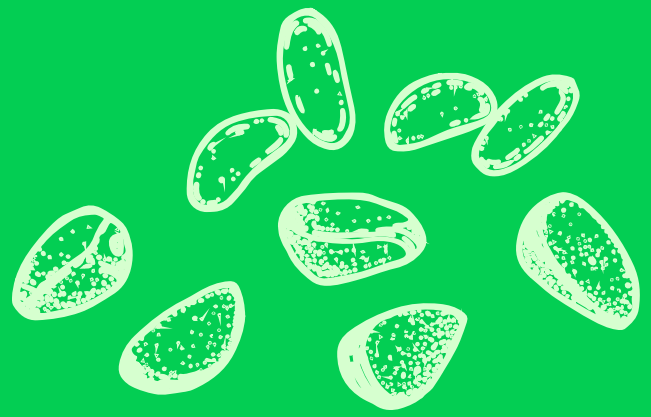

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Stone pine cone production: a long-term study on permanent plots

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[4]UNAC – União da Floresta Mediterrânica, Portugal

Objectives

Main Goal: Contribute to the structuring, organization and expansion of phenotypic data in stone pine

AGRO 451

Improvement and Management of Stone Pine Stands for the Cone and Kernel Production

PINEA

Modelling growth and pine nuts production for *Pinus pinea* under changing environmental conditions

SELECT PINEA

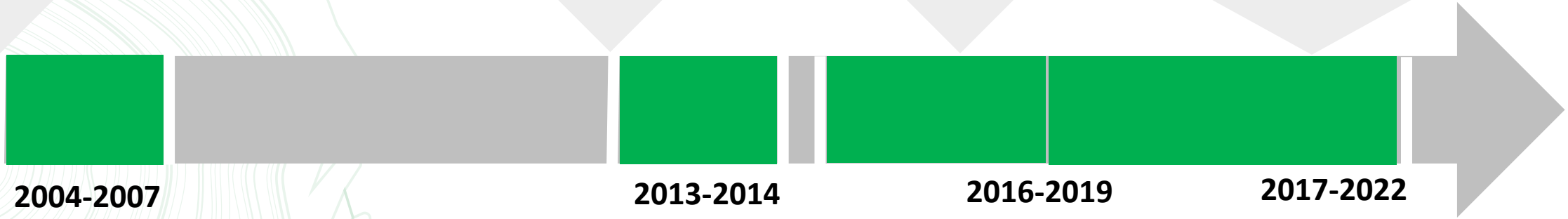
Development of genetic markers methodology for selected traits of interest in *Pinus pinea*

