



# **EVOLution of TREEs** as drivers of terrestrial biodiversity

<http://www.evoltree.eu/>

# Outline

What is EVOLTREE

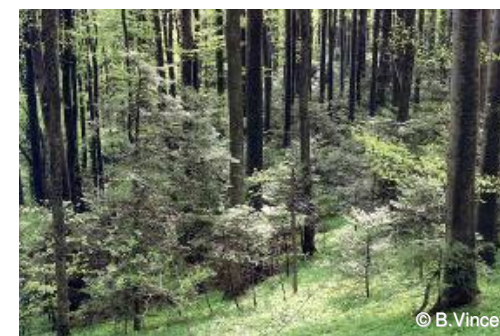
Issues addressed

Why a Network of Excellence

Structure and activities

Practical implication of scientific findings

Long term objectives



# EVOLTREE

*LINKING GENOMICS AND ECOLOGY TO  
UNDERSTAND THE EVOLUTION OF DIVERSITY  
IN TERRESTRIAL ECOSYSTEMS*

EVOLTREE is a Network of Excellence under the  
EC 6th framework programme for research

Focus: Assessing and forecasting changes in  
biodiversity, structure, function and dynamics of  
ecosystems and their services

# EVOLTREE



Coordinator: Antoine Kremer (INRA, France)

Consortium of 25 institutions in 15 countries, 228 scientists

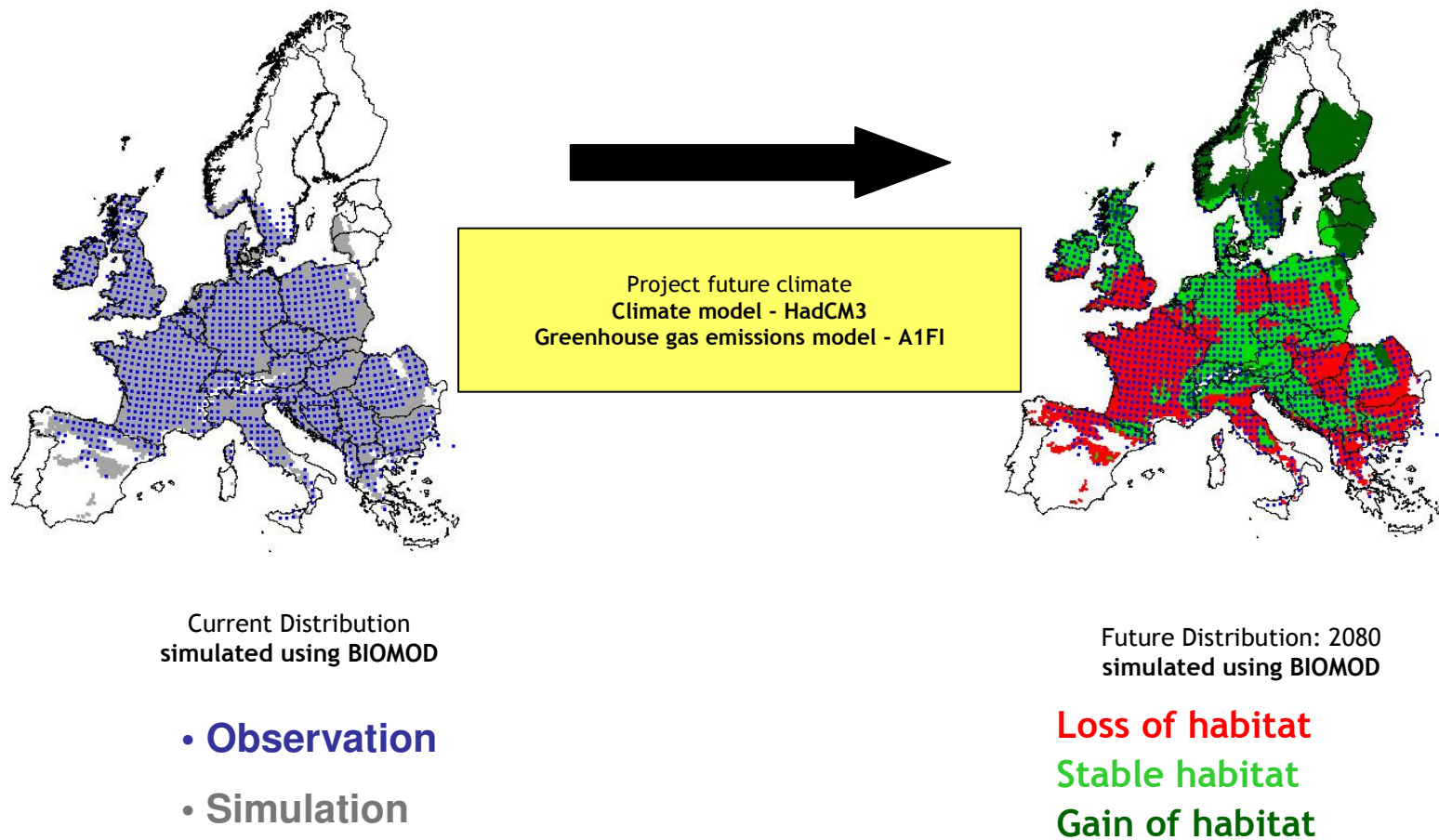
EC contribution: 14.3 million euros

Project starting date: 1 April 2006

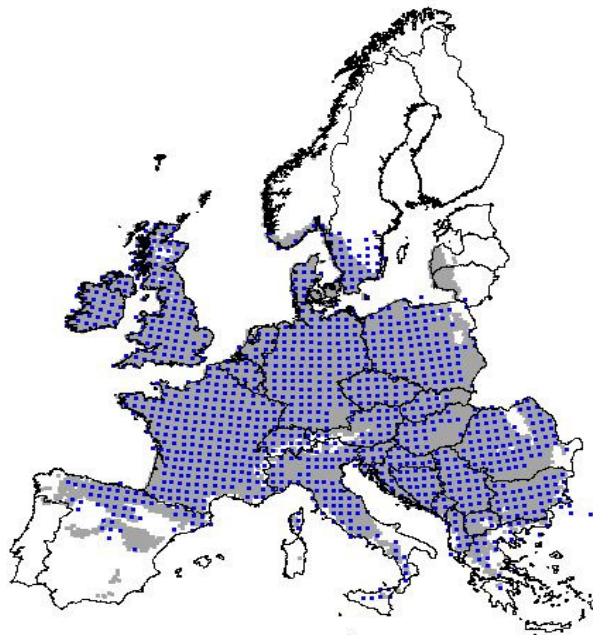
Duration: 4 years



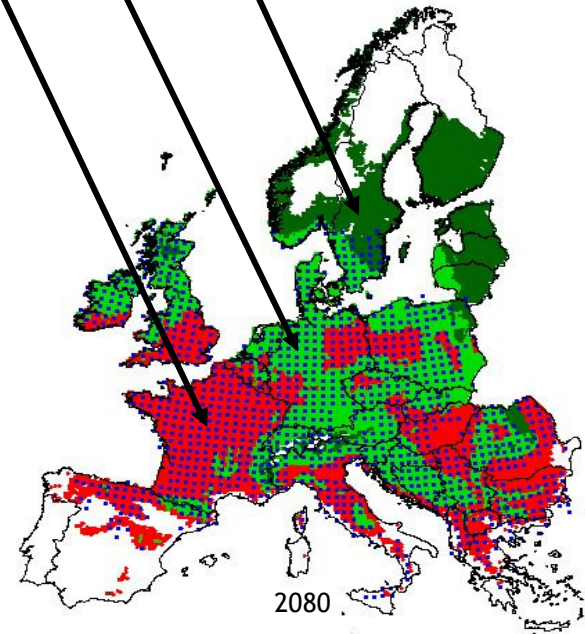
# Shift of *Quercus petraea* bioclimatic envelope as a results of climate change



