THE SOIL FACTOR IN THE DISTRIBUTION OF MEDITERRANEAN OAK FORESTS IN MONTSEC (NORTHEASTERN SPAIN)

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INTRODUCTION

- SOILS HAVE SHOWN A SIGNIFICANT INFLUENCE ON FOREST DISTRIBUTION AND PERFORMANCE BUT ARE VERY RARELY INTEGRATED IN TERRESTRIAL ECOSYSTEM ECOLOGY

OBJECTIVES

- TO ANALYSE THE INFLUENCE OF SOILS, AND SOIL AVAILABLE WATER HOLDING CAPACITY (AWHC) IN PARTICULAR, ON THE DISTRIBUTION OF *QUERCUS ILEX* AND *Q. FAGINEA/Q. CERRIOIDES* STANDS

MATERIALS AND METHODS

- LOCATION: MONTSEC MOUNTAINS (LLEIDA; NORTHEASTERN SPAIN); ON A NORTH-FACING SLOPE AT 700-900 m a.s.l.

- DATA FROM 46 200 m^2-PLOTS DOMINATED BY EITHER:
  - EVERGREEN *QUERCUS ILEX* (*QI* STANDS)
  - SEMI-DECIDUOUS *QUERCUS FAGINEA* / *Q. CERRIOIDES* (*QF* STANDS)

- STAND VARIABLES:
  - DENSITY OF ALL TREE SPECIES
  - TREE HEIGHT AND DIAMETER, AND BASAL AREA OF EACH TREE SPECIES AND STAND

- SITE VARIABLES:
  - ALTITUDE AND SLOPE

- SOIL VARIABLES:
  - ROOTABLE DEPTH, AWHC
  - ORGANIC HORIZONS: MASS, OC, N, P
  - MINERAL HORIZONS: pH, OC, Nt, C/N, TEXTURE, CaCO3, ACTIVE LIME, exch K, Olsen P

- DATA ANALYSES:
  - LOGISTIC REGRESSION TO ESTABLISH THE SOIL/SITE VARIABLES EXPLAINING THE PRESENCE OF EITHER *QI* (n= 23) OR *QF* STANDS (n=23)
  - REGRESSION TREE ANALYSIS TO QUANTIFY THE VALUES OF VARIABLES DEFINING THE LIMITS BETWEEN *QI* AND *QF* STANDS
  - LOGISTIC REGRESSION TO ESTABLISH THE SOIL/SITE VARIABLES EXPLAINING THE PRESENCE (n=34) OR ABSENCE (n=12) OF *Q. ILEX* TREES
  - LOGISTIC REGRESSION TO ESTABLISH THE SOIL/SITE VARIABLES EXPLAINING THE PRESENCE (n=37) OR ABSENCE (n=9) OF *Q. FAGINEA* TREES

RESULTS AND DISCUSSION

1.- STANDS:

