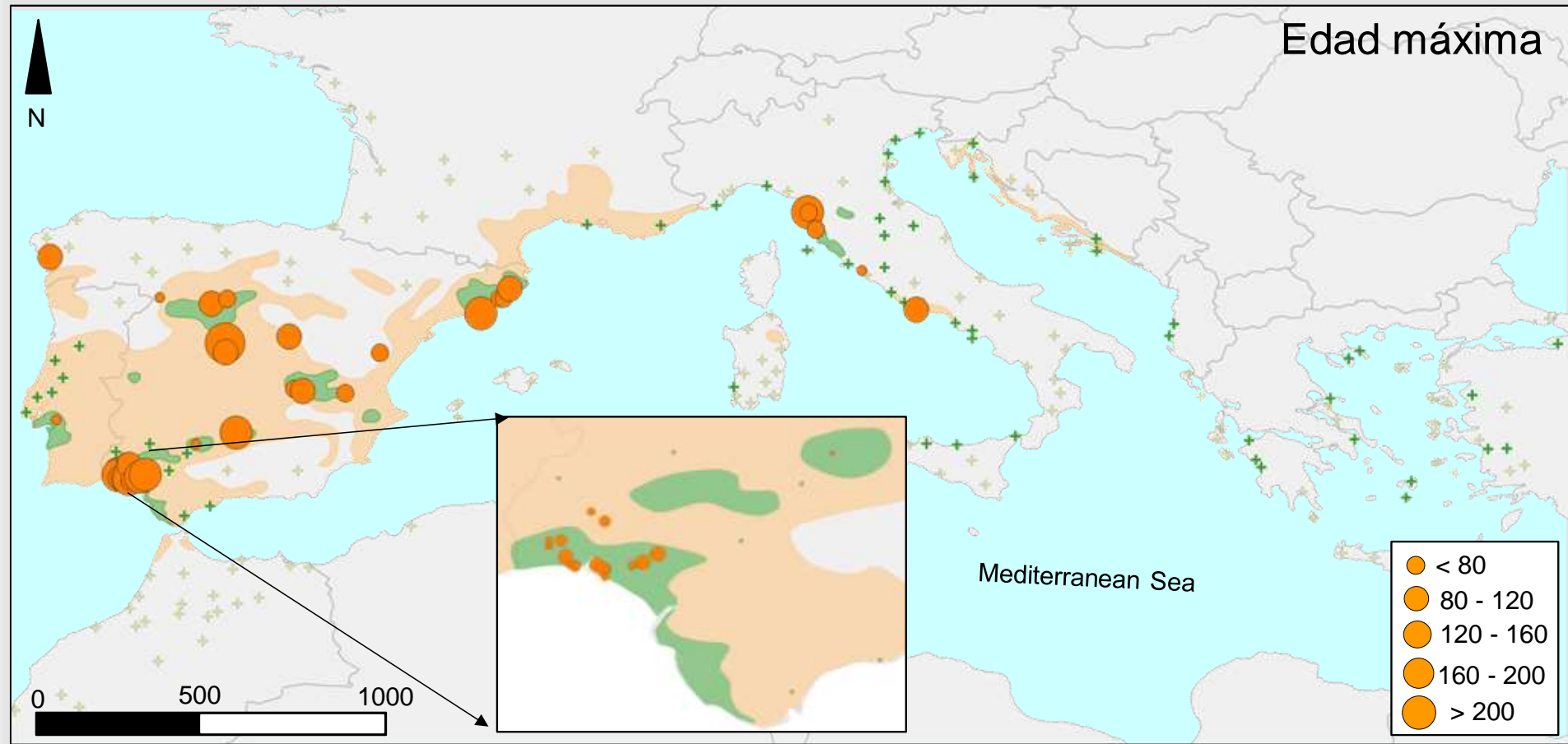


Zonas de costa templadas con masas naturales

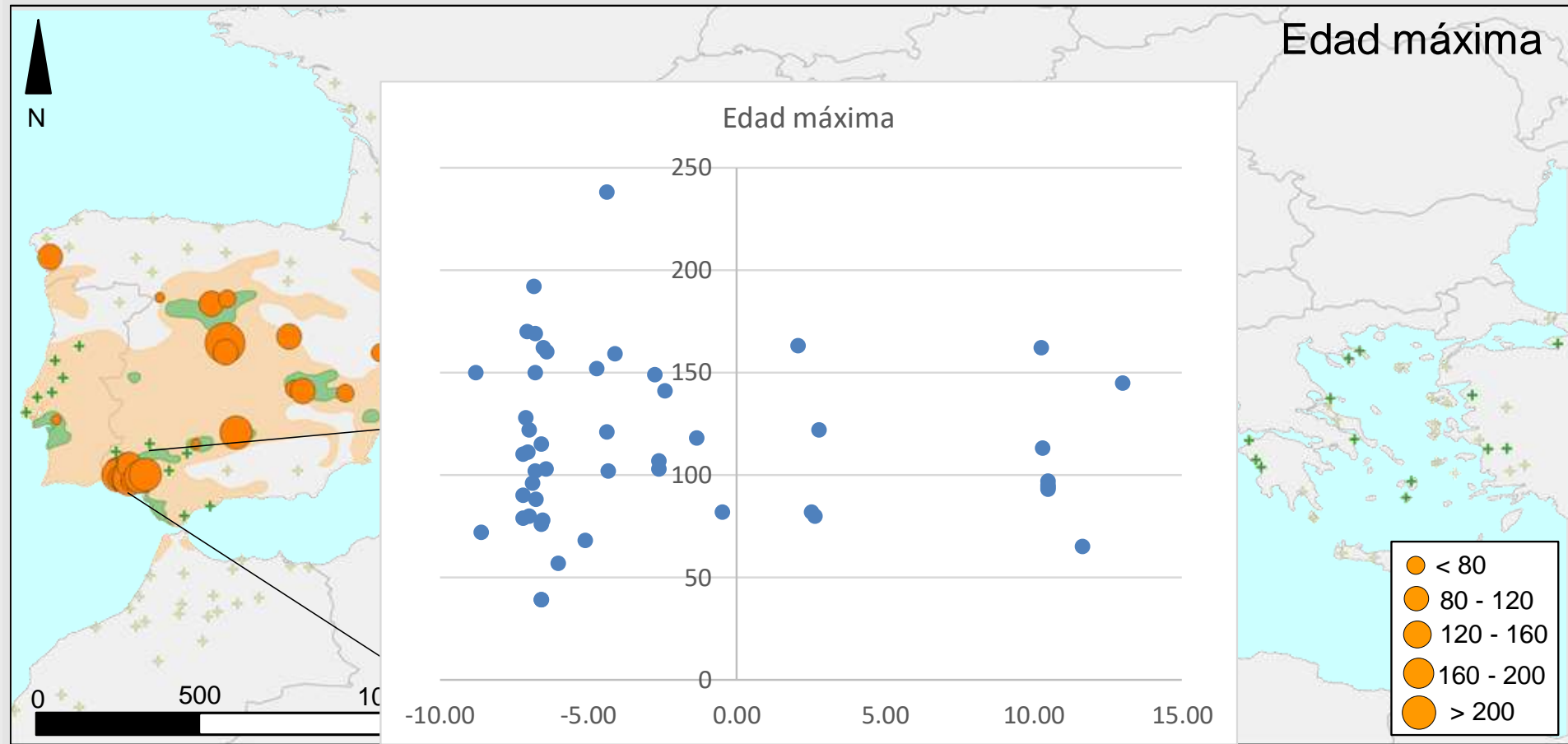