FERTIPINEA

Nutrition and fertilization of stone pine

+PINHÃO

Pests and diseases

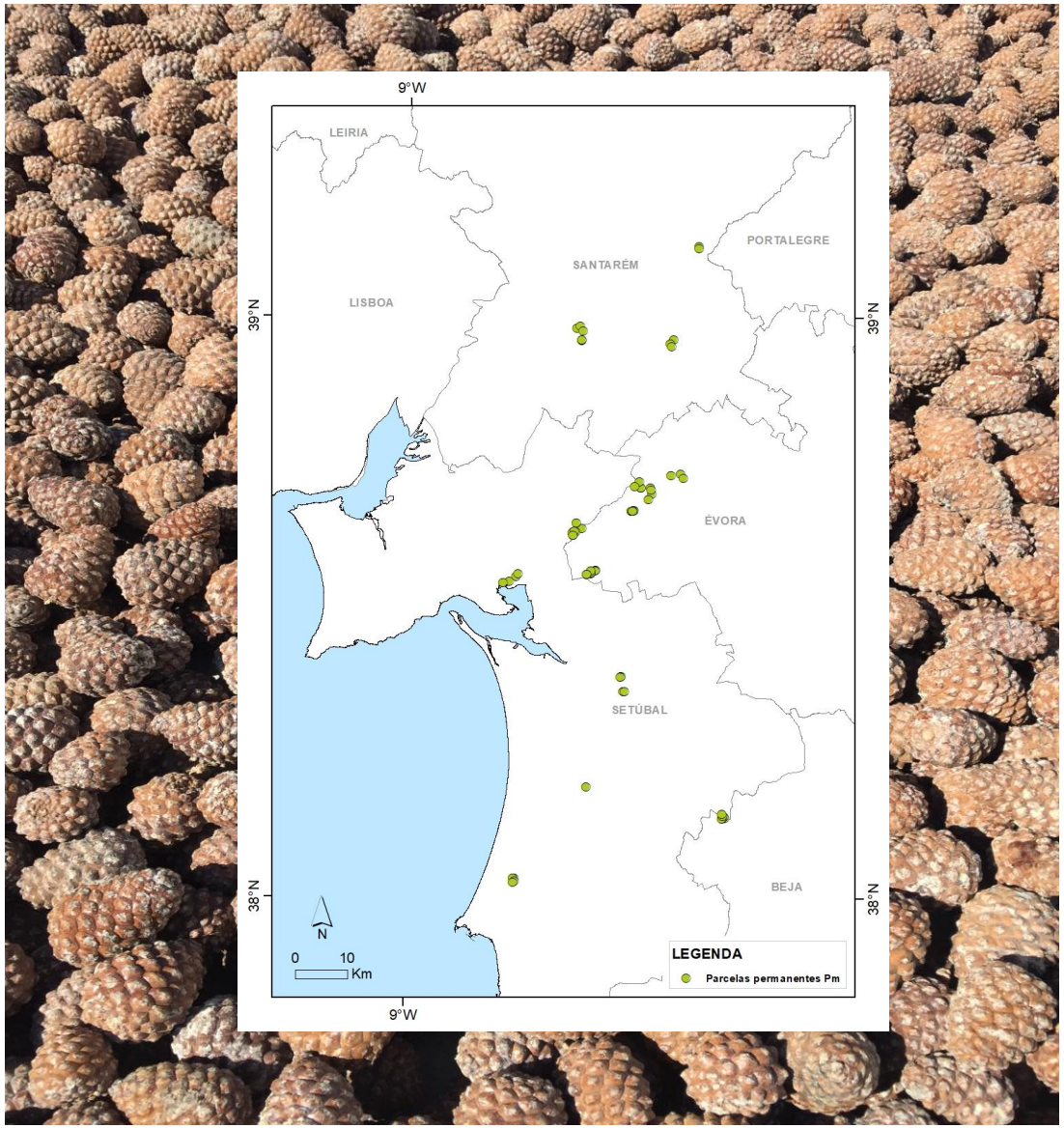


Research projects	Institutions envolved	Main Objetives
AGRO 451	INIAV, ICNF, ISA, UNAC In colaboration with: APFC, ANSUB	• Model pine cone production; • Model kernel yield
PINEA	ISA, INIAV In colaboration with: APFC, ANSUB	• Create and validate a physiological-based model as a tool for evaluating stone pine productivity; • Support the decision regarding locations for new plantations
SELECT PINEA	CEBAL, ICNF, ISA UNAC, In colaboration with: APFC, ANSUB	• Develop genetic markers for pinecone and kernel yield production using trees for which phenotypic information exists.
FERTIPINEA	INIAV, ISA, ICNF, UNAC, In colaboration with: APFC, ANSUB, ACHAR, AFLOSOR	• Establish reference values for interpreting leaf analysis to diagnose nutritional imbalances in trees, which can be corrected by rational fertilization
+PINHÃO	ISA, INIAV, ICNF, FCT-UNL, UNAC, CL, HA, VC, Florgénese, SAMS-Lda in colaboration with: APFC, ANSUB	• Study of the most relevant pests and diseases in stone pine

In 2004, 62 stone pine permanent plots were established in homogeneous stands representative from the Portuguese Provenance Region V.

The stands selection was implemented by the Portuguese Forest Services in cooperation with local associations of private forest landowners.

Since then, in some of those permanent plots the pine cone production was continuously evaluated under different research projects and a data base was constructed.

