

Habitat suitability models for species selection in ecological restoration: an application to legume shrubs selection for roadside revegetation

Gastón A. *, García-Viñas J.I., Maroto J., Herrero B., Ropero C., Technical University of Madrid, Spain. * aitor.gaston@upm.es

Species distribution data



- Native legume shrubs, nitrogen fixation may facilitate the recruitment of other species (Pugnaire et al., 1996).
- Thorny species excluded, may be a problem in roadsides (Seth, 2004).

- Distribution data from the Forest Map of Spain (Ruiz, 1990).
- Poorly represented species excluded (< 180 records) to allow more than 10 events per variable (Harrell, 2001).



Environmental data

Climate (Sánchez-Palomares et al., 1999)

- mean seasonal and annual temperatures and rainfalls
- mean maximum and minimum temperatures
- dry season length and intensity
- mean annual potential evapotranspiration
- mean annual water surplus and deficit

Lithology (Van Liedekerke et al., 2006)

- Calcareous or siliceous soil parent material



Logistic regression model

Modeling strategy (Harrell, 2001)

- Reduction of the number of climatic predictors to five using cluster analysis and principal components
- Predictors added to the model as 3 d.f. restricted cubic splines
- Lithology added linearly
- Internal validation of models using bootstrap
- Uniform shrinkage of regression coefficients using optimism corrected calibration slope and intercept.

Model predictions

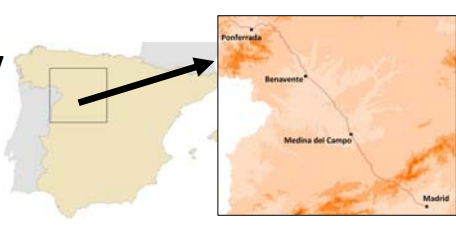
Example 1: 78 km marker of the A6 highway (near Villacastín).

Mean annual temperature: 10.2°C
 Mean annual rainfall: 600 mm
 Mean summer rainfall: 85 mm
 Soil parent material: siliceous

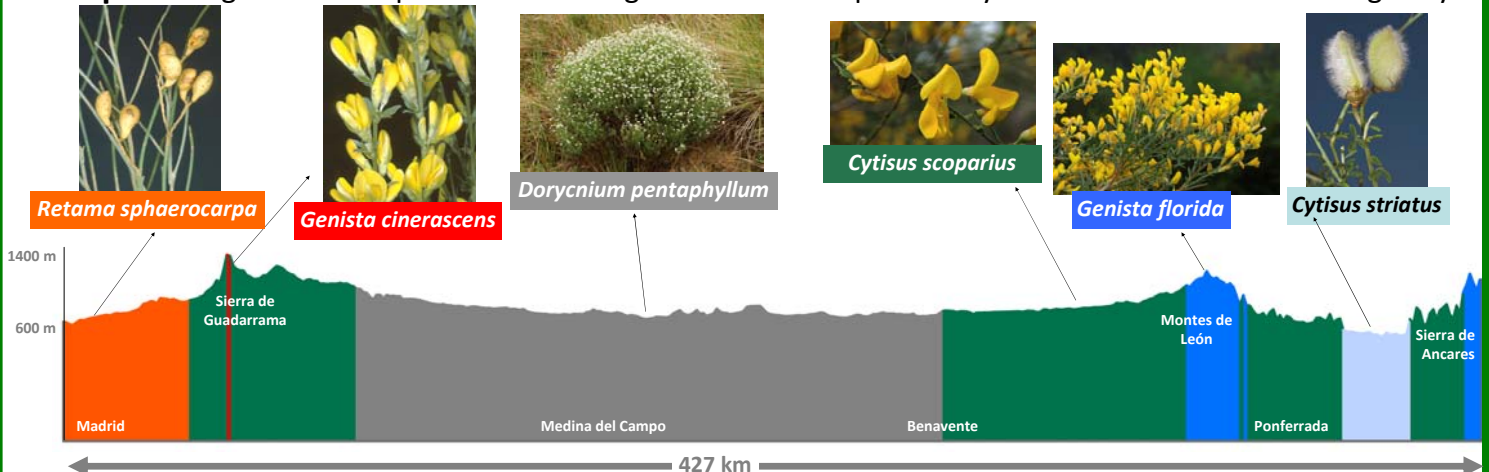
Suitable legume shrub species ordered by occurrence probability

Dorycnium pentaphyllum
Genista cinerascens
Cytisus scoparius
Adenocarpus complicatus

Case study: A6 highway (Spain)



Example 2: Legume shrub species with the highest occurrence probability for each section of the A6 highway



Acknowledgments: All photographs are reproduced courtesy of Pablo Galán, to whom we are very grateful.

References:
 HARRELL F. E., 2001. Regression modelling strategies with applications to linear models, logistic regression and survival analysis. Springer, New York, NY, USA. 568 pp.
 PUGNAIRE F. J., HAAZE P., PUIGDEFABREGAS J., CUATO M., CLARK S. C., INCOLL L. D., 1996. Facilitation and succession under the canopy of a leguminous shrub, *Retama sphaerocarpa*, in a semi-arid environment in south-east Spain. *Oikos* 76:455-464.
 RUIZ J., 1990. Mapa forestal de España, escala 1:200.000, memoria general. MAPA, Madrid, 191 pp.
 SÁNCHEZ-PALOMARES O., SÁNCHEZ-SERRANO F., CARRETERO M. F., 1999. Modelos y cartografía de estimaciones climáticas termopluviométricas para la España peninsular. INIA, Madrid, Spain. 192 pp.
 SETH M. A., 2004. Trees and Their Economic Importance. *The Botanical Review* 69(4): 323-376.
 VAN LIEDEKERKE M., JONES A., PANAGOS P., 2006. ESDb2 Raster Library - a set of rasters derived from the European Soil Database distribution v2.0. European Commission and the European Soil Bureau Network, CDROM, EUR 19945 EN.