¿Falta de gestión?



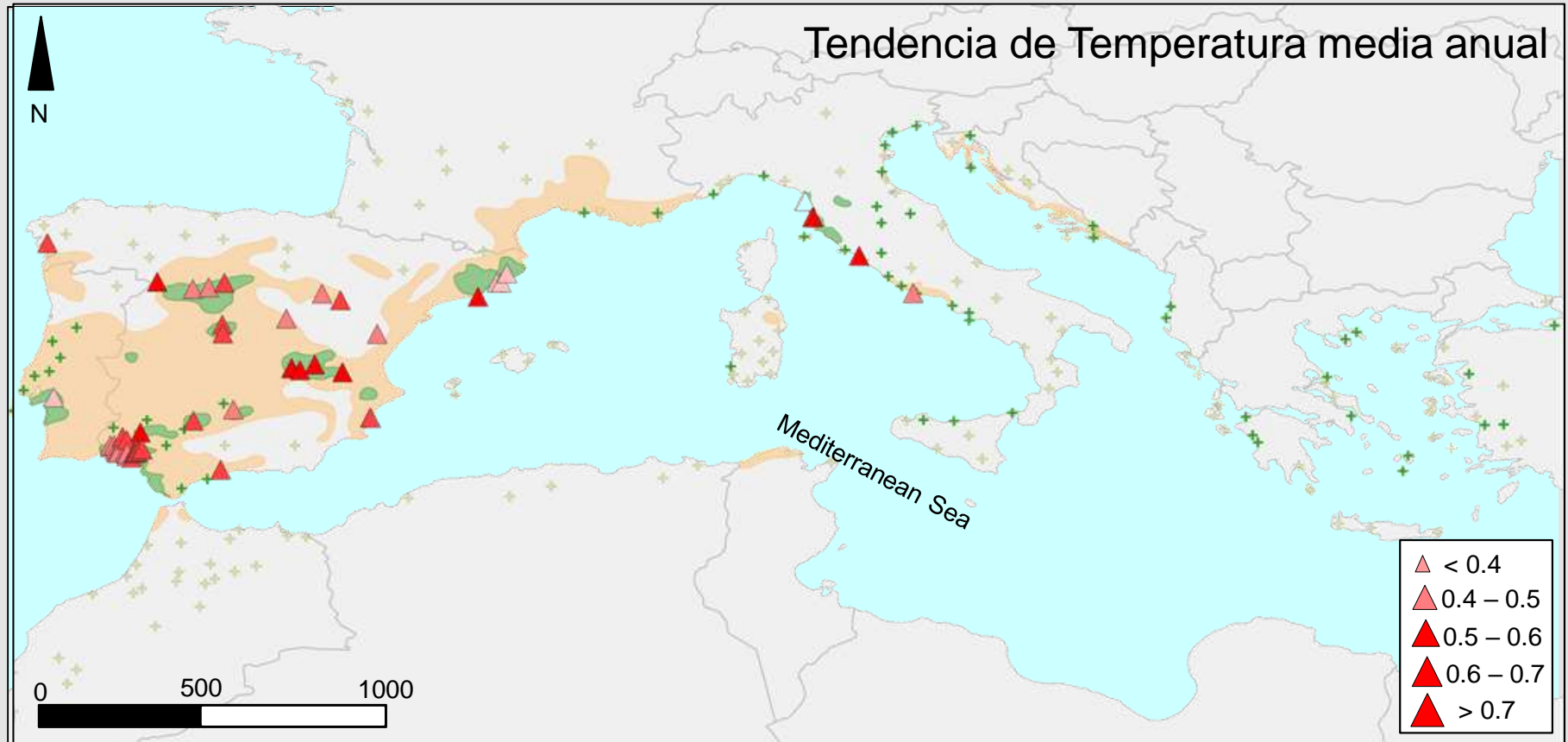
Historia del piñonero a través de los anillos



