

Mediterranean Stone pine and pine nuts: more knowledge for a better management

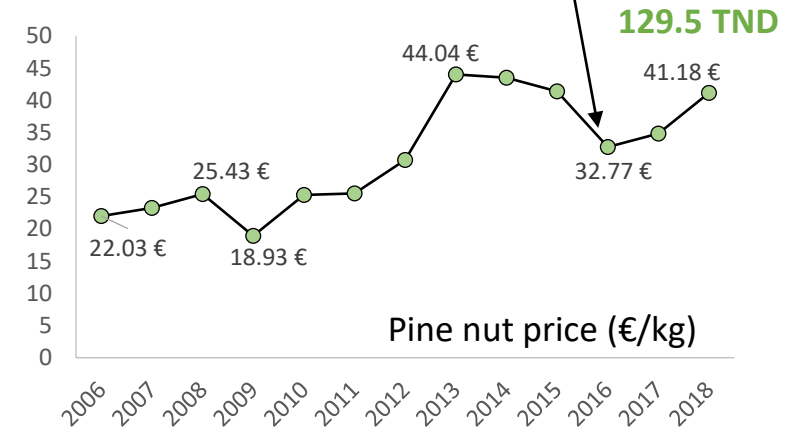
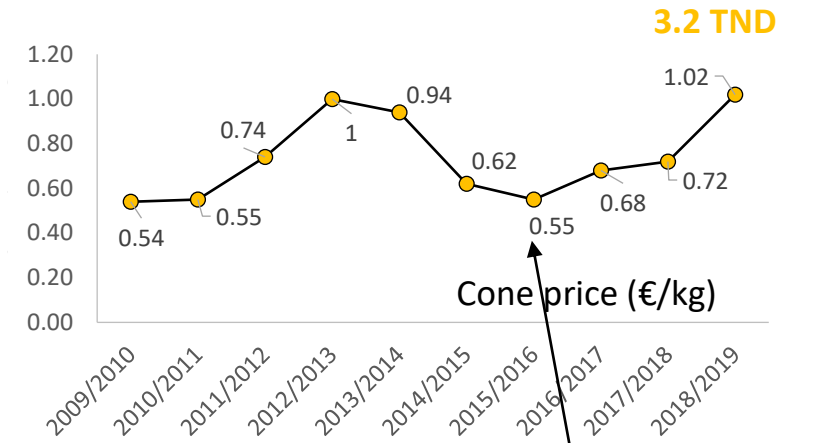
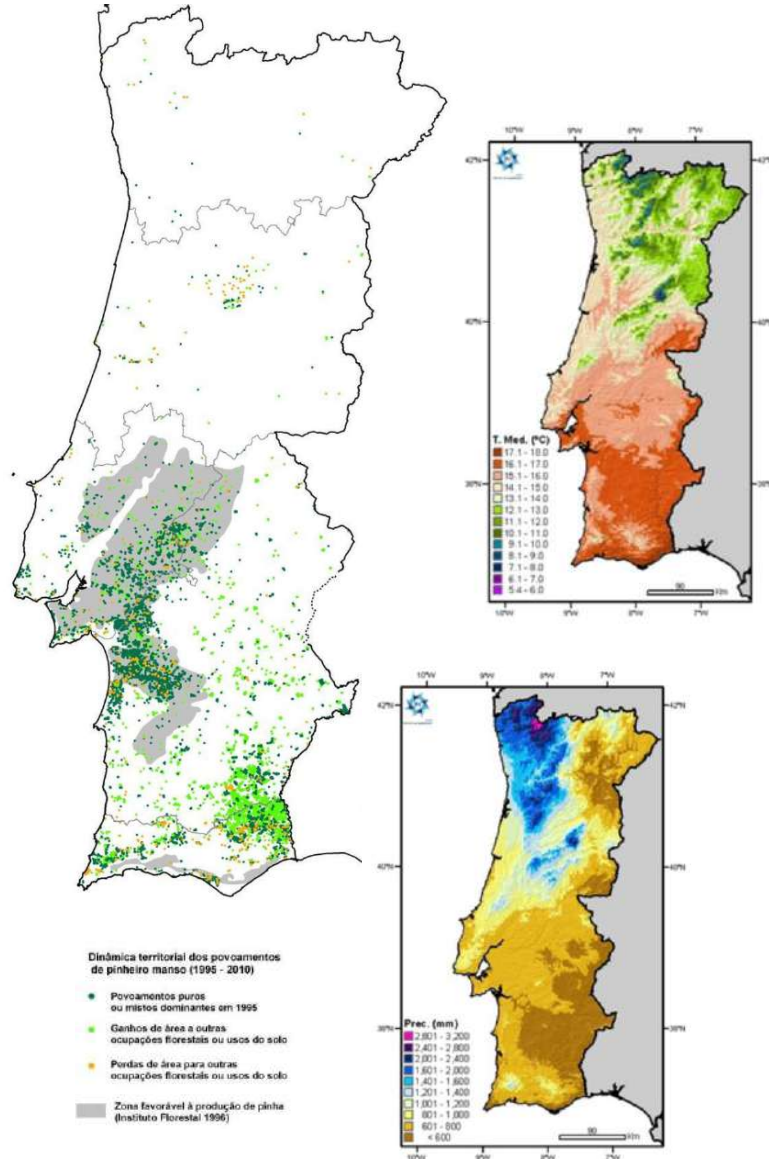
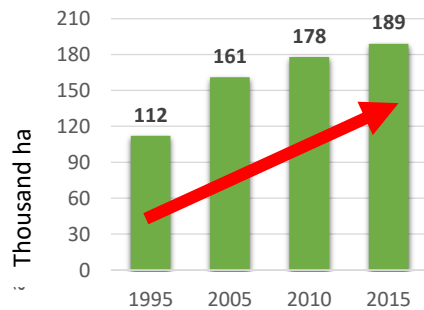
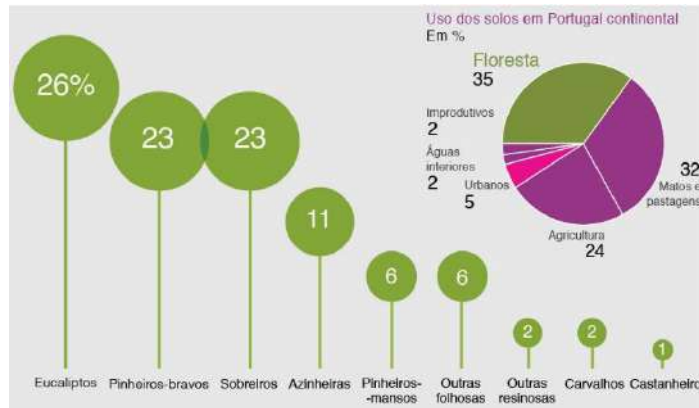
Alexandra Correia
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(Portugal)