# What will happen to trees in these areas ??



Current



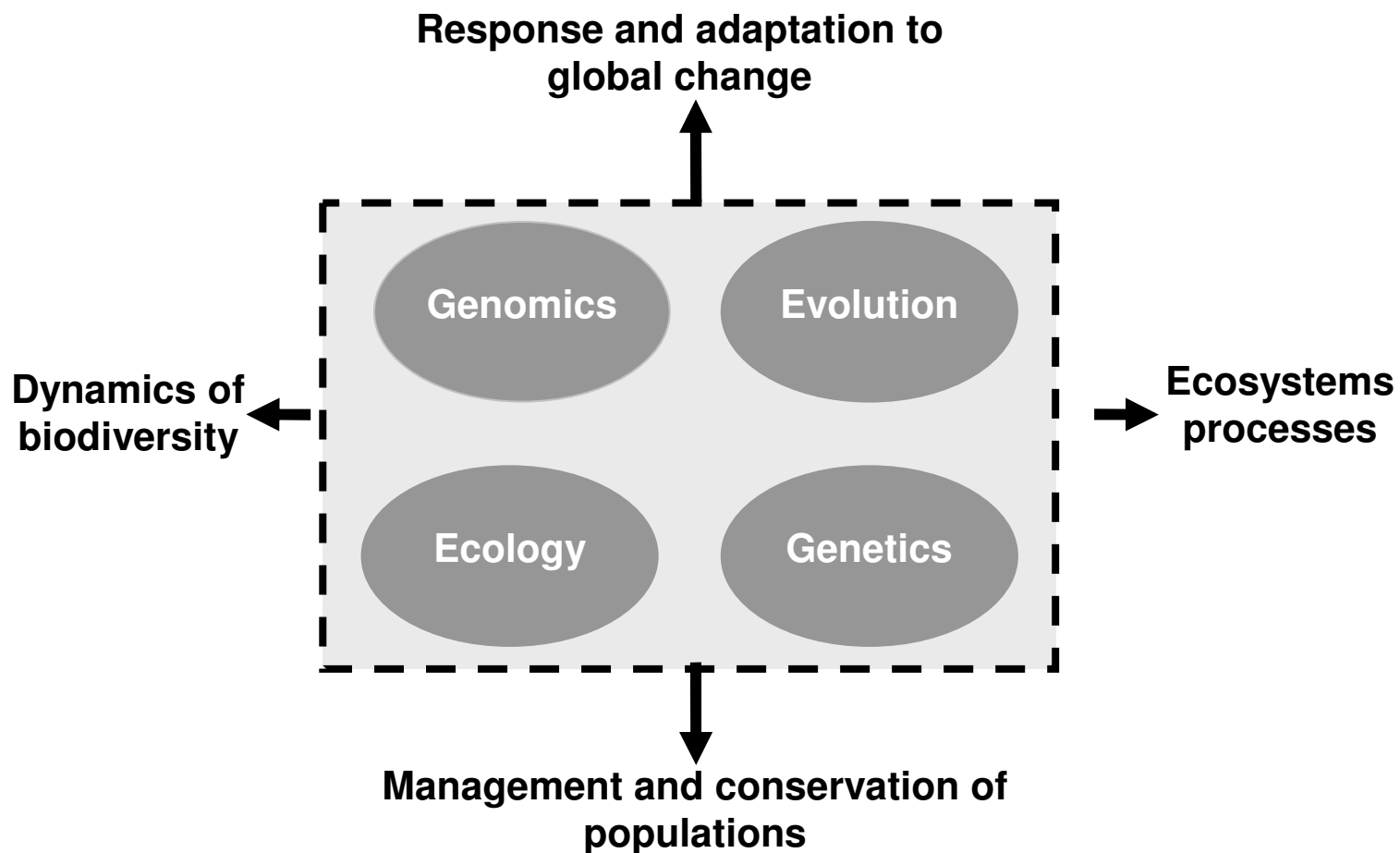
2080

Thuiller GCB 2003, Thuiller et al. PNAS 2005

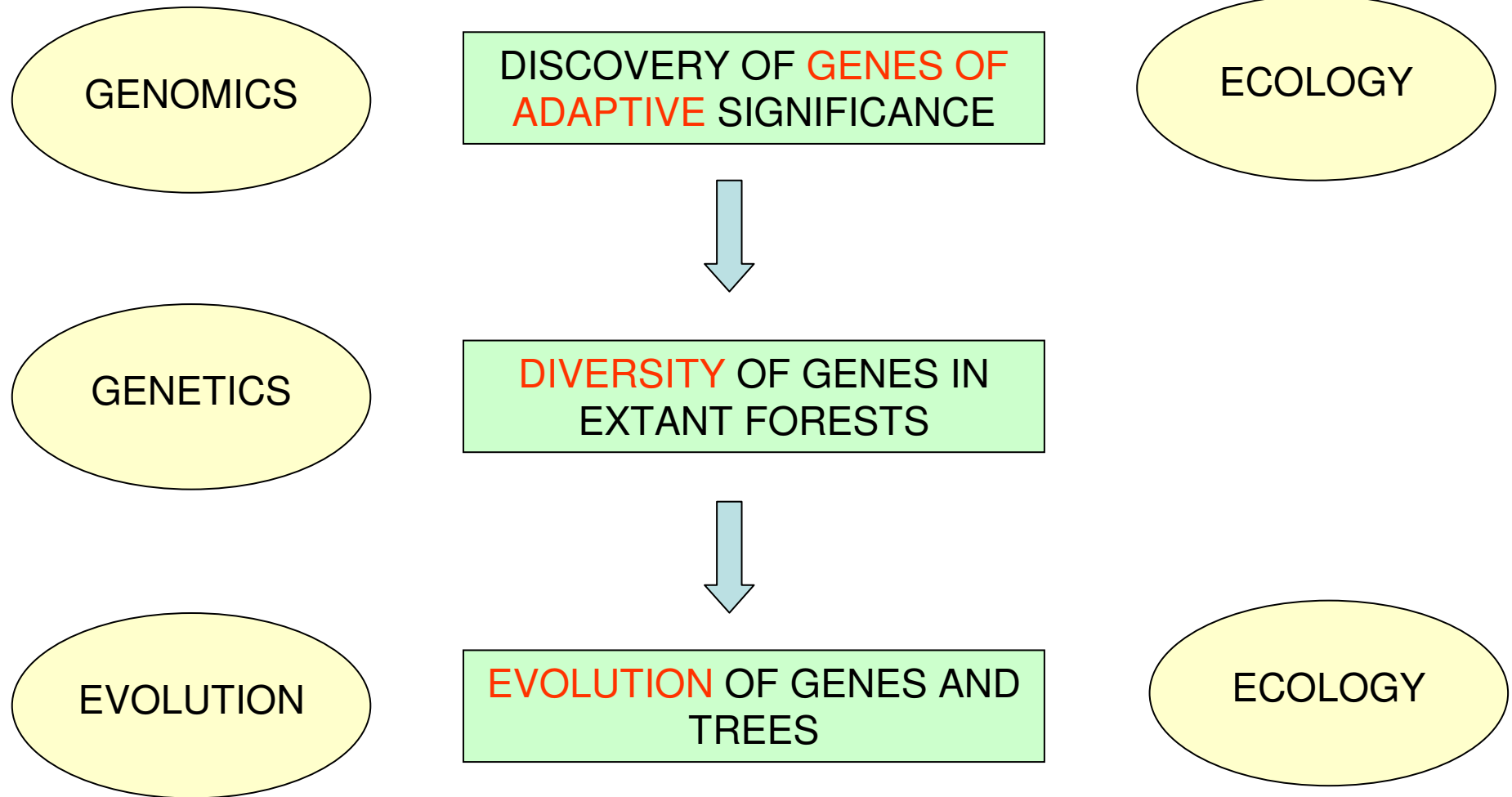
**Get adapted ?? Decrease in fitness ?? Die ??**

**Rate of migration ? Adaptation ?**

# EVOLTREE: linking disciplines



# Understanding adaptive diversity



# EVOLTREE: major objectives



Contribute to understanding **adaptive diversity** in trees and associated organisms (mycorrhizal fungi and insects)

Assemble and integrate the complementary disciplines in the field of ecological genetics and genomics (**ecosystem genomics**)

Establish and implement a **European research platform** in this field in the form of “laboratory without walls”

Install **common infrastructures** (repository centre), field experimental sites, data management systems

**Spread a high level excellence** to the scientific community, end-users and to the public



# Why an interdisciplinary network of excellence?

The issues addressed are regional and not simply national

They need to be tackled through interdisciplinary research

Research is highly demanding in resources

Only long-term research can provide answers to the specific questions addressed



# Network of Excellence



NoEs were created for the first time within the 6th framework programme (2002-2006)

NoEs are instruments to overcome the fragmentation of the European research and to strengthen European excellence in a given area

The purpose is to reach a durable restructuring/shaping and integration of efforts and institutions

NoEs include not only research activities, but also integration and dissemination activities



