



**THE PRESENCE OF *QUERCUS*  
*ESTREMADURENSIS* O. SCHWARZ IN  
IBERIAN PENINSULA - SYNTAXONOMIC  
AND BIOGEOGRAPHIC ANALYSIS**

**Carlos Martins Vila-Viçosa**

Vila-Viçosa C., Lomba A. Almeida R., Mendes P., Pinto-Gomes C., Meireles C., Mohedano R., Vázquez FM.

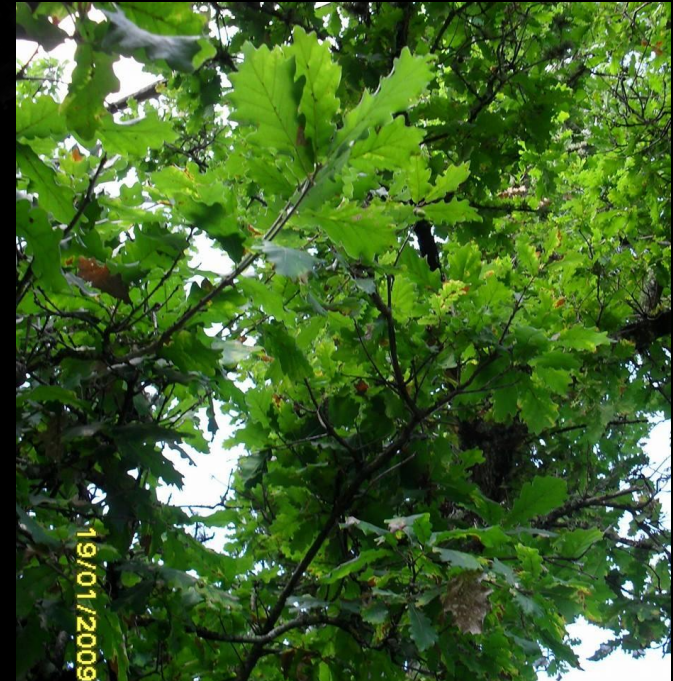


**Riaño**



## | INDEX

- Background (Syntaxonomic and Taxonomic surveys)
  - Field work
  - Herbaria and classic bibliography research
- Problematics (Taxonomic and Syntaxonomic affiliation)
- Species Distribution Model
- Scientific questions? Proposals?
- Discussion
- Final considerations



## INTRODUCTION

Fagaceae

*Quercus robur* subsp. *estremadurensis* (O. Schwarz) A. Camus

*Quercus estremadurensis* O.Schwarz, Notizbl. Bot. Gart. Berlin-Dahlem 12: 463. (1935)  
(lectotype: In JE n.v.; isotype: P06857428! )

Synonyms: =*Quercus robur* subsp. *estremadurensis* (O.Schwarz) A.Camus, Chênes, Atlas 2: 50 (1935); =*Quercus robur* var. *conimbricensis* A.Camus, Bull. Soc. Bot. France, 81: 815 (1934) (lectotype: P06857428!) =*Quercus racemosa* Brot., Fl. Lusit. 2: 31 (1804) (P06856882!) non Lamarck, Encycl. [J. Lamarck & al.] 1(2): 715 (1785)



Semi-deciduous (Marcescent) to evergreen





## INTRODUCTION

*Quercus robur* subsp. *estremadurensis* (O. Schwarz) A. Camus

Marcescent tree,

Anfractuans branches.

Irregular (rhomboidal) sclerophilous leaves,

Lobate (acute lobes),





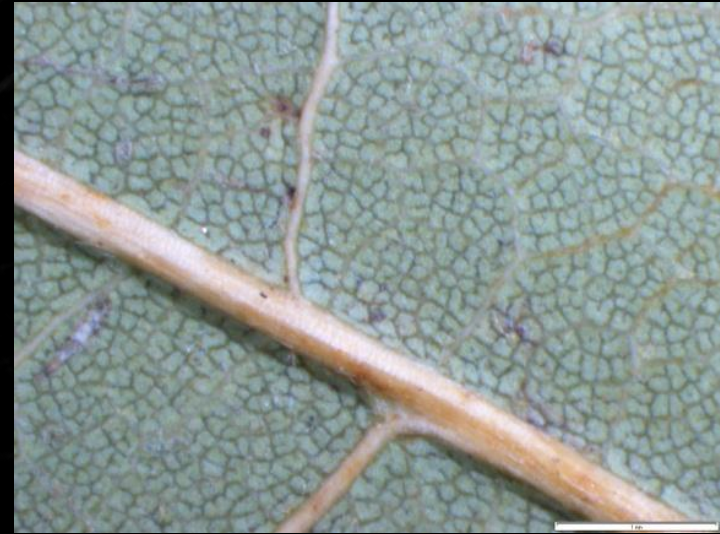
## INTRODUCTION

*Quercus robur* subsp. *estremadurensis* (O. Schwarz) A. Camus

Intercalary veins and very short petiole (almost null).

Adaxial surface glabrous and abaxial surface glabrous to glabrescent, sometimes with stellate trichomes, or simple, dispersed mainly in midrib and less times in secondary veins.

Pedunculate fruits





## INTRODUCTION

*Quercus robur* subsp. *estremadurensis* (O. Schwarz) A. Camus

Intercalary veins and very short petiole (almost null).

Adaxial surface glabrous and abaxial surface glabrous to glabrescent, sometimes with stellate trichomes, or simple, dispersed mainly in midrib and less times in secondary veins.

Pedunculate fruits





## INTRODUCTION

*Quercus robur* subsp. *estremadurensis* (O.Schwarz) A.Camus

*Quercus estremadurensis* O.Schwarz

Schwarz, O. 1935, *Einige neue Eichen des Mediterransgebiet und Vorderasien* Notizbl. Bot. Gart. Berlin-Dahlem 12: 463.

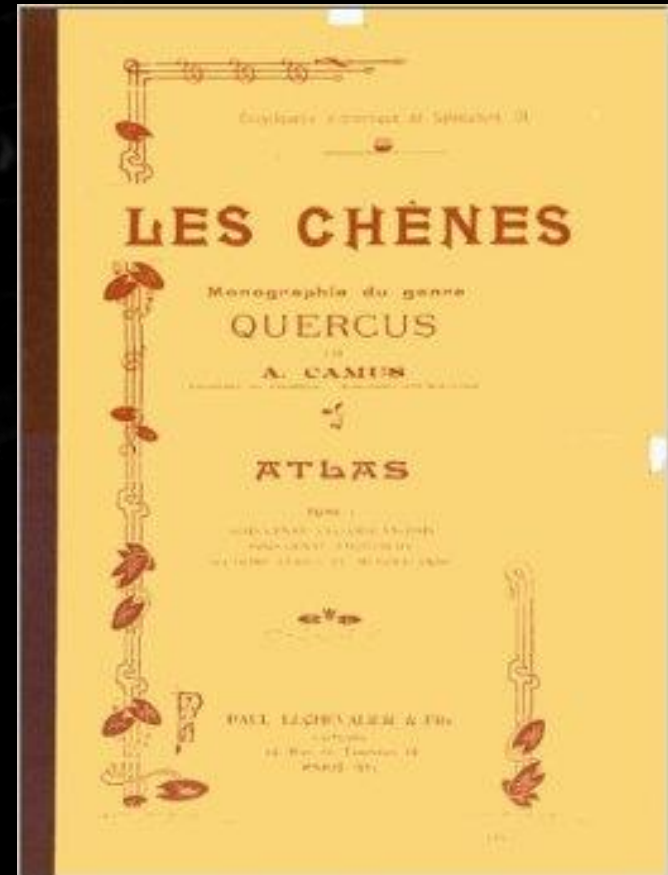
### *Quercus estremadurensis* Schwz.

Uma árvore rara, como o *Q. canariensis*, e até agora só conhecida de Portugal. Observou-se esta espécie em Gou-

*Árvores de Portugal*

147

veia, Bussaco, Coimbra e Sintra, sendo os exemplares desta última localidade muito bonitos. Não se sabe absolutamente nada sobre o seu porte, crescimento, madeira, etc. O seu estudo deve ser de tão grande interesse florestal como botânico. Distingue-se facilmente do *Quercus Robur* pelas fôlhas muito menos sinuosas e com muito mais lóbulos (mais de 8 em geral) e pelo número elevado de nervuras secundárias (9 ou mais de cada lado).



Rothmaler, W. 1941, *As Árvores de Portugal*. Bol. Soc. Broteriana. 15. 133-148.

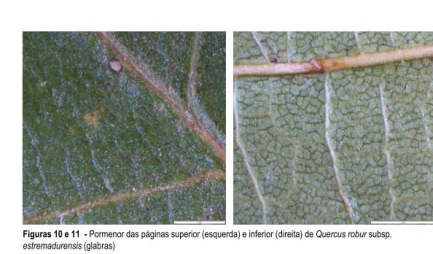
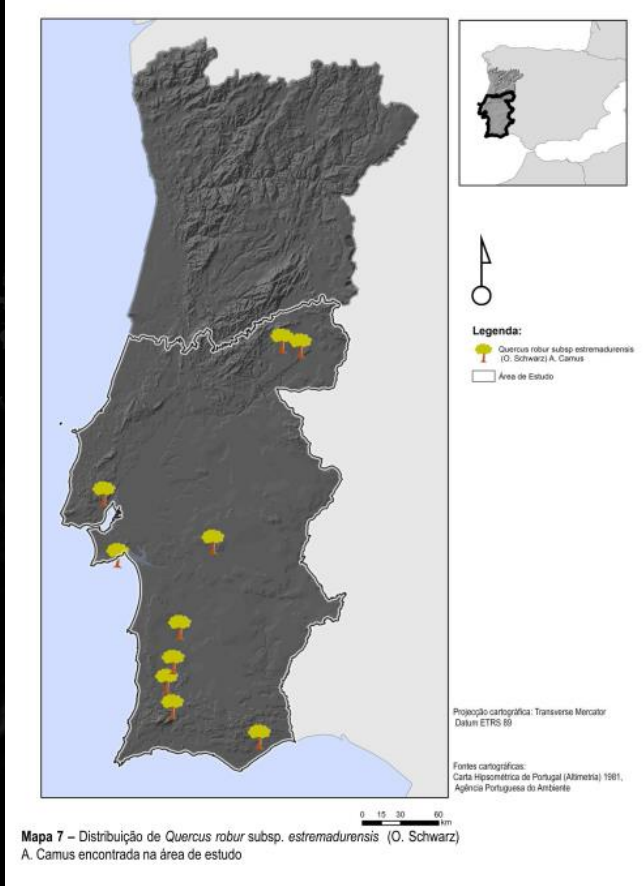


# INTRODUCTION

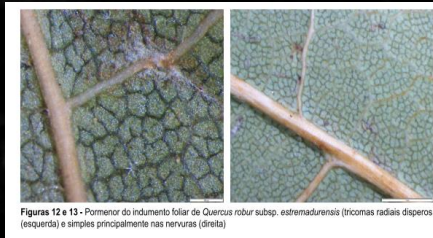
*Quercus robur* subsp. *estremadurensis* (O. Schwarz)  
A. Camus



Figura 7 - Pormenor da folha de *Quercus robur* subsp. *estremadurensis* (Lobos agudos)



Figuras 10 e 11 - Pormenor das páginas superior (esquerda) e inferior (direita) de *Quercus robur* subsp. *estremadurensis* (glandulas)



Figuras 12 e 13 - Pormenor do indumento foliar de *Quercus robur* subsp. *estremadurensis* (trichomas radiais dispersos (esquerda) e simples principalmente nas nervuras (direita))