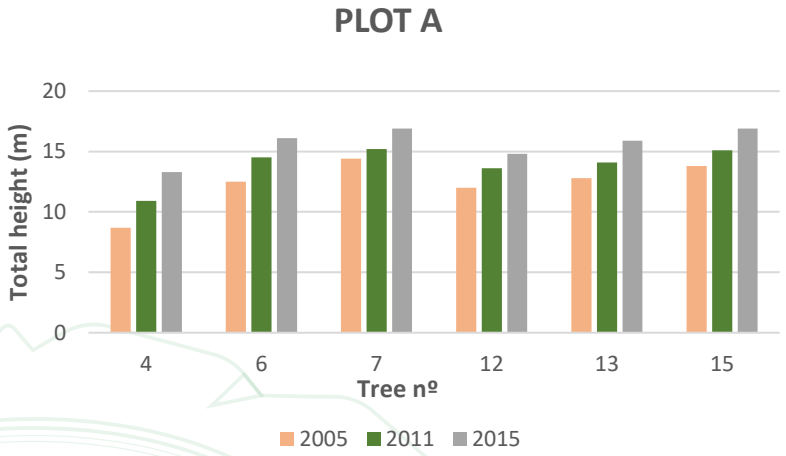


- For this study we have selected three different plots (PLOT A, PLOT B and PLOT C) to show the importance of maintaining their periodical evaluation.

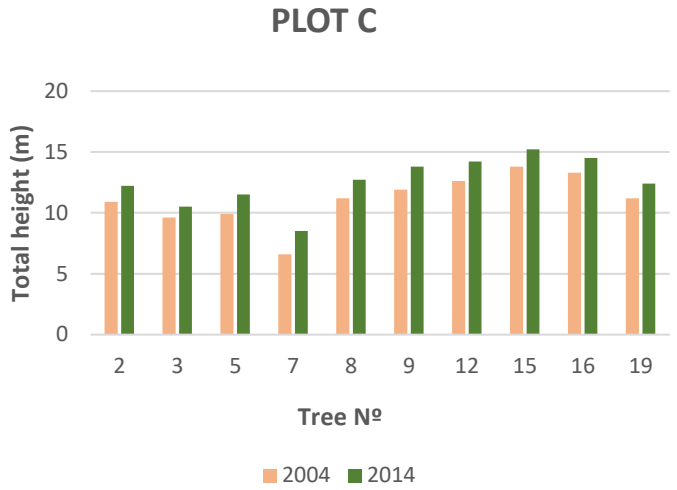
PLOT A	PLOT B	PLOT C
Data available 2005 – 2015	Data available 2004 - 2007 2014 – 2021	Data available 2005 - 2021

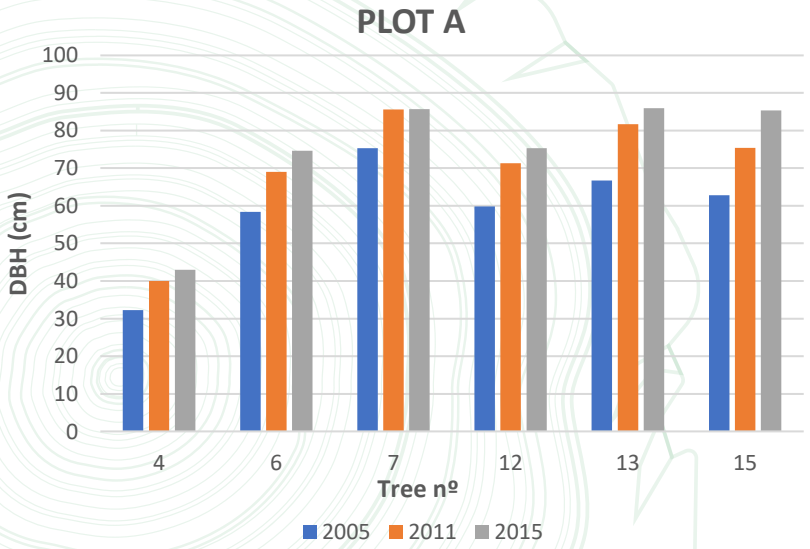
- For each plot, sample trees were evaluated for total height, DBH, cone production (number and weight);
- For each sample tree, ten healthy cones were collected and for each cone, the number of pine seed, the number of healthy kernels and their weight per cone was assessed.