# Participant institutions



1. Institut national de la recherche agronomique (France)
2. Alterra - Wageningen University and Research (The Netherlands)
4. Bundesforschungsanstalt für Forst und Holzwirtschaft (Germany)
5. Consiglio Nazionale Ricerche (Italy)
6. Flanders Interuniversity Institute for Biotechnology (Belgium)
7. Geological Survey of Denmark and Greenland (Denmark)
8. Georg-August Universität Göttingen (Germany)
9. Inra Transfert (France)
10. Bioversity International (Italy)
11. Natural Environment Research Council CEH (United Kingdom)
12. Phillips University of Marburg (Germany)
13. Swiss Federal Research Institute WSL (Switzerland)
14. Technical University in Zvolen (Slovakia)
15. Technical University of Munich (Germany)
16. Instituto Nacional de Investigacion y Tecnologia Agraria y Alimentaria (Spain)
17. Università degli Studi di Udine (Italy)
18. Centre national de la recherche scientifique (France)
19. Umeå Plant Science Centre (Sweden)
20. University of Bydgoszcz (Poland)
21. University of Oulu (Finland)
22. University of Southampton (United Kingdom)
23. University of West Hungary (Hungary)
24. Uppsala University (Sweden)
25. Max Planck Institute (Germany)
26. Austrian Research Centers GmbH - ARC (Austria)



# Third parties

The third parties are represented by an identified Contractor. These third parties are the following:

**INRA (P1)** shall represent:

- Université de Bordeaux I
- Université de Nancy I
- Université d'Evry
- CNRS

**Alterra (P2)** shall represent:

- Plant Research International
- A&F

**INIA (P16)** shall represent:

- Universidad Politecnica de Madrid, Escuela Tecnica Superior de Ingenieros de Montes (ETSI)
- Instituto Vasco de Investigacion y Desarrollo Agrario (NEIKER)

**CNRS (P18)** applies the special clause 23 and shall represent:

- Université Paris-Sud - Paris XI
- AgroParisTech
- Université Victor Segualen - Bordeaux II
- Université Sciences et Technologies - Bordeaux I
- Université Paul Cézanne - Aix-Marseille 3
- Université Sciences et techniques du Languedoc - Montpellier II

**Uniwersytet Kazimierza Wielkiego (P20)** shall represent:

- Forest Research Institute (IBL)
- Institute of Dendrology (IDPAN)

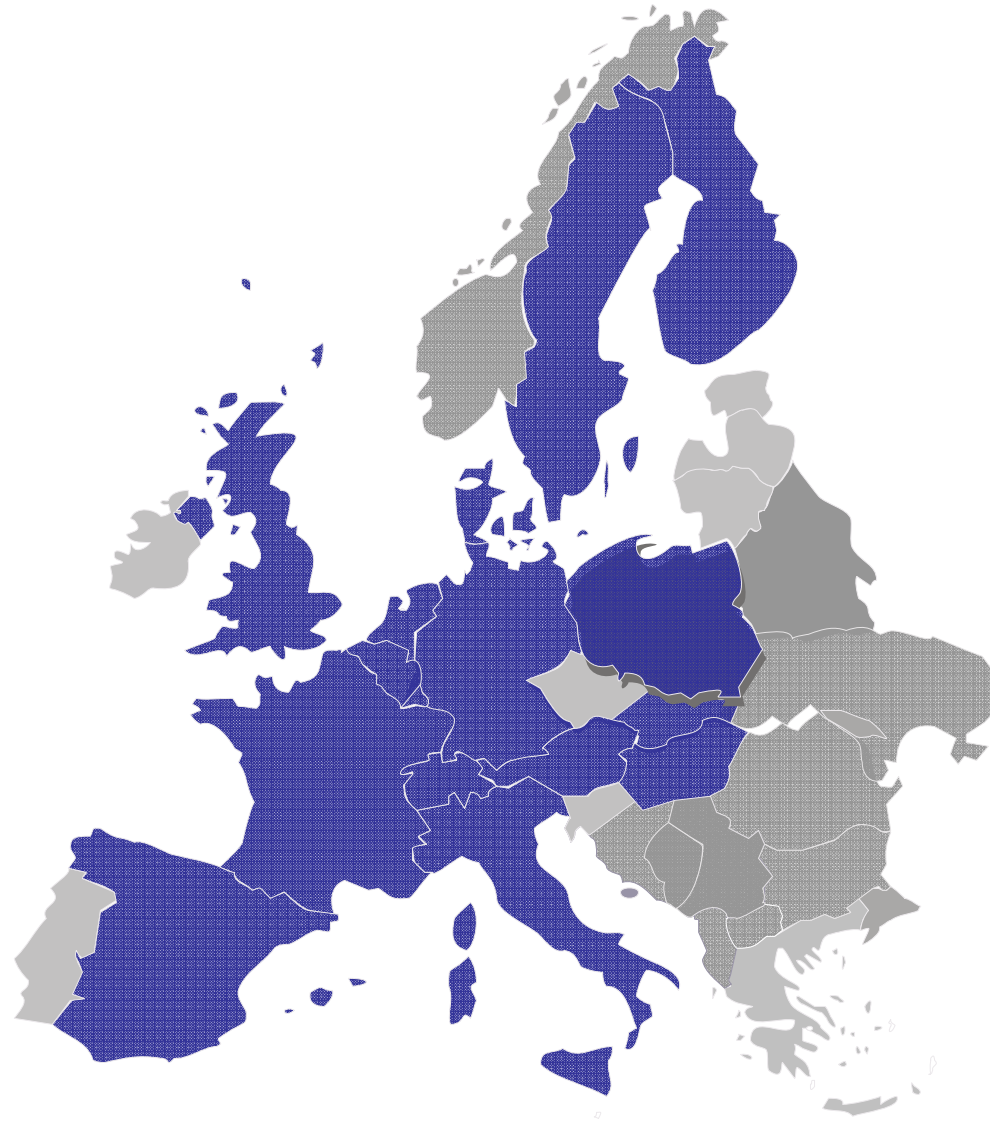
**Oulun Yliopisto (P21)** shall represent:

- The Finnish Forest Research Institute, METLA

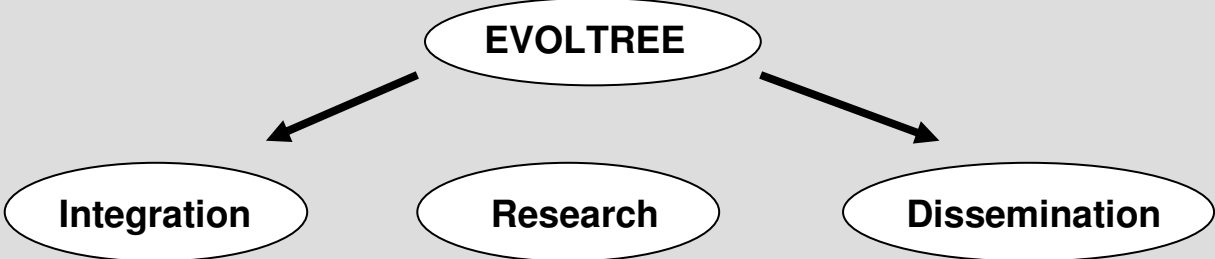
**University of West Hungary (P23)** shall represent:

- Forest Research Institute
- Agricultural Quality Control (OMMI)

# Participant countries



# EVOLTREE: structure and major impacts

<p><b>ACTIVITIES</b></p> <p><b>MAIN ACHIEVEMENTS</b></p> <p><b>MAIN IMPACTS</b></p>	<div data-bbox="588 329 1794 586">  <pre> graph TD     EVOLTREE([EVOLTREE]) --&gt; Integration([Integration])     EVOLTREE --&gt; Research([Research])     EVOLTREE --&gt; Dissemination([Dissemination])           </pre> </div> <div data-bbox="588 662 1794 833"> <p><b>Laboratory without walls</b> <b>Infrastructures</b></p> <p><b>Adaptive diversity</b> <b>Intraspecific and interspecific processes</b></p> <p><b>Training</b> <b>Technology transfer</b> <b>International cooperation</b></p> </div> <div data-bbox="588 904 1794 1070"> <p><b>Harmonization</b> <b>Synergy</b> <b>Excellence reinforced</b></p> <p><b>New discipline: community genomics</b></p> <p><b>Excellence spreading</b> <b>Competitiveness</b> <b>EU policy and regulations</b></p> </div>
<p><b>STAKEHOLDERS</b></p>	<p><b>Scientific community, Regulation makers, Conservation agencies, Land managers, nurseries, Forest services, Seed companies, Wood industries, Certification agencies, Biotechnological companies</b></p>

