WG1- Progress report

Climatic marginality of forest tree populations in Europe

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on behalf of Julian Gonzalo

Objective

Define ecologically (climatic) marginal populations in different European forest tree species:

- *Pinus halepensis* Mill.
- *Pinus pinaster* Ait.
- *Pinus nigra* Arnold.
- *Pinus pinea* L.
- *Pinus sylvestris* L.
- *Abies alba* Mill.

marginality: 5 and 10% thresholds of climatic niche

Distribution of the species

- Tree Species Distribution for Europe (TSDE; Köble & Seufert, 2001) from the Joint Research Center's AFOLU data portal. 1 km resolution.

(ftp://mars.jrc.ec.europa.eu/Afoludata/Public/DS66/).

- EUFORGEN database from the European forest genetic resources programme (http://www.euforgen.org/distribution_maps.html).
- By filtering TSDE occurrences with EUFORGEN we obtained a good approximation of species´ native range distributions
- We downloaded the 19 bioclimatic variables available in WORLDCLIM (Hijmans et al., 2005) representative of the period 1950-2000 for the analysis

Models

- We selected Generalized Additive Models (GAM; Hastie & Tibshirani, 1986) processed in BIOMOD (Thuiller et al., 2009) using the package “biomod2”
- Model performance was assessed by True Skill Statistic (TSS) and Area Under the ROC Curve
- Probabilistic model outputs based on current climatic conditions were converted to binary maps (environmentally suitable vs environmentally unsuitable) by defining thresholds that optimized TSS values.

(Climatic) Marginal populations

- those inhabiting rare or extreme environmental conditions within the current distribution of the species.
- We defined those that obtained a predicted probability of environmental suitability below the 5th and 10th percentile of the distribution of the species.

Set of relevant and weakly correlated bioclimatic predictors selected for each target species

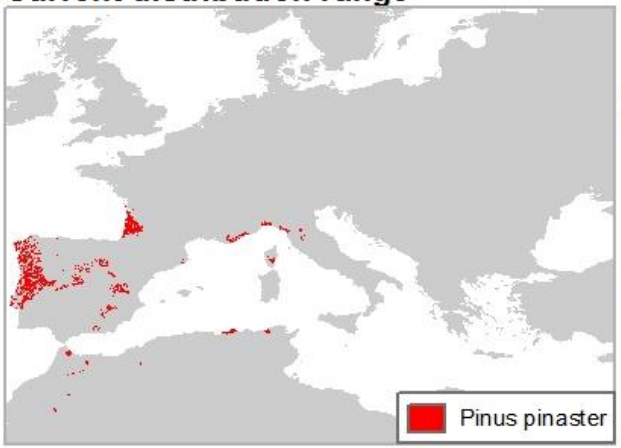
Species	Temperature predictor 1	Temperature predictor 2	Precipitation predictor 1	Precipitation predictor 2
Pinus halepensis *Pinus pinaster*	BIO4 (Temperature Seasonality)	BIO11 (Mean Temperature of Coldest Quarter)	BIO12 (Annual Precipitation)	BIO18 (Precipitation of Warmest Quarter)
Pinus nigra *Pinus pinea*	BIO4 (Temperature Seasonality)	BIO11 (Mean Temperature of Coldest Quarter)	BIO18 (Precipitation of Warmest Quarter)	BIO19 (Precipitation of Coldest Quarter)
Pinus sylvestris	BIO4 (Temperature Seasonality)	BIO6 (Min Temperature of Coldest Month)	BIO16 (Precipitation of Wettest Quarter)	BIO18 (Precipitation of Warmest Quarter)

5 and 10 percentiles values used as thresholds to define marginal populations

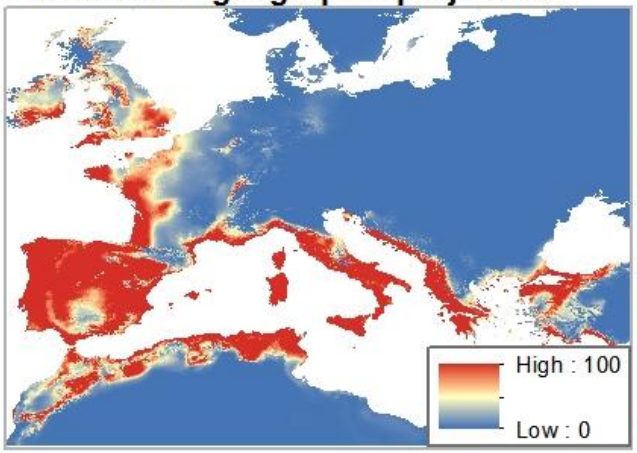
Species	5th percentile	10th percentile
P. halepensis	56.0	69.9
P. pinaster	58.3	71.2
P. nigra	44.1	57.9
P. pinea	66.4	76.2
P. sylvestris	57.9	73.9