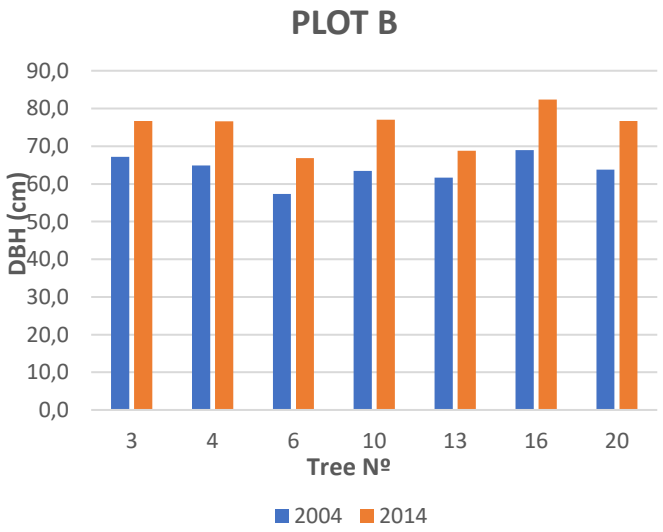
- Kernel yield variability was evaluated through the ratio between the weight of the healthy kernel and the dry weight of the pine cone, when opened. Data from campaigns 2004-2005 and 2005-2006 was used.

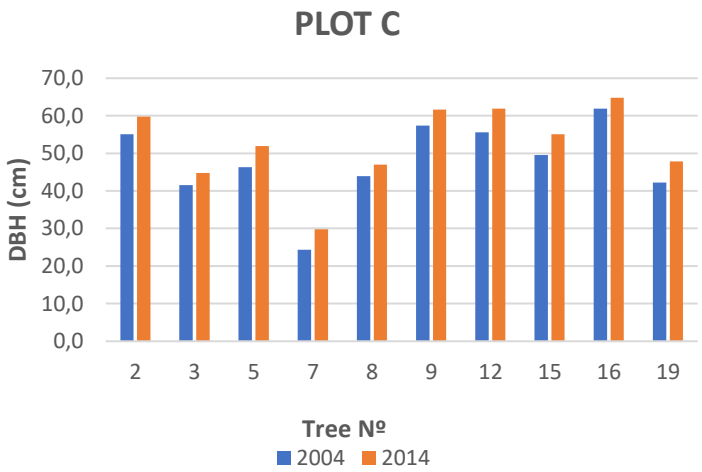

PLOT A
Total height (m)
0
5
10
15
20
4
6
7
12
13
15
Tree nº
2005
2011
2015

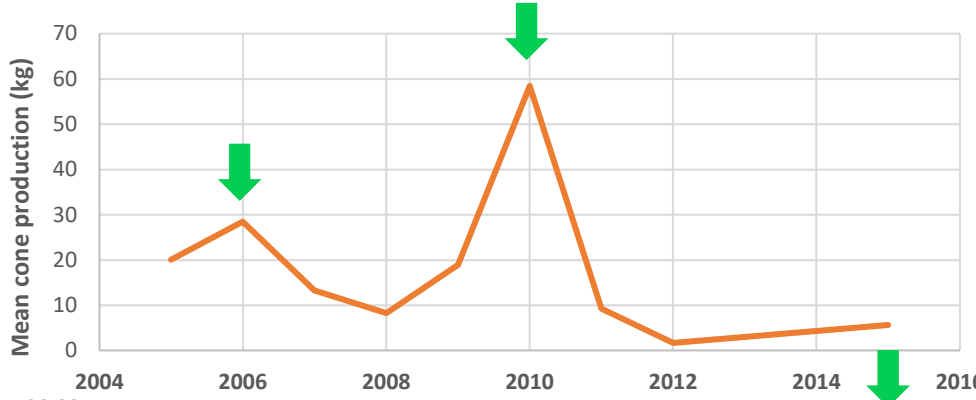

PLOT B
Total height total (m)
0
5
10
15
20
25
3
4
6
10
13
16
20
Tree Nº
2004
2014


