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Co-ordination of tree breeding in Europe



Key external stakeholders

Farmers, foresters, consultants, The Department of Agriculture and Food, forestry, EC, Coillte

Practical implications for stakeholders:

- The European community of tree breeders in 19 countries have created a vast data base of their field trials of genetic materials which are in the process of being genetically improved using a variety of conventional and new technologies.
- The infrastructure of tree breeders their resources and collective approaches has been assembled.
- A series of species monographs in relation to breeding has been prepared.
- The project concluded that tree breeders face many common challenges and they have prepared outlines for collaborative breeding.

Main results:

- Breeders of forest trees across the EU have collaborated to create a large meta-data base of all field experiments for nine of the major forest species in Europe, their location, design, and genetic constitution.
- A network of EU personnel with identifiable expertise and their facilities has been collated.
- A series of nine species monographs on the state of the art and the objectives for cooperative breeding at EU level has been prepared as well as many other position papers.
- Full proceedings of important conferences on mass propagation by seed and vegetative means are available.

Opportunity / Benefit:

End users can gain access to the work of the project via the project website: <http://treebreedex.eu/> and they can interface with tree breeders via the e-mail discussion forum indicated below.

Many project outputs are available and all will be public in 2012 including a series of species monographs.

Collaborating Institutions: INRA, France; BFW, Austria; INBO, Belgium; SBS, Germany; METLA, Finland; (FR)FC, UK; ALTErrA, Netherlands; NFLI, Norway; SKOGFORST, Sweden.

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1. Project background:

Teagasc was a partner in the infrastructure project TREEBREEDEx. It consisted of 28 partners in 18 countries. They were either public-funded -national or regional- forestry research institutions or private agencies, covering major fields of R&D in forest sciences. The project focussed on the upgrading of genetic resources of trees available in Institutes throughout Europe. Over decades, huge collections of trees of economic species and vast networks of experimental trials have been established which are a unique infrastructure of biological materials. In addition, the methodologies in genetics and in related sciences to recombine, test, evaluate, analyse, select and mass-produce forest tree species have been developed but are scattered throughout the EU.

The main aim of the project was to develop a scientific and technical research framework in forest genetics and tree breeding at the European level to ensure:

- a better co-ordination and integration of tree breeding research activities
- the enhancement of a more multidisciplinary approach to solve acute new challenges facing breeders through a closer co-operation with other fields of research such as physiology, climatology, molecular biology, pathology, and wood technology.
- an increase in scientific and technical excellence,
- a facilitated access to complementary national institutes research facilities and expertise, so as to optimise the use of technical resources,
- an improved linkage between research activities and economic outputs from forests,
- a greater interaction with policy-makers, stake-holders and the public,
- a strong support background for studies on the multi-functionality of European forests.

2. Questions addressed by the project:

- What trials are underway to test the performance of different sources of tree germplasm of different species in Europe?
- What are the most important forest species now and emerging species for the future throughout Europe?
- Which countries have significant trial networks, who are the personnel which can be contacted so that greater access and cooperation can be fostered?
- Can the scientific and technical excellence of R&D activities across Europe be enhanced by complementation among teams?
- Can R & D programmes in tree improvement, in member states, be progressively integrated into co-operative improvement programmes?
- Can specialist facilities and teams be opened to the wider scientific community in forestry, agriculture & horticulture (fruit, ornamental trees)?
- Can a Virtual Tree Breeding Centre for Europe be created?

3. The experimental studies:

The project was implemented through a set of Activity Tasks, one of which was coordinated by Teagasc. In collaboration, the partners developed sets of defined tools which would facilitate the building of the research infrastructure by :

- Creating and managing web-based co-ordination tools, mainly in the form of a common meta-database in which data on existing trials were entered. This together with position reports and species monographs forms the core of the 'Virtual Tree breeding Centre' in Activity Task 2.
- Enhancing the circulation of information, knowledge and expertise among tree breeders in their field of research by publications, seminars and workshops,
- Establishing scientific and technical methodological standards for common scientific work such as experimental trials, data storage and analysis,
- Identification of gaps in knowledge and new research needs for important forest species,
- Organising training through seminars in tree breeding,
- Preparing the scientific, technical and legal background for the development of true co-operative breeding programmes on some pilot-species.

4. Main results:

Many documents produced by the project are currently available at the main Treebreedex website: <http://treebreedex.eu/> and all of them will be made public in 2012.