# Work packages



## Integration activities

- IA1 – Laboratory without Walls for Ecosystem Genomics (Gail Taylor )
- IA2 - Common infrastructures (Silvia Fluch)
- IA3 - Harmonization, consolidation, and perpetuation (Antoine Kremer)
- IA4 - Human resource exchange (Hans Peter Koelewijn)

## Jointly Executed Research Activities

- JERA1 – Ecological genomics (Michele Morgante)
- JERA2 – Genomic diversity in natural populations (Outi Savolainen)
- JERA3 – Community structure and dynamics (Birgit Ziegenhagen)
- JERA4 – Dynamics of biodiversity and evolution of populations (Reiner Finkeldey)

## Spreading Excellence Activities

- SEA1 – Training and Education (Ladislav Paule)
- SEA2 – Dissemination (Jozef Turok)
- SEA3 – Technology transfer (Bernd Degen)
- SEA4 - International cooperation /cross-linking (Michele Morgante)

## Management activities

- MA1 – Network strategy (Antoine Kremer )
- MA2 - Programme monitoring (Marie de Prémèsnil)
- MA3 - Consortium management (Marie de Prémèsnil)



# Breakdown among activities

50 % Integration activities

30 % Research activities

13 % Dissemination

7 % Management



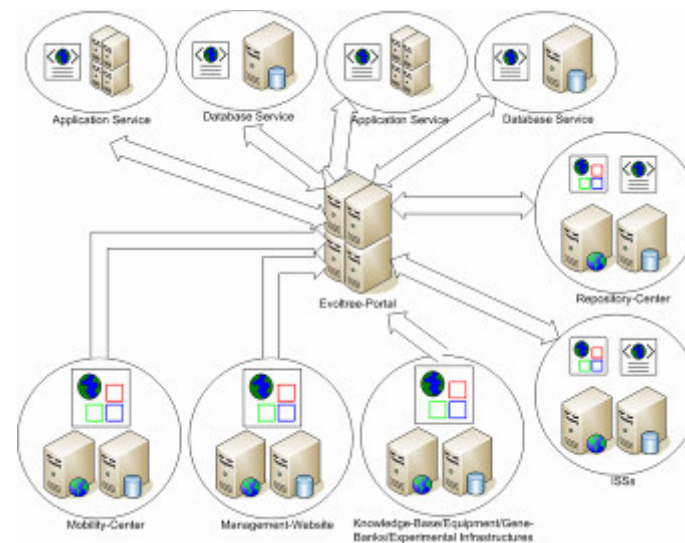
# Integration

# Integration

## SHARED GENOMIC RESOURCES – REPOSITORY CENTRE



## SHARED VIRTUAL RESOURCES



## INTENSIVE STUDY SITES

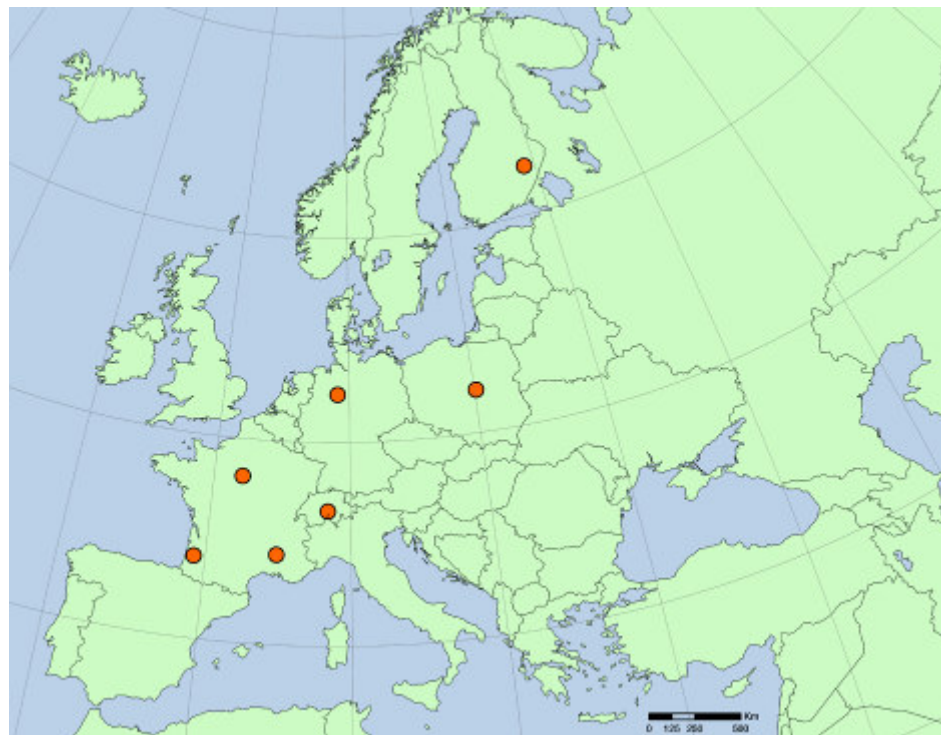


## COMMON EXPERIMENTAL INFRASTRUCTURES



# Intensive Study Sites - ISS

- ✓ Boreal: Punkaharju (Finland)
- ✓ Temperate: Solling (Germany)
- ✓ Untouched: Puszcza Świętokrzyska (Poland)
- ✓ Riparian: Loire (France)
- ✓ Alpine: Valais (Switzerland)
- ✓ Intensively managed: Landes (France)
- ✓ Mediterranean: Ventoux (France)



# One of the ISS: the alpine site of central Valais





## Intensive research activities since 1970






### 1. Systematic sites

-  National inventory plots

### 2. Monitoring sites

-  Thinning trials
-  ILTER / ICP-Forest sites

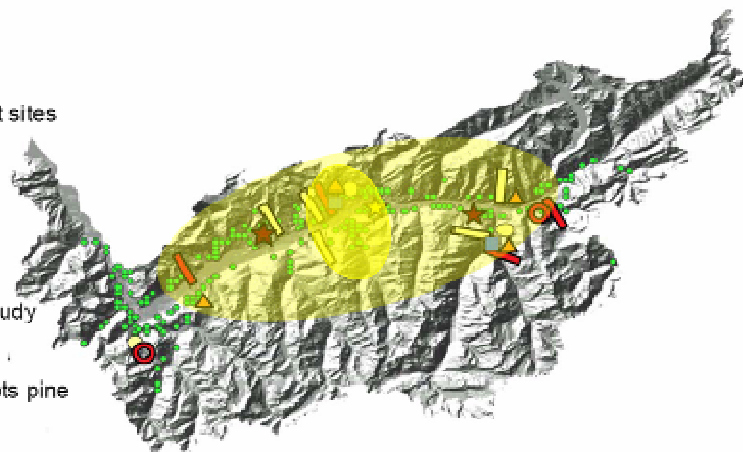
### 3. Case studies

-  Felling trials
-  Pine-oak growth study
-  Ecological studies
-  Genetic study, Scots pine
-  Forest fires