PLOT C
Total height (m)
0
5
10
15
20
2
3
5
7
8
9
12
15
16
19
Tree Nº
2004
2014

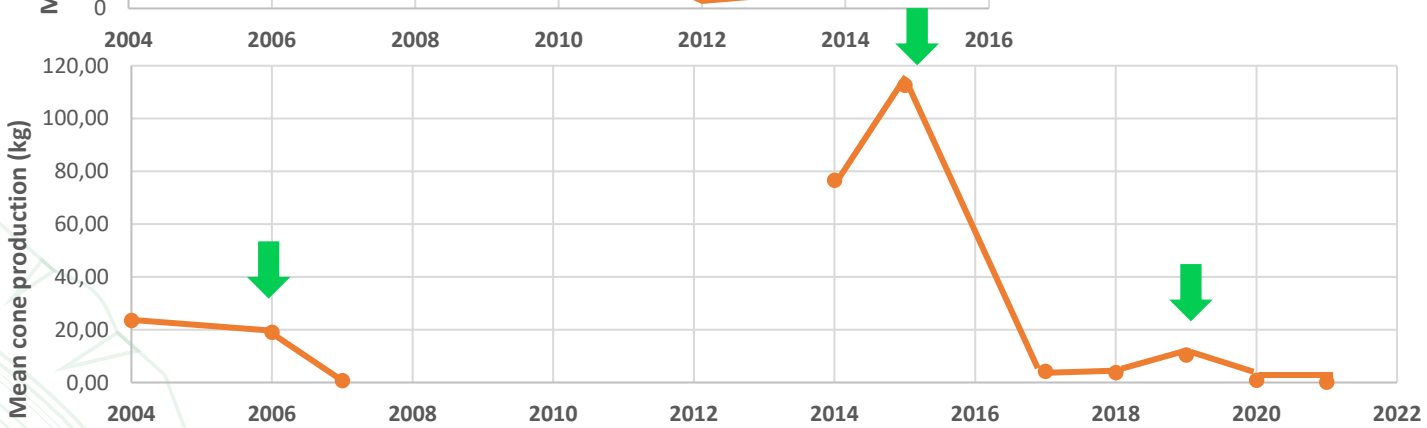

PLOT A
DBH (cm)
0
10
20
30
40
50
60
70
80
90
100
4
6
7
12
13
15
Tree nº
2005
2011
2015


PLOT B
DBH (cm)
0,0
10,0
20,0
30,0
40,0
50,0
60,0
70,0
80,0
90,0
3
4
6
10
13
16
20
Tree Nº
2004
2014

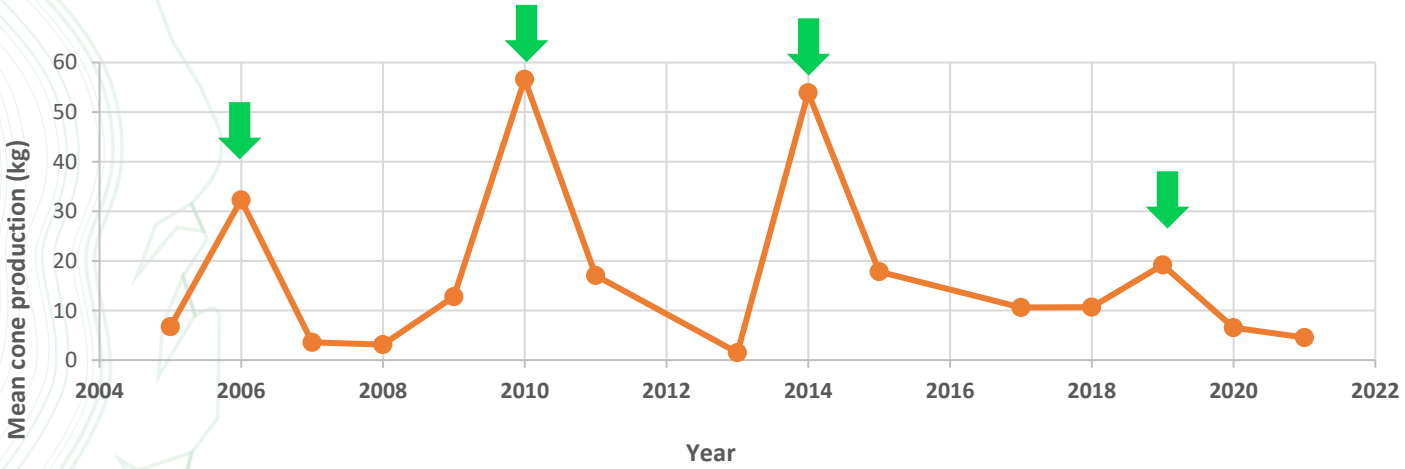

PLOT C
DBH (cm)
0,0
10,0
20,0
30,0
40,0
50,0
60,0
70,0
2
3
5
7
8
9
12
15
16
19
Tree Nº
2004
2014



