



iufro2019

Curitiba • Brazil

SEPT 29 - OCT 5



INSTITUTO
SUPERIOR DE
AGRONOMIA
Universidade de Lisboa



ForChange
Forest Ecosystem Management Under Global Change

<http://www.isa.ulisboa.pt/cef/forchange/>



CEF
Centro
de Estudos
Florestais

Mapping cork caliper in Portugal using percentile regression

Joana Paulo*, Paulo Firmino, Sónia Faias, Margarida Tomé

Acknowledgements

FCT (SFRH/BPD/96475/2013; SFRH/BD/133598/2017;
UID/AGR/00239/2019)

* joanaap@isa.ulisboa.pt

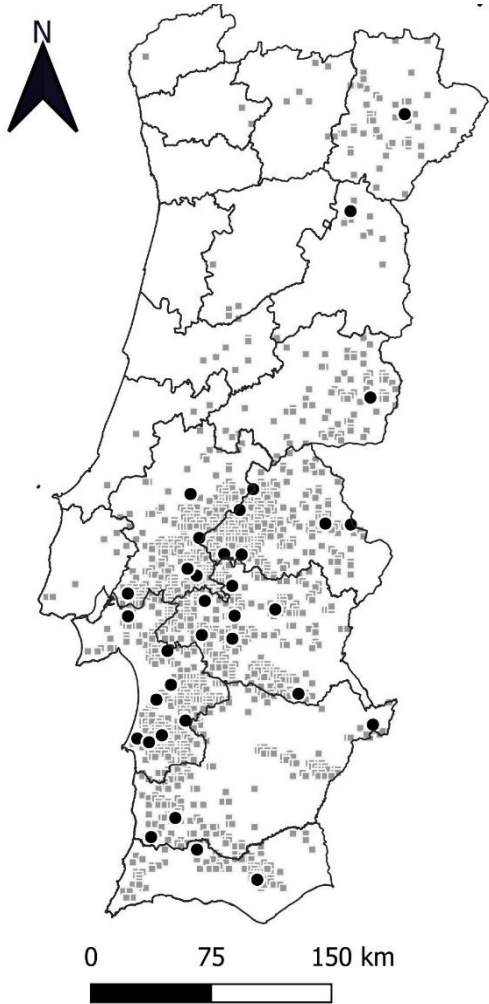
<https://fenix.isa.ulisboa.pt/qubEdu/homepage/isa114126/>

Context



- Cork oak (Mediterranean basin distribution)
- NWFP: cork
- Minimum period between cork extraction: 9 years
- Diversity of products (cork stoppers are the main one)

Context



Context

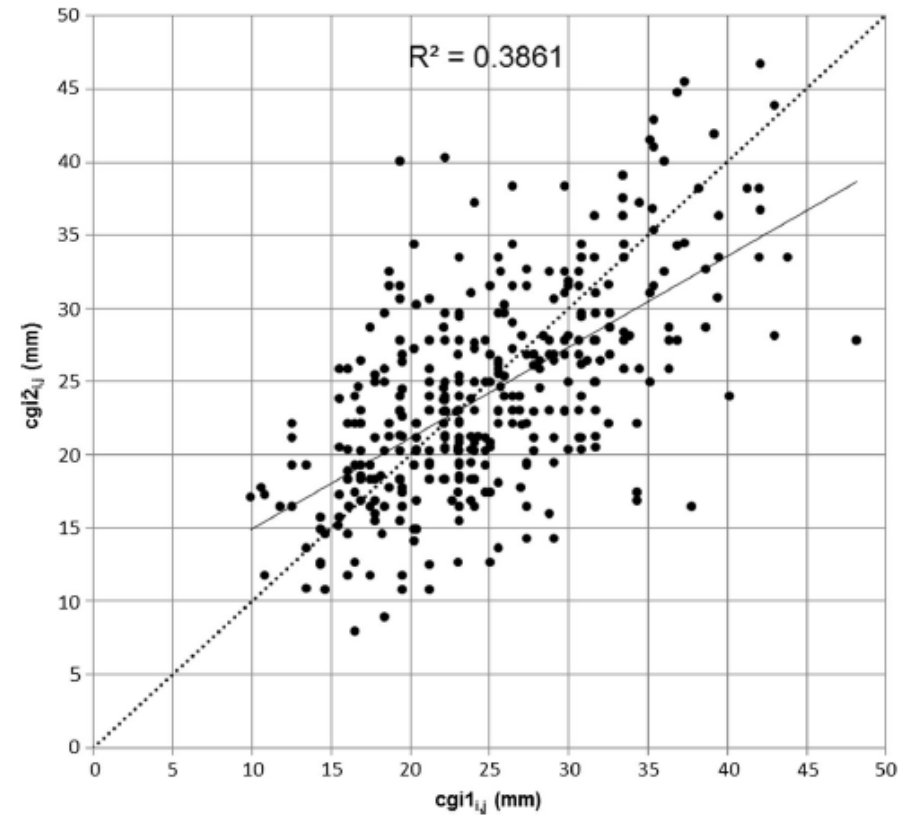
Climate effect!