### 4. Experiment

-  Irrigation experiment

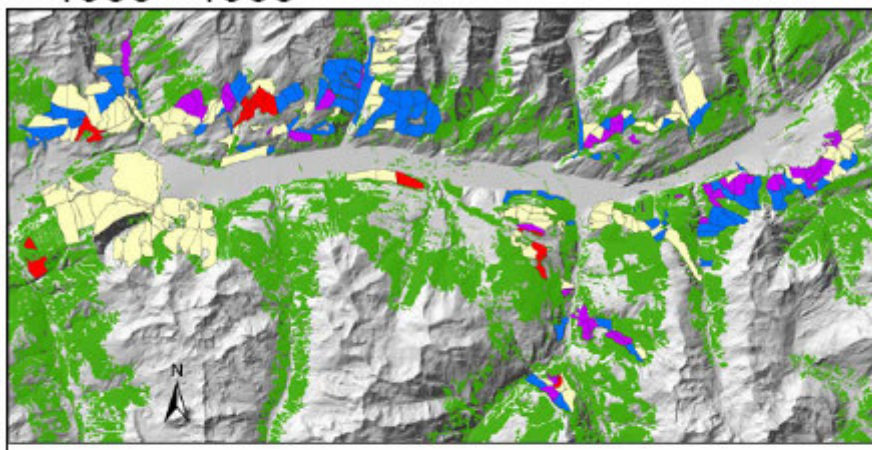
### 5. Historical studies



# The alpine ISS of central Valais

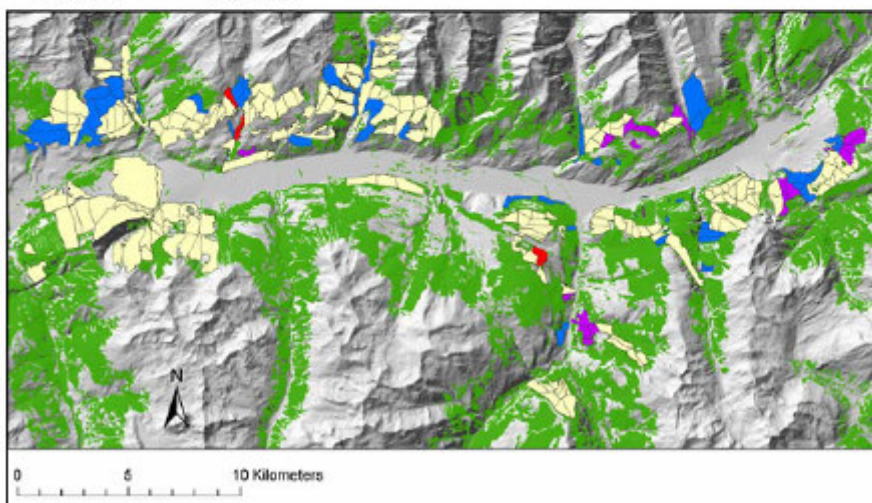
## Spatial and historical integration

~1900 - 1930



- wood pasture (goat and/or sheep)
- forest litter collecting
- combination
- no such use
- other forests

1930 - ~1960

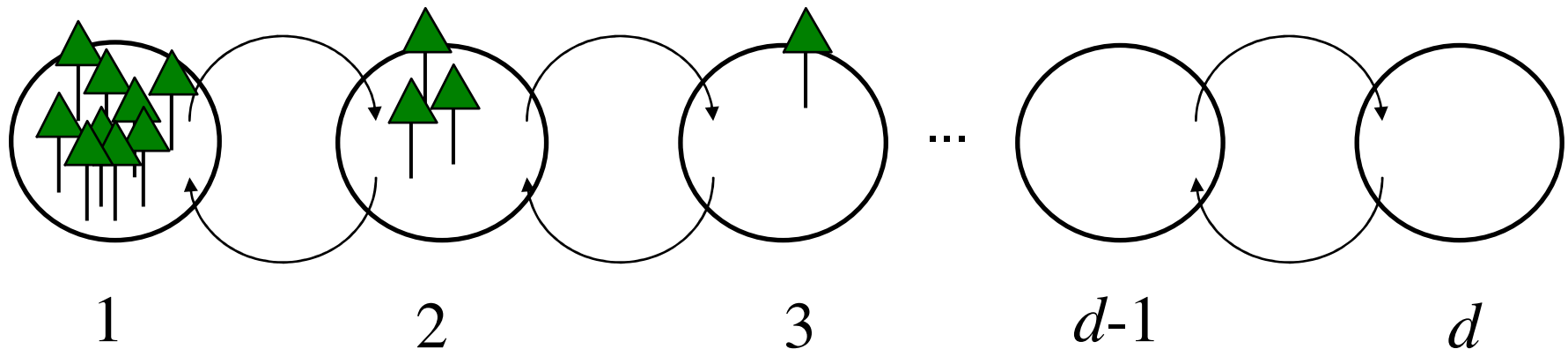


Gimmi *et al.* in prep.

# Modelling platform

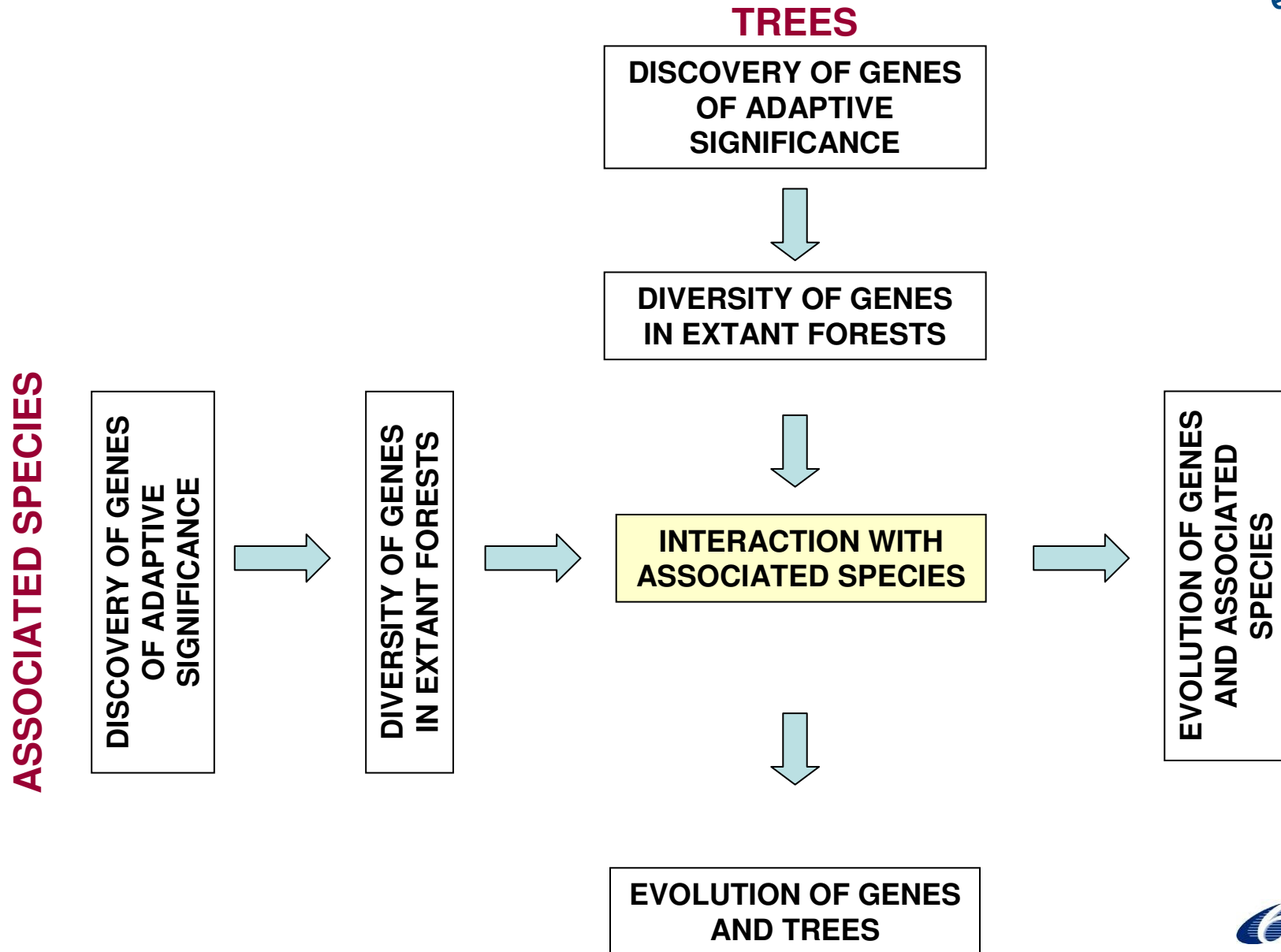
It will integrate:

- data on the genetic architecture of adaptive traits
- evolutionary processes
- environmental change and climatic scenario



# **Jointly executed research activities**

# Jointly executed research activities



# Jointly executed research activities

- Identify genes of adaptive significance with regard to global change in model species of trees (*Pinus*, *Populus* and *Quercus*), phytophagous insects (*Limantria*) and mycorrhizal fungi (*Laccaria* and *Glomus*)
- Assess the level and distribution of nucleotide diversity in genes of adaptive significance in trees, insects and mycorrhizal fungi
- .....