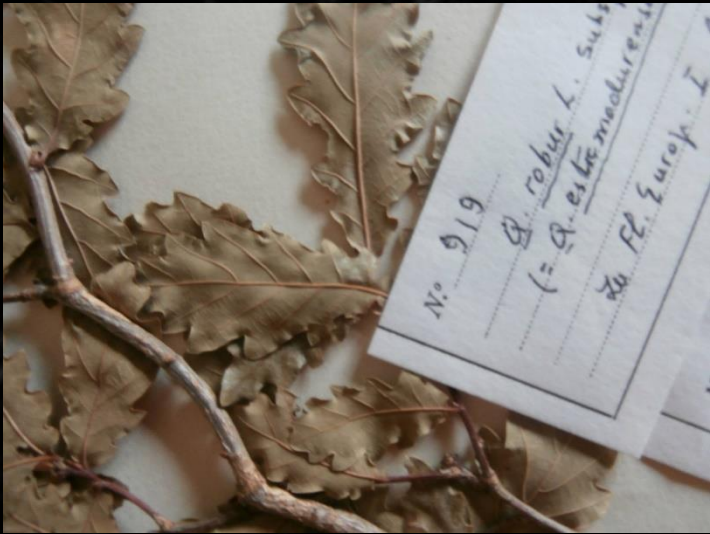


Figura 8 - Pormenor da folha de *Quercus robur* subsp. *estremadurensis* (Pecíolo curto, quase nulo)



# INTRODUCTION

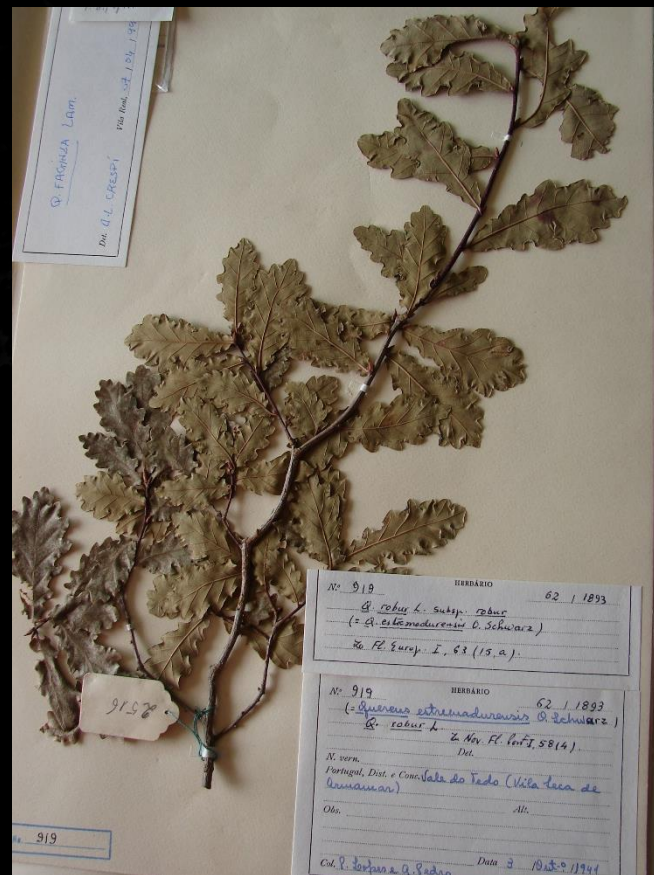
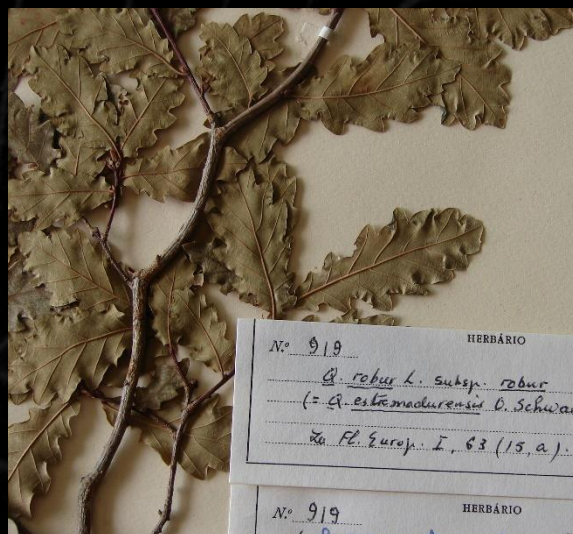
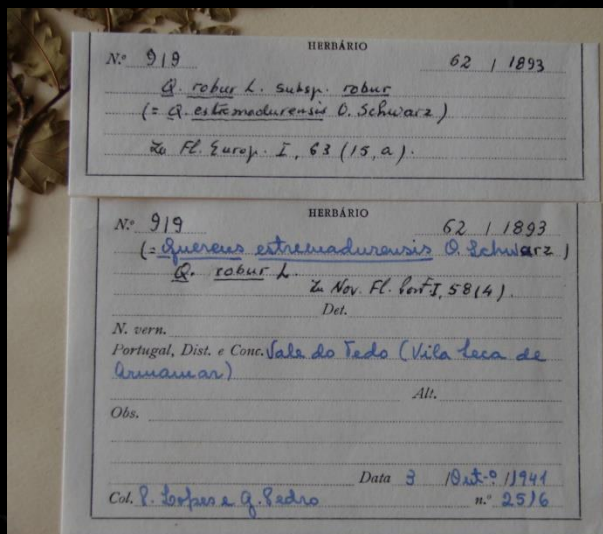
*Quercus robur* subsp. *estremadurensis* (O. Schwarz) A. Camus





# INTRODUCTION

*Quercus robur* subsp. *estremadurensis* (O. Schwarz) A. Camus





## | INTRODUCTION

*Quercus* × *ferreirae* A.Camus (*Q. estremadurensis* < *Q. faginea*)



*Quercus* × *molleri* A.Camus (*Q. estremadurensis* > *Q. faginea*)





*Quercus robur* subsp. *estremadurensis* (O. Schwarz) A. Camus

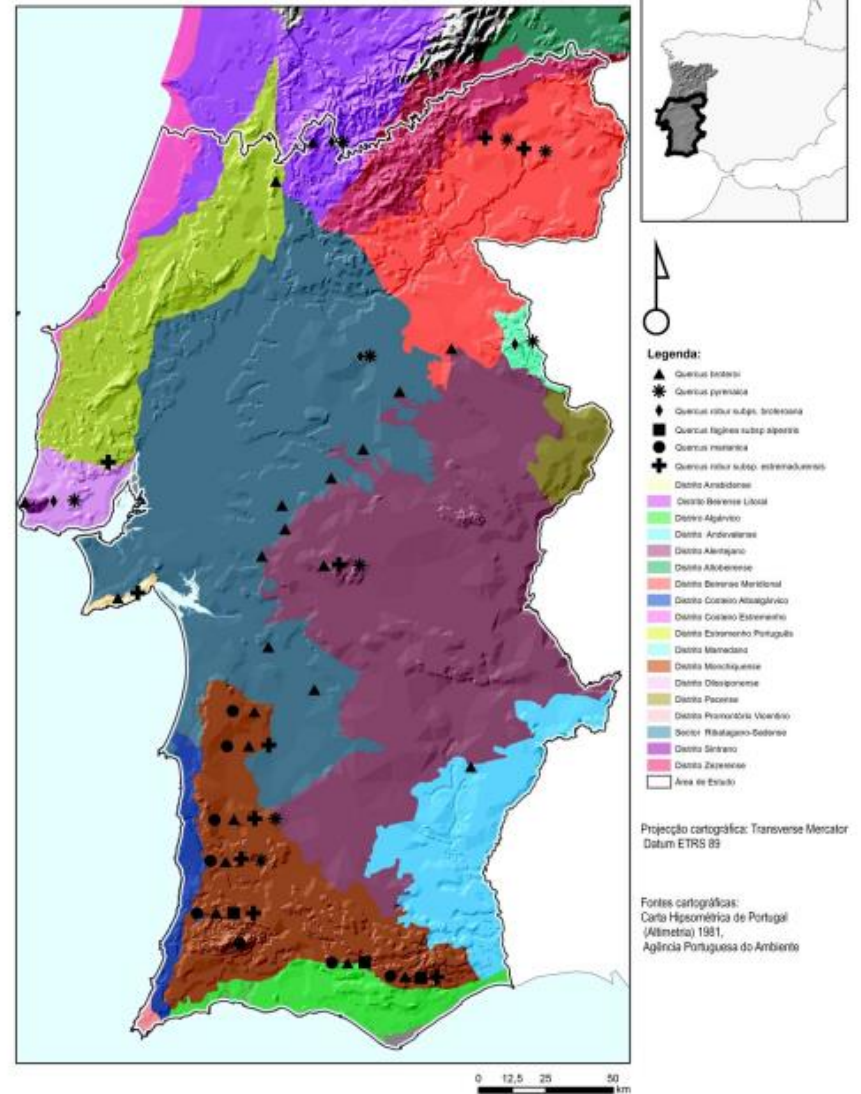
Mediterranean Douro





## INTRODUCTION

- Field Work
  - Initially Southwestern Portugal (2005)
- Mature stages (Holarctic Kingdom)
- Characteristic from typically Sub-Mediterranean ecotones (Temperate vs Mediterranean)
- Related to specific edapho-climatic envelopes



Mapa 5 – Relação biogeográfica encontrada entre táxones



## | INTRODUCTION / OBSERVATION

### Monchiquense District

Hyper-humid and hyperoceanic bioclimatic belt above sienitic batholith (>700 m)

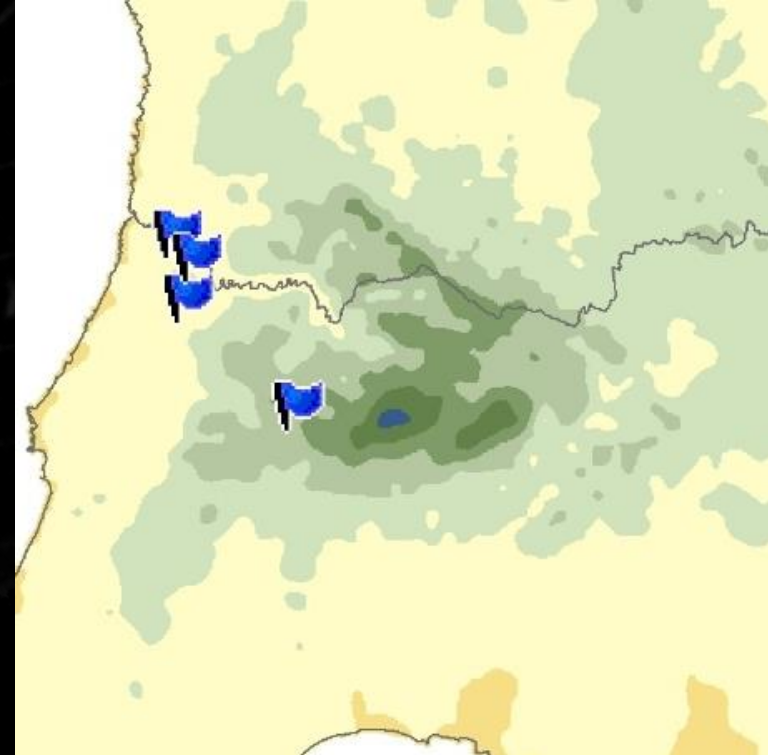
### *Campanulo primulifoliae-Rhododendretum pontici*

Vila-Viçosa, J.C. Costa, Quinto-Canas & Pinto-Gomes fringes  
(*Quercetum roboris* s.l.) (*Arbuto-Laurion* + *Ilex aquifolium*, *Myrica faia*)

*Quercus estremadurensis* and *Campanula primulifoliae* community (Vila-Viçosa, 2012)

Climatophilous?? (facing *Euphorbio-Quercetum canariensis*)

*Cisto crispi-Ulicetum minoris*



Adapted from Monteiro-Henriques (2010)



## | INTRODUCTION / OBSERVATION

- Monchiquense District
- *Campanulo alatae-Quercetum estremadurensis* ass. nova. hoc loco (Vila-Viçosa, 2012)
- Climatophilous??? (facing *Euphorbio-Quercetum canariensis*)
- Hyper-humid and hyperoceanic bioclimatic belt above sienitic batholith (>700 m)
- *Campanulo alatae-Rhododendretum pontici* Vila-Viçosa, J.C. Costa, Quinto-Canas & Pinto-Gomes fringes (*Quercetum roboris* s.l.) (*Arbuto-Laurion* + *Ilex aquifolium*, *Myrica faia*)
- *Cisto crispi-Ulicetum minoris*