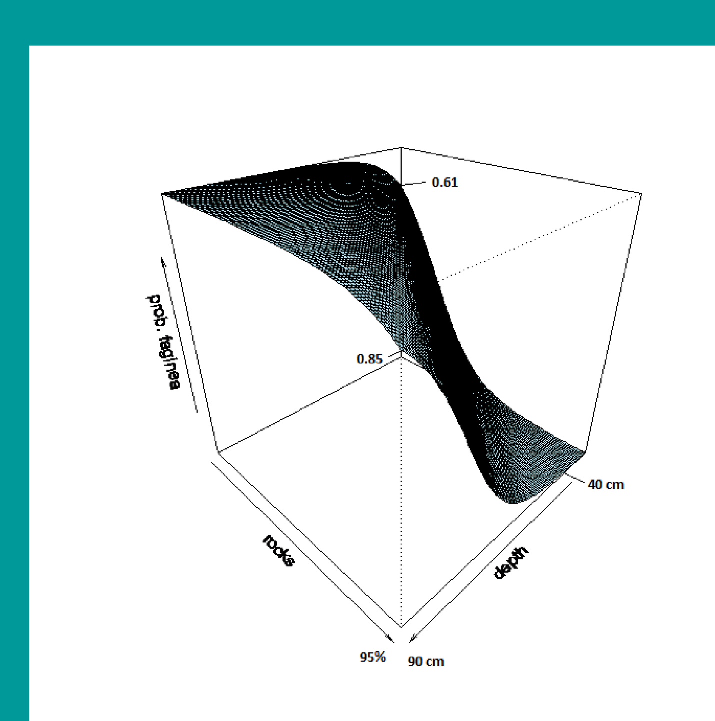
Stand characteristics	QI stands	QF stands
Tree density (trees.ha^{-1})	3202 (1250-5050)	3274 (1750-5700)
Q. ilex density (trees.ha^{-1})	3057 (1250-4800)	100 (0-500)
Q. faginea/Q. cerrioides density (trees.ha^{-1})	96 (0-450)	2878 (1450-5650)
% pure stands	39 %	52 %
Q. ilex trees / total tree density	96% (> 77 %)	< 15 %
Q. faginea/Q.cerrioides trees / total tree density	< 10 %	89% (> 57%)

2.- SOILS: WELL-DRAINED, NON-SALINE LITHIC HAPLOXEROLLS

Mean values and ranges	QI stands	QF stands
Soil rootable depth (cm)	17 (4-42)	36 (15-90)
Rock fragments (%)	52 (4-95)	16 (3-53)
Sand (%)	32 (14-66)	31 (12-65)
pH min	7.7 (6.8-8.1)	8.0 (6.1-8.2)

3.- DISTRIBUTION OF FOREST TYPES (QI OR QF STANDS)
- LOGISTIC REGRESSIONS FOR QF STANDS

Variables	Parameter Estimate	Pr>|z|	AIC	Null deviance	Residual deviance
Intercept+ + rock fr.	3.4 - 0.10	< 0.001 < 0.001	36.34	63.8	32.3
Intercept+ rock fr.+ +depth	0.46 - 0.10 0.12	0.74 0.001 0.03	30.93	63.8	24.9
Intercept+ + AWHC	- 4.17 0.16	0.001 0.001	35.2	63.8	31.2



- *Q.FAGINEA/Q.CERRIOIDES* DOMINATE STANDS ON SOILS WITH AN AWHC OF MORE THAN 22 mm AND LESS THAN 26% ROCK FRAGMENTS
- AWHC PROVIDES LESS EXPLANATORY POWER THAN THE COMBINATION OF SOIL ROOTABLE DEPTH AND ROCK FRAGMENT CONTENT

4.- THE PRESENCE OF *Q. ILEX* TREES IS BEST EXPLAINED BY A COMBINATION OF SOIL ROOTABLE DEPTH (NEGATIVE EFFECT) AND ROCK FRAGMENT CONTENT (POSITIVE EFFECT)

5.- THE PRESENCE OF *Q.FAGINEA/Q.CERRIOIDES* TREES IS BEST EXPLAINED BY A COMBINATION OF ROCK FRAGMENT (NEGATIVE EFFECT) AND SAND (NEGATIVE EFFECT) CONTENTS, AND pH OF MINERAL HORIZON (POSITIVE EFFECT)

CONCLUSIONS

- THE DISTRIBUTION OF *QUERCUS ILEX*- AND *Q. FAGINEA/Q. CERRIOIDES*-DOMINATED STANDS IN THE STUDY AREA IS RELATED TO SOIL PHYSICAL PROPERTIES: AVAILABLE WATER HOLDING CAPACITY AND AERATION CAPACITY

- MODELS EXPLAINING THE PRESENT DISTRIBUTION AND FUTURE RESPONSE OF THESE FORESTS TO CLIMATE CHANGE SHOULD INCORPORATE SOIL INFORMATION