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Breeding Trends in Portugal

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Forest covers around 3 300 000 ha in the Continent and 25 970 ha in Azores (DGF 2002).

Economic value of forest production is higher than 562 000 000 € per year, representing 34% of the National Gross Domestic Product, excluding the recreation value (CESE 1998).

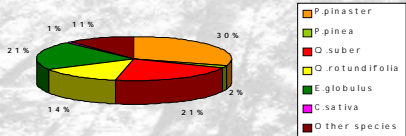
Export/import balance contributes positively to the national economy. Forest products exports (2.7 millions €) represented 11% of total exports in 2000 (DGF 2002).

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Species composition



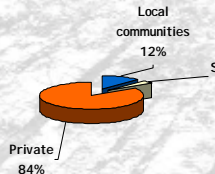
- In continental Portugal, *P. pinaster* and *Q. suber* are the most important autochthonous species.
- *Eucalyptus globulus*, an exotic species, has an important role in pulp and paper industry

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Forestland ownership





- ✓ More than 400 000 forest owners
- ✓ In the North and Central part of the country average forest property area is lower than 5 ha

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Traditional silviculture
↔
Clonal forest

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Challenges to the forest ecosystems in the XXI Century:

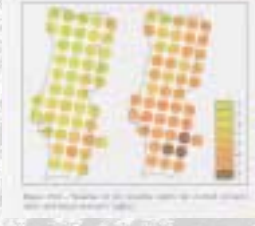
- ✎ Increase of human influence over forest ecosystems
- ✎ The need to adequate forest multiple use with wood production
- ✎ Improve forest products quality to the end users
- ✎ Competitive cost against alternative products
- ✎ Increased Public awareness of environmental issues
- ✎ Need to guarantee economic, social and environmental sustainability
- ✎ Certification: Control of production conditions

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Climate change scenario*:



* Had RM - Haddley Center' model downgraded to the Iberian Peninsula

- Longer, more frequent and more intense drought periods are expected. **Water stress** will therefore be a leading constraint to primary production.
- The combined effects of **drought** and **high temperatures** will bring about further decreases in carbon assimilation in some areas.
- Species distribution** will mainly depend on stress caused by the expansion of arid and semi-arid climate throughout the country.
- In some regions winter warming with CO₂ fertilization will be beneficial (North).
- The South and interior regions may be inhospitable for some of present species (cork oak, Pinus pinaster).

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Pinus Pinaster Ait

Objective: To increase de productivity and the wood quality

Deployment: Production of 10 kg of seeds/year with a genetic gain of 10% in volume and 17% in stem straightness



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Pinus Pinaster Ait

Foreseen activities:

- Enlargement of the genetic base of breeding population
- Establishment of the 3rd generation
- Ensure that improved seed has adequate genetic diversity
- Deployment of improved propagules for a sustainable forest
- Evaluation of wood quality
- Evaluation of the adaptability

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IN VITRO CULTURE-Goals/Competences

Support to the breeding program

- Vegetative propagation
- Criopreservation
- Genetic transformation

Axillary multiplication
Adventitious regener.
Somatic embryogenesis



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MOLECULAR BIOLOGY

- Genetic stability of in vitro cultures
- Evaluation of the genetic diversity of the breeding population as compared to that of the metapopulation
- Pollen contamination in seed orchards and studies of consanguinity
- Adaptive genetic diversity in natural populations
- Functional genomics

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Eucalyptus globulus Labill. Celbi - Storaenso

Objective: Breeding for pulp yield production, pulp quality and diversity evaluation.

Strategy: Nucleus breeding.

Production Population: 14 full-sib families

Deployment: 15 kg full-sib seed year⁻¹

Plantations area established with improved seedlings: 5 000 ha

Biotechnology:

- Evaluation of genetic diversity through molecular markers.
- Vegetative propagation: Micropropagation and Somatic Embryogenesis

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Eucalyptus globulus Labill. Raiz - Portucel and Soporcel

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Objective: Increase the value and vitality of the eucalyptus plantations.

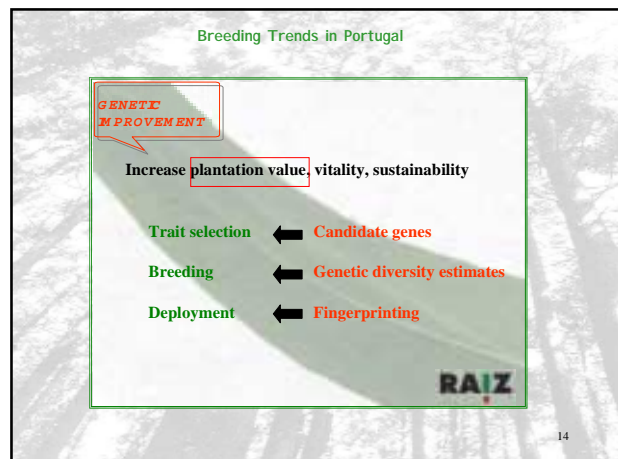
Strategy: Rolling-front.

Production Population: 15 clones

Deployment: 1 new clone year⁻¹ (2000 - 3000 mother-trees); new clone genetic identity certification; evaluation of genetic diversity

Clonal Forest area: 14 000 ha

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Improvement of Statistical Models for Estimating Genetic Merit

- ⇒ Quantifying the importance of dominance relative to additive genetic effects in non inbred populations
- ⇒ Accounting for site variability in field tests by using spatial analytical methods

Evaluation of Genotype by Environment (G x E) Interactions

- ⇒ Analysis of G x E interactions in Portugal
- ⇒ Evaluation of G x E interactions using different sets of genetic material
- ⇒ Analysis of G x E interactions across Portugal and Australia

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Studies on genetic variability:

- *Quercus suber*
- *Pinus pinea*
- *Castanea sativa*
- *Quercus rotundifolia*
- *Cryptomeria japonica*

Through genetic tests and molecular markers

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Adaptability evaluation is linked to physiological process

Improvement of wood traits is a target in breeding

Biotechnology is recognized as a tool in breeding activities

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