Pinus pinea distribution in Portugal

Forested area ~3.2 million ha



Stone pine stands in Portugal

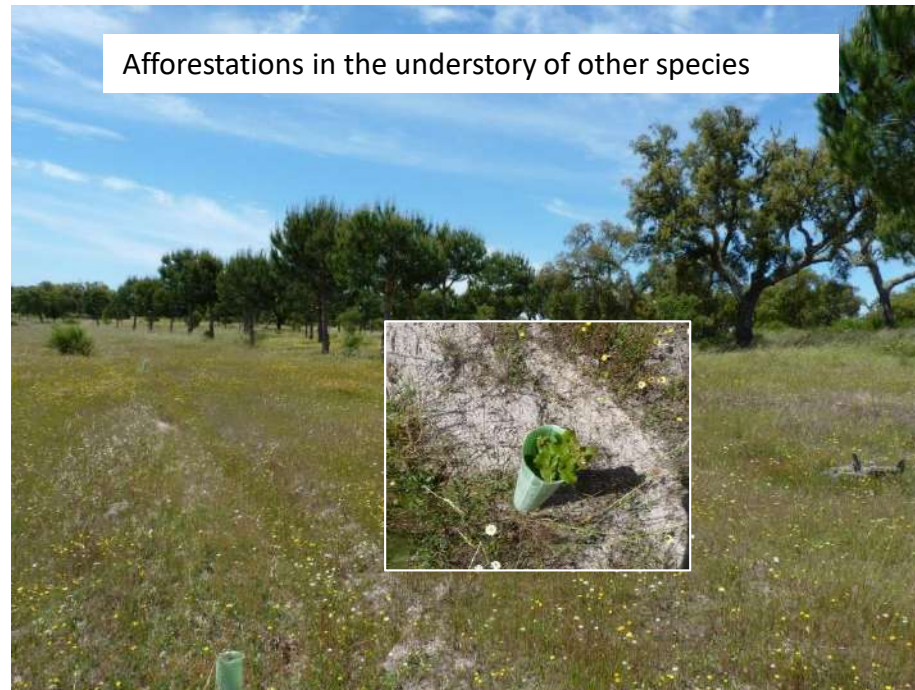
Natural regeneration stands



Natural regeneration stands mixed with cork oak



Afforestations in the understory of other species



New plantations for grafting

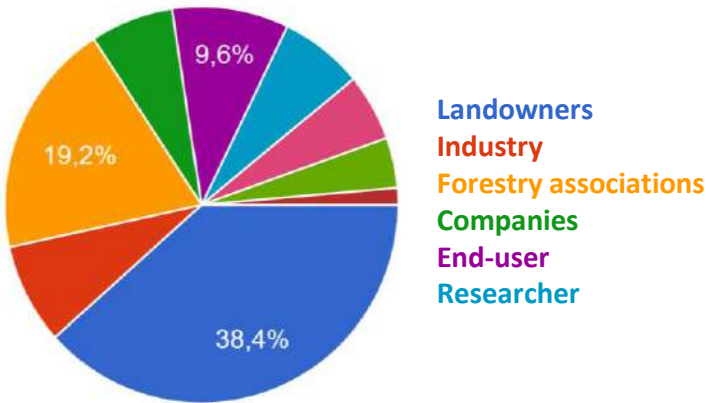


Grafting
success
rates
~80-90%

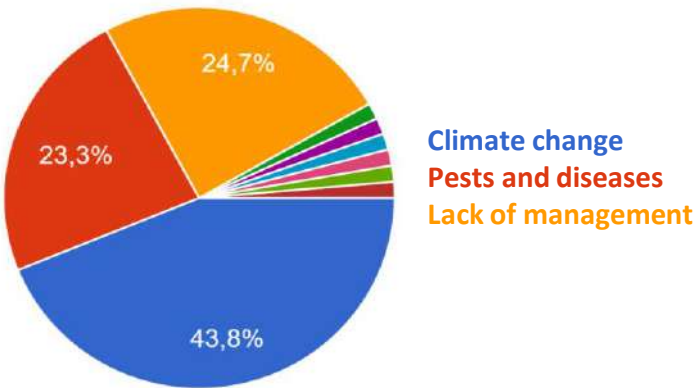
Managers main problems and research interests

Survey
(75 participants)