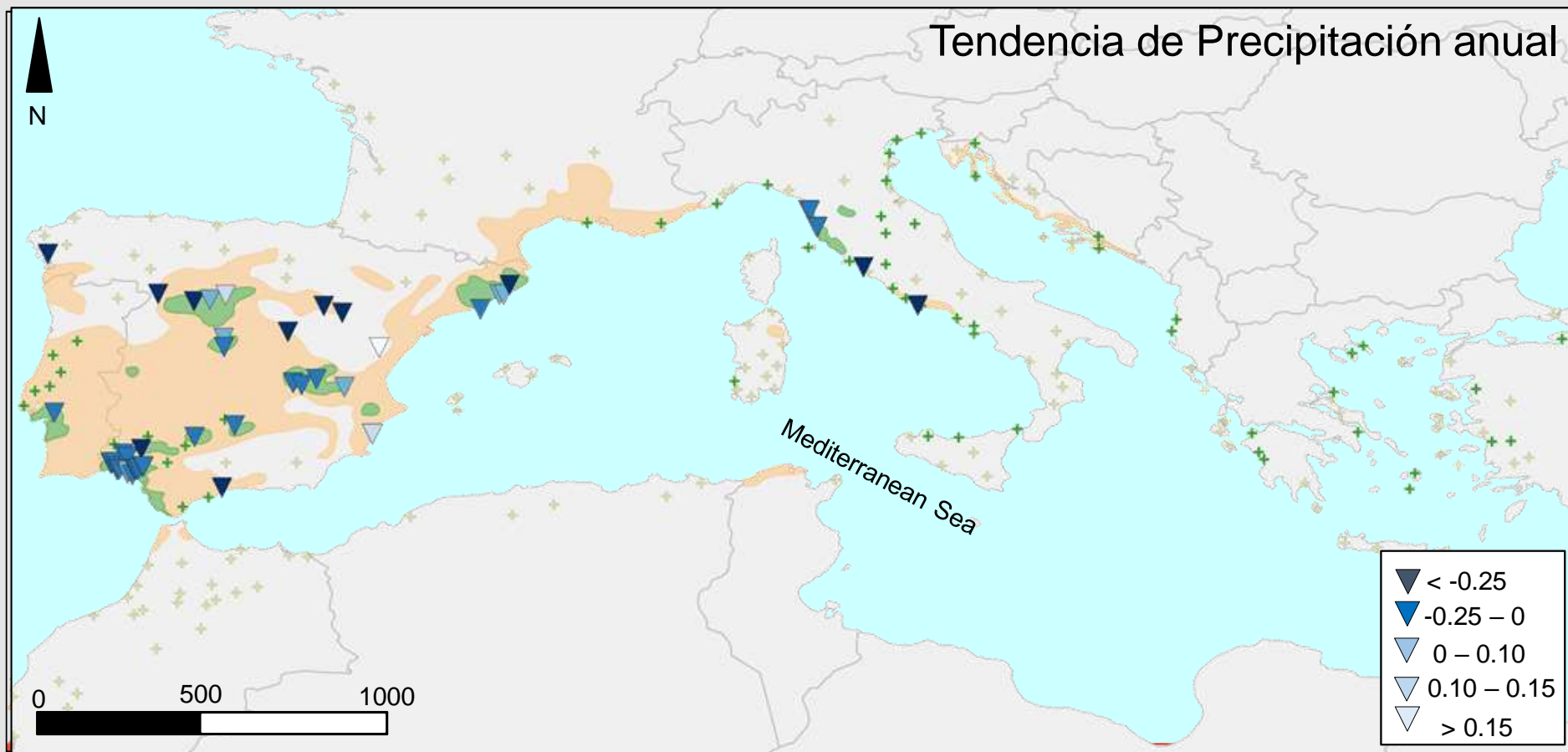
Historia del piñonero a través de los anillos