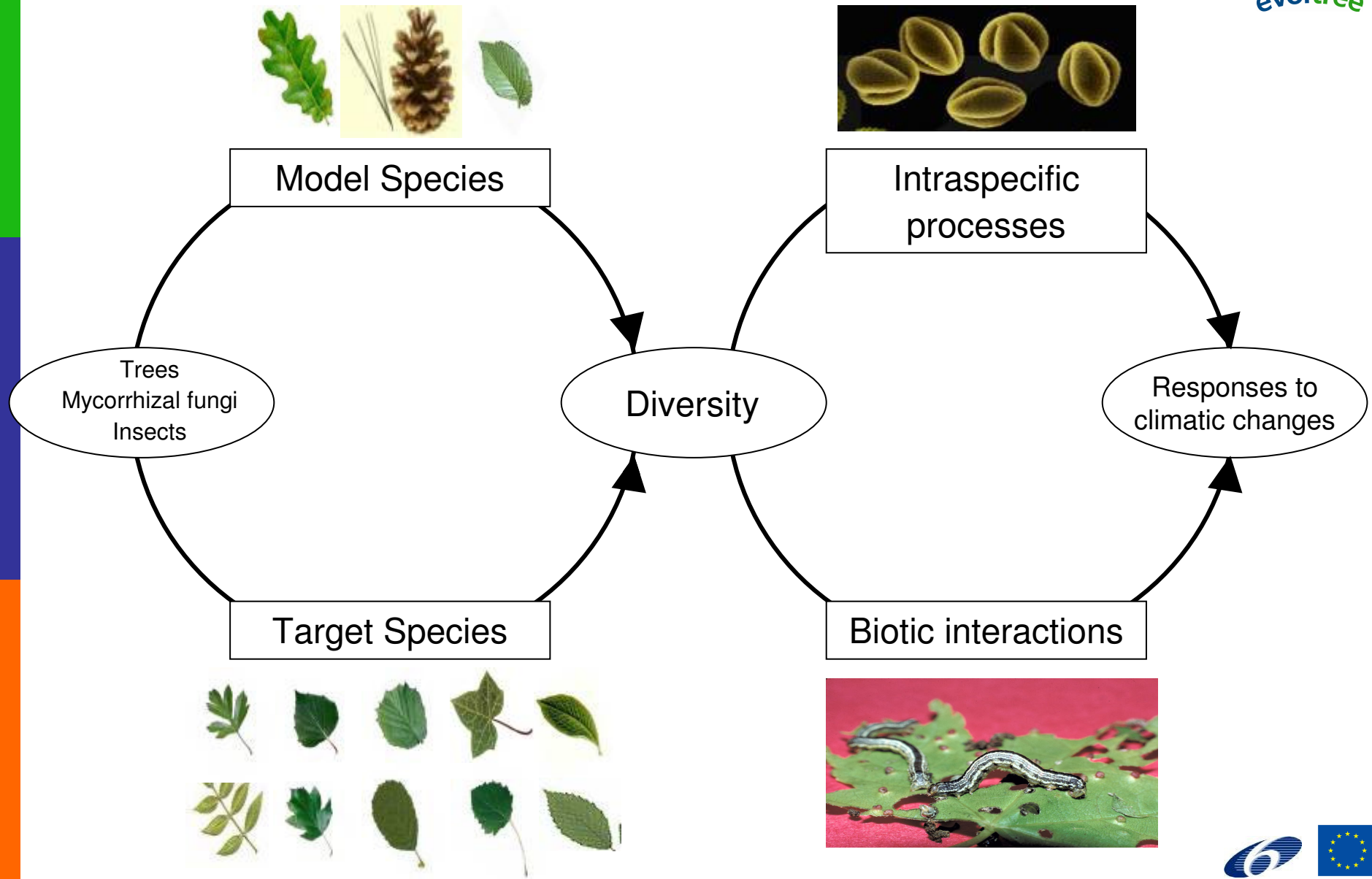
# Jointly executed research activities

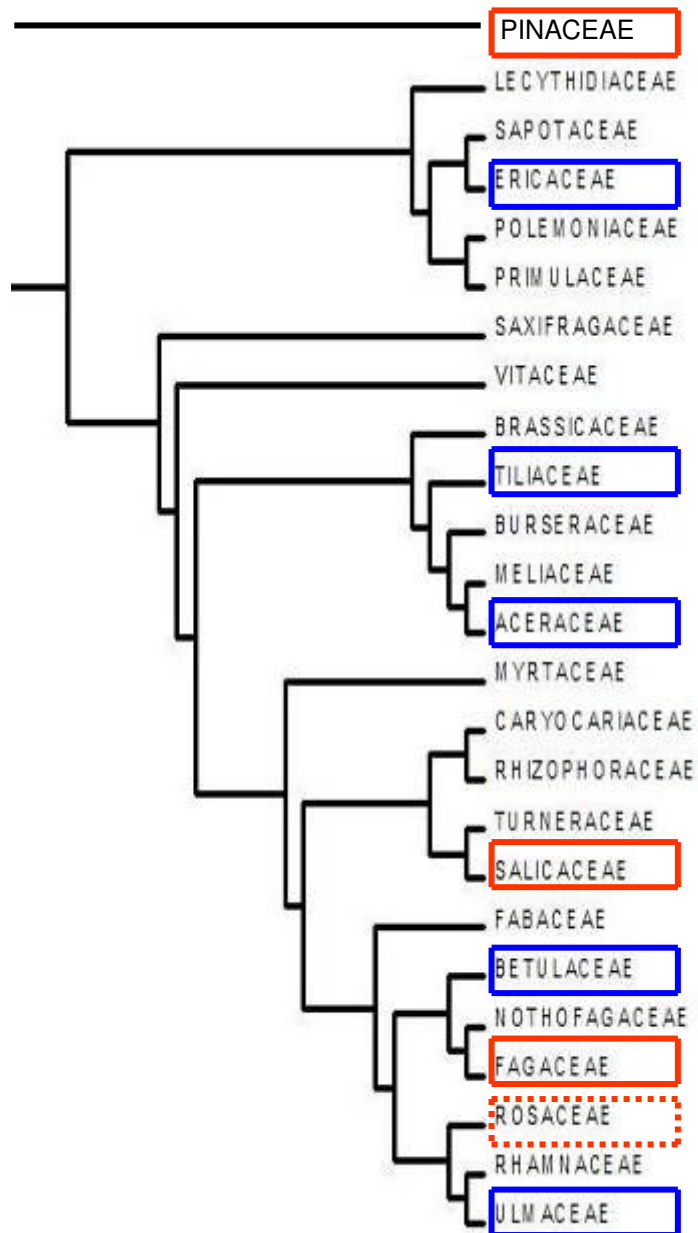


- .....
- Assess the impact of trees on the composition of communities by studying interactions between trees and their associated species
- Investigate the evolutionary processes in trees by reconstructing their past history and predicting their future response to global change