Adapted from Monteiro-Henriques (2010)

## | INTRODUCTION / OBSERVATION

### Monchiquense District

*Quercus estremadurensis* and *Campanula primulifoliae* community (Vila-Viçosa, 2012)

Climatophilous??? (facing *Euphorbio-Quercetum canariensis*)

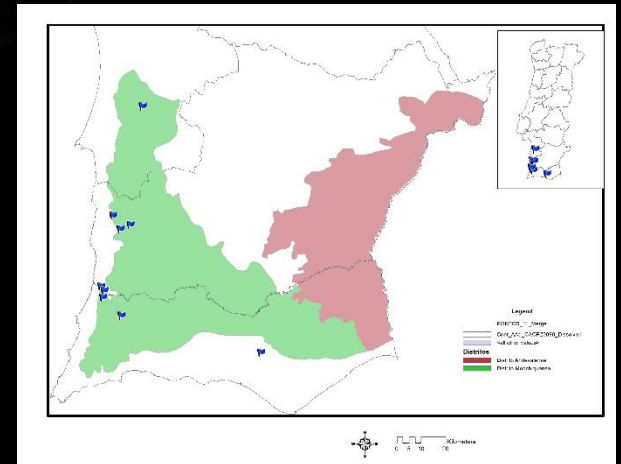
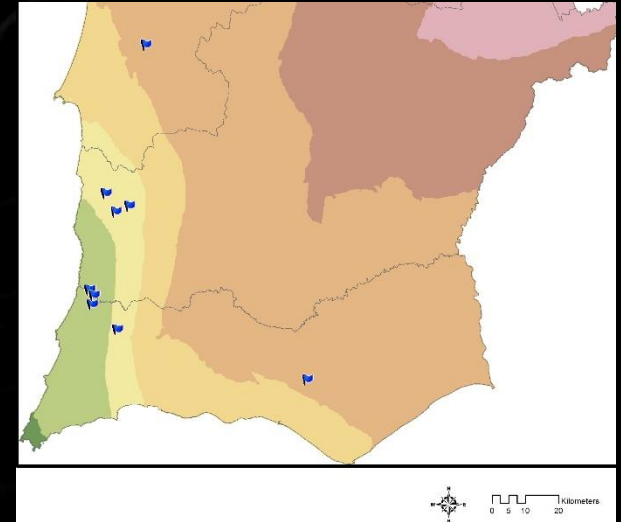
Hyper-humid and hyperoceanic bioclimatic belt above sienitic batholith (>700 m)

*Campanulo primulifoliae-Rhododendretum pontici*

Vila-Viçosa, J.C. Costa, Quinto-Canas & Pinto-Gomes fringes

(*Quercetum roboris* s.l.) (*Arbuto-Laurion* + *Ilex aquifolium*, *Myrica faia*)

• *Cisto crispi-Ulicetum minoris*



Adapted from Mendes et. al. inéd.

## | INTRODUCTION / OBSERVATION

**Monchiquense District (Vila-Viçosa, 2012)**

*Temporihygrophilous* facing *Avenello strictae*-  
*Quercetum marianicae*,

Upper sub-humid to humid or dry hyperoceanic  
bioclimatic belts from schistose soils

*Pruno-Rubion ulmifolii*





## | INTRODUCTION / OBSERVATION

**Monchiquense District (Vila-Viçosa, 2012)**

**Temporihygrophilous facing *Avenello strictae*-  
*Quercetum marianicae*,**

Upper sub-humid to humid or dry hyperoceanic  
bioclimatic belts from schistose soils

***Pruno-Rubion ulmifolii* fringe**





## | INTRODUCTION / OBSERVATION

Monchiquense District (Vila-Viçosa, 2012)





## | INTRODUCTION / OBSERVATION

- Monchiquense District (Vila-Viçosa, 2012)





## | INTRODUCTION / OBSERVATION

- Monchiquense District (Vila-Viçosa, 2012)





Phytosociological approach (Braun-Blanquet 1979; Géhu & Rivas-Martínez 1981), Rivas-Martínez (2005), Géhu (2006), Biondi (2011)

The red oak groves of Mirbeck's oak in Southern Iberia 7

Table II. *Quercus strictae* - *Quercetum maritanicae* ass nova hoc loco (*Quercetum rivamaritima*-*iberici*, *Quercion iberoi*, *Quercetalia iberoi*, *Quercina iberoi*).

Redes number	4	5	7	3	6	11	2	1	10	Process
Aspect	N	NW	N	NE	NW	SW	NW	N	SW	
Area (m <sup>2</sup> )	600	500	500	600	400	300	600	400	200	
Slope (°)	15	20	30	20	25	35	20	15	25	
Cover (%)	100	100	100	100	100	100	100	100	100	
Maximum height (m)	13	15	12	15	13	12	12	12	13	
Altitude (m)	77	30	100	150	188	58	24	321	70	
Oridinal number	1	2	3	4	5	6	7	8	9	
Association characteristics		4	4	2	3	4	3	4	3	V
<i>Quercus maritima</i>	+	+	+	+	+	+	+	+	+	V
<i>Aspidelia strictae</i> (ass. diff.)	+	+	+	+	+	+	+	+	+	V
<i>Quercus iberoi</i>	+	+	+	+	+	+	+	+	+	V
<i>Luzula foresti</i> subsp. <i>iberica</i>	+	+	+	+	+	+	+	+	+	V
<i>Quercus iberoi</i>	+	+	+	+	+	+	+	+	+	V
<i>Quercus iberoi</i> subsp. <i>extremadurensis</i> (ass. diff.)	+	+	+	+	+	+	+	+	+	III
<i>Quercus lusitana</i> (ass. diff.)	+	+	+	+	+	+	+	+	+	I
<i>Quercus pedunculata</i>	+	+	+	+	+	+	+	+	+	I
<i>Quercus rivamaritima</i> (ass. diff.)	+	+	+	+	+	+	+	+	+	I
Alliance and upper units characteristics		+	+	+	+	+	+	+	+	V
<i>Olea europaea</i> subsp. <i>europaea</i>	+	+	+	+	+	+	+	+	+	V
<i>Sonchus aspera</i> var. <i>altissima</i>	+	+	+	+	+	+	+	+	+	V
<i>Rubus fruticosus</i>	+	+	+	+	+	+	+	+	+	V
<i>Ruscus aculeatus</i>	+	+	+	+	+	+	+	+	+	V
<i>Pyrus boissiana</i>	+	+	+	+	+	+	+	+	+	III
<i>Carex distachya</i>	+	+	+	+	+	+	+	+	+	III
<i>Rhamnus alaternus</i>	+	+	+	+	+	+	+	+	+	III
<i>Asplenium ovifrons</i>	+	+	+	+	+	+	+	+	+	III
<i>Phytolacca</i> sp.	+	+	+	+	+	+	+	+	+	III
<i>Pinus</i> sp.	+	+	+	+	+	+	+	+	+	III
<i>Quercus xbetulica</i>	+	+	+	+	+	+	+	+	+	III
<i>Quercus ilex</i>	+	+	+	+	+	+	+	+	+	III
<i>Quercus ilex</i> subsp. <i>iberica</i>	+	+	+	+	+	+	+	+	+	III
<i>Daphne genkwa</i>	+	+	+	+	+	+	+	+	+	III
<i>Scrophularia hybridus</i>	+	+	+	+	+	+	+	+	+	III
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	+	+	+	+	+	+	III
<i>Lonicera implexa</i>	+	+	+	+	+	+	+	+	+	III
<i>Quercus subintegerrima</i>	+	+	+	+	+	+	+	+	+	III
<i>Phytolacca</i> sp.	+	+	+	+	+	+	+	+	+	III
<i>Arctostaphylos</i>	+	+	+	+	+	+	+	+	+	III
Companions		2	2	2	3	3	2	3	3	V
<i>Erica arborea</i>	+	+	+	+	+	+	+	+	+	V
<i>Dactylis hispanica</i> subsp. <i>lusitana</i>	+	+	+	+	+	+	+	+	+	IV
<i>Asphodelus tenuifolius</i>	+	+	+	+	+	+	+	+	+	IV
<i>Panicum aquilinum</i>	+	+	+	+	+	+	+	+	+	IV
<i>Quercus rivamaritima</i> 1	+	+	+	+	+	+	+	+	+	IV
<i>Phytolacca angustifolia</i>	+	+	+	+	+	+	+	+	+	IV
<i>Robinia pseudoacacia</i>	+	+	+	+	+	+	+	+	+	IV
<i>Lotus pedunculatus</i> subsp. <i>hispanica</i>	+	+	+	+	+	+	+	+	+	IV
<i>Baccharis pinnatifida</i>	+	+	+	+	+	+	+	+	+	III
<i>Larunchea stridii</i>	+	+	+	+	+	+	+	+	+	III
<i>Cistus monspeliensis</i> subsp. <i>ibericus</i>	+	+	+	+	+	+	+	+	+	III
<i>Thymus villosus</i>	+	+	+	+	+	+	+	+	+	III
<i>Heterosida</i>	+	+	+	+	+	+	+	+	+	III
<i>Pinus lusitana</i>	+	+	+	+	+	+	+	+	+	III
<i>Ulex minor</i> var. <i>lusitanicus</i>	+	+	+	+	+	+	+	+	+	III
<i>Cymus algeriensis</i>	+	+	+	+	+	+	+	+	+	III
<i>Bradybosum subulatum</i>	+	+	+	+	+	+	+	+	+	III
<i>Axon dactyloides</i> subsp. <i>neglectum</i>	+	+	+	+	+	+	+	+	+	III
<i>Erica australis</i>	+	+	+	+	+	+	+	+	+	III
<i>Lomatium tuberosum</i>	+	+	+	+	+	+	+	+	+	III
<i>Trachium scorodonia</i>	+	+	+	+	+	+	+	+	+	III
<i>Amorpha montana</i>	+	+	+	+	+	+	+	+	+	III
<i>Galium verum</i>	+	+	+	+	+	+	+	+	+	III
<i>Digitalis thapsus</i>	+	+	+	+	+	+	+	+	+	III
<i>Platanus purpurea</i>	+	+	+	+	+	+	+	+	+	III