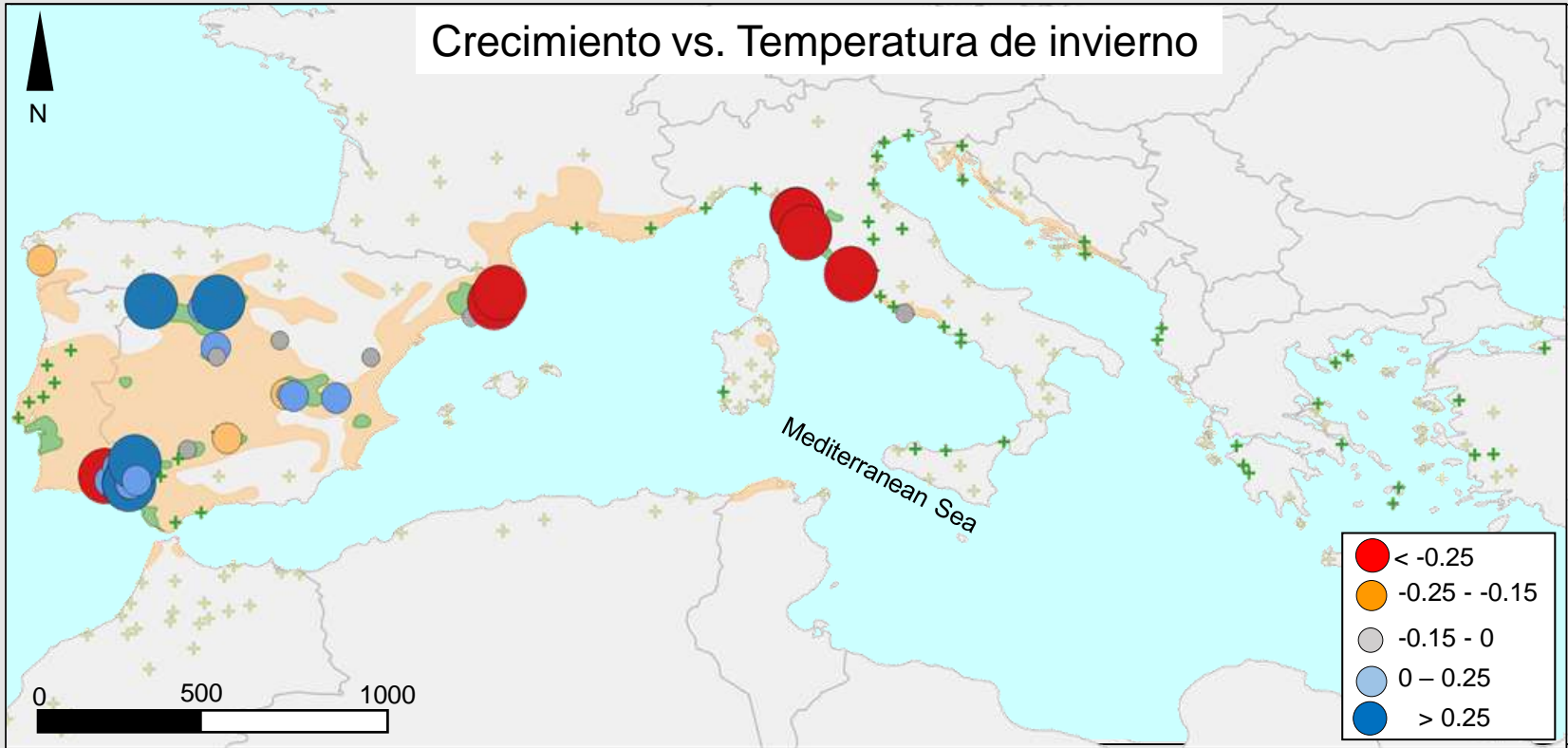
Tendencias climáticas



Tendencias climáticas



Relaciones clima-crecimiento



↑ T verano ↓ Crecimiento

Mayor vulnerabilidad
en zonas más frías

↑ T invierno ↑ Crec (viejos)
(otoño p) continental

↑ T invierno ↓ Crecimiento
Jóvenes-costa

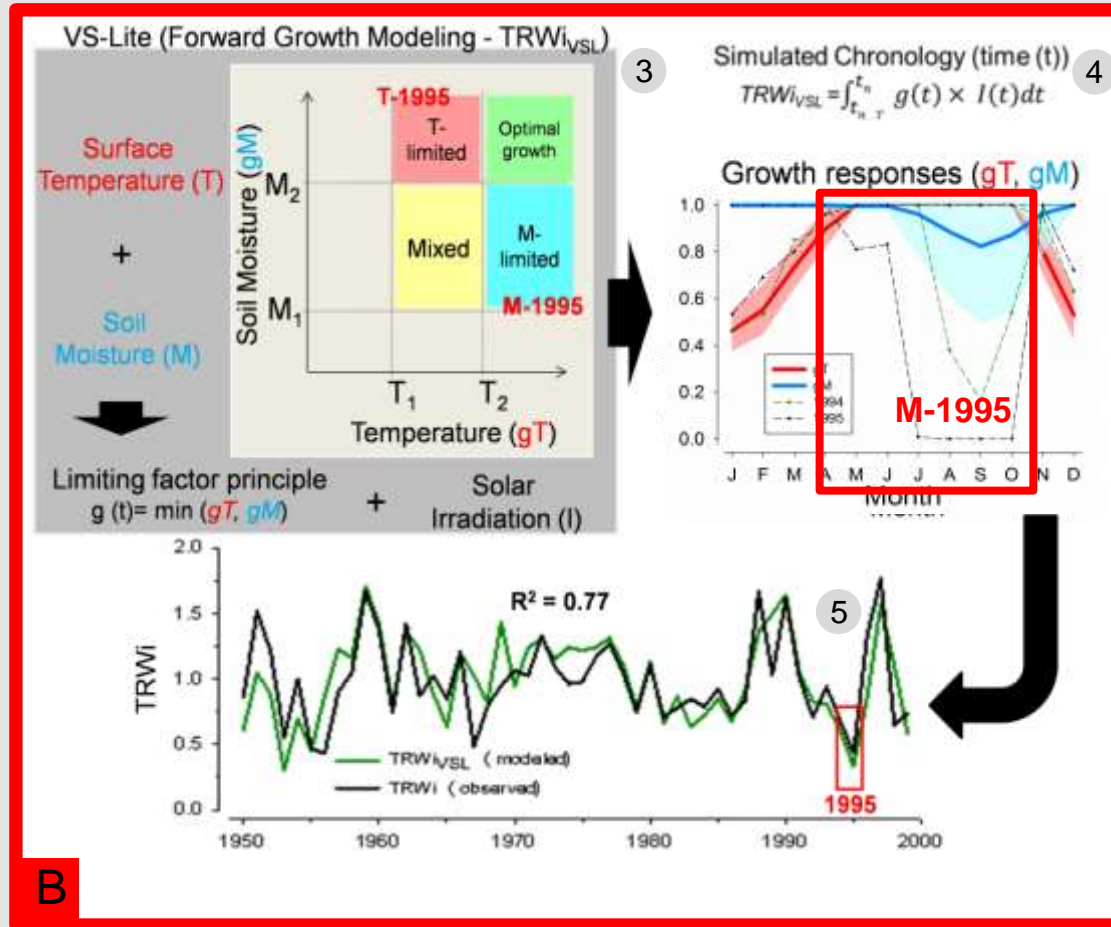