PLOT A



PLOT B



PLOT C

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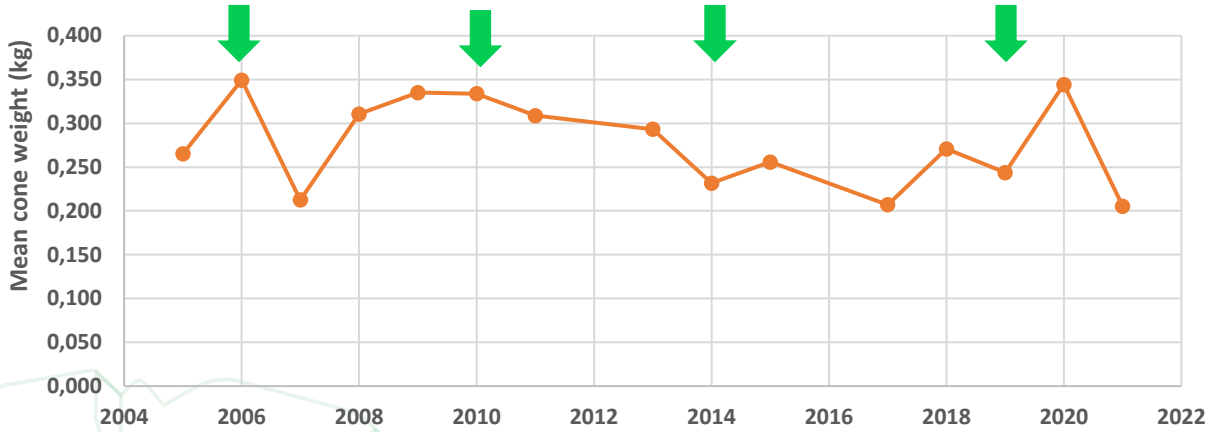