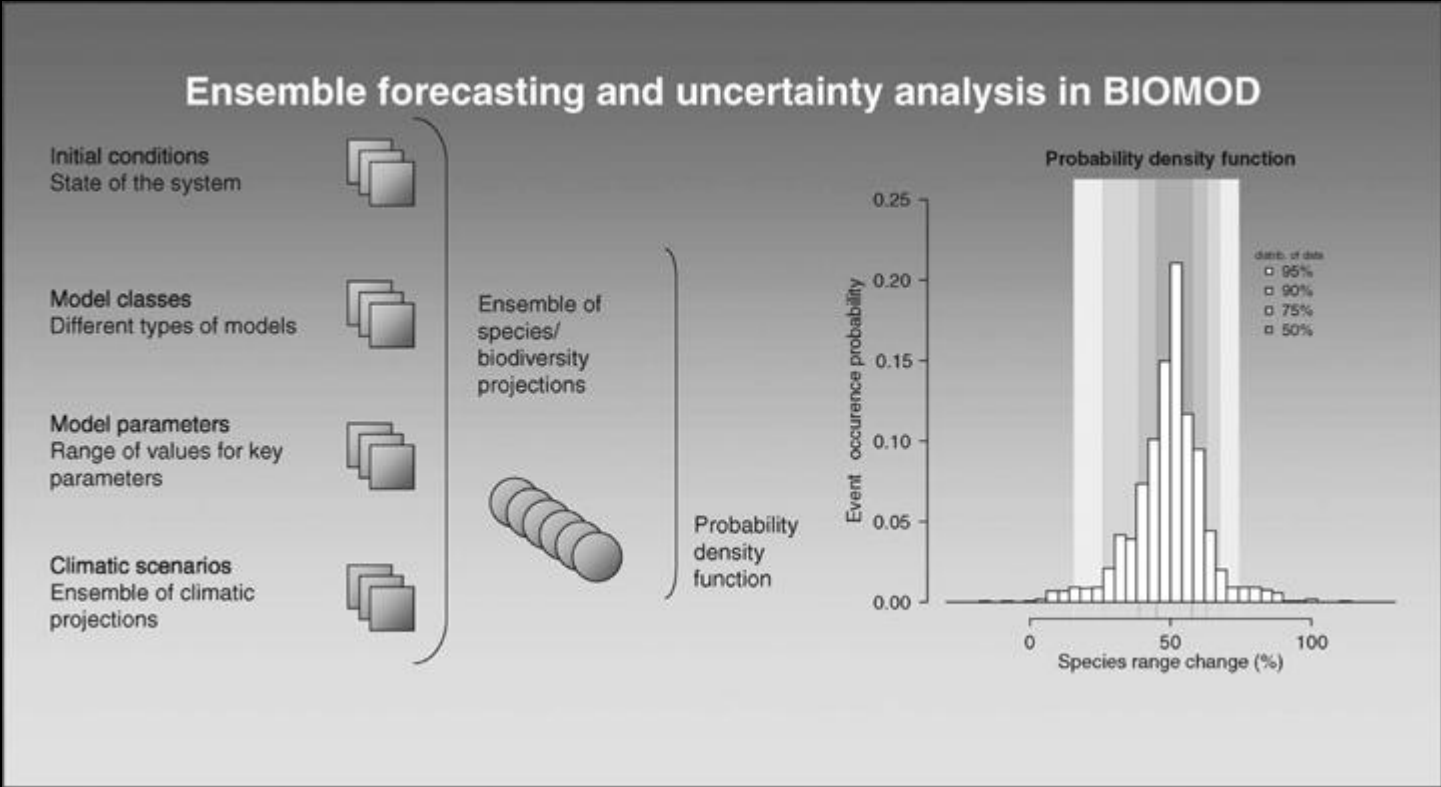
Table III. Synoptic table of Mirbeck's oak formations.

Association characteristics and differentials	A	D	B	C
Number of relevés	9	6	17	38
<i>Quercus maritima</i>	V	IV	V	-
<i>Quercus iberoi</i>	V	I	III	II
<i>Quercus ilex</i>	V	IV	III	III
<i>Luzula foresti</i> subsp. <i>iberica</i>	V	IV	III	III
<i>Aspidelia strictae</i>	V	V	-	-
<i>Quercus iberoi</i> subsp. <i>extremadurensis</i>	II	-	-	-
<i>Quercus lusitana</i>	+	-	-	-
<i>Quercus rivamaritima</i>	+	-	-	-
<i>Quercus pedunculata</i>	I	II	-	-
<i>Trachium scorodonia</i>	I	-	-	-
<i>Adiantum platyneuron</i>	+	-	-	-
<i>Tamponia vireoides</i> subsp. <i>iberica</i>	+	-	-	-
<i>Dromicium plantaginum</i>	+	-	-	-
<i>Quercus subintegerrima</i>	+	-	-	-
<i>Pinus lusitana</i>	+	-	-	-
<i>Pinus nigra</i>	+	-	-	-
<i>Pinus pinaster</i>	+	-	-	-
<i>Pinus massoniana</i>	+	-	-	-
<i>Ruscus aculeatus</i>	+	-	-	-
<i>Buxus sempervirens</i>	+	-	-	-
Alliance, order and class characteristics		V	IV	V
<i>Olea europaea</i> subsp. <i>europaea</i>	V	IV	V	II
<i>Ruscus aculeatus</i>	V	IV	IV	
<i>Pyrus boissiana</i>	IV	V	V	
<i>Sonchus aspera</i> var. <i>altissima</i>	IV	II	IV	
<i>Robinia pseudoacacia</i>	IV	IV	III	
<i>Carex distachya</i>	III	III	V	
<i>Rhamnus alaternus</i>	III	II	II	
<i>Asplenium ovifrons</i>	III	III	IV	
<i>Daphne genkwa</i>	II	IV	IV	
<i>Phytolacca</i> sp.	II	IV	II	
<i>Pinus</i> sp.	II	IV	II	
<i>Pinus iberoi</i>	II	IV	II	
<i>Sanguisorba hybrida</i>	II	I	-	
<i>Lonicera implexa</i>	II	I	-	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	II	-	-	
<i>Quercus stricta</i>	II	-	-	
<i>Quercus subintegerrima</i>	I	-	-	
<i>Phytolacca</i> sp.	I	-	-	
<i>Arctostaphylos</i>	I	-	-	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>	+	+	+	
<i>Rosa canina</i>	+	+	+	
<i>Sanguisorba hybrida</i>	+	+	+	
<i>Lonicera implexa</i>	+	+	+	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	
<i>Quercus stricta</i>	+	+	+	
<i>Quercus subintegerrima</i>	+	+	+	
<i>Phytolacca</i> sp.	+	+	+	
<i>Arctostaphylos</i>	+	+	+	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>	+	+	+	
<i>Rosa canina</i>	+	+	+	
<i>Sanguisorba hybrida</i>	+	+	+	
<i>Lonicera implexa</i>	+	+	+	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	
<i>Quercus stricta</i>	+	+	+	
<i>Quercus subintegerrima</i>	+	+	+	
<i>Phytolacca</i> sp.	+	+	+	
<i>Arctostaphylos</i>	+	+	+	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>	+	+	+	
<i>Rosa canina</i>	+	+	+	
<i>Sanguisorba hybrida</i>	+	+	+	
<i>Lonicera implexa</i>	+	+	+	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	
<i>Quercus stricta</i>	+	+	+	
<i>Quercus subintegerrima</i>	+	+	+	
<i>Phytolacca</i> sp.	+	+	+	
<i>Arctostaphylos</i>	+	+	+	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>	+	+	+	
<i>Rosa canina</i>	+	+	+	
<i>Sanguisorba hybrida</i>	+	+	+	
<i>Lonicera implexa</i>	+	+	+	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	
<i>Quercus stricta</i>	+	+	+	
<i>Quercus subintegerrima</i>	+	+	+	
<i>Phytolacca</i> sp.	+	+	+	
<i>Arctostaphylos</i>	+	+	+	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>	+	+	+	
<i>Rosa canina</i>	+	+	+	
<i>Sanguisorba hybrida</i>	+	+	+	
<i>Lonicera implexa</i>	+	+	+	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	
<i>Quercus stricta</i>	+	+	+	
<i>Quercus subintegerrima</i>	+	+	+	
<i>Phytolacca</i> sp.	+	+	+	
<i>Arctostaphylos</i>	+	+	+	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>	+	+	+	
<i>Rosa canina</i>	+	+	+	
<i>Sanguisorba hybrida</i>	+	+	+	
<i>Lonicera implexa</i>	+	+	+	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	
<i>Quercus stricta</i>	+	+	+	
<i>Quercus subintegerrima</i>	+	+	+	
<i>Phytolacca</i> sp.	+	+	+	
<i>Arctostaphylos</i>	+	+	+	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>	+	+	+	
<i>Rosa canina</i>	+	+	+	
<i>Sanguisorba hybrida</i>	+	+	+	
<i>Lonicera implexa</i>	+	+	+	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	
<i>Quercus stricta</i>	+	+	+	
<i>Quercus subintegerrima</i>	+	+	+	
<i>Phytolacca</i> sp.	+	+	+	
<i>Arctostaphylos</i>	+	+	+	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>	+	+	+	
<i>Rosa canina</i>	+	+	+	
<i>Sanguisorba hybrida</i>	+	+	+	
<i>Lonicera implexa</i>	+	+	+	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	
<i>Quercus stricta</i>	+	+	+	
<i>Quercus subintegerrima</i>	+	+	+	
<i>Phytolacca</i> sp.	+	+	+	
<i>Arctostaphylos</i>	+	+	+	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>	+	+	+	
<i>Rosa canina</i>	+	+	+	
<i>Sanguisorba hybrida</i>	+	+	+	
<i>Lonicera implexa</i>	+	+	+	
<i>Hederia madrensis</i> subsp. <i>iberica</i>	+	+	+	
<i>Quercus stricta</i>	+	+	+	
<i>Quercus subintegerrima</i>	+	+	+	
<i>Phytolacca</i> sp.	+	+	+	
<i>Arctostaphylos</i>	+	+	+	
<i>Quercus monophylla</i>	+	+	+	
<i>Pinus densata</i>				

# METHODOLOGY

## SPECIES DISTRIBUTION MODELS (SDMs)

### BIOMOD2 – A PLATFORM FOR ENSEMBLE FORECASTING OF SPECIES DISTRIBUTIONS



#### Ecography

Volume 32, Issue 3, pages 369-373, 29 JUN 2009 DOI: 10.1111/j.1600-0587.2008.05742.x

<http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0587.2008.05742.x/full#f1>