Umbrales de vulnerabilidad

Methods

1. Growth response by VS-Lite model (T, M, I), growth parameters (T_1 , T_2 , M_1 , M_2).

3. Comparison mean optimal growth responses vs. **Observed drought – induced reductions**.

4. The gM during extremes years was used to define resilience indices (**growing season**).



B

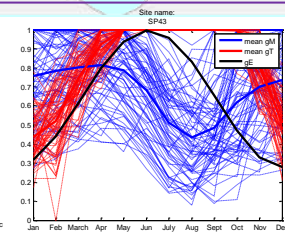
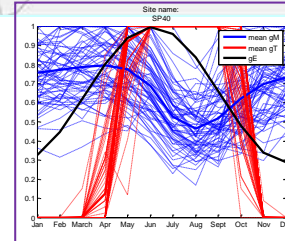
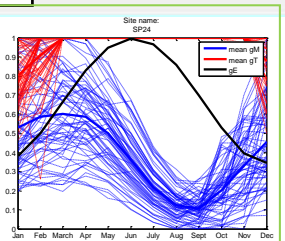
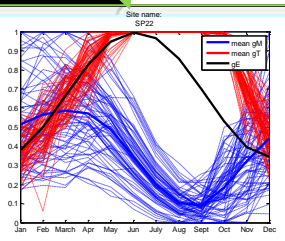
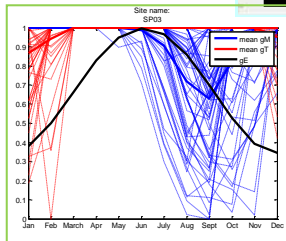
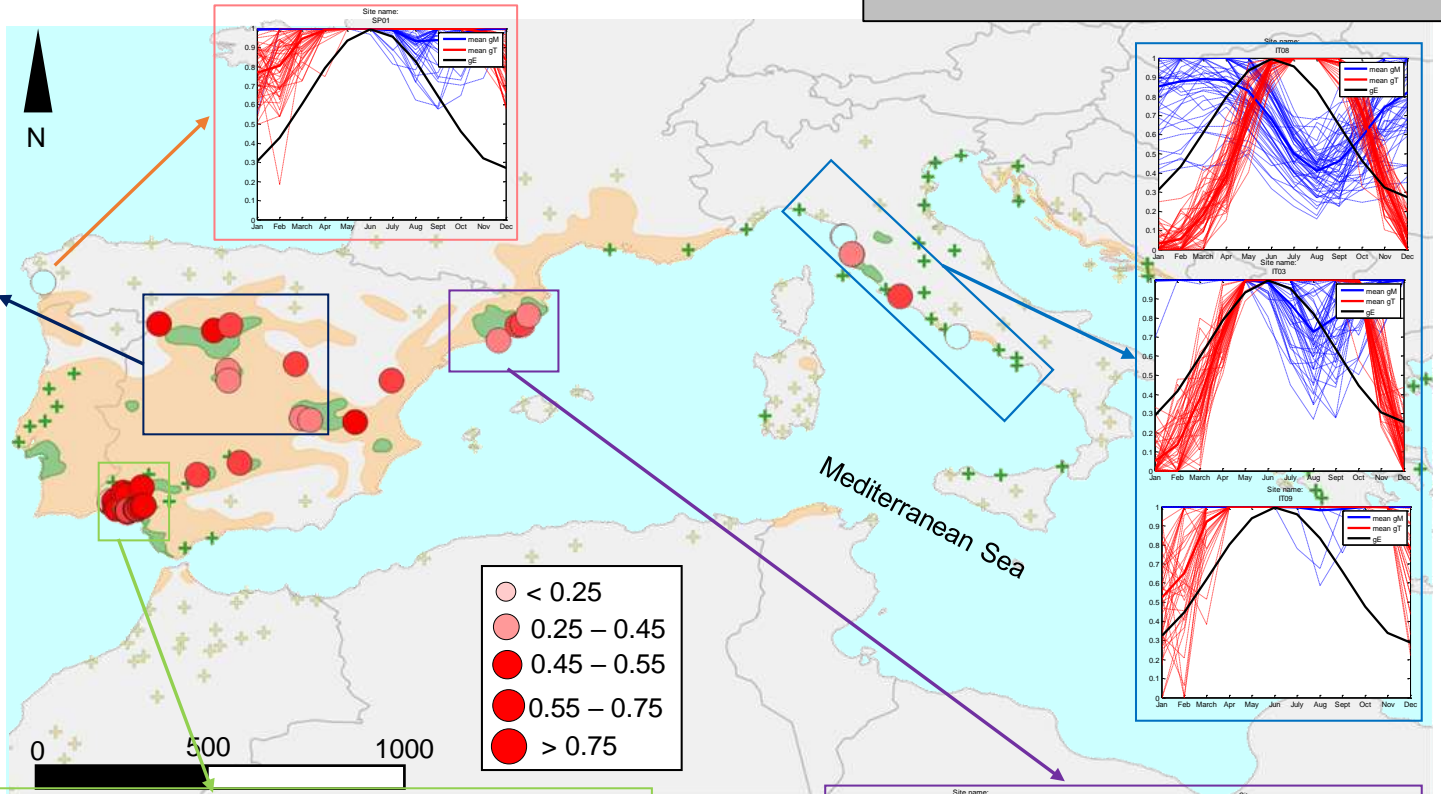
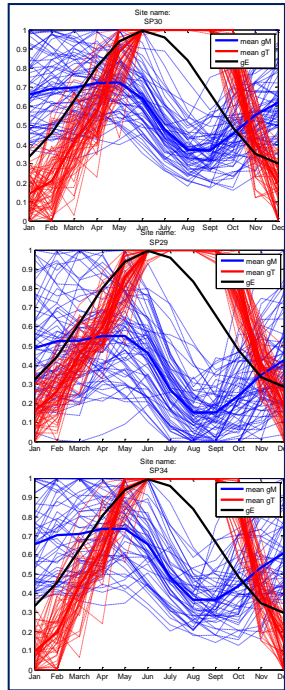
Umbrales de vulnerabilidad