Table 4 Correlation coefficients between the plot random effects (u_j) and tree, stand, management and precipitation explanatory variables

| Variable | Pearson's correlation coefficients | p Value |
|------------------------------------|------------------------------------|----------|
| $du_{i,j}$ | -0.0357 | 0.4941 |
| $ht_{i,j}$ | -0.1357 | 0.009** |
| $hdv_{i,j}$ | -0.0663 | 0.2032 |
| $hdtot_{i,j}$ | -0.0488 | 0.3563 |
| $nbru_{i,j}$ | -0.0380 | 0.4665 |
| $dcoef_{i,j}$ | -0.0983 | 0.0629 |
| N_j | -0.0836 | 0.1083 |
| Gu_j | 0.1442 | 0.0055** |
| dug_j | 0.1893 | 0.0003** |
| $PNovJun_{j,2} - P_{NovJun_{j,1}}$ | 0.2939 | <.0001** |
| $P_{j,2} - P_{j,1}$ | 0.2793 | <.0001** |

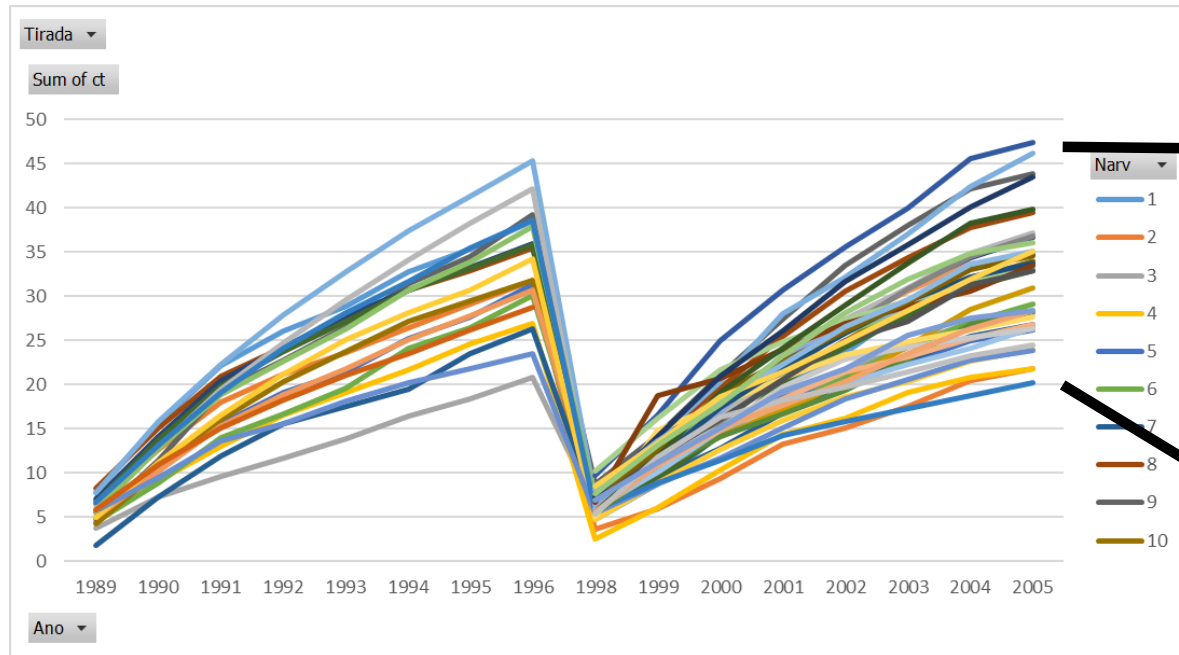
Fig. 4 Plot of cork growth index for the 1st and 2nd cork growth periods, respectively $cgi1_{ij}$ and $cgi2_{ij}$, showing the cgi evolution between two consecutive cork growth periods at tree level ($n = 370$ trees)

Individual tree effect!