# METHODOLOGY

## Climate

**TMIN** | Minimum temperature of the coldest month

**PREC** | Precipitation



## Land-use

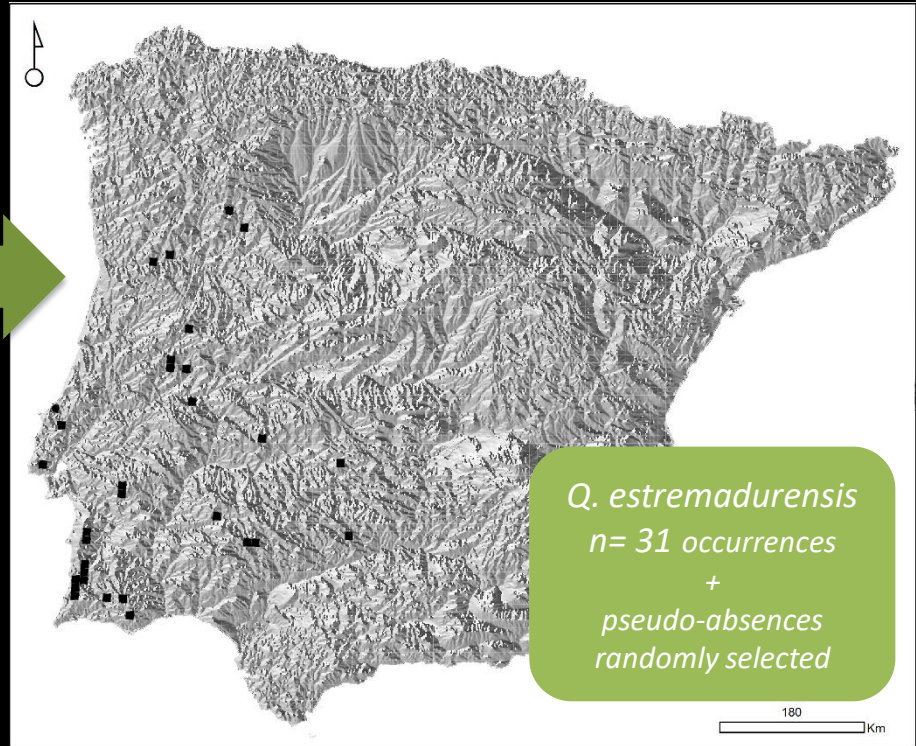
**For** | Percentage cover of forests



## Terrain complexity

**Rugg** | Ruggedness index

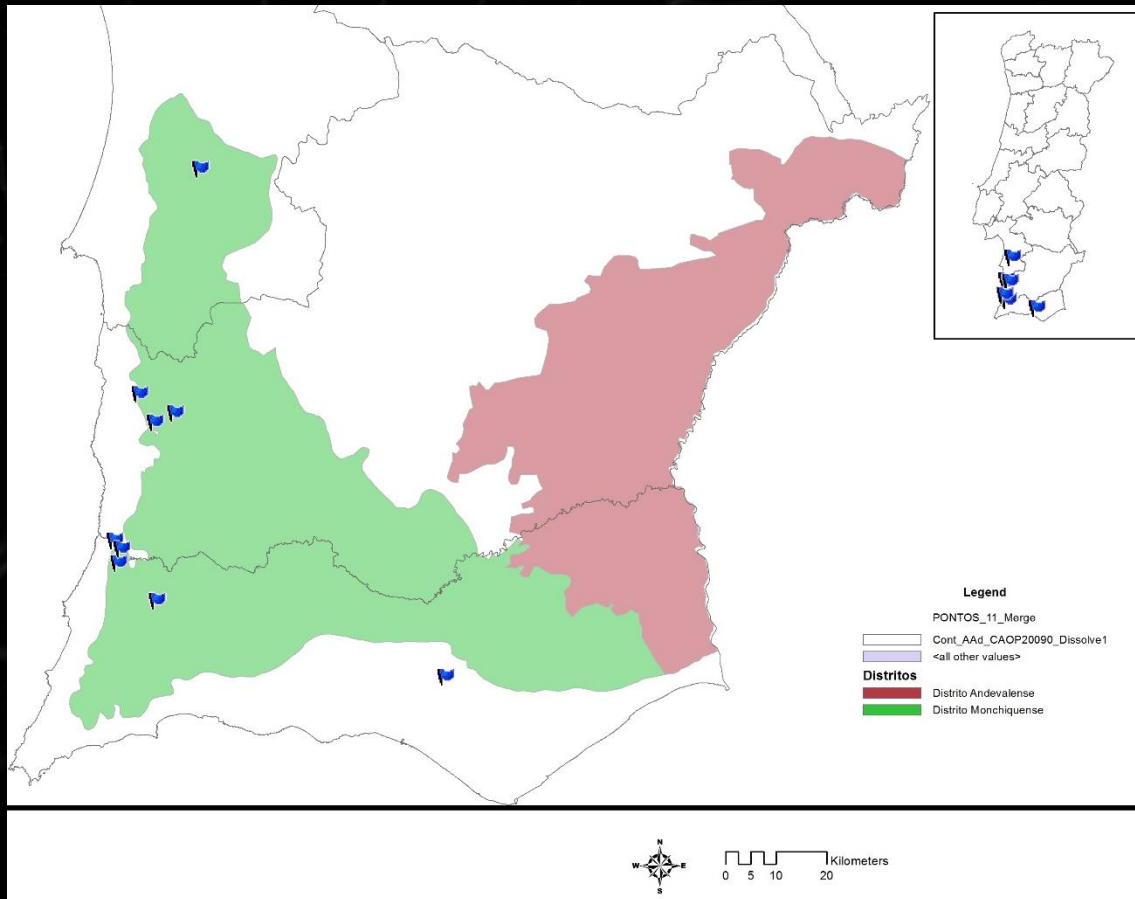
Quantitative measurement of terrain heterogeneity summarizes change in elevation



- All environmental predictors tested for correlation ( $\rho < 0.7$ ), using STATISTICA 12;
- BIOMOD2 package for R© software– 10 cutting-edge modelling techniques (GLM, GAM, GBM, MAXENT, RF, ANN, CTA, MARS, FDA,SRE ), replicated 30 times;
- Pseudo-absences selected randomly from background (excluding species occurrences);
- Data split according to a 80/20 subset (due to the lack of confirmed absences) for evaluation (ROC);
- Outcome: ensemble model of *Q. estremadurensis* potential distribution produced by weighting the best models (AUC>0.7)

# | RESULTS

## Phytosociological reléves *Quercus estremadurensis* community 2012-2014



Adapted from  
Mendes et. al. inéd.



# RESULTS

Quercus	1	2	3	4	5	6	7	8	9	10	11	P
Relevé number	1	2	3	4	5	6	7	8	9	10	11	P
Area	200	350	500	600	450	300	250	400	350	400	450	R
Altitude	150	75	90	45	250	255	251	79	49	32	55	E
Cover	100	100	100	100	100	100	100	100	100	100	100	S
Aspect	E	E	NE	N	NW	W	SW	W	N	NW	W	E
Slope	25	15	25	5	15	5	10	15	5	20	5	N
Height	8	10	12	15	10	12	15	15	12	15	10	C
Characteristics												E
<u>Quercus robur subsp. estremadurensis</u>	2	3	2	4	2	+	-	4	2	1	3	V
<u>Quercus marianica</u>	1	2	4	+	3	+	1	1	1	4	3	V
<u>Quercus broteroi</u>	4	2	+	1	1	3	4	1	2	+	+	V
<u>Avenella stricta</u>	1	1	2	-	1	1	2	1	+	-	+	V
<u>Luzula forsteri subsp. baetica</u>	+	1	-	-	+	2	+	1	1	-	1	V
<u>Quercus xbeturica</u>	+	-	+	-	+	1	-	+	+	+	+	IV
<u>Campanula alata</u>	-	-	1	1	-	+	+	2	-	+	-	III
<u>Rhododendron ponticum</u>	-	-	1	-	-	1	1	+	-	+	-	II
<u>Quercus rivasmartinezii</u>	-	-	+	+	-	-	-	1	-	+	-	II
<u>Quercus lusitanica</u>	-	-	1	-	-	+	-	+	-	1	-	II
<u>Laurus nobilis</u>	-	-	1	-	+	-	-	1	+	+	1	II
<u>Franquula baetica</u>	-	-	1	-	-	-	-	2	-	+	+	I
<u>Lavandula viridis</u>	-	-	-	+	+	-	-	-	-	-	-	I
<u>Myrica faia</u>	-	-	-	-	-	-	+	1	-	1	-	I
<u>Quercus xwewitschii</u>	-	-	-	-	+	-	-	-	-	-	+	I
<u>Quercus xlousoae</u>	-	-	+	-	-	-	+	-	-	-	-	I
<u>Quercus xrosa-pintii</u>	-	-	+	-	-	-	+	-	-	-	-	I

Relevé number	1	2	3	4	5	6	7	8	9	10	11	P
Area	200	350	500	600	450	300	250	400	350	400	450	R
Altitude	150	75	90	45	250	255	251	79	49	32	55	E
Cover	100	100	100	100	100	100	100	100	100	100	100	S
Aspect	E	E	NE	N	NW	W	SW	W	N	NW	W	E
Slope	25	15	25	5	15	5	10	15	5	20	5	N
Height	8	10	12	15	10	12	15	15	12	15	10	C
Characteristics												E
<u>Quercus robur subsp. estremadurensis</u>	2	3	2	4	2	+	-	4	2	1	3	V
<u>Quercus marianica</u>	1	2	4	+	3	+	1	1	1	4	3	V
<u>Quercus broteroi</u>	4	2	+	1	1	3	4	1	2	+	+	V
<u>Avenella stricta</u>	1	1	2	-	1	1	2	1	+	-	+	V
<u>Luzula forsteri subsp. baetica</u>	+	1	-	-	+	2	+	1	1	-	1	V
<u>Quercus xbeturica</u>	+	-	+	-	+	1	-	+	+	+	+	IV
<u>Campanula alata</u>	-	-	1	1	-	+	+	2	-	+	-	III
<u>Rhododendron ponticum</u>	-	-	1	-	-	1	1	+	-	+	-	II
<u>Quercus rivasmartinezii</u>	-	-	+	+	-	-	-	1	-	+	-	II
<u>Quercus lusitanica</u>	-	-	1	-	-	+	-	+	-	1	-	II
<u>Laurus nobilis</u>	-	-	1	-	+	-	-	1	+	+	1	II
<u>Franquula baetica</u>	-	-	1	-	-	-	-	2	-	+	+	I
<u>Lavandula viridis</u>	-	-	-	+	+	-	-	-	-	-	-	I
<u>Myrica faia</u>	-	-	-	-	-	-	+	1	-	1	-	I
<u>Quercus xwewitschii</u>	-	-	-	-	+	-	-	-	-	-	+	I
<u>Quercus xlousoae</u>	-	-	+	-	-	-	+	-	-	-	-	I
<u>Quercus xrosa-pintii</u>	-	-	+	-	-	-	+	-	-	-	-	I

# RESULTS

Alliance and upper units characteristics												
<i>Olea europea</i> subsp. <i>sylvestris</i>	1	+	-	1	2	+	+	1	-	1	1	V
<i>Ruscus aculeatus</i>	2	1	-	1	-	+	1	2	+	1	1	V
<i>Rubia peregrina</i>	+	1	-	+	-	+	+	1	+	1	-	IV
<i>Carex dystachia</i>	1	2	1	-	+	-	+	1	-	+	+	IV
<u><i>Viburnum tinus</i></u>	1	+	2	1	1	1	-	3	1	1	1	IV
<i>Smilax aspera</i> var. <i>altissima</i>	-	+	-	+	-	-	+	2	-	1	1	IV
<i>Pyrus bourgaeana</i>	1	-	2	1	+	-	-	+	-	1	+	III
<i>Rhamnus alaternus</i>	1	+	-	+	-	+	-	2	-	+	+	III
<i>Asplenium onopteris</i>	1	+	-	1	+	-	-	1	+	-	-	III
<i>Hedera hibernica</i>	-	1	1	+	-	-	+	1	-	-	1	III
<i>Arisarum simorrhinum</i>	-	1	-	+	-	+	-	+	-	-	+	II
<i>Phillyrea latifolia.</i>	-	-	1	1	-	-	-	1	-	-	+	II
<i>Sanguisorba hybrida</i>	+	-	-	-	-	-	-	1	1	-	+	I
<i>Paeonia broteroi</i>	-	-	-	+	-	-	-	-	1	+	-	I
<i>Daphne gnidium</i>	-	-	+	-	+	-	+	-	-	-	-	I
<i>Lonicera implexa</i>	-	-	-	-	-	+	+	-	-	-	-	I

Species	Quantitative characteristics (no. axes for each)											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Olea europaea</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Ruscus aculeatus</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Rubia perigrina</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Carex dystachia</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Viburnum tinus</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Smilax aspera</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Pyrus bourgaeana</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Rhamnus alaternus</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Asplenium onopteris</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Hedera hibernica</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Arisarum simorrhinum</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Phillyrea latifolia</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Sanguisorba hybrida</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Paeonia broteroi</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Daphne gnidium</i>	1	2	3	4	5	6	7	8	9	10	11	12
<i>Lonicera implexa</i>	1	2	3	4	5	6	7	8	9	10	11	12



# RESULTS

<b>Rhamno-Prunetea characteristics</b>												
<i>Rubus ulmifolius</i>	2	1	1	2	3	3	2	1	+	1	2	V
<i>Crataegus monogyna</i> subsp. <i>brevispina</i>	1	2	1	+	+	1	+	1	+	+	+	V
<i>Dioscorea communis</i>	-	1	1	-	1	-	+	1	+	+	-	IV
<i>Lonicera periclymenum</i> subsp. <i>hispanica</i>	-	+	-	+	2	1	+	1	+	1	1	IV
<i>Rosa pouzinii</i>	-	1	+	-	+	-	-	1	-	-	+	II
<i>Rosa canina</i>	-	-	+	-	-	-	+	-	+	+	-	II