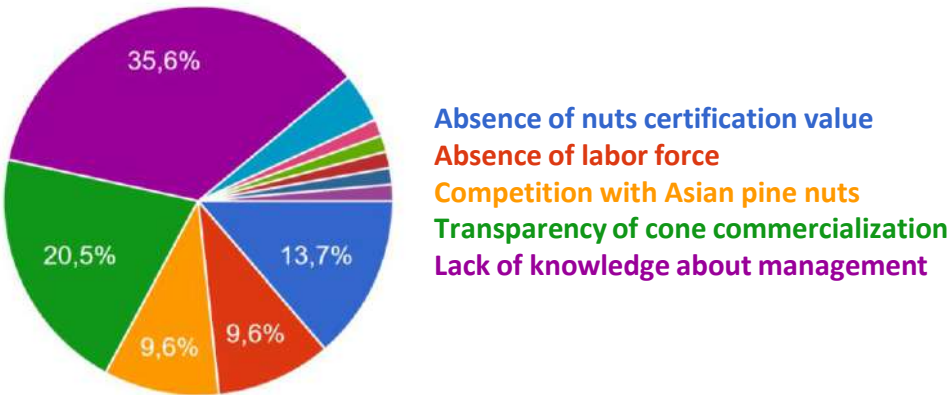
Who was present?



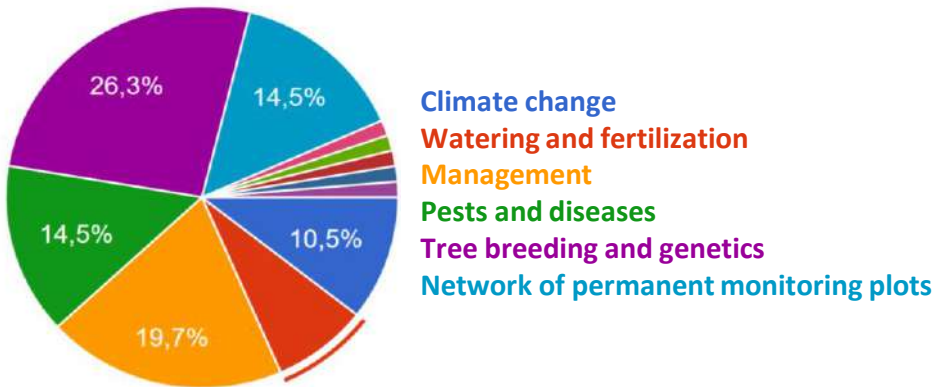
Main threats to cone production:



Main problems on the chain of custody:



Research priorities:



Reported reduction in cone production

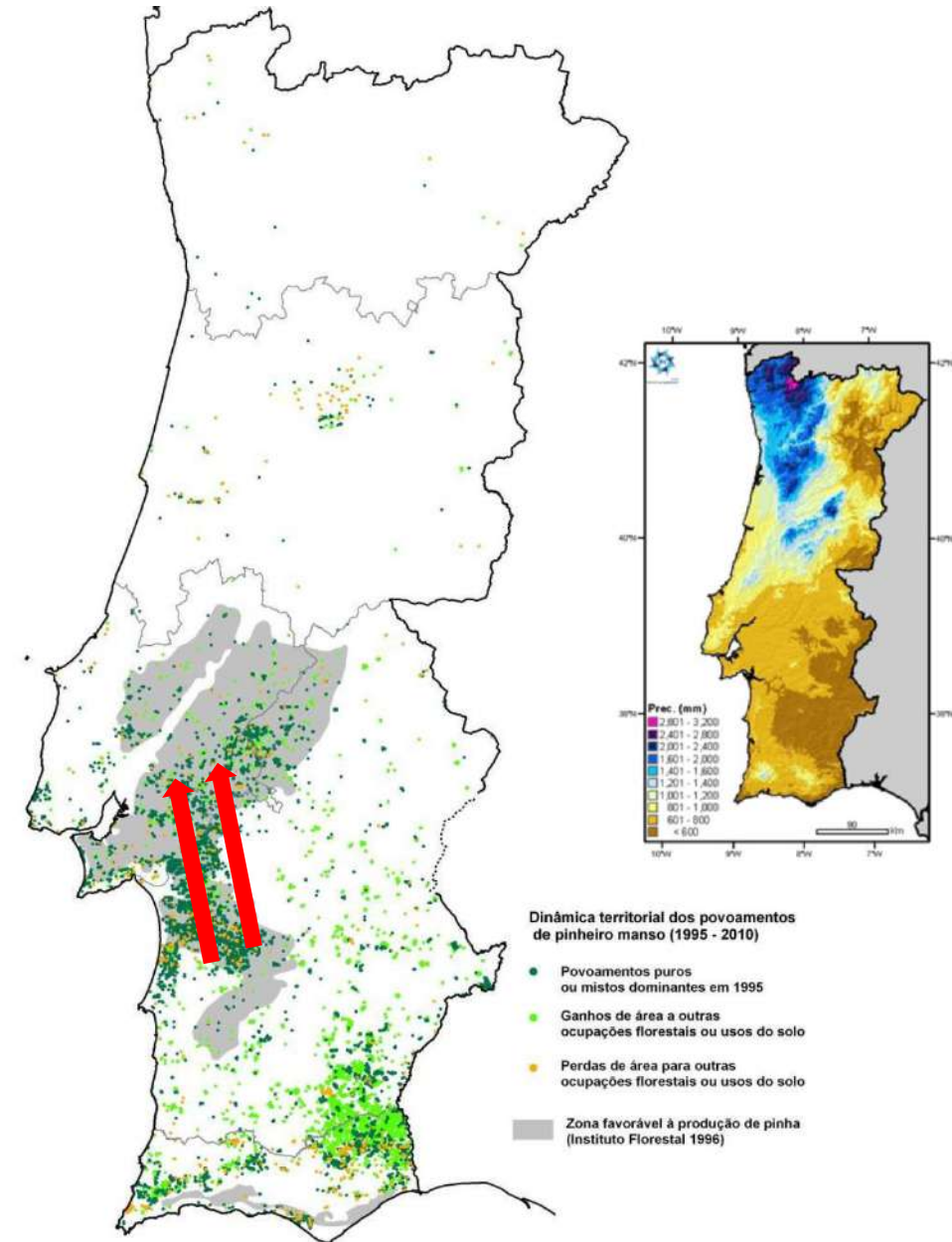
Especially in south regions without production for a couple of years

What to do with these stands?