Research question

Are climate conditions (and other factors) affecting all trees in the same way?



Methodology

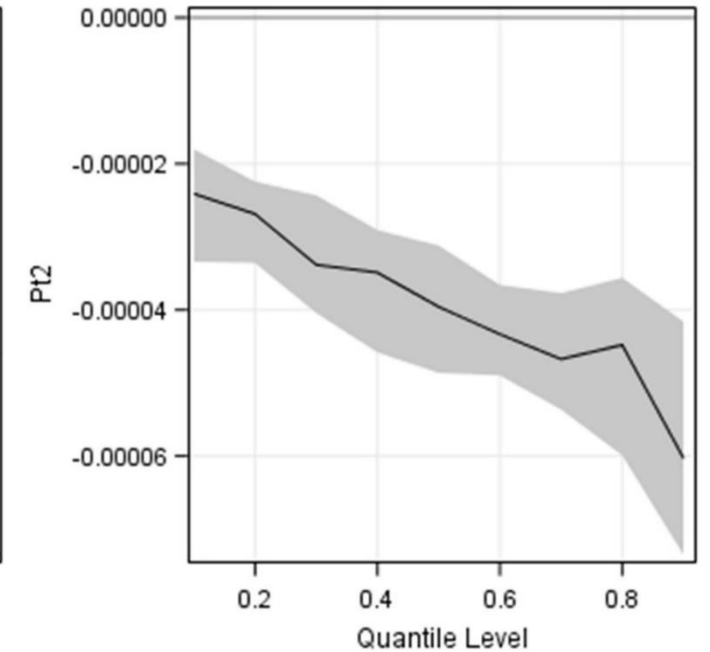
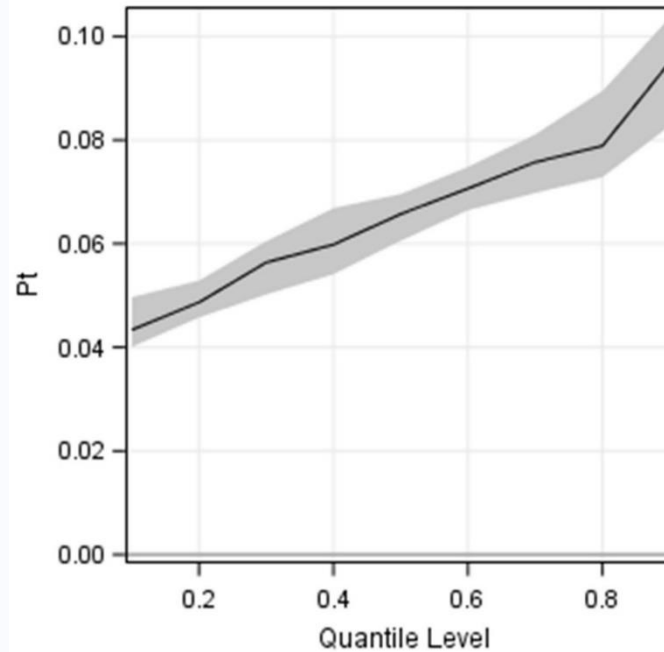
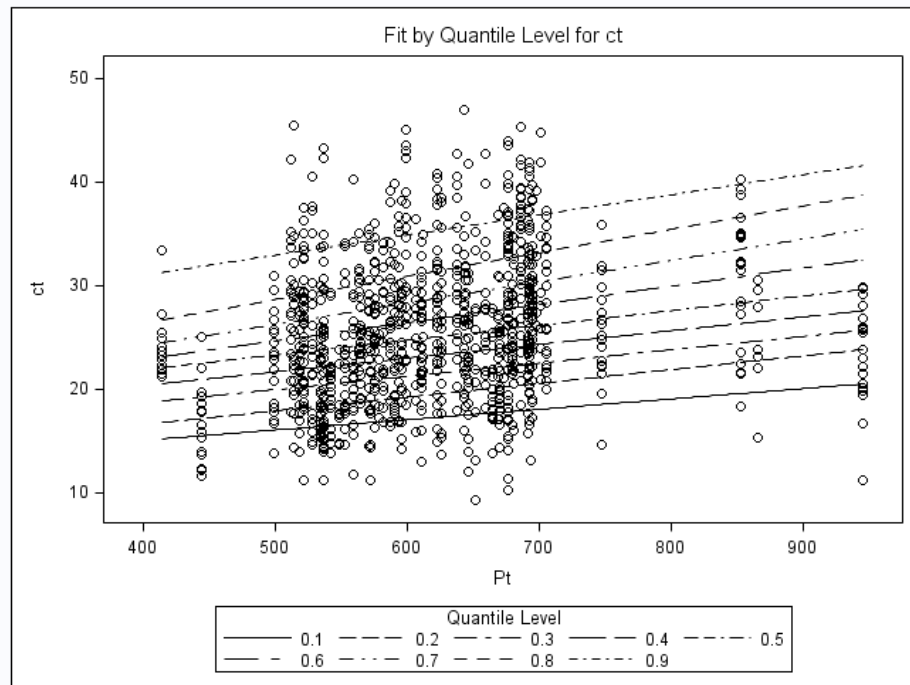
- The complex interactions existing between the variables considered are difficult to account for using more frequent statistical approaches (e.g. ordinary least squares regression).
- Quantile regression, instead, aims at the estimation of the conditional mean of the response variable given certain values of the predictor variables, focus at estimating different quantiles of the response variable.