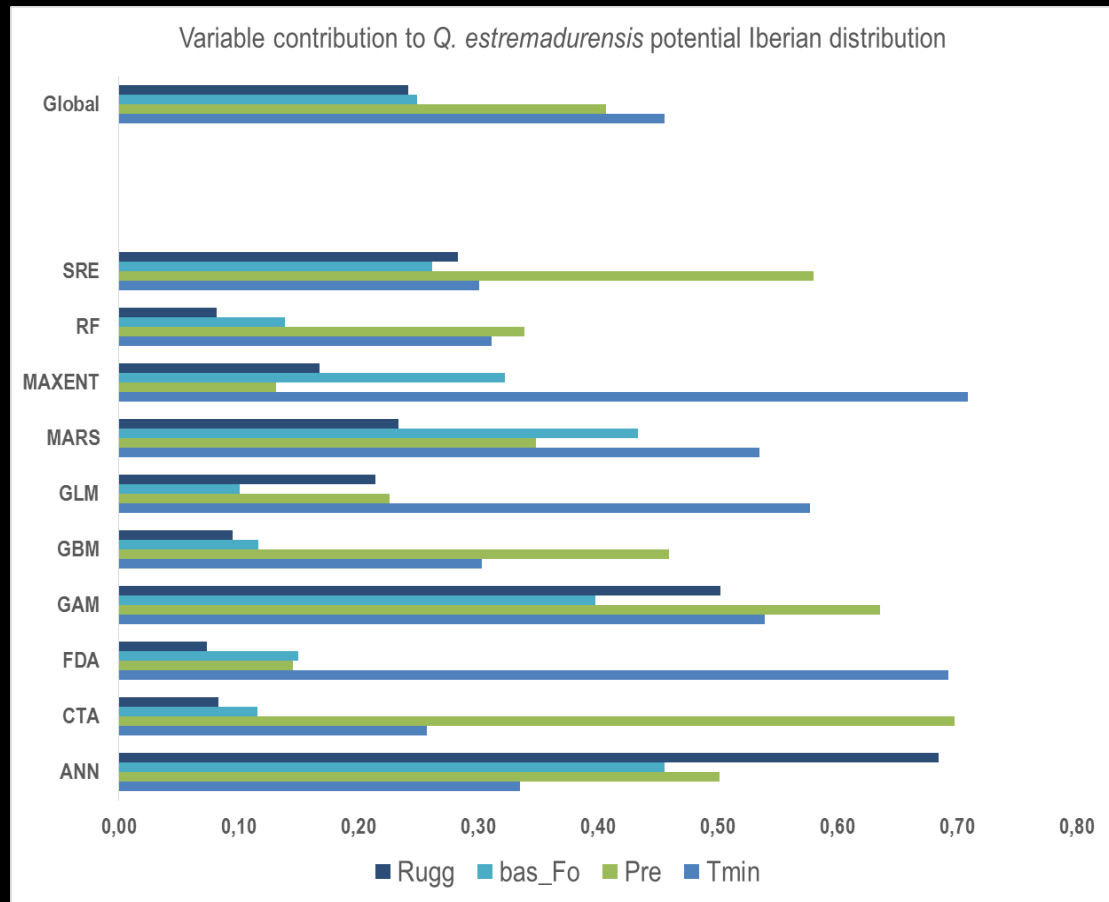
# RESULTS

Companions												
<i>Arbutus unedo</i>	2	1	1	1	+	1	1	2	1	1	+	V
<i>Erica arborea</i>	+	1	2	3	2	1	+	1	1	+	2	V
<i>Dactylis hispanica</i> subsp. <i>lusitanica</i>	1	-	+	+	+	+	-	-	+	+	-	V
<i>Asparagus aphyllus</i>	+		1	+				1	1	+	1	IV
<i>Bellis sylvestris</i>	+		1		1			1		+	+	IV
<i>Phyllirea angustifolia</i>	1	1	-	1	-	+	-	1	+	1	1	IV
<i>Brachypodium phoenicoides</i>	1	-	+	-	1	-	+	-	1	1	1	IV
<i>Brachypodium sylvaticum</i>		2	+	+		1		1	+		1	IV
<i>Myrtus communis</i>	1		1		+	1		1			+	III
<i>Genista triacanthos</i>	-	-	+	-	+	-	-	+	1	-	+	III
<i>Osyris alba</i>	-	+	1	-	1	-	-	+	-	-	+	III
<i>Teucrium scorodonia</i>	-	1	+	-	1	+	-	1	-	-	-	III
<i>Thapsia villosa</i>	1	-	-	+	-	+	-	-	1	+	-	II
<i>Holcus mollis</i>	2	-	-	-	1	1	-	1	-	-	-	II
<i>Leontodon tuberosus</i>	1	-	+	-	+	-	-	-	-	-	+	II
<i>Magydaris panacifolia</i>	1	-	-	-	+	-	-	1	-	-	+	II
<i>Erica lusitanica</i>	-	-	+	-	-	-	+	1	-	+	+	II
<i>Cynara algarbiensis</i>	-	+	-	+	1	-	-	-	-	-	+	II
<i>Arum italicum</i> subsp. <i>neglectum</i>	-	+	-	+	-	+	-	1	-	-	+	II
<i>Pistacia lentiscus</i>	-	-	-	-	+	+	-	-	-	+	1	II
<i>Hyacinthoides hispanica</i>	-	-	-	+	-	+	-	+	-	-	-	II
<i>Scilla monophyllos</i>	-	+	-	-	-	+	-	-	+	-	-	II
<i>Osyris quadripartita</i>	-	-	+	+	-	-	-	-	-	+	-	II
<i>Ulex minor</i> var. <i>lusitanicus</i>	+	-	-	-	-	-	-	+	-	-	-	I
<i>Erica australis</i>	-	-	-	-	+	+	-	-	-	-	-	I
<i>Arenaria montana</i>	-	-	-	-	+	-	-	+	-	-	+	I
<i>Asphodelus aestivus</i>	-	-	-	-	-	+	-	-	-	-	+	I
<i>Ditrichia viscosa</i> subsp. <i>revoluta</i>	-	-	-	-	-	-	-	-	-	-	+	I
<i>Lavandula xalportelensis</i>	-	-	-	-	+	-	+	-	-	-	-	I
<i>Scrophularia scorodonia</i>	-	-	-	-	-	+	-	+	-	-	-	I
<i>Fraxinus angustifolia</i>	-	-	+	-	-	-	-	+	-	-	-	I
<i>Arrhenatherum album</i>	-	-	-	+	+	-	-	-	-	-	-	I
<i>Salix atrocinerea</i>	-	+	-	-	-	-	-	+	-	-	+	I
<i>Geum sylvaticum</i>	-	-	-	-	-	+	-	-	+	-	+	I
<i>Vitis sylvestris</i>	-	+	-	-	-	-	-	1	-	-	-	I
<i>Scolymus hispanicus</i> subsp. <i>occidentalis</i>	-	-	-	+	-	-	-	-	-	-	+	I
<i>Bupleurum fruticosum</i>	-	-	-	-	-	+	-	-	-	-	1	I
<i>Erica scoparia</i>	-	-	-	-	-	-	-	+	-	-	-	I
<i>Adenocarpus anisochillus</i>	-	-	-	-	-	-	-	+	-	-	-	I
<i>Euphorbia paniculata</i> subsp. <i>monchiquensis</i>	-	-	-	-	-	-	-	+	-	-	-	I
<i>Staurachanthus boivinii</i>	-	-	-	-	+	-	-	-	-	-	-	I
<i>Clematis flammula</i>	-	-	-	-	+	-	-	-	-	-	-	I
<i>Salix australis</i>	-	-	-	-	+	-	-	-	-	-	-	I
<i>Pulicaria odora</i>	-	-	-	-	+	-	-	-	-	-	-	I



# | RESULTS – VARIABLE CONTRIBUTION

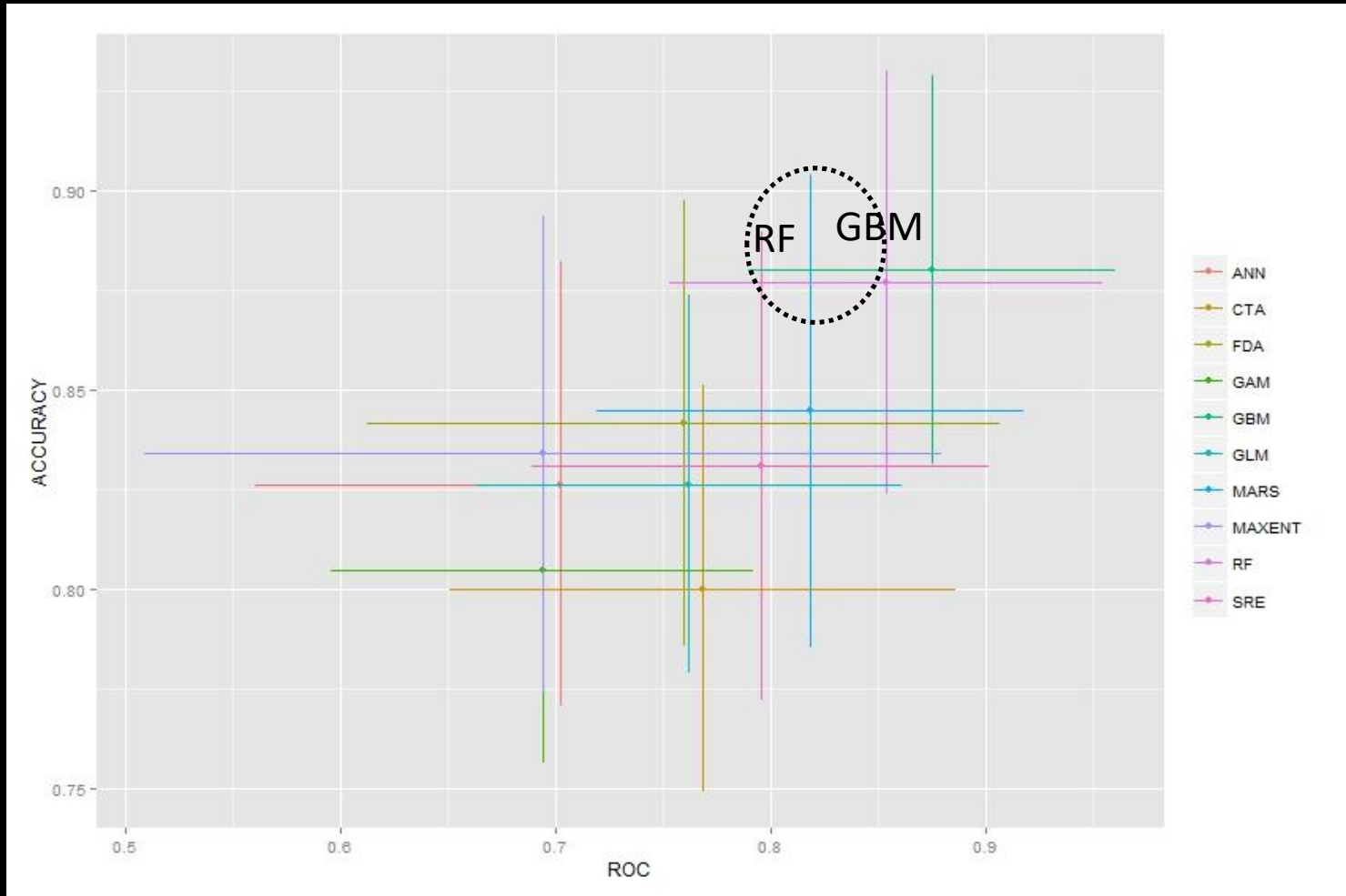
	Tmin	Pre	bas_Fo	Rugg
Global	<b>0,46</b>	<b>0,41</b>	0,25	0,24
SRE	0,30	<b>0,58</b>	0,26	0,28
RF	0,31	0,34	0,14	0,08
MAXENT	<b>0,71</b>	0,13	<b>0,32</b>	0,17
MARS	<b>0,53</b>	0,35	<b>0,43</b>	0,23
GLM	<b>0,58</b>	0,23	0,10	0,21
GBM	0,30	0,46	0,12	0,10
GAM	<b>0,54</b>	<b>0,64</b>	<b>0,40</b>	<b>0,50</b>
FDA	<b>0,69</b>	0,15	0,15	0,07
CTA	0,26	<b>0,70</b>	0,12	0,08
ANN	0,33	<b>0,50</b>	<b>0,46</b>	<b>0,68</b>



-Overall, climatic variables appear to be more determinant for *Q. estremadurensis* Iberian distribution (Tmin: 0,46; Prec: 0,41), followed by the percentage of forests (0,25) and terrain ruggedness (0,24);