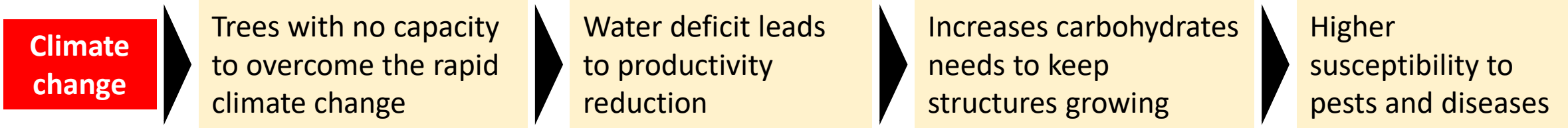
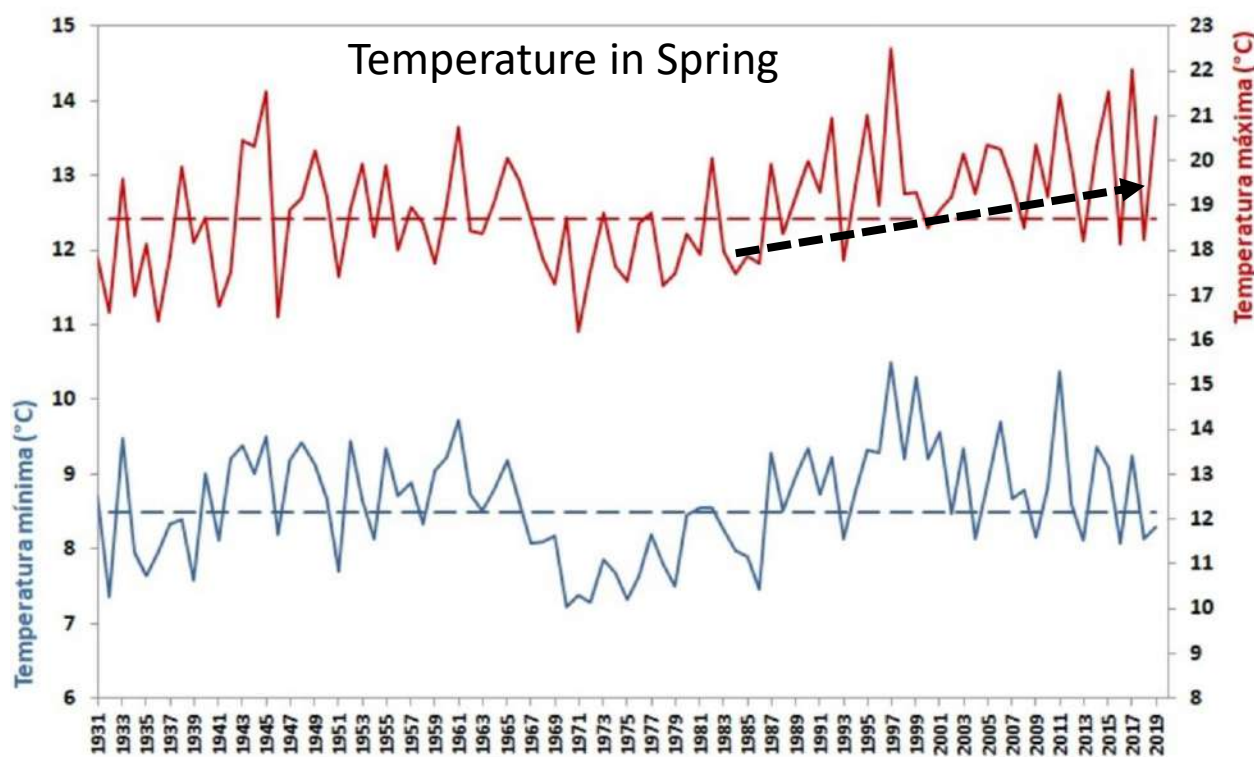
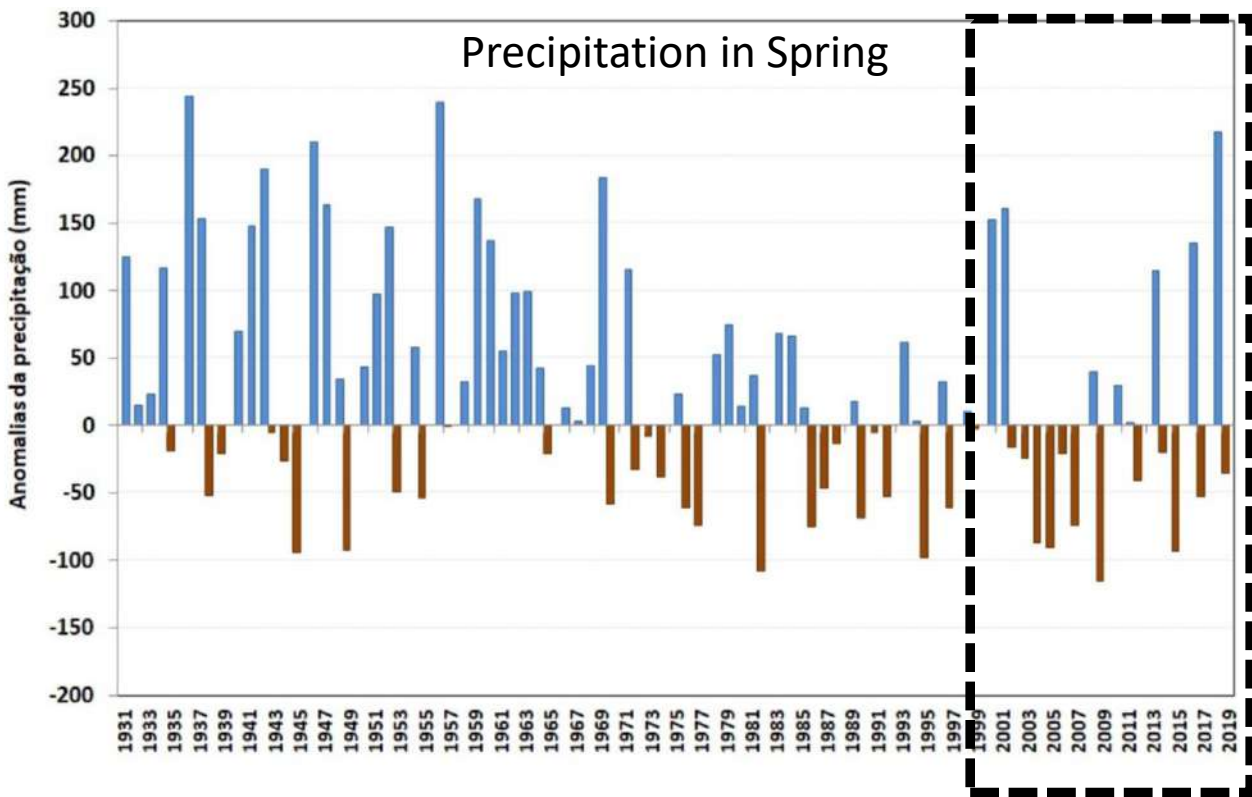
Management alternatives to increase cone production ?
(irrigation, fertilization)