P. pinaster

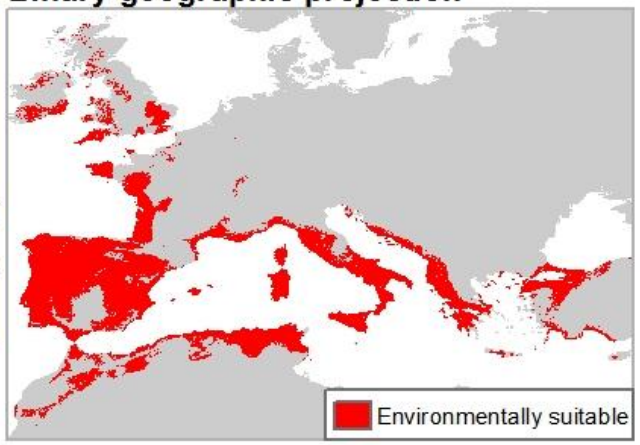
Current distribution range



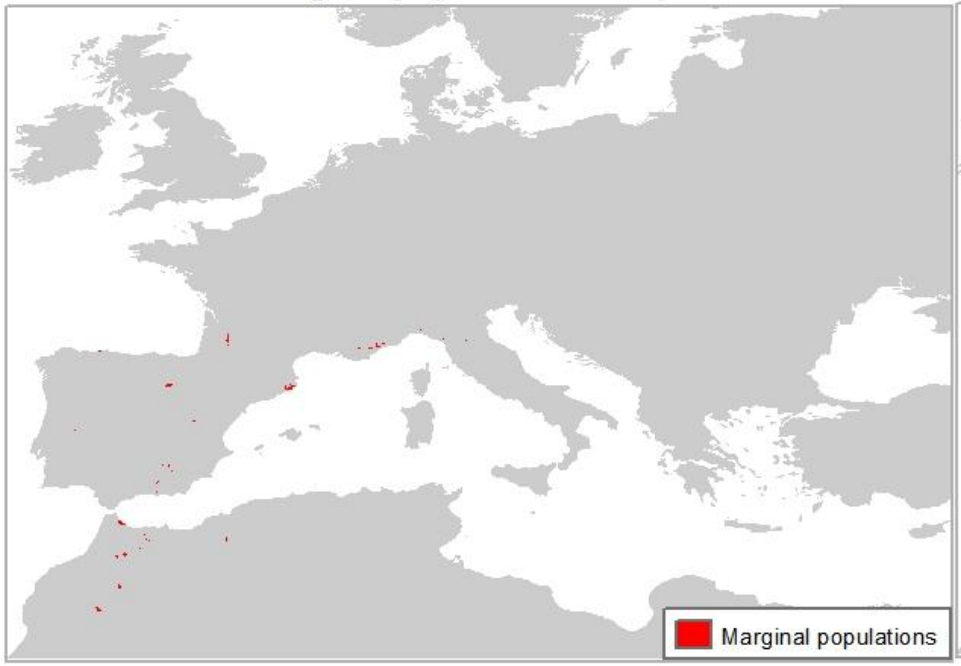
Probabilistic geographic projection



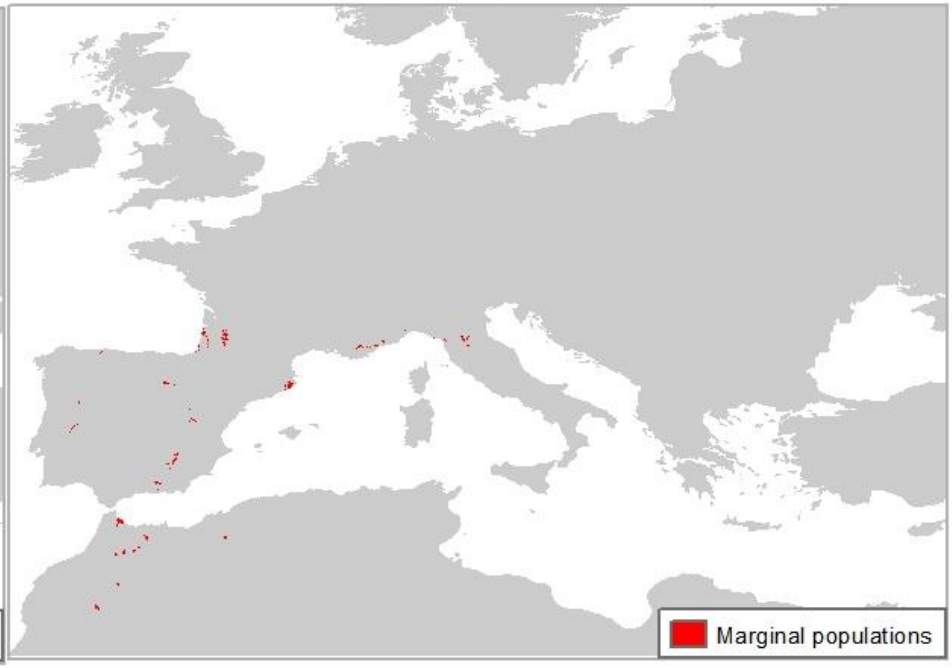
Binary geographic projection



Environmental Marginal populations: 5th percentile

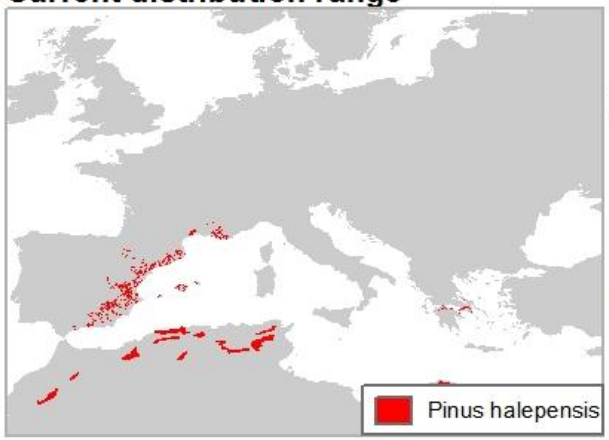


Environmental Marginal populations: 10th percentile

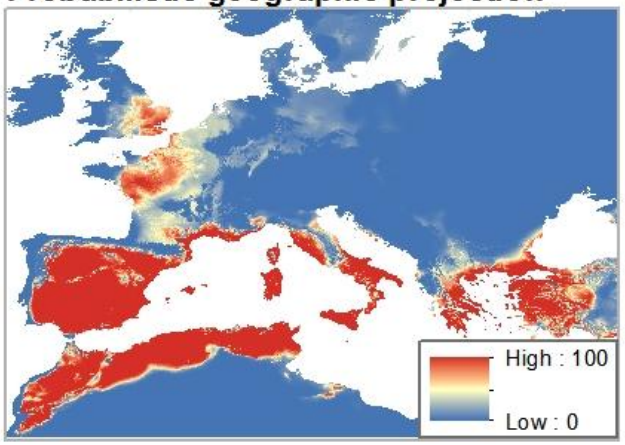