$$Q_{\tau}(y_i) = \beta_0(\tau) + \beta_1(\tau)x_{i1} + \dots + \beta_p(\tau)x_{ip}, (i = 1, \dots, n)$$

where y_i is the i observation of the response variable c_{gi} , Q_{τ} is the quantile level τ , $\beta_0(\tau)$, $\beta_1(\tau)$, ... $\beta_p(\tau)$ are the p quantile level τ model parameters, and x_{ip} are the p independent variables included in the model.

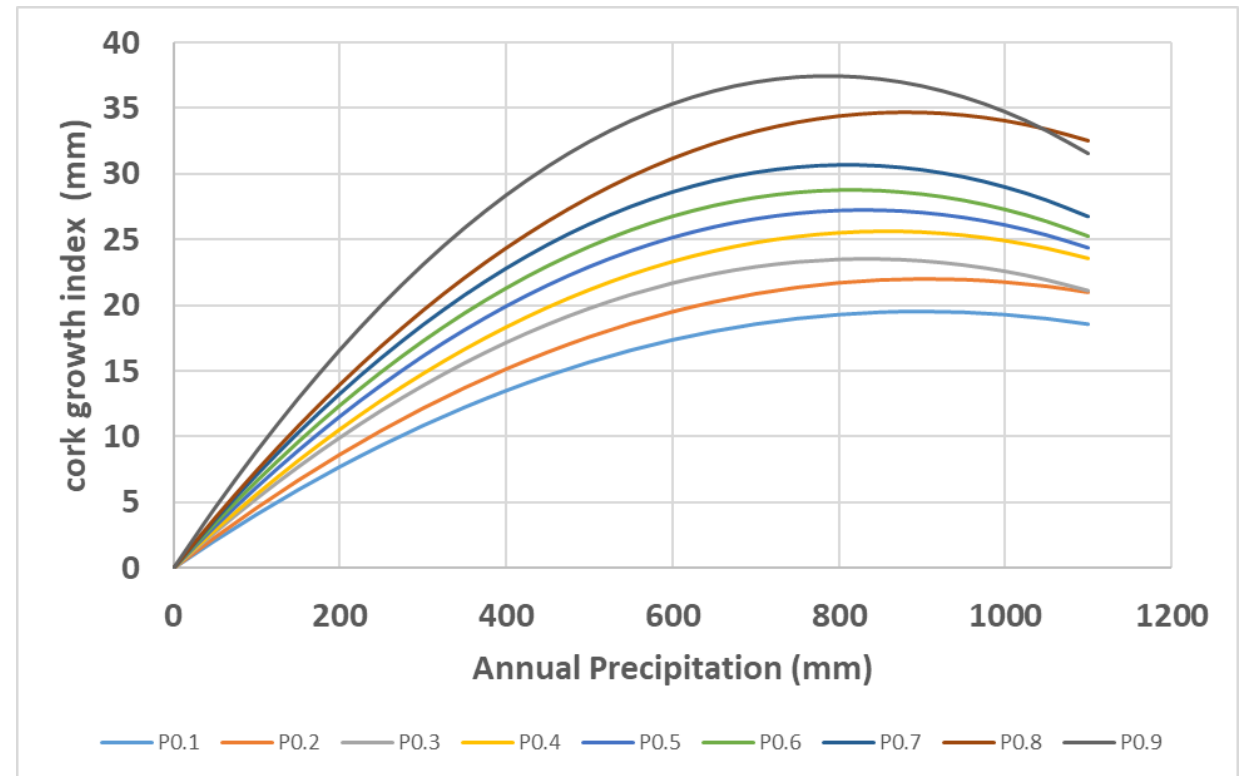
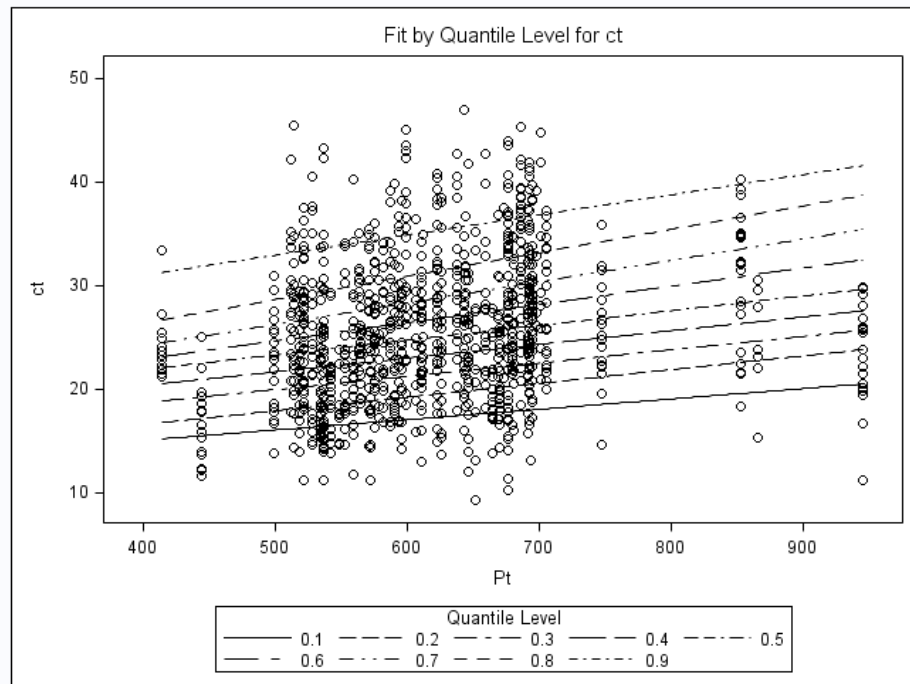
Results and discussion