Commercial: Resin exploitation?

Ecological: Soil protection; biodiversity



Climate change



SPRING: pollination, flowering, diameter growth, new branches, fertilization

Pine cone theft



Pine cone declaration Law nº 77/2015, de 12 de Maio **mandatory for all the operators involved in the collection, transport, storage, processing, import and export of pine cones of stone pine in continental territory**

Monitoring the commercialization of pine cones from harvest to the final destination, allowing for increased **phytosanitary control**, including import inspection

Improve the **transparency of marketing channels** for pine cones and the knowledge of authorities and economic operators in the sector.

Allow traceability throughout the economic circuit of the pine cones, **enabling certification and quality control** processes.

To **compile statistical information** on the sector that supports decision-making on forestry policy and the development of the sector.

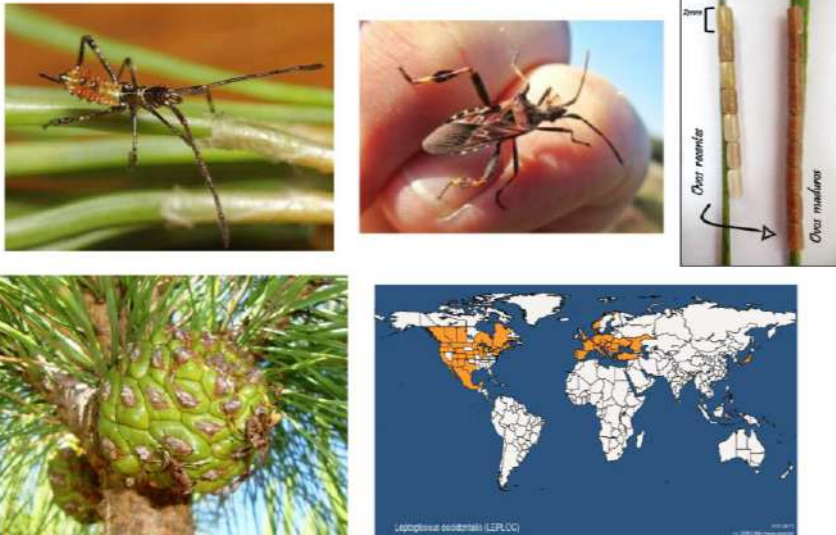
Reinforcement of the **monitoring and surveillance** component

Pests and diseases

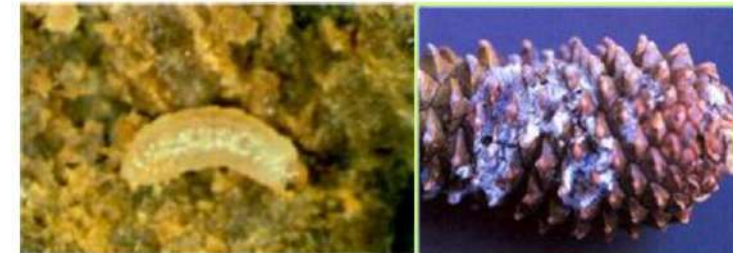
Dioryctria mendacella
Traça das pinhas



Leptoglossus occidentalis
Sugador das pinhas



Pissodes validirostris
Gorgulho das pinhas



Detetado em Portugal pela 1ª vez em 2000

What is the focus of our investigation at the moment?