-High variation among individual modelling techniques and runs;

# RESULTS – EVALUATION & ACCURACY ACROSS MODELS

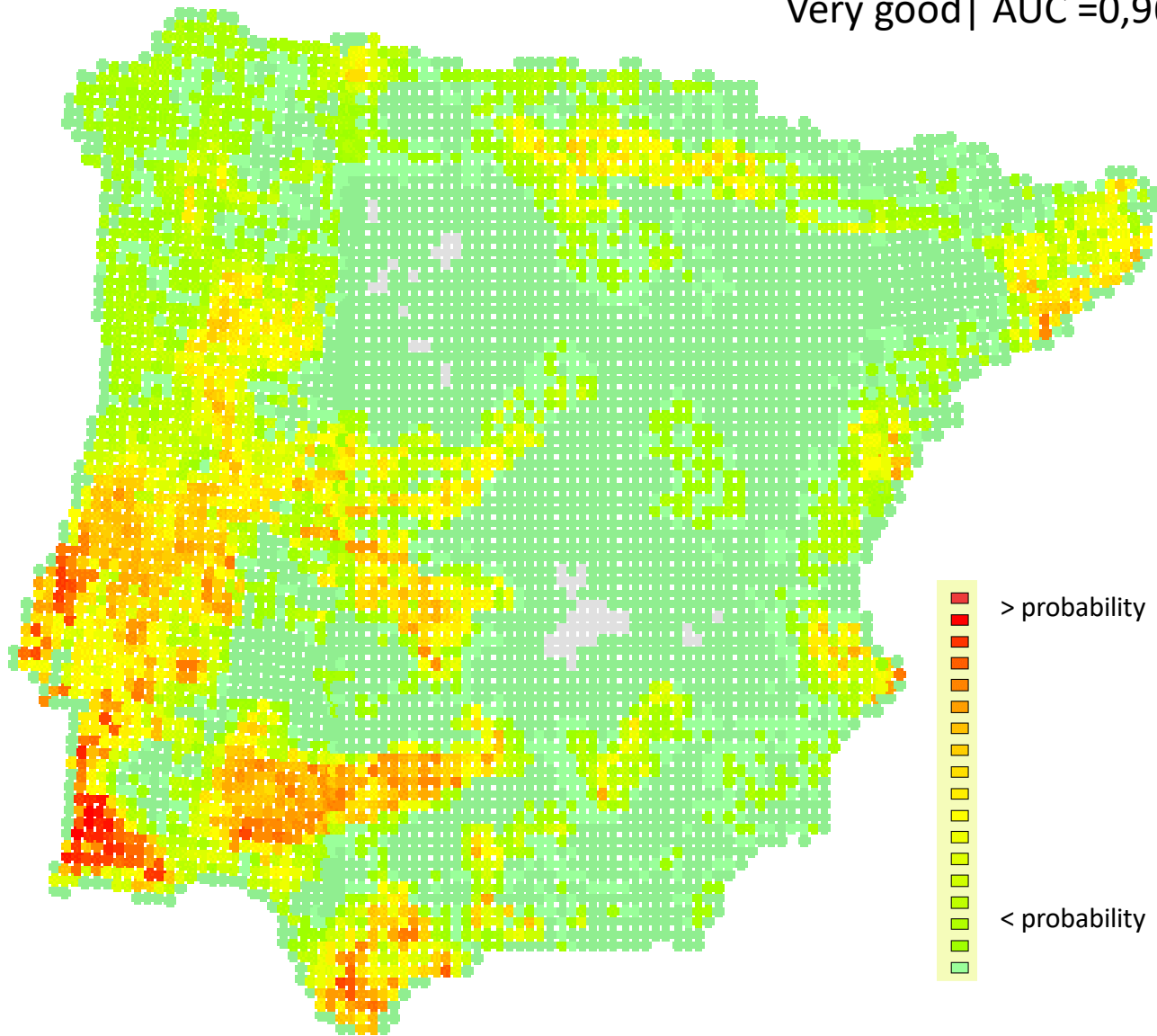


-High variation among individual modelling techniques and runs in relation to all evaluation metrics (e.g. AUC and Accuracy)



# RESULTS – ENSEMBLE MODEL OF *Q. ESTREMADURENSIS* DISTRIBUTION

Very good | AUC = 0,96



## | DISCUSSION / BIOGEOGRAPHIC INFERENCES

- Biogeographic assumptions (not detected) or corresponding to *Quercus robur* subsp. *broteroana*, *Quercus xcouthoi* Samp. and *Q. faginea*





## | DISCUSSION / BIOGEOGRAPHIC INFERENCES

Biogeographic assumptions (not detected) or corresponding to *Quercus robur* subsp. *broteroana*, *Quercus xcouthoi* Samp. and *Q. faginea*

LUSO-EXTREMADURENSE Subprovince

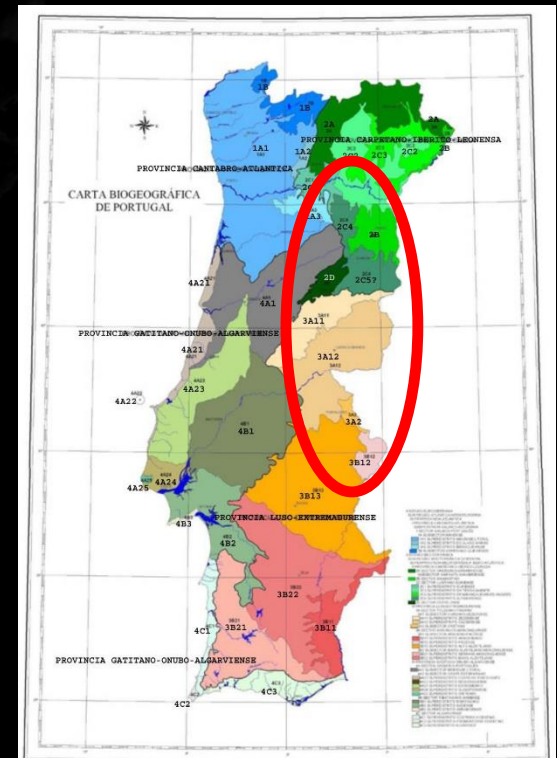
Mamedan District

South Beirense District

Temporihygrophilous facing *Arisaro-Quercetum pyrenaicae* and *Pistacio-Quercetum broteroï*

(*Quercenion pyrenaicae* and *Quercion broteroï*)

*Quercus estremadurensis* and *Prunus spinosa* community



## | DISCUSSION / BIOGEOGRAPHIC INFERENCE

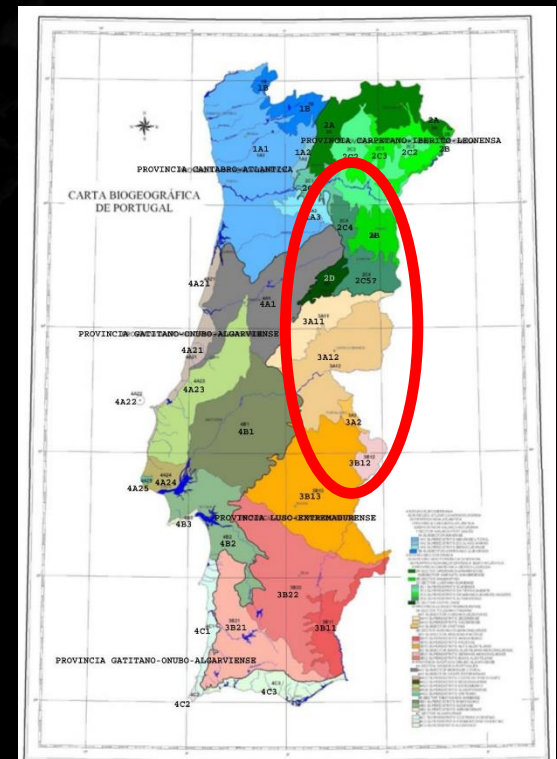
- Biogeographic assumptions (not detected) or corresponding to *Quercus robur* subsp. *broteroana*, *Quercus xcoutinhoi* Samp. and *Q. faginea*

- **MONTEMURO AND ESTRELA SIERRAN Sector**

- Montemuro and Caramulo Sierran District
- High Beirese District
- Estrela Sierran District
- Guardan District
- Zezerese District

Temporihygrophilous facing *Arbuto Quercetum pyrenaicae*  
and *Holco-Quercetum pyrenaicae*  
(*Quercenion pyrenaicae*)

*Quercus estremadurensis* and *Prunus spinosa* community





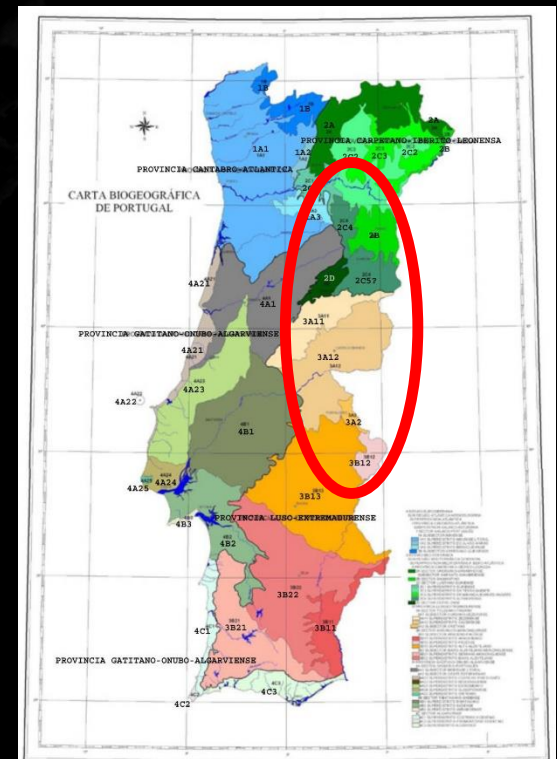
## | DISCUSSION / BIOGEOGRAPHIC INFERENCE

- Biogeographic assumptions (not detected) or corresponding to *Quercus robur* subsp. *broteroana*, *Quercus xcouthoi* Samp. and *Q. faginea*

- *DURIESE LUSITANIAN Sector*
- *Braganzan District*
- *Vilarealense-Verinense District*
- *Terraquentense District*
- *Low Duriense Lusitanian District*

Temporihygrophilous facing *Hedero-Quercetum faginea* and *Epipacto duriensis-Quercetum faginea* Alves, Vila-Viçosa, Aguiar inéd.  
(*Aceri-Quercion faginea*)

*Quercus estremadurensis* and *Prunus spinosa* community



## DISCUSSION / BIOGEOGRAPHIC INFERENCES

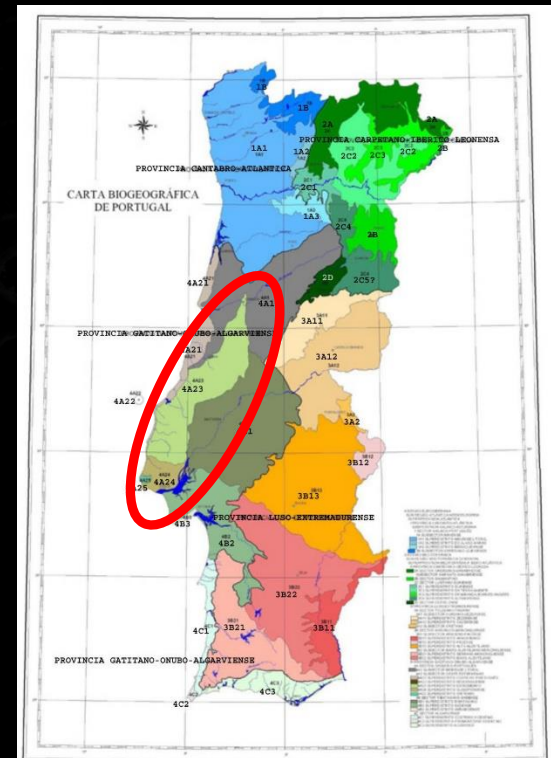
- Biogeographic assumptions (not detected) or corresponding to *Quercus robur* subsp. *broteroana*, *Quercus xcoutinhoi* Samp. and *Q. faginea*

- PORTUGUESE DIVISORIAN Sector
  - Extremenian Portuguese District,
  - Littoral Beirense District
  - Sintra Sierran District
  - Olissiponense District

Temporihygrophilous facing *Arisaro-Quercetum broteroi*

*Quercus estremadurensis* and *Prunus insititioides* community

(*Quercion broteroi*)





# | SCIENTIFIC PROBLEMATICS

- Facing Morphological with Molecular Data
- Featuring introgression
- Trichome analysis validation (Environmental vs Genetics)
- Taxonomic inflation??
- Overestimated hybridization??