Total annual precipitation (Pt)



Results and discussion

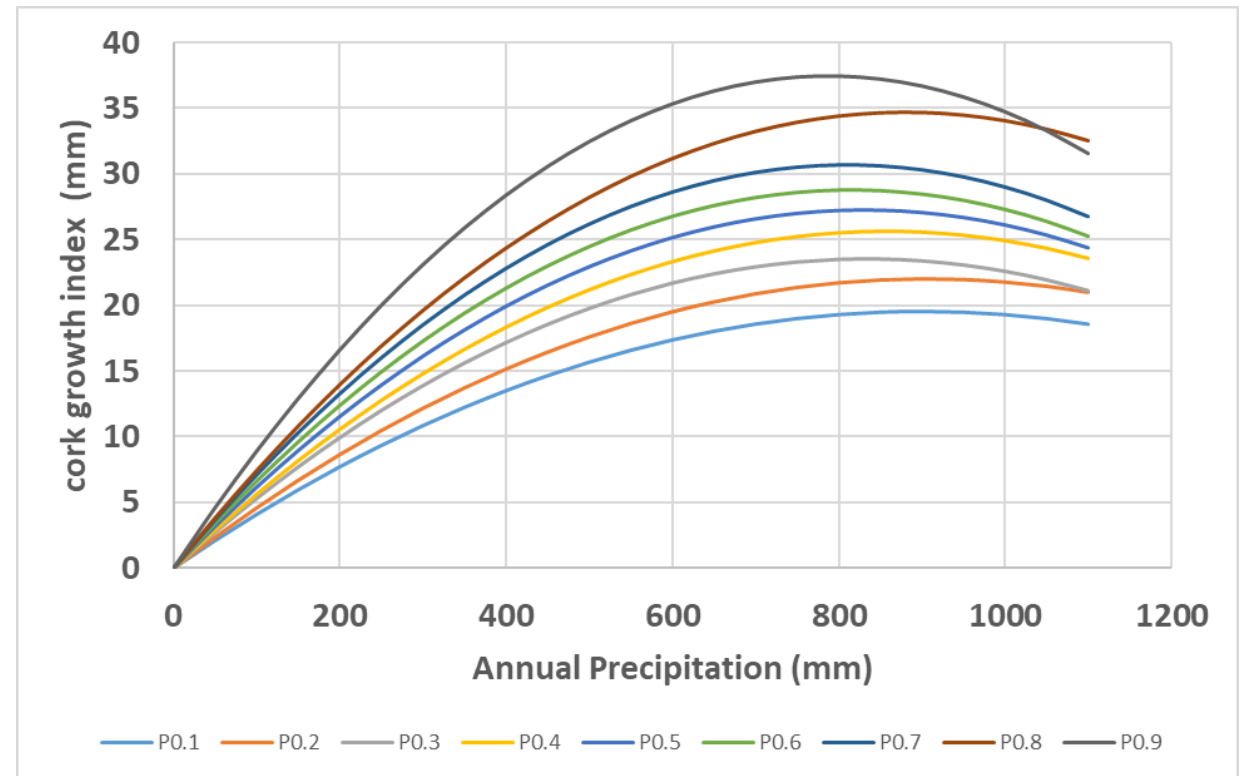
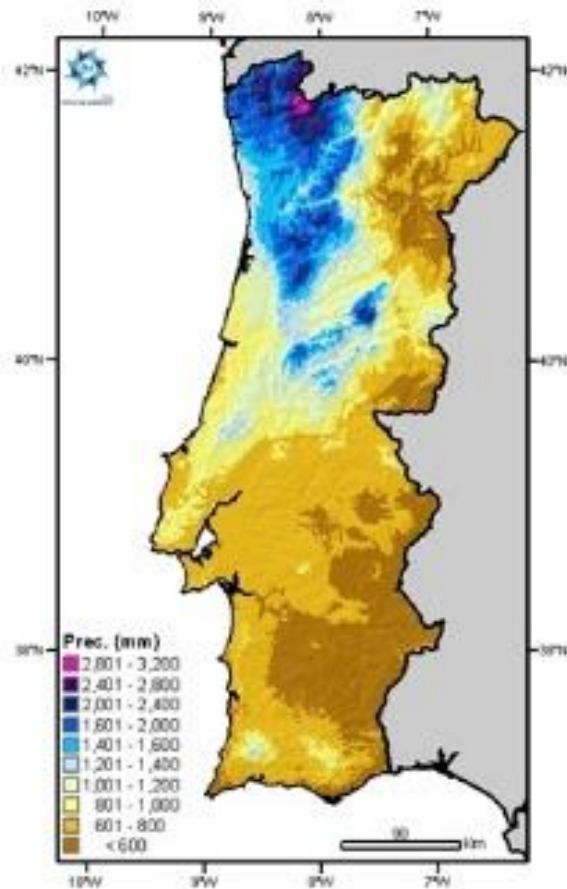
Total annual precipitation (Pt)