Biomass allometric models for stone pine (aboveground and roots) suitable to use in Mediterranean countries



Generalized biomass equations for Stone pine (*Pinus pinea* L.) across the Mediterranean basin

Correia A.C.^{a,*}, Faia S.P.^a, Ruiz-Peinado R.^{b,c}, Chianucci F.^c, Cutini A.^d, Fontes L.^a, Manetti M.C.^d, Montero G.^{c,f}, Soares P.^a, Tomé M.^a

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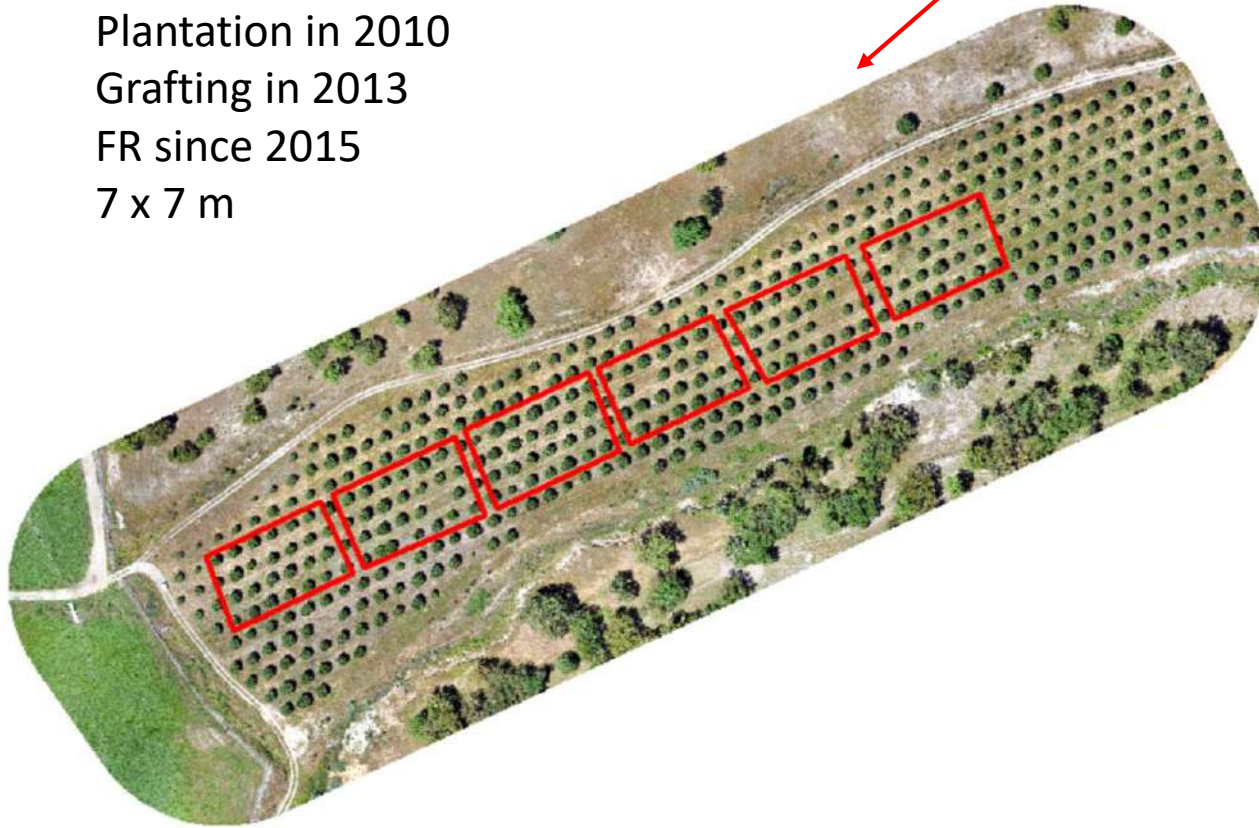
^e IuFOR, Sustainable Forest Management Research Institute, UNO-INIA, Av. de Madrid, 503, 34004 Palencia, Spain