P. halepensis

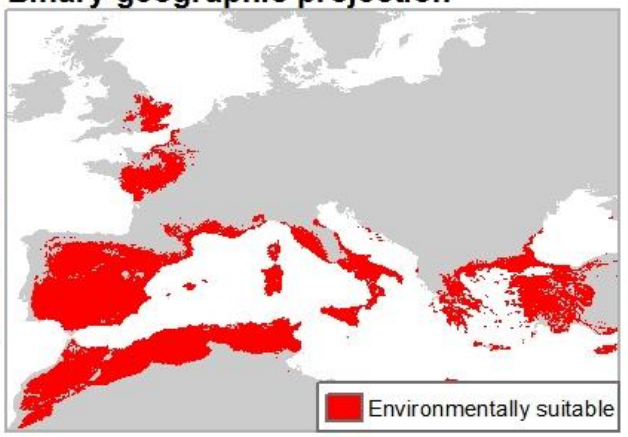
Current distribution range



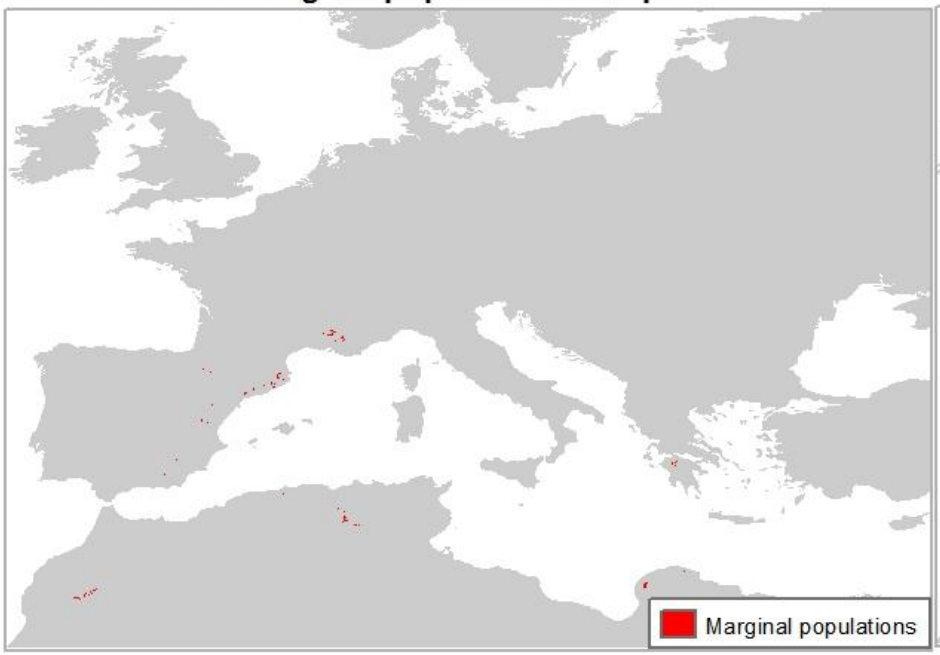
Probabilistic geographic projection



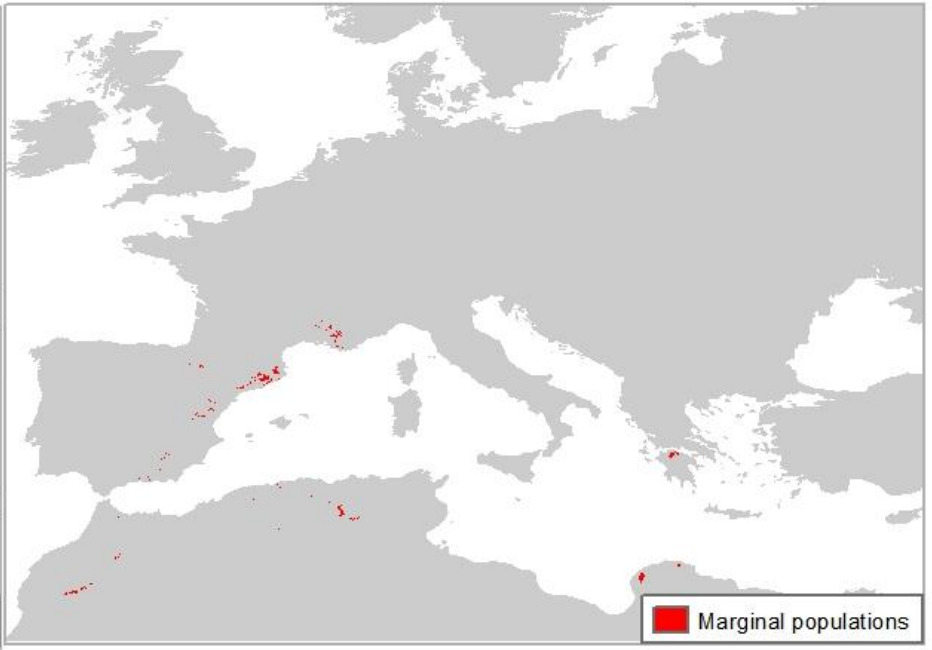
Binary geographic projection



Environmental Marginal populations: 5th percentile



Environmental Marginal populations: 10th percentile



Perspectives

- Are those maps useful for other WP?
- They are based in maps not tested by different experts in the different countries. Probably some important populations are missing. We have no means to improve this information at a reasonable cost (time)
- These evaluation can provide a overview of the imprtance of marginal (climatic) populations in Europe.
- Do we proceed with this analysis (Expert group to advance in this task. Volunteers?)