- In Activity Task 2, the project has created a large meta-data base of all field experiments for nine of the major forest species in Europe, their location, design, and genetic constitution. Specifically it provides information on 4111 genetic field trials comprising, nearly 107000 genetic units; that is 5632 provenances, 2012 synthetic populations, 44139 half-sib progenies, 10508 full-sib progenies and 44644 clones. These are in and 244 provenance trials, 283 progeny trials, 140 clonal trials, 12 variety trials, 112 seed orchards, 36 clonal archives, and 23 other trials types. The data base is searchable.
- Activity Task 3 dealt with the geographical structure of genetic resources and has produced Reports on the 'Principles of Seed transfer' and workshop reports on 'Adaptability and plasticity in relation to breeding'
- Significant reports have been produced on: 'Defining access rules to genetic material collections and benefit sharing arrangements' and on the 'Principles of joint long term management and conservation of breeding populations' in Activity Task 4 'Assessing the Structure & Organisation of Breeding Material'
- Activity Task 5 dealt with 'Optimisation of breeding strategies' and has established the EU network of breeders and reports on: 'Assessment of drought and frost hardiness of young trees', the 'Layout of field trails' and 'Common protocols and reference standards for lab and field experimentation, assessment, and analysis'.

5. Opportunity/Benefit:

Teagasc was responsible for Activity Task 6, that is, the 'Optimisation of Improved Variety Mass-Production and Deployment in Forests'. The following outputs were developed:

- A discussion forum on tree improvement was established to elicit and share information on various subjects related to breeding. Contact with the network of 85 subscribers of European tree breeders can be assessed automatically by e-mailing TREEBREEDEX-[SUBSCRIBE-REQUEST@quava.ease.lsoft.com](mailto:REQUEST@quava.ease.lsoft.com)
- A European 'expert group' of scientists on mass propagation by seed and vegetative means was collated with 52 names and contact details.
- A catalogue was prepared of web-links which identified and created links to relevant pages and contact personnel for the national data bases of forest reproductive materials as well as the national regulations. It also has web-linked documents on websites related to Breeding, Forest Reproductive Material Acts and National Lists.
- A workshop report on 'Concerns of the public in relation to tree breeding' was produced.
- To aid in the standardization of new varieties a report was prepared 'Guidelines on Genetic Quality of Forest Reproductive Materials, Plant Variety Rights, and a Proposal to define 'descriptors' for use in Certifying 'Tested' material and 'Trademarks' for tree varieties'.
- Important conferences and workshops were held on methods for mass-propagation; for the 'Seed Orchard Conference' in, Sept 2007 the publications details are given below.
- The conference on: 'Vegetative propagation and Deployment of Varieties-The Scope for Europe', was in April 2009 and the following themes emerged.

- o Developing varieties for clonal forestry is practised in several places worldwide.
- o Ensuring that deployed genetic material is adaptable to future, often unknown climate conditions ('future proofing') is a challenge to breeders
- o Although variety development is concentrated on short-rotation species, increasingly this is not the case (e.g. white spruce in Canada). Clonal forestry may not be the answer for all organisations. The economics may not justify such an approach and there are other issues such as certification and acceptance by stakeholders. Foresters may find that the next best option of 'family forestry' in which high performing families are vegetatively propagated is quite productive and acceptable for their own circumstances.
- o Some countries are investing more money in tree breeding as a means of locking up more carbon from the atmosphere.
- o Developing improved varieties can help tackle climate change by maximising carbon sequestration and producing better-grade construction timber to displace carbon-intense building products such as metal and concrete.
- o The message from existing enterprises which deploy varieties was that the investment in people and facilities may not be prohibitive.
- o More extensive demonstrations of clonal variety trials are needed for breeders to evaluate that the effort is worth while (i.e. to check whether realised gains match theoretical figures or not). This will help to convince budget holders and policy makers on the real potential based on production facts.
- o The demand for clonal varieties is clearly already here and viable (Eucalyptus in Portugal, poplar etc) but its uptake and development will vary depending on the national / regional forestry objectives.

6. Dissemination:

The main vehicle for dissemination of the reports, conclusions and outcomes of this project is the web site: <http://treebreedex.eu/> All information not currently present will be public in 2011.

Main publications:

- As indicated above two conferences and workshops were held on methods for mass-propagation: for the 'Seed Orchard Conference, Sept 2007. Summaries of all papers are available at : <http://treebreedex.eu/IMG/pdf/Seed-Orchard-Summary-080812.pdf> and on the Teagasc website.
- The full conference proceedings are available at <http://pub-epsilon.slu.se:8080/151/01/ZProcFinalFeb08.pdf> as well as on the Teagasc website.
- The project has generated a series of monographs on the breeding of important forest species for Europe such as Spruces (Sitka and Norway), Pines, Douglas fir, Larch, Wild cherry, poplar and Sycamore. Teagasc was responsible for the monograph on Ash (*Fraxinus excelsior*); all of these will be public in 2012.

7. Compiled by: Dr. Gerry Douglas