# Model and target species of trees and associated organisms





33%

*Pinus sylvestris*  
*Pinus pinaster*



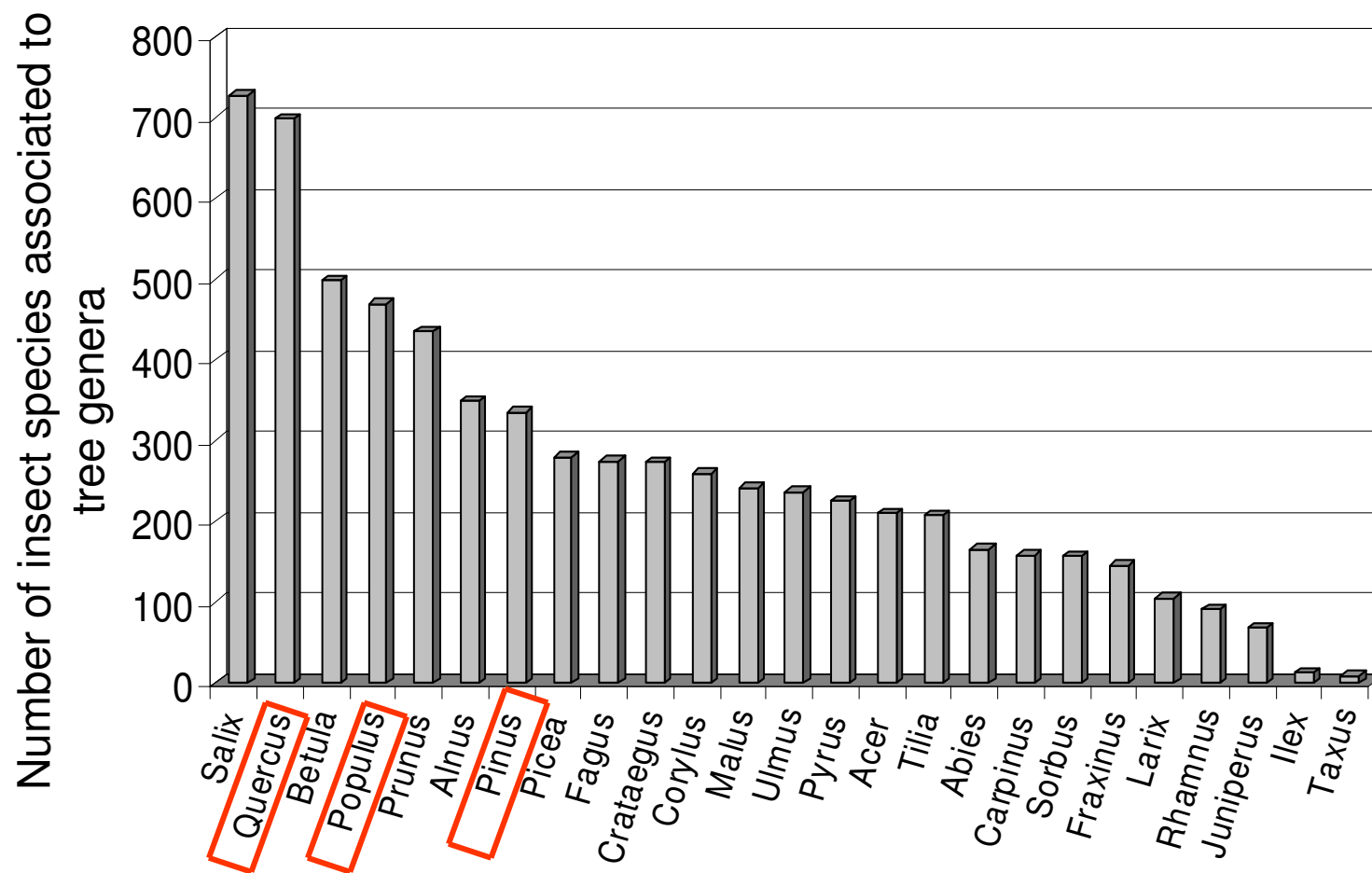
1%

*Populus nigra*

*Quercus petraea*  
*Quercus robur*



54 %



Brändle and Brandl, 2001, *Journal of Animal Ecology* 70:491-504

# Mycorrhizal fungi: *Laccaria bicolor*

## Taxonomy:

Mycota

Basidiomycota

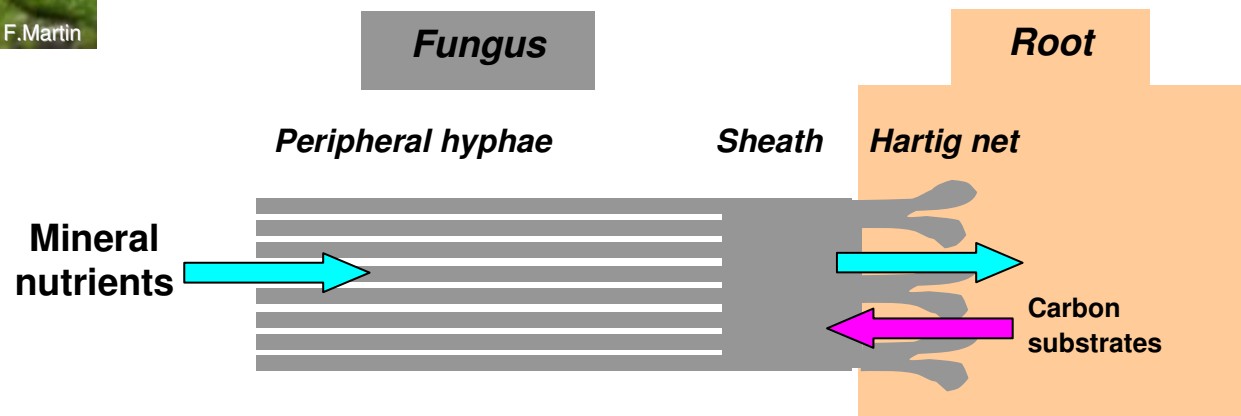
Agaricales

Tricholomataceae



- A generalist fungus found in most temperate & boreal forests
- Ecologically-relevant species
- A symbiont of poplar
- Well-known physiology
- **A partial genetic map, cDNA libraries & 44,000 ESTs**

## Mycorrhiza-Tree Symbiosis



# Insects : The gypsy moth, *Limantria dispar*

## Taxonomy:

Insecta

Lepidoptera

Lymantriidae

- Native to most of temperate Europe and Asia, introduced to North America 130 years ago
- Extremely polyphagous, known to feed on hundreds of different tree species
- ***No cDNA libraries, EST collections, genetic maps... currently available!***



Phenological  
Synchronization  
Herbivory



# Spreading excellence activities

# Spreading excellence activities



Training and education

Dissemination

Technology transfer

International cooperation



# Spreading excellence activities



## Training and education

SEA1.1 Towards integrated PhD programmes

SEA1.2 Course activities and summer schools

SEA1.3 Host training workshops SEA1.4 Researcher and staff training courses

## Dissemination

SEA2.1 Dissemination to the scientific community

SEA2.2 Dissemination to stakeholders

SEA2.3 Public awareness

## Technology transfer

SEA3.1 Identification of technology opportunities

SEA3.2 Enhancement and protection of technology

SEA3.3 Exploitation strategy

SEA3.4 Licensing

## International cooperation

SEA4.1 Cross-linking with other European programmes

SEA4.2 Collaboration with third countries' programmes and organisations

SEA4.3 Collaboration with developing countries



# The Stakeholder Group



The objective of the Stakeholder Group is to establish a interface between science and policy

A dialogue will be established between stakeholders and the scientists in EVOLTREE

The stakeholders will have an opportunity to formulate questions related to the scientific understanding that supports forest management practices

Ca. 25 members have joined the initiative, from international and national institutions and associations in Europe

First round table discussion planned for February 2008



# Stakeholder Group – International institutions participating



**CEPI - Confederation of European Paper Industries**  
Brussels, Belgium  
<http://www.cepi.org/>



**ENFE - European Network of Forest Entrepreneurs**  
Sölden, Germany  
<http://www.enfe.net/>



**CEPF - Confédération Européenne des Propriétaires Forestiers**  
Bruxelles, Belgium  
<http://www.cepf-eu.org/>



**European Forest Institute**  
Joensuu, Finland  
<http://www.efi.int/>



**MCPFE Liaison Unit**  
Warsaw, Poland  
<http://www.mcpfe.org/>



**PEBLDS Secretariat**  
Geneva, Switzerland  
(Pan-European Biological and Landscape Diversity Strategy)  
<http://www.strategyguide.org/>



# **Stakeholder Group – National institutions participating**



**Swedish Forest Agency  
Jonkoping, Sweden**

**Forest & Landscape Denmark  
Denmark**

**Forestry & Forest Preservation Dept.  
Moscow State Forest University,  
Moscow, Russia**

**Forest Research Institute  
Sofia, Bulgaria**

**Warsaw Agricultural University  
Faculty of Forestry,  
Warszawa, Poland**

**Instytut Badawczy Lesnictwa  
Forest Research Institute  
Sekocin Stary, Poland**

**Administration des Eaux et Forêts  
Luxembourg**

**Department of Forest Policy  
Ministry of Agriculture  
Republic of Latvia**

**Forest Tree Breeding and Genetics Lab  
Forest Research and Management Institute  
Ilfov, Romania**

**Área de Ordenación y Planificación Forestal  
Ministerio de Medio Ambiente  
Madrid, Spain**

**Ministry of Agriculture, Forestry and Food  
Ljubljana, Slovenia**

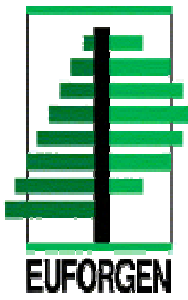
**National Forests  
Iceland Forest Service, Iceland**

**Norwegian Genetic Resource Centre,  
Norway**

**CONECOFOR Office, National Forest Service,  
Italy**



# Linkages EVOLTREE - EUFORGEN



## European Forest Genetic Resources Programme (EUFORGEN)

[www.euforgen.org](http://www.euforgen.org)

Collaborative programme among European countries to promote conservation and sustainable use of forest genetic resources

EUFORGEN was established in 1994 to implement the Strasbourg Resolution 2, it is coordinated by Bioversity International in technical collaboration with FAO

More than 30 member countries

Phase III (2005-2009)

- Conifers Network
- Scattered Broadleaves Network
- Stand-forming Broadleaves Network
- Forest Management Network