^f Sociedad Española de Ciencias Forestales (SECF), Spain

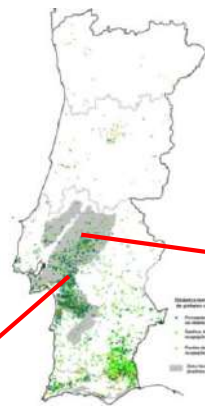
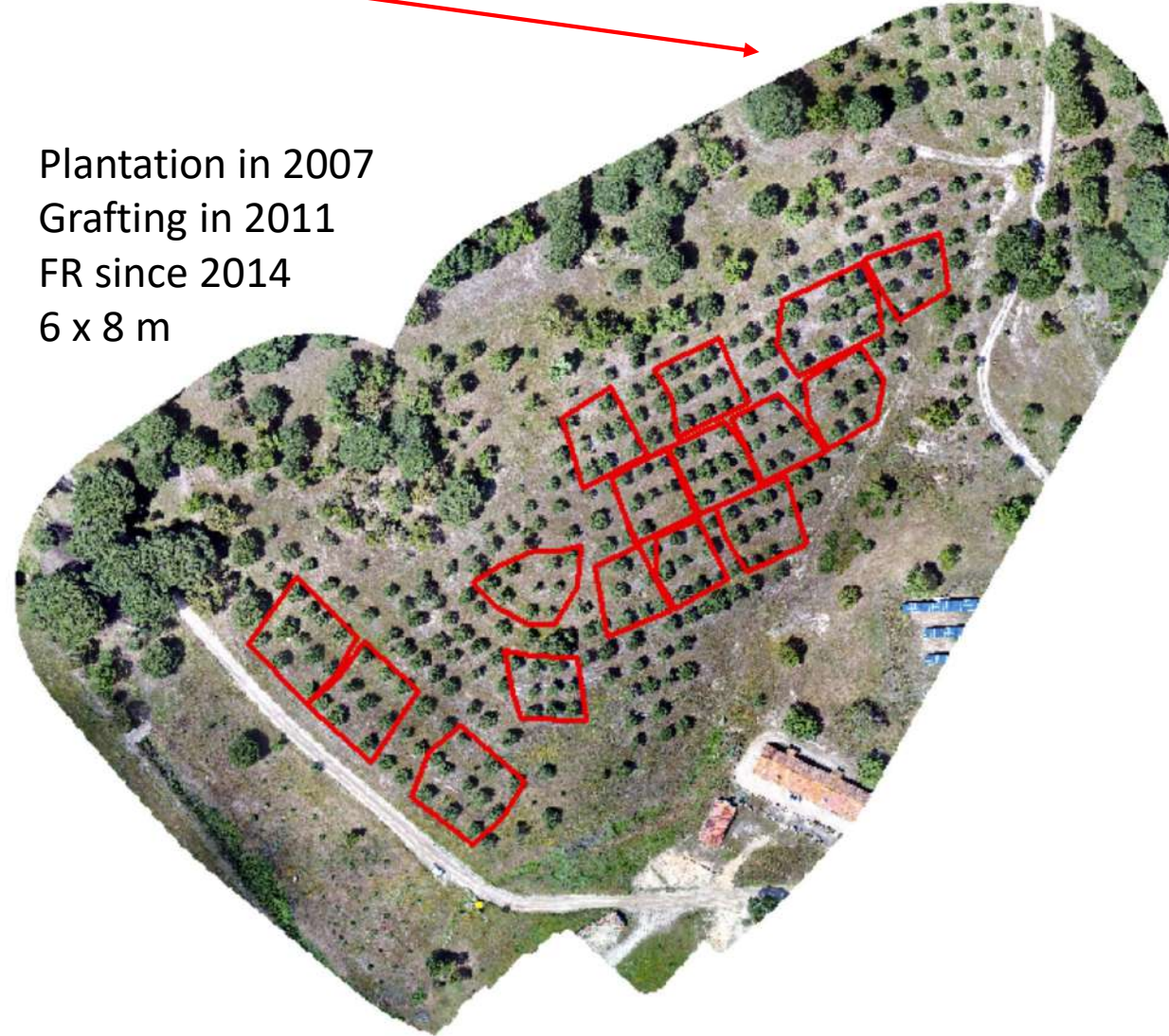


Fertirrigation trials

Plantation in 2010
Grafting in 2013
FR since 2015
7 x 7 m



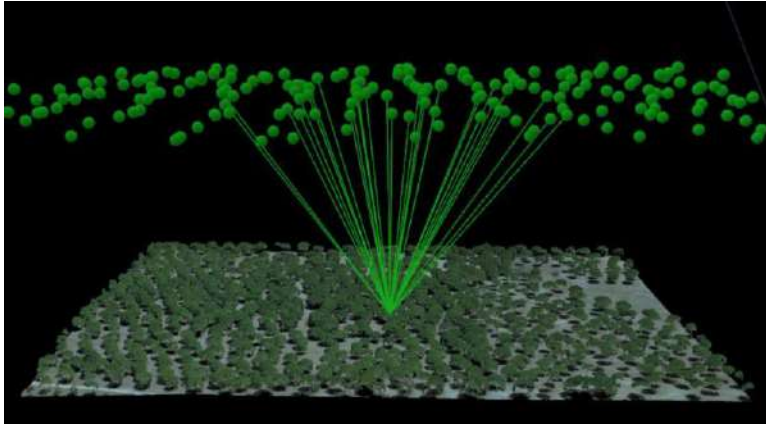
Plantation in 2007
Grafting in 2011
FR since 2014
6 x 8 m



