



COST Action FP1202

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

2013 TRAINING SCHOOL

**Genetic, ecological properties of marginal populations
and their importance for conservation and use under climate change**

REPORT

**15 July - 19 July 2013,
Chania, Greece**



COST Action FP1202

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

LIST OF TRAINEES AND TRAINERS

	Name	Surname	Country	email	Contact	Role
1	Evaggelia	Donta	Greece	oiti_ed@otenet.gr	Parnassou 3, Lamia Post Code 35100	Trainee
2	Evaggelia	Aramidou	Greece	aevaggelia@yahoo.com	4-6 Mitr. Karavaggeli str. , Neapoli , Thessaloniki , P.C : 56728	Trainee
3	Nicolas-George	Eliades	Cyprus	niceliades@gmail.com	19A Lykavitou Av, 2401, Egkomi, Nicosia, Cyprus	Trainee
4	Marine	Pouget	France	marine.pouget@imbe.fr	Mediterranean institute for biodiversity and ecology (UMR CNRS IRD 7263). Europôle Méditerranéen de l'Arbois Bâtiment Villemin, BP 80 13545 AIX-EN-PROVENCE Cedex 04	Trainee
5	Paulina	Szydłowska	Poland	pszydłowska5@o2.pl	Szerzyny 555, 38-246 Szerzyny, Tarnow district, Malopolska Province	Trainee
6	Francisca	Rodrigues Dos Reis	Portugal	franciscareis@bio.uminho.pt	Department of Biology, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal	Trainee
7	Felipe	Perez Martin	Spain	fperez@magrama.es	Av. Gran Vía de San Francisco, 4. 5th Floor. E-28005. Madrid. Spain (Directorate-General for Rural Development and Forest Policy.)	Trainee
8	Marie	Roumet	Switzerland	marie.roumet@env.ethz.ch	ETH Zurich, Institute of Integrative Biology (IBZ) Universitätstrasse 16 8092 Zurich, Switzerland	Trainee
9	Joana	Magalhaes	Portugal	joanamagalhaes@hotmail.com	Rua Nova nº 88 3º D 5000 – 652 Vila Real Portugal	Trainee
10	Ecaterina Nicoleta	Chesnoiu	Romania	cathyches@yahoo.com	FOREST RESEARCH AND MANAGEMENT INSTITUTE (ICAS) Genetics and Tree breeding Laboratory Voluntari 077190, B-dul Eroilor 128, Judetul Ilfov ROMANIA	Trainee
11	Guia	Giovannelli	Italy	guiagiovannelli@yahoo.it	CRA SEL, Viale Santa Margherita 80, 52100 Arezzo	Trainee
12	Roberta	Proietti	Italy	roberta.proietti@entecra.it	CRA SEL, Viale Santa Margherita 80, 52100 Arezzo	Trainee
13	Rana	El Zein	Lebanon	ranaelzein@hotmail.com	University of Henri Poincaré (UHP) Faculty of Science and Techniques. Nancy, France	Trainee
14	Khiari	Habiba	Tunisia	khiarish@live.fr	Magazin Oumaya, rue SMIT, Béni Khalled, Tunisia	Trainee

COST Action FP1202

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



15	Aglaia	Papadina	Greece	aglaiap@for.auth.gr	Raidestou 13, 54636 Thessaloniki, Greece	Trainee
16	Adara	Pardo	Spain	adharapv@gmail.com	c/ El Pilar, nº5, 4ºD, Plasencia, Cáceres, Spain	Trainee
17	Krista	Kanberga-Silina	Latvia	krista.silina@silava.lv	Maza Nometnu 63-1, Riga, Latvia, LV-1002	Trainee
18	Maurizio	Marchi	Italy	maurizio.marchi@entecra.it	Via Poggio del Tesoro, 94/1, 50041 Calenzano (loc. Le Croci) - (FI - Italy)	Trainee
19	Aysun Demet	Gulsoy	Turkey	agulsoy@metu.edu.tr	Faculty of Science and Art Department of Biological Sciences METU ÇANKAYA 06531 ANKARA	Trainee
20	Paloma	Torroba	Spain	paloma.torroba@gmail.com	INIA, Forest Research Centre, La Coruña road km 7.5, 28040 Madrid, Spain	Trainee
21	Ali Murat	Gulsoy	Turkey	alimuratgulsoy@ogm.gov.tr	TOBB – Dumlupınar Bulvarı No: 252 (Eskişehir Yolu 9. km) 06530 Ankara/TURKEY	Trainee