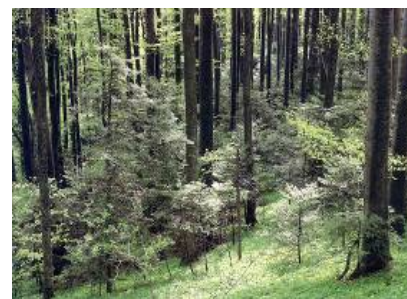


# Linkages EVOLTREE - EUFORGEN



Implications of research findings in forest management, relevant for the Forest Management Network of EUFORGEN

EUFORGEN members participate to the EVOLTREE Stakeholder Group, in the science – policy dialogue



# Future

EVOLTREE as a long-term durable effort

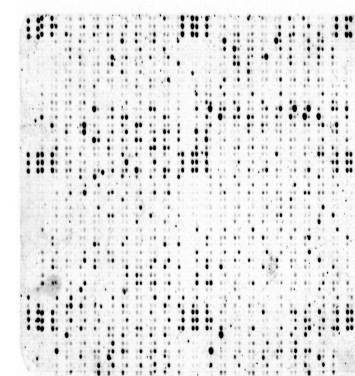
Activities distributed across European centers

Legal status

Supported by the integration of national and EC resources



*Laccaria*



# Towards a global assessment of biological diversity

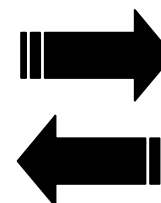
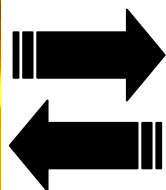
Genes



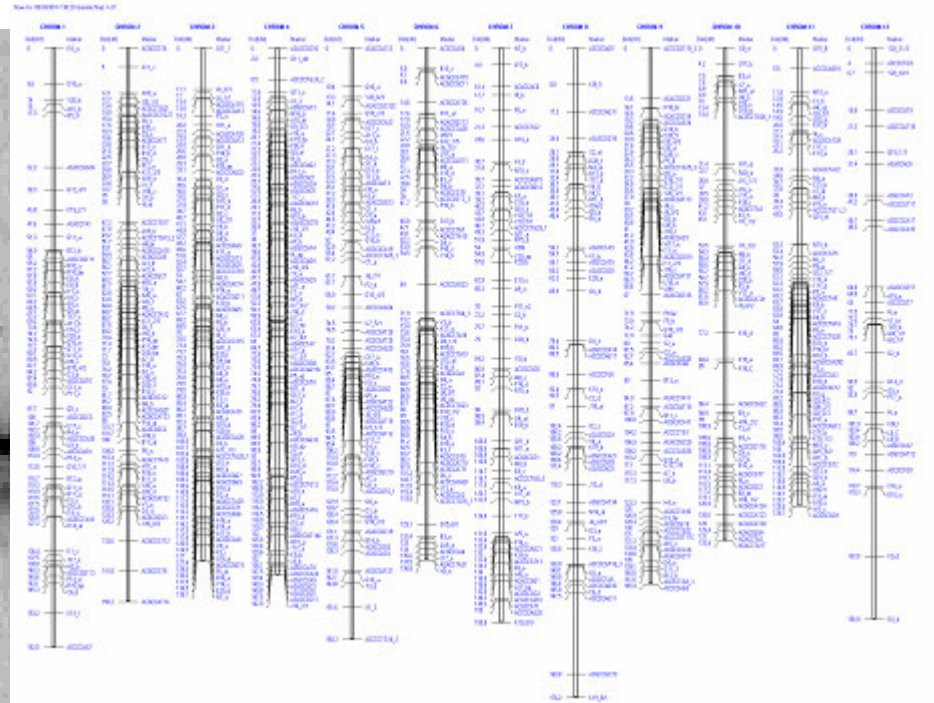
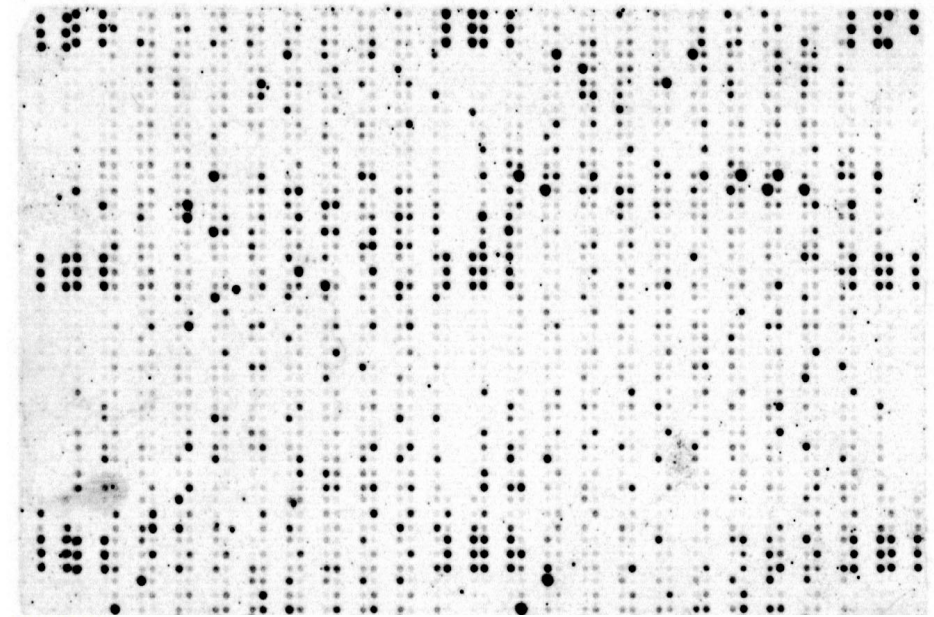
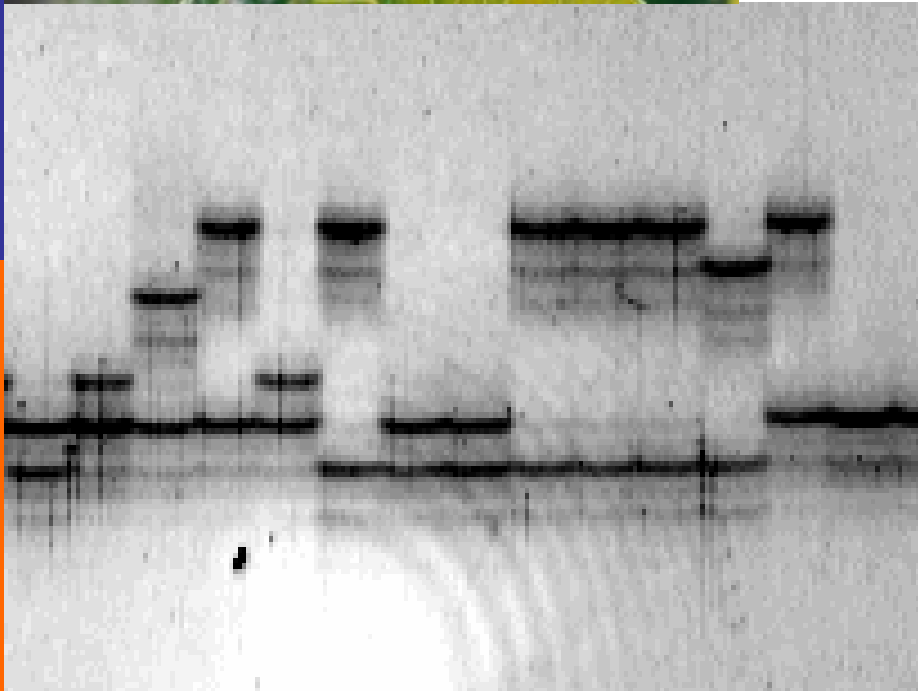
Phenotypes



Communities



# Inventory of gene diversity at a pangenomic and paneuropean level



# Practical implication of scientific findings from EVOLTREE

Contribution to standardization, regulations, certification

1. Contribute to enabling independent certification of origin and identity of forest reproductive material based on genetic fingerprinting
2. Redefinition of national and international units of source-identified forest reproductive material and revision of utilization guidelines
3. Contribute to enabling tracking of wood products to fight illegal logging



# Practical implication of scientific findings from EVOLTREE

4. Revise technical guidelines for managing forest stands to maintain genetic diversity and dynamic evolutionary processes
5. Adapt current regulations for seed zones/provenance and reproductive material in order to produce country specific and Europe wide recommendations, based on observed population structure of adaptive genetic diversity



# Contacts



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**For information on EVOLTREE DISSEMINATION ACTIVITIES please contact:**

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E-mail: [b.vinceti@cgiar.org](mailto:b.vinceti@cgiar.org)





**<http://www.evoltree.eu/>**