Ajuste del modelo VS-lite

gT (temperatura) —

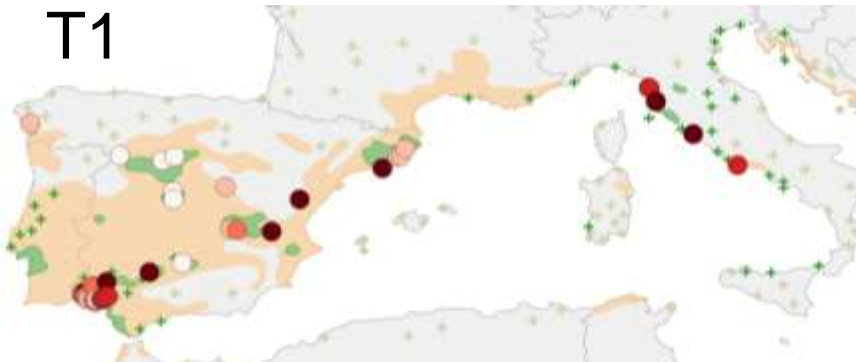
gM (humedad suelo) —

Extremos - - -

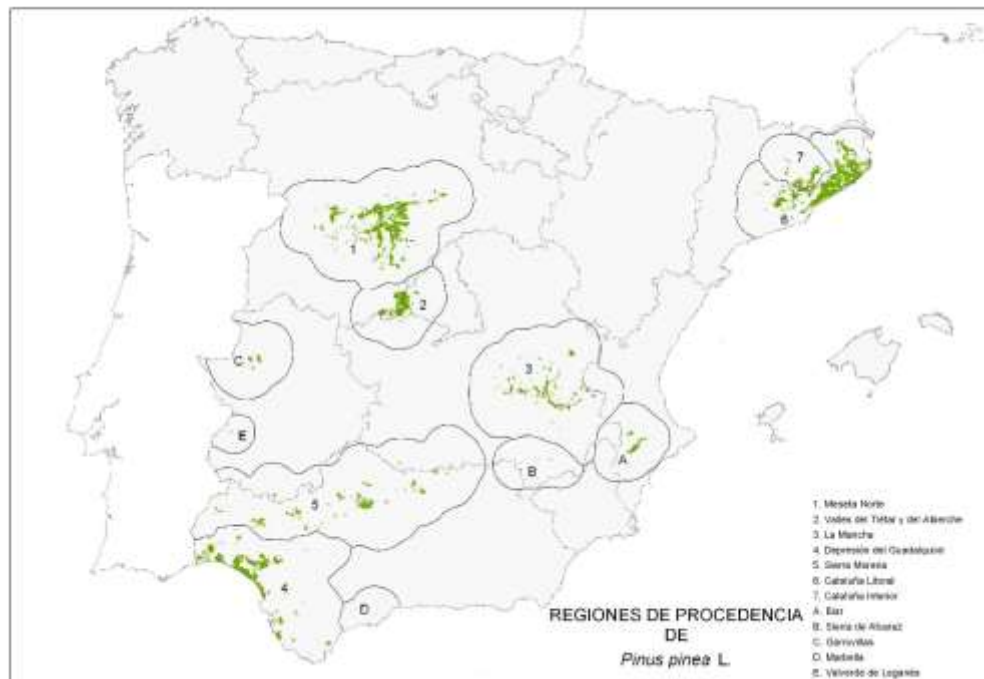
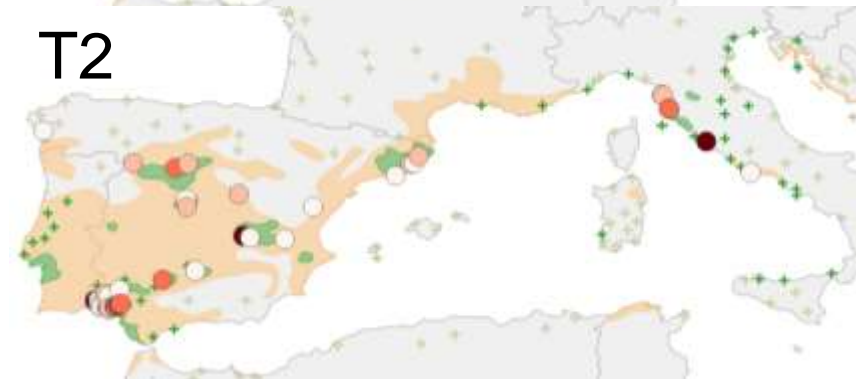


