



COST Action FP1202: Strengthening conservation: a key issue for adaptation of marginal/ peripheral populations of forest trees to climate change in Europe (MaP-FGR)



WG1 - Gathering available data and ecological, genetic and global change information (particularly climate effects), on FGR and distribution of MaP populations (e.g. climatic scenarios and models, forest decline maps, lists of endangered materials).

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Participants (averaged): 21

Final report

Maps, atlas, databases (**D1, D2, D3, D4**)...Inventory of regional/ national maps and/or links to web sites of climatic maps including future scenarios, reduce a climate scenarios map, location of soil types and morphology, pedo-climatic parameters characterizing species ranges.

WG1 in interaction with WG2

Maps were created using the following methods and tools regarding the range of ten selected species using 2 different approaches to be integrated with the genetic information supplied by WG2:

1.- High Resolution (1 km) European Database of Ecological Factors:

HR Bioclimatic Database (current):

- WORLDCLIM (BIOCLIM – 19 Bioclimatic Variables)
- GEnS_Base- Global Environmental Stratification / European Environmental Stratification (37 Bioclimatic Variables + EnvZon)

HR Soil Database:

- ESDB soil map soil Inspire (Lambert Azimuthal) EurAsia polygons, ascii polygon maps and 1*1 km maps available - European Soil Data Centre (ESDAC)

HR Physiographic Database:

- GTOPO30 - Global Multi-resolution Terrain Elevation Data 2010, GMTED2010

2.- High Resolution (1 km) European Species Distribution Database:

Tree Species Distribution for Europe. New Dataset were created and homogenized from:

- National Forest Inventories: European Forest Data Center (EFDAC);
- Forest Information System for Europe (FISE);
- Joint Research Centre + EUFORGEN/Eufgis maps or Map of the Natural Vegetation of Europe scale 1 : 2,500,000, da Bohn, U. et al) to select natural populations or populations growing in their phytosociological area (problem with several Mediterranean conifers).

Meanwhile were considered:

i) Maps for Forest Tree Species in Europe: 115 species distribution maps in 30 European countries: %area- sp 1km2: AFOLU DATA : JRC (ICP Forest Level I 16 x 16 km: 5513 plots + IDW %area sp)

ii) Tree species maps for European forests. G. J. Nabuurs, D. J. Brus, G. M. Hengeveld, D. J. J. Walvoort, P. W. Goedhart, A. H. Heidema, K. Gunia. In cooperation with EFI, Alterra / Wageningen University and Research Centre has released a set of 1x1 km tree species maps showing the distribution of 20 tree species over Europe (Brus et al. 2011).

Description of the database:

Subfolders:

- **Biomod2**: all documents about biomod2 package (R package; the ensemble platform for species distribution modeling).
- **borders_CNTR_2010_03M_SH**: administrative limits for the countries included in the FP1202 and others.
- **eg_pnigra**: a complete example of analysis made with Pinus nigra at Sesimbra Meeting.
- **GENSbase**: the 37 bioclimatic factors of the Global Environmental Stratification (Alterra); Metzger, M.J., et al., Environmental stratifications as the basis for national, European and global ecological monitoring. Ecol. Indicat. (2012)
- **jrc_species**: 20 sp and gens distribution. Tree Species Distribution for Europe. New Dataset homogenized from National Forest Inventories. Joint Research Centre. European Commission.
- **Sesimbra2014_docs**: the WG1 presentations and Minutes in Sesimbra Meeting.
- **Software**: R software and other important packages.

At this stage, the maps have been obtained for the most important forest species, were discussed in the Florence (Italy) meeting (April 2016) and now are being updated with the comments by the different participants.

Two marginality index are going to be computed for each population with genetic data: Climatic marginality (already defined), and geographical marginality.

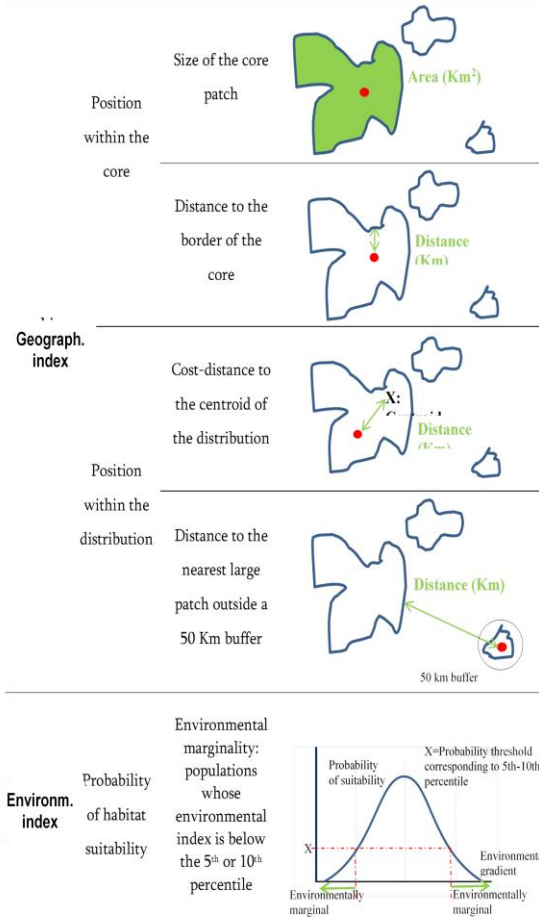
Results

- A niche model approach were used to define marginality of the populations.
- Geographical marginality indexes for the different species/populations were also defined.
- Niche models were based on 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 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.
- A set of relevant and weakly correlated bioclimatic predictors were selected for each target species:

Species	Temperature predictor 1	Temperature predictor 2	Precipitation predictor 1	Precipitation predictor 2
<i>Pinus halepensis</i> <i>Pinus pinaster</i>	BIO4 (Temperature Seasonality)	BIO11 (Mean Temperature of Coldest Quarter)	BIO12 (Annual Precipitation)	BIO18 (Precipitation of Warmest Quarter)
<i>Pinus nigra</i> , <i>Pinus pinea</i>	BIO4 (Temperature Seasonality)	BIO11 (Mean Temperature of Coldest Quarter)	BIO18 (Precipitation of Warmest Quarter)	BIO19 (Precipitation of Coldest Quarter)

<i>Pinus sylvestris</i>	BIO4 (Temperature Seasonality)	BIO6 (Min Temperature of Coldest Month)	BIO16 (Precipitation of Wettest Quarter)	BIO18 (Precipitation of Warmest Quarter)
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Indexes were defined to assess geographical and environmental marginality. In the following example figure on *Pinus halepensis* populations, *Blue polygons* represent the distribution. *Red dots* are genetically characterized populations. Example of indexes defined for populations.



Name	Long	Lat	Env.index	Env.percentil	dist.border.m	size.core.ha	distance.core.km	dist.centroid
Amfilohia	21,28	38,88	72,5	7,18	-79544,87686	163025,0765	80,72243632	66074,36058
North Euk	23,18	38,58	94,3	60,41	-5374,531667	21441,77373	53,43416894	69606,88498
Elea	21,53	37,77	90,2	32,12	-15526,16352	163025,0765	81,50382722	68595,79668
Zaouia Ifr	-5,14	33,57	87,8	24,62	-40360,69744	131965,808	158,4105826	24811,45552
Kassandra	23,88	40,09	95,7	74,04	-139629,0773	32500,26016	140,7337122	69911,75772
Imperia	8,05	43,9	90	31,34	-140068,4963	407490,1258	141,0298983	44326,34777
Shaharia	34,83	31,6	1,5	0,09	-1179421,598	522406,9597	1180,243903	72916,96307
Litorale T	17,12	40,62	96,5	82,13	-473198,5625	163025,0765	474,3448844	50676,25438
Thala	8,65	35,57	96,2	79,65	6269,047201	778425,0348	69,52278542	17907,63521
Aures Ber	6,83	35,17	96,6	83,09	-7304,357832	540120,9179	110,3538791	15861,13423
Querciane	10,34	43,49	87,7	24,36	-317078,7681	407490,1258	317,7848634	49979,21474
Tabarka	9,08	36,51	93,4	51,95	2128,003117	242335,822	186,05989	19236,23435
Alcotx	4,17	39,97	94,6	63,01	2684,44644	26692,72854	67,76806574	21772,18684
Carlo Fort	8,18	39,08	NA	100	-278662,6971	242335,822	279,8108421	41681,40819
Santanyi	3,05	39,28	96,1	78,76	-5184,504754	993,1131877	52,37525033	16725,39258
Otricoli	12,38	42,24	85	17,95	-504892,1247	407490,1258	505,761273	54221,71427
Gargano M	15,94	41,9	93,5	52,82	-638471,7063	163025,0765	639,6388948	53170,11847

Networking, Products, Dissemination activities and Future perspectives

- Both the ecological and genetic indexes have been distributed to the responsible of the different species, for compilation and uses;
- These marginality indexes are being used to establish the relationship among marginality and genetic diversity for the target species, in collaboration with the other WP2 and WP3 and will serve also in the framework of Gene Tree EU project..
- A Review and another methodological papers are being prepared, and a preliminary version was discussed during the last WG group meeting held in Florence in November 2016.

Maps and DBs in interaction with WG2 for producing deliverables

Please read [in the Restricted area] draft articles, showing the major results covering Deliverables **1, 2, 3,4 5, and 6** in cooperation with WG2 and WG3 titled:

- **WG 1 Marginality_Draft paperv01 FD.pdf**, [file:///C:/Users/User/Downloads/WG1-Marginality-paperv01-and-maps-FD%20\(1\).pdf](file:///C:/Users/User/Downloads/WG1-Marginality-paperv01-and-maps-FD%20(1).pdf)
- **WG 1 Methods_definitions_marginality_indexes FD.pdf**, [file:///C:/Users/User/Downloads/WG-1-Methods-definitions-marginality-indexes-FD%20\(1\).pdf](file:///C:/Users/User/Downloads/WG-1-Methods-definitions-marginality-indexes-FD%20(1).pdf)