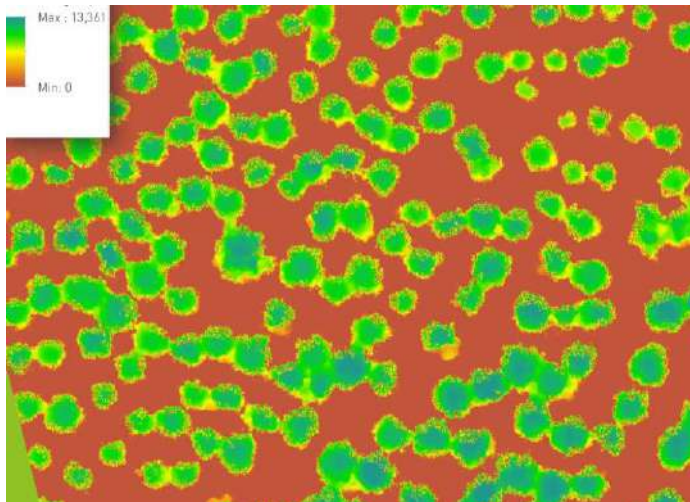
Using drones for forest management



Models for canopy height using photogrammetry



Tree counting and vigour quantification using multispectral sensors



Visible light flights above the canopies



SHORT COMMUNICATION

Forest Systems
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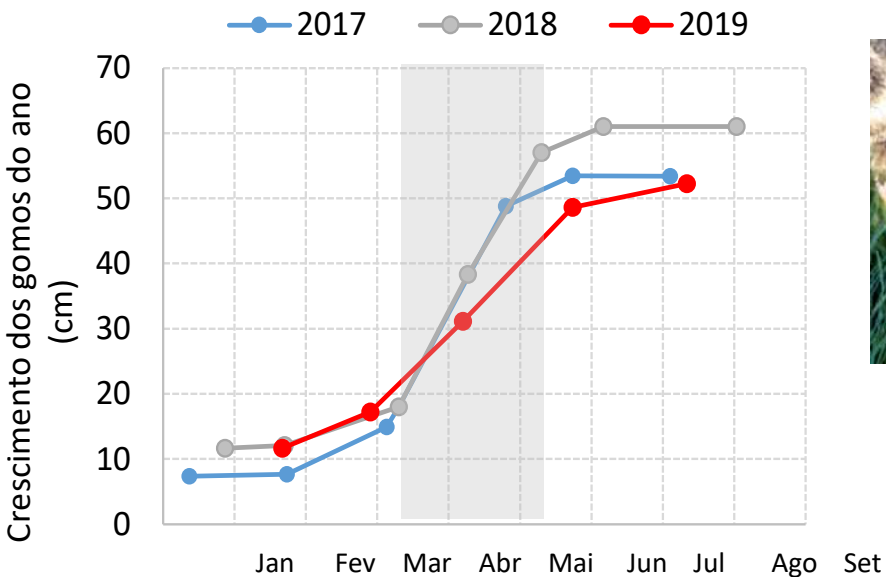
Using high resolution UAV imagery to estimate tree variables in *Pinus pinea* plantation in Portugal

Juan Guerra-Hernández^{*1}, Eduardo González-Ferreiro^{2,3,4}, Alexandre Sarmiento⁵, João Silva¹, Alexandra Nunes¹, Alexandra C. Correia¹, Luis Fontes¹, Margarida Tomé¹, Ramón Díaz-Varela⁶

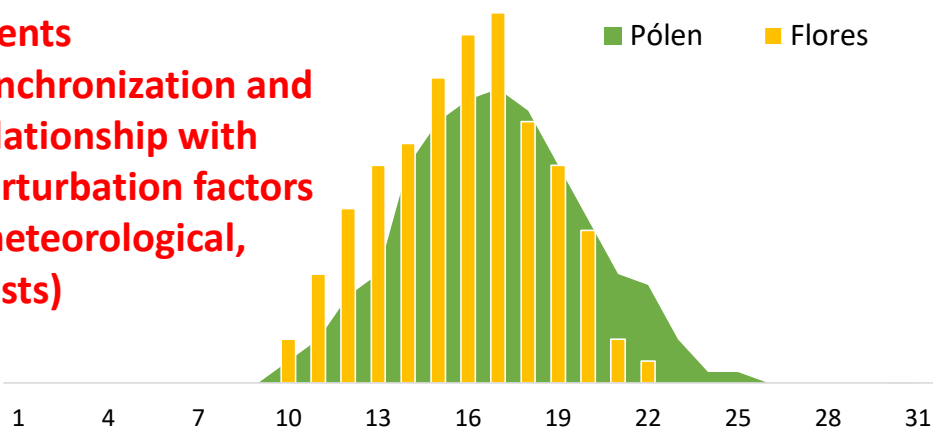
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Reproductive phenology

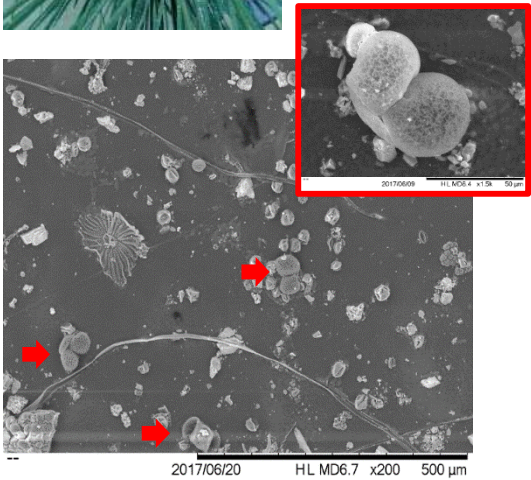
Flower receptivity



Events
synchronization and
relationship with
perturbation factors
(meteorological,
pests)






Pollen dehiscence



Integrated management of the biotic agents associated with loss of stone pine nut production (+ PINHÃO)



Main objectives:

-  Develop **diagnostic and monitoring processes** to determine the impact of biotic agents on stone pine nut production.
-  Determine periods of pine cone development at risk by correlating the pine tree phenology with the biological cycle of biotic agents.
-  Develop **processes and control tools** for biotic agents affecting pine nut production



Nutrition and fertilization of rainfed and irrigated *Pinus pinea* (FERTIPINEA)



Main objectives:

- ✓ Establishment of **fertilizer recommendations** for installation of **new stone pine stands** based on soil analysis
- ✓ Establishment of fertilizer recommendations for **young** and **adult stone pine stands** based on soil and leaf (needles) analysis and, where applicable, irrigation water quality
- ✓ Establishment of reference values for needle analysis interpretation to stone pine stands
- ✓ Validation of irrigation opportunity criteria at the most critical stages of the vegetative cycle
- ✓ Establishment of biometric and ecophysiological indicators for monitoring environmental stresses to pine stone



CONCLUSIONS



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✓ Portugal is...

Active in the stone pine research, using new tools in forest management to increase cone production

Making an effort to improve its strategy for the transparency of marketing channels

Communicating and sharing research knowledge with stakeholders

✓ The investigation is focused on...

Climate change topic, namely the impacts of heat waves, precipitation reductions on the reproductive biology

Pests and diseases, especially in developing monitoring methodologies

Silviculture: sustainable watering and fertilization

→ Always open to collaborations with other countries