Max. cgi between 788 and 900 mm

Results and discussion

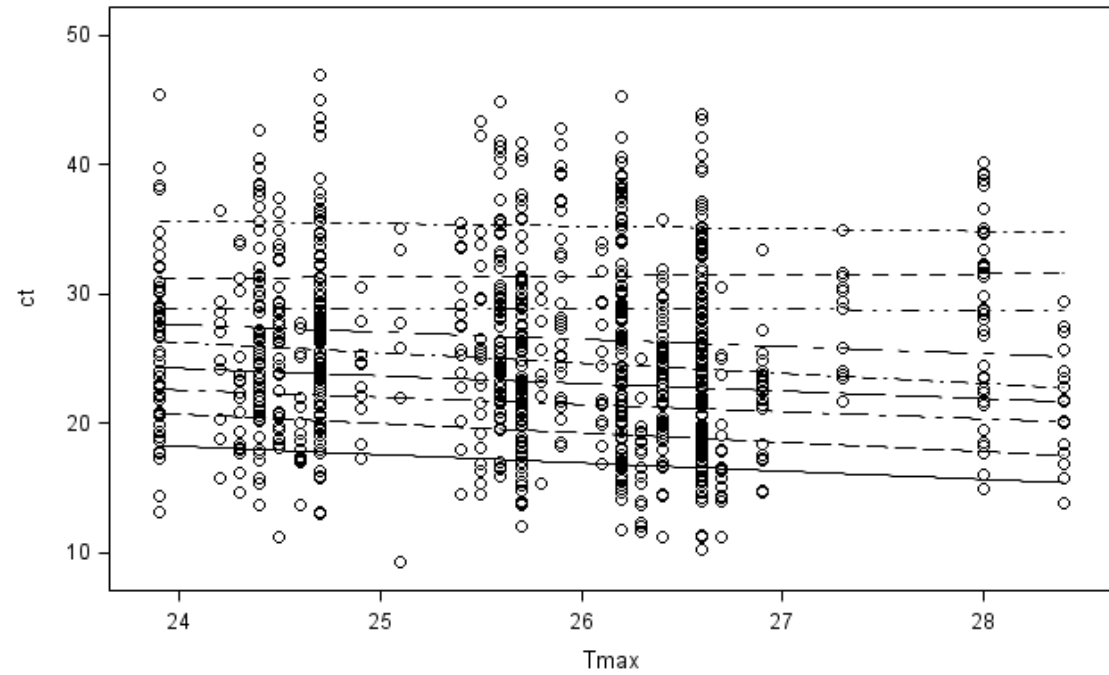
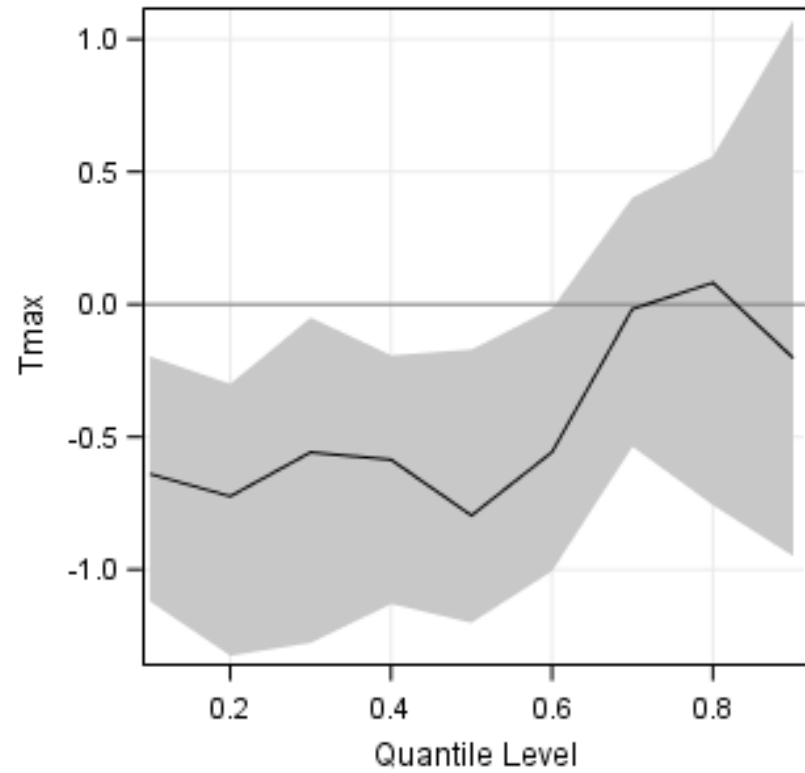