1	Paraskevi	Alizoti	Greece	alizotp@for.auth.gr	Aristotle University of Thessaloniki School of Forestry and Natural Environment Laboratory of Forest Genetics and Tree Improvement	TS coordinator and trainer
2	Philippos	Aravanopoulos	Greece	aravanop@for.auth.gr	Laboratory of Forest Genetics & Tree Breeding Faculty of Forest & Environmental Science Aristotle University of Thessaloniki	Trainer
3	Giovanni Giuseppe	Vendramin	Italy	vendramin@fi.cnr.it	National Research Council Plant Genetics Institute	Trainer
4	Bruno	Fady	France	Bruno.Fady@avignon.inra.fr	INRA, FR ECCOREV, UR629 Ecologie des Forêts Méditerranéennes (URFM) Domaine St Paul, Site Agroparc, CS 40509, Avignon cedex 9	Trainer (reimbursement not required)
5	Julian	Gonzalo	Spain	jgonzalo@pvs.uva.es	Department of Vegetable Production and Forest Resources University of Valladolid Higher Tech. Col. of Agricultural Engineering	Trainer
6	Annette	Menzel	Germany	menzel@forst.tu-muenchen.de	Fachgebiet Ökoklimatologie TU München Hans-Carl-von-Carlowitz Platz 2 85354 Freising	Trainer
	Valentina	Garavaglia	Italy	valentina.garavaglia@fao.org	FAO- Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, Rome, Italy	Scientific Secretary

COST Action FP1202

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



TRAINING SCHOOL PROGRAM

	Intro to genetics of MaP pops	Structure and conservation of MaP pops	Ecology of MaP pops	Adaptation and Evolution of MaP pops	Adaptation and evolution of MaP pops / Practical techniques
	Mon 15-Jul-13	Tues 16-Jul-13	Weds 17-Jul-13	Thurs 18-Jul-13	Fri 19-Jul-13
9.00-10.30	Welcome Introduction to the TS Programme of the week Roundtable presentation of trainers/trainees (Paraskevi Alizoti)	Genetic conservation of marginal populations (Bruno Fady)	Climate constraints in species distribution models (Annette Menzel)	Field trip	Population, landscape and adaptive genetics / genomics in marginal and peripheral populations (incl. case studies from Greece) (Philippos Aravanopoulos)
10.30-11.00	Coffee break	Coffee break	Coffee break		Coffee break
11.00-13.00	Distribution of genetic diversity in Mediterranean species and populations (Bruno Fady)	Genetic monitoring and conservation genetics in marginal, peripheral and small populations (Bruno Fady/ Phil Aravanopoulos)	Applications of Ecological Niche Modeling for forest trees species delimitation and MaP populations dynamics (Julian Gonzalo)		Effects of abiotic stresses (climatic change and environmental pollution) in the evolutionary genetics of forest tree populations (Phil Aravanopoulos)
13.00-14.00	Lunch	Lunch	Lunch	Lunch	Lunch
14.00-16.00	Genetic consequences of being at the ecological and geographical margins (Bruno Fady)	Spatial genetic structure in marginal versus core populations (Giuseppe Vendramin)	What shapes the geographic limits of the species? The ecological, the evolutionary and the adaptive plasticity questions (Paraskevi Alizoti)	Molecular basis of adaptation in marginal populations (Giuseppe Vendramin)	Computer lab/SAS or SPSS software (Paraskevi Alizoti)
16.00-16.30	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
16.30-18.00	Presentation of the trainees (10' each)	Presentation of the trainees (10' each)	Open discussion/questions of trainees	Molecular markers and Bayesian clustering approaches (Giuseppe Vendramin)	Open discussion/questions of trainees Closing

COST Action FP1202

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



The training School has been hosted by the **International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) - Mediterranean Agronomic Institute of Chania (Crete, Greece)** (<http://www.maich.gr/>).

Cutting edge topics were covered by TS trainers (P. Alizoti, F. Aravanopoulos, B. Fady, J. Gonzalo, A. Menzel, G. Vendramin). In detail the topics covered in the lectures and according to the program of the Training School were the following:

Definition of natural population; the special cases of marginal, peripheral, small populations. Panmictic model and relaxations due to marginality and population size. Bottlenecks, founder effects. Census and effective population size. Leading edge versus rear edge (trailing and stable edge) populations. Conservation of MaP populations. Evolutionary processes in MaP populations. Genetic monitoring in MaP populations: definitions, objectives, methodology. Criteria, indicators, verifiers. The gene-ecological approach. Genetic monitoring parameters - application in MaP populations. Main motivations for genetic conservation in forest tree species (*in situ* genetic conservation in Europe, with focus on marginal populations).

Introduction to population and landscape genomics of MaP populations. Caveats of population and landscape genomics and the case of MaP populations. Population and landscape Genomics as the precursors of adaptive genomics in MaP populations. Population and landscape genomics as the precursors of conservation genomics in MaP populations. Examples of studies at the south-eastern edge: (1) Marginal vs. central population genetic value: the centre-periphery model, the Eckert-Hampe/Petit debate and the case of *Prunus*, (2) *Populus* genomes and marginality: the case of *Quercus*; (3) Marginality and co-evolution: the case of *Picea abies* and *Pityogenes chalcographus*.