Umbrales de vulnerabilidad

T1

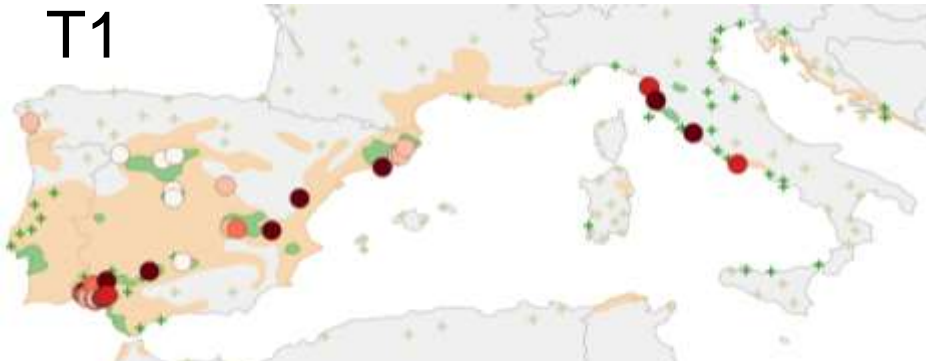


T2



Umbrales de vulnerabilidad

T1



M1



T2



M2



Sequías extremas y resiliencia

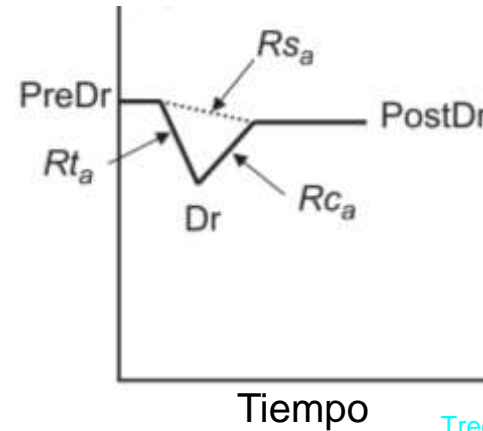
Metodos

1. Evaluar la estabilidad del crec.
(**Resilience indices**)

2. **Anillos** (nivel árbol)

3. **Edad**

Resiliencia



$$Rt = Dr / PreDr$$

$$Rc = PostDr / Dr$$

$$Rs = PostDr / PreDr$$

$$rRs = Rs - Rt$$



Sequías extremas y resiliencia

Resistencia (Rt)

reduccion de crec. durante el evento

$Dr / PreDr$



Recuperación (Rc)

Capacidad de recuperarse del daño del evento extremo

$PostDr / Dr$



Resiliencia (Rs)

Capacidad de recuperar niveles de Crec. Previos al evento

$PostDr / PreDr$



Resiliencia relativa (rRs)

Resiliencia ponderada por el daño del evento extremo

$PostDr - Dr / PreDr$



Sequías extremas y resiliencia

2005

Impacto



Resistencia



Recuperación



Resiliencia

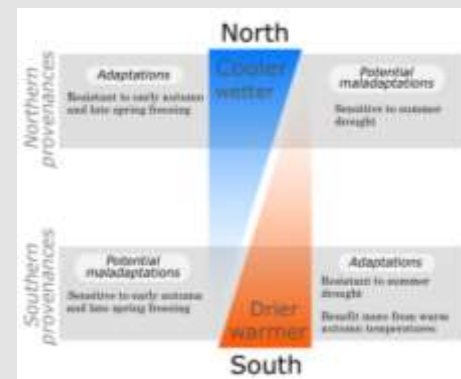
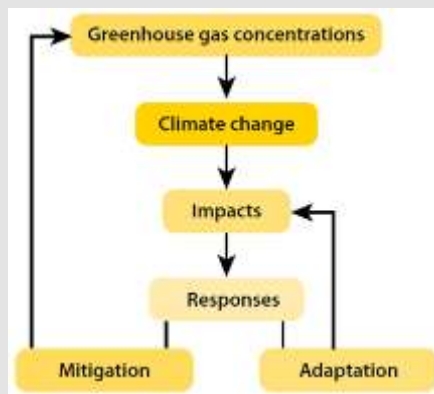
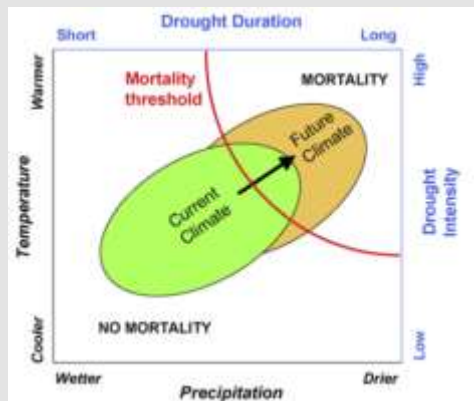


¿Falta de gestión?



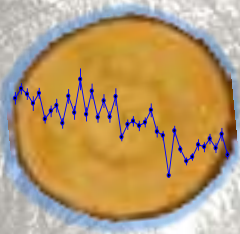
Algunas conclusiones

- Conservación y sostenibilidad de **recursos genéticos forestales**
- **Zonificación** ecobiogeográfica de la **resiliencia** basada en procedencias
- Identificación de **procedencias mejor adaptadas** para un **manejo adaptativo** en el siglo XXI
- Programas de **migración asistida** basados en la resiliencia y adaptación local
- Información relevante para **MDE** y **proyecciones futuras de vulnerabilidad**



¡Gracias!

DendroOlavide

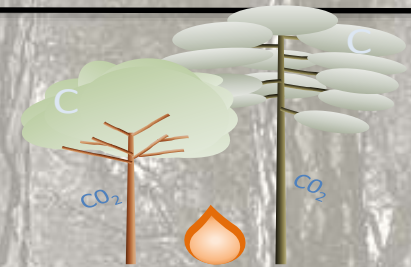


PAIDI 2020. IE19_074
DendOlavide II

Proyecto UPO-1263216
VULBES

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