Total annual precipitation (Pt)



Max. cgi between 788 and 900 mm

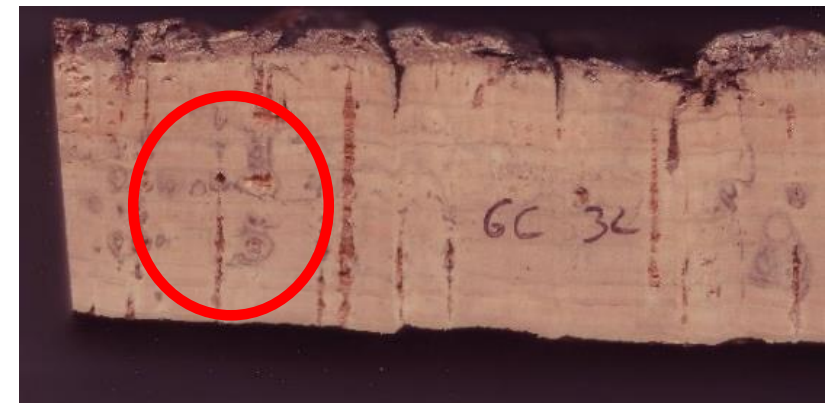
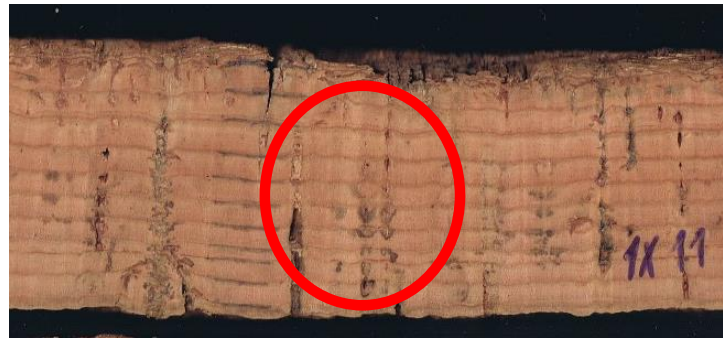
Results and discussion