## Taxonomic Validation

## Genetics and Evolution NGS

- **Phylogeographic essay**
  - Relationships between taxa
    - Ancestry??
- Hybridization (*Q. robur* x *Q. faginea* s.l.)
  - Heavily “introgressed” ones
  - Biological invasion of hybrids?? (hybrid vigor)
  - Factors promoting the occurrence of Hybrid-zones?
  - Vicariant hybridization?
  - Bottleneck effect related to paleoclimatic constrains,

- ***Quercus estremadurensis* O. Schwarz**
  - Most threatened tree in Europe
- Genetic diversity
- Conservation threats
  - Introgression
  - Climatic shift
  - Anthropic action

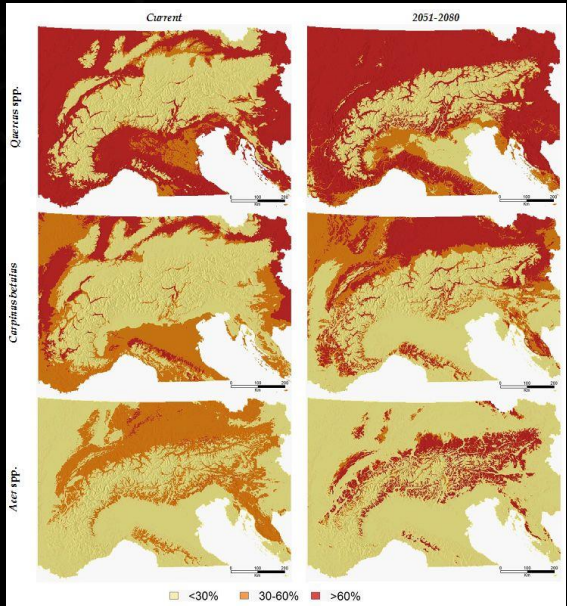
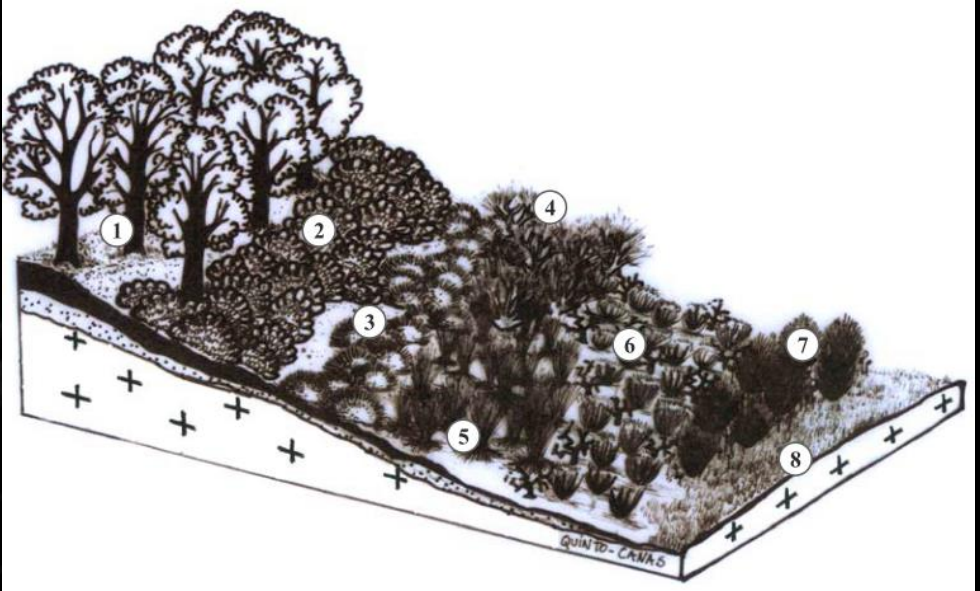
## Conservation

# DISCUSSION / FINAL CONSIDERATIONS

Landscape Ecology

Catenal Dynamic models

SDM



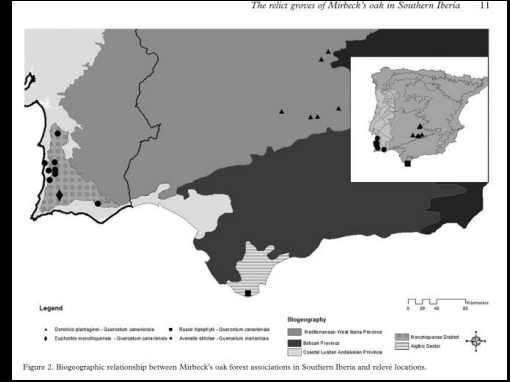
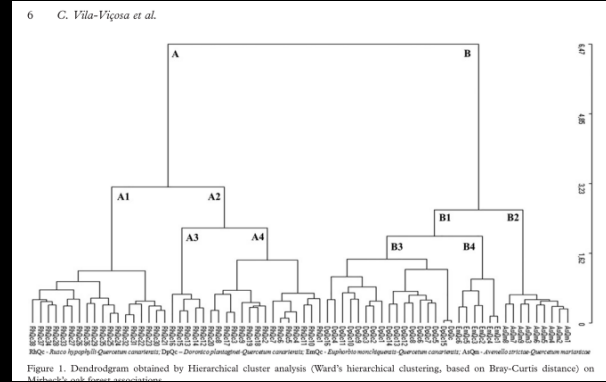


# DISCUSSION / FINAL CONSIDERATIONS

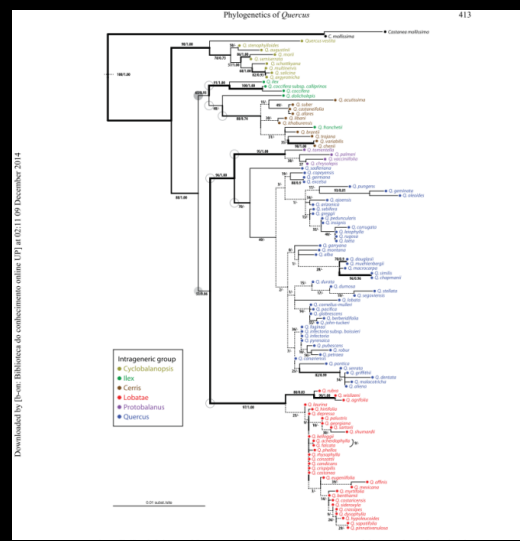
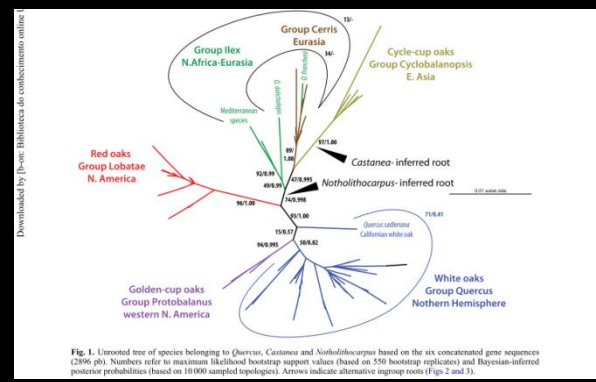
## Taxonomy



## Syntaxonomy / Biogeography

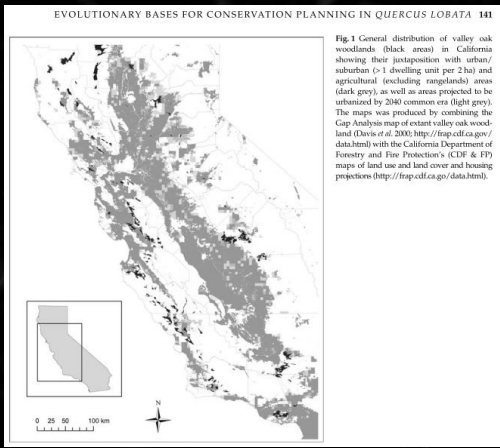
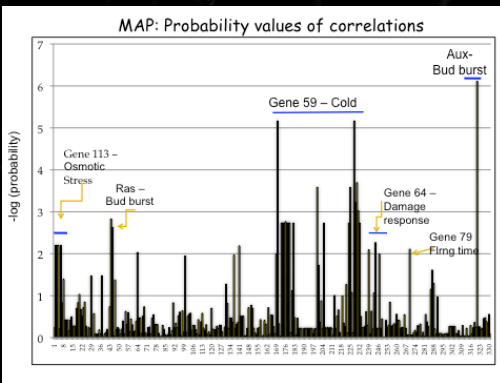


## Phylogeography



## Landscape genomics

Study of massive amounts of markers from a single-species genome to identify regions under selection and population structuring.



146 D. GRIVET *ET AL.*

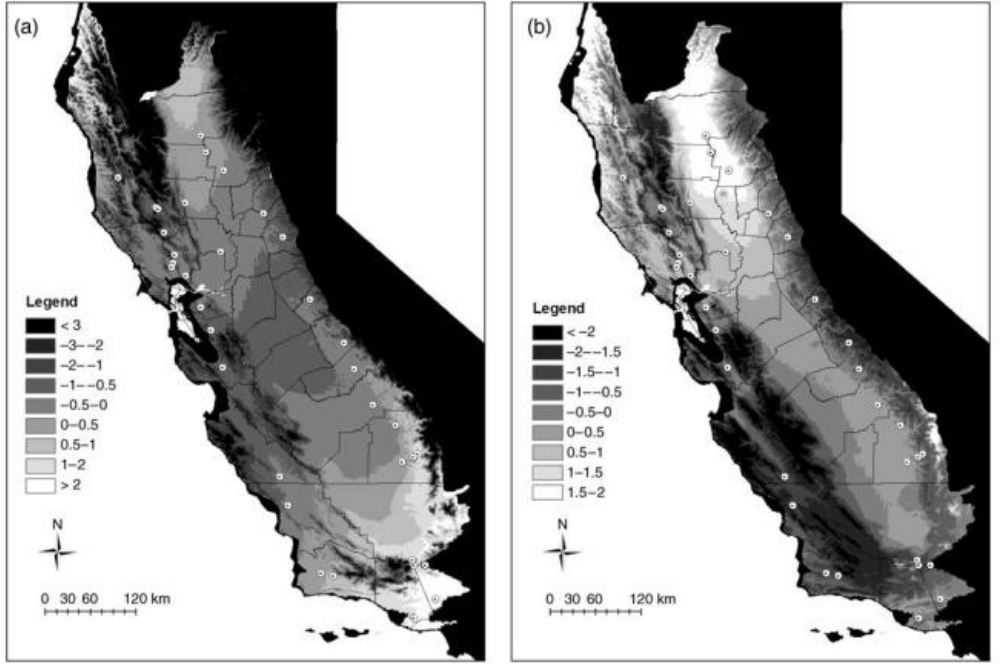


Fig. 3 Spatial trends in chloroplast genetic markers using the population mean standardized canonical scores based on the canonical correlation analysis of multivariate chloroplast genotypes vs. geographical variables. (a) Trend surface of the first canonical axis. (b) Trend surface of the second canonical axes. See Table 2 for statistical results. The shadings indicate the classes of canonical scores (see legends); dark colours represent negative values, and light colours positive values around the population mean, but no biological significance is attached to having