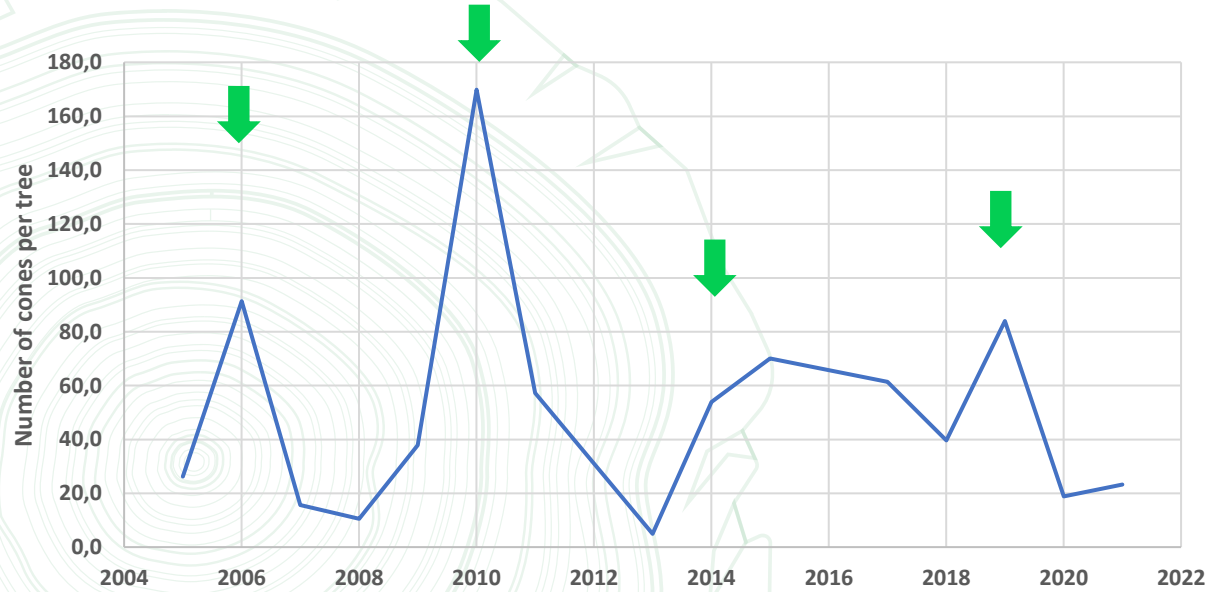
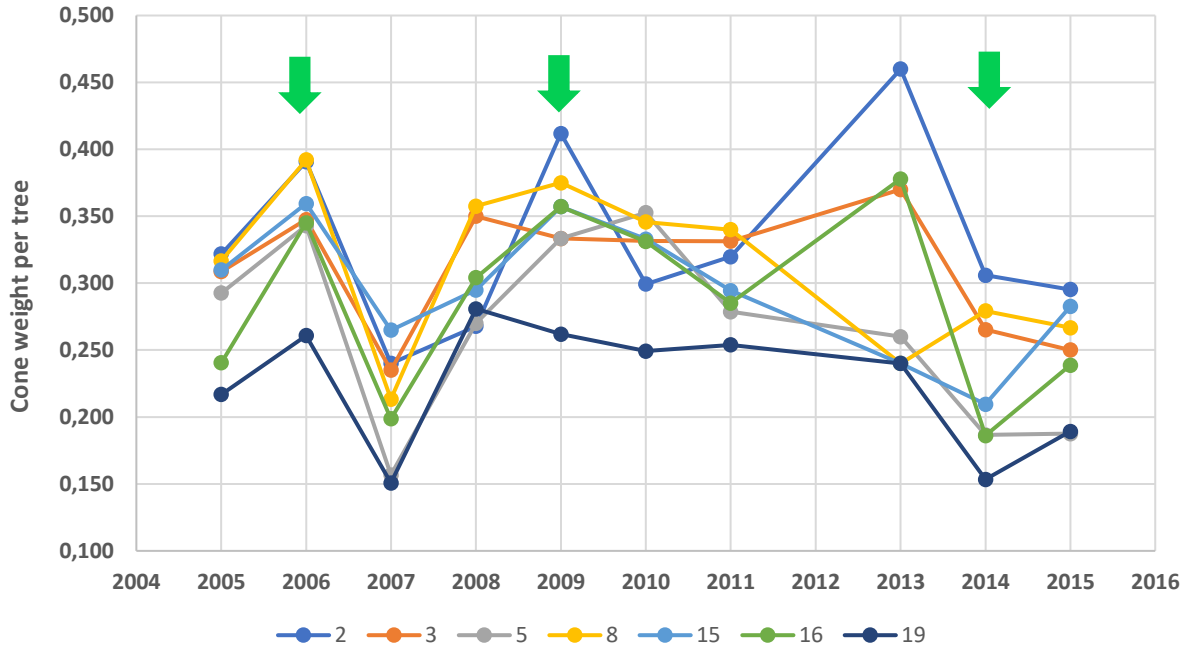
PLOT C