Maximum temperature (Tmax)



Mapping the percentage of cork suitable for cork stopper

Threshold for cork caliper that allows the material to be used for cork stopper production: 30.7 mm to 46.1 mm.



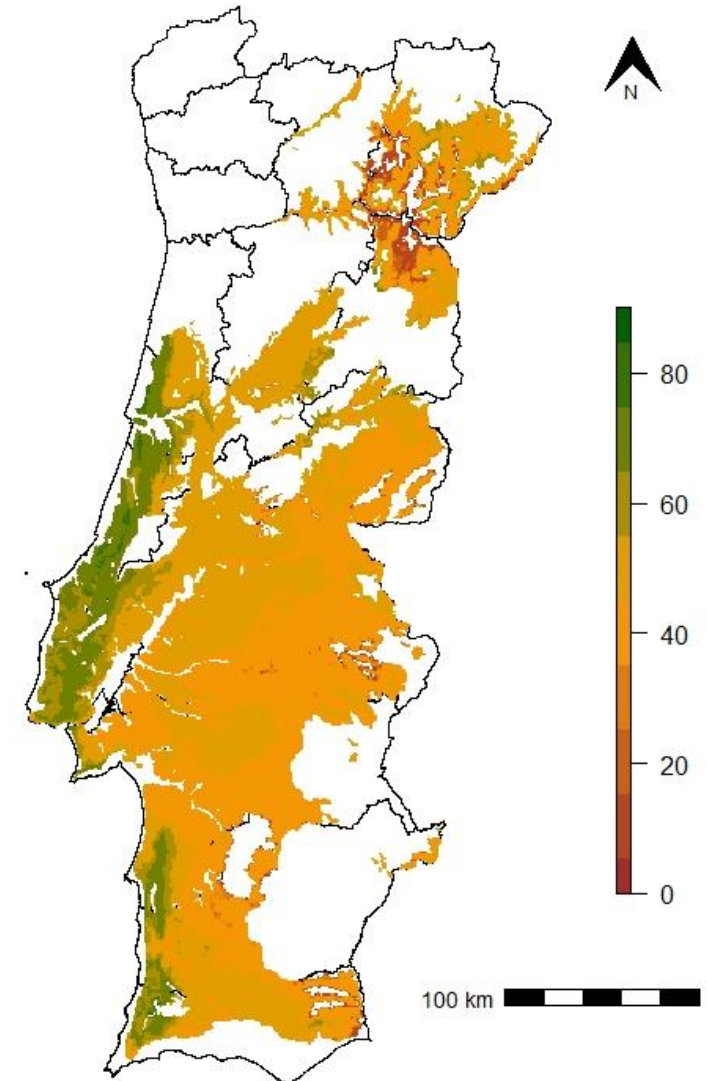
Mapping the percentage of cork suitable for cork stopper

Steps:

1. Establishment of a national 1x1 km² grid
2. Estimation of values for the 9 deciles of each point of the grid
3. Location, for each point of the grid, of the lower (Dl) and higher (Dh) decile, that equals the 30.7 mm and 46.1 mm values
4. Estimation of the percentage of cork production that is suitable for cork stopper production: $PR_{\text{rollable}} = Dh - Dl$

Mapping the percentage of cork suitable for cork stopper

- Map made with precipitation and temperature values from the 30 years average (1971 – 2000)
- Large variation of values: 20% to 60%
- Higher values in coastal areas
- In accordance to the map for site index distribution from the species
- Limitation: soil info missing (**next step**)





iufro2019

Curitiba • Brazil

SEPT 29 - OCT 5



INSTITUTO
SUPERIOR DE
AGRONOMIA
Universidade de Lisboa



ForChange
Forest Ecosystem Management Under Global Change

<http://www.isa.ulisboa.pt/cef/forchange/>



cef
Centro
de Estudos
Florestais

Mapping cork caliper in Portugal using percentile regression

Joana Paulo*, Paulo Firmino, Sónia Faias, Margarida Tomé

Thank you!