Main concepts about spatial structure at different spatial scales and in marginal/peripheral versus core populations of forest tree species. Statistical approaches and software to detect spatial structure. Choice of molecular markers to detect spatial genetic structure (presentation of several case studies). Practical implications for populations management and conservation. Dissection of the role of demography and selection in shaping diversity in forest trees. Molecular markers and statistical approaches to make inferences about the demographic and selection processes. Presentation of case studies. Use of software for the detection of signature of selection. Usefulness of the new sequencing approaches for monitoring putatively adaptive variation. Association studies and importance of phenotyping. Presentation of the most commonly used molecular markers for population genetic studies. New generation sequencing approaches. Pros and cons of the most commonly used Bayesian clustering approaches, with particular emphasis to STRUCTURE and TESS. Presentation of case studies. Application of ABC methods to identify the most likely scenarios shaping the diversity in forest tree species.

Environmental pollution, climatic change and the stresses they impose on forest trees and their populations. Importance for stresses in MaP populations. Influence of stresses (climatic change and environmental pollution) on the evolutionary genetics of forest trees. Stresses (climatic change and environmental pollution) as an evolutionary force. Stresses (climatic change and



COST Action FP1202

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

environmental pollution) and genetic drift, gene migration, natural selection. Case studies and the response of central vs. peripheral populations.

Factors contributing to the potentially low genetic diversity of marginal populations which could thus be considered of poor conservation and breeding value. Contrasting cases studies indicating that marginal populations may harbor low or high genetic diversity and factors that explain the different patterns of diversity. Major patterns of genetic diversity in Mediterranean species (plants - animals). Meta-analysis on marginal populations generally reveals their low diversity and thus considered as of poor value for conservation, breeding and sustainable management.

Ecological (abiotic and biotic) factors shaping the geographic limit of species. Evolutionary explanations for species range limits. Ecology versus evolution. Meta-population dynamics. Breeders's equation to evaluate response to natural selection. Significance of Heritability / Evolvability of fitness traits for MAP populations. Natural selection and fitness. Mapping phenotypes - canalization, plasticity and developmental stability. Costs and limits of adaptive phenotypic plasticity. Migration, local adaptation and evolution of plasticity. Plasticity vs fixity in MAP populations. Quantitative estimation of phenotypic plasticity. Ecological limits to plant phenotypic plasticity. Adaptive plasticity and genetic evolution. Adaptive value of epigenetic memory. Genetic correlations and species range shifts. Significance of multi-environmental evaluation of genotype by environment interaction for evaluation of population adaptive potential (especially for MAP populations in stressful environments).

Hypothetical construction of a human distribution model by martians, general problems associated with assessing complete and correct plant species distributions, examples (AFE, EUFORGEN, ISPRA, BOHN, MEUSEL, ...), climate data - stations versus gridded data, inherent problems of products in relation to data quality and scaling issues, examples for climatic variation in meso / microclimate, role of future climate scenarios and their interpretation, examples of GLMs in the MARGINS project. Main methods for developing ecological niche models of plant species, focusing on niche differentiation according populations (defining and considering genetic clusters). We also consider niche evolution, through a phylogeographic and phylogenetic approach to improve the projections of species ranges into the future with special emphasis on the results obtained on marginal/peripheral populations. Case studies are developed using R software.

Trainees' Workshop

On the 15th and 16th of July and during the late afternoon sessions the trainees had the opportunity to present an overview of their research, research achievements and interests in 10-min. presentations that were followed by short discussion and questions. During the sessions the trainees had the opportunity to discuss issues related to their research with the trainers and get advice on how to proceed more efficiently with their work and also receive questions regarding their research from the their colleagues.



COST Action FP1202

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

FIELD TRIP

A field trip was organized on Thursday July 18, 2013. The marginal and isolated population of the endemic species *Phoenix theophrastii* (common name: Theophrastus's date palm) growing in the area of Preveli and along the Kourtaliotis ravine was visited. This palm species is classified as Near Threatened (NT) on the IUCN Red List and is growing in eight subpopulations on the Greek Island of Crete, with the largest population containing a few thousand individuals. The Cretan date palm is a dioecious species and prefers to grow in the damp sandy beds of valleys and temporary streams, but it can also be found on rocky ground. It tends to grow fairly close to the sea, and does not occur above an altitude of 250 metres. During the visit in Preveli palm forest, the trainees had the opportunity to discuss very extensively and lively with the trainers all issues related to marginal and isolated populations of forest tree species.

Chania, Crete , 19th July 2013

Dr. Paraskevi Alizoti



Training School Coordinator

Assistant Professor

Aristotle University of Thessaloniki

School of Agriculture, Forestry and

Natural Environment, Laboratory of

Forest Genetics and Tree Improvement

54124, Thessaloniki, Greece



COST Action FP1202

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