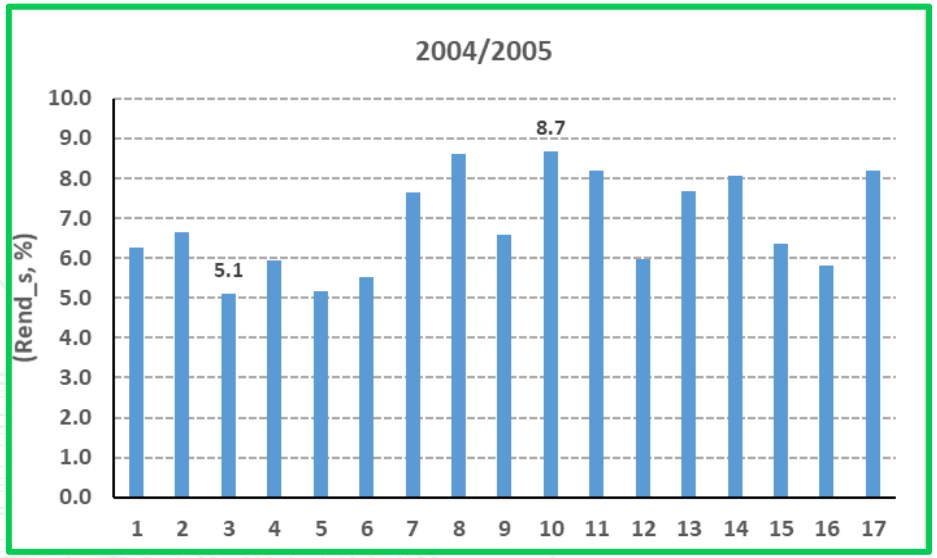




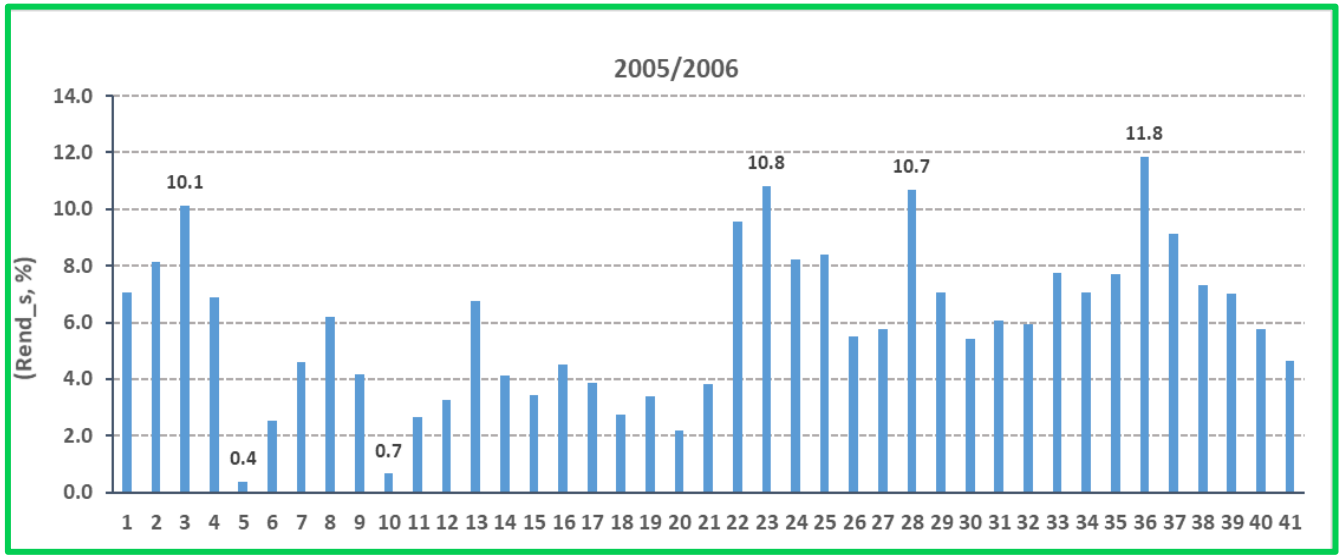
Mean cone weight per tree varied from 207g (2017) to 349g (2006)

Mean number of cones per tree varied from 5 (2013) to 170 (2010)





Plots



Plots

rend_s - Kernel yield

A number of priorities have been identified for further implementation:

- **Combine efforts to maintain a constant and regular assessment of permanent plots: pine cone production, pine nut yield, dendrometry variables, assessment of losses and damages, etc.**
- **Select and continuous monitor a set of plots representative of the different conditions in which stone pine is distributed in our country: ecological, stand structure, type of exploitation, etc.**
- **Validate existing production models or establish others better adjusted to the current time series**
- **Study genetic variability based on information collected in these plots, given the high variability observed among the different characteristics evaluated**
- **Extend this study to more provenance regions**

We would like to thank all the entities that contributed to data collection, ISA, ICNF, INIAV, Forest Producers Associations: APFC, ANSUB, AFLOSOR, ACHAR, forest owners and to all the colleagues involved.

A special thank to Abel Rodrigues, João Freire, Luís Fontes, Margarida Tomé, João Silva, Paula Soares

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