Rapid genetic delineation of regions of provenance

Case study of *Alnus glutinosa* (L.) Gaertn. in Flanders

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Regions of provenance

• EU directive (1999/105/EC) on the marketing of forest reproductive material: “For a species or sub-species, the region of provenance is the area or group of areas subject to sufficiently uniform ecological conditions in which stands or seed sources showing similar phenotypic or genetic characters are found, taking into account altitudinal boundaries where appropriate.”
Regions of provenance

• Seed zones
• Use of planting stock of certain origin
• Method of delineation different in different countries
• Boundaries often administrative borders
• Usually one delineation for all species
Regions of provenance

Before implementation directive
Regions of provenance

After implementation

Mostly non-indigenous tree species

Legend:
1: Ten noorden van Samber en Maas
   Nord du sillon Sambre et Meuse
2: Ten zuiden van Samber en Maas
   Sud du sillon Sambre et Meuse
Regions of provenance

Indigenous trees and shrubs

Legend:
3.1: Vlaamse Zandstreek
3.2: Polders
3.3: Kust en duinen
4: Kempen
5: Brabants District West - Brabant
6: Brabants District Oost - Hesbaye
7: Laag Maasplateau - Bas Plateaux Mosans
8: Ardennen
9: Gaume

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Regions of provenance

- Small regions: to keep genetically different autochthonous populations separate
- Not too small: to avoid inbreeding and to keep seed collection/growing planting stock of different regions feasible

balance between inbreeding and outbreeding without scientific evidence
Regions of provenance

- Autochthonous trees and shrubs: recommend to use planting stock from the same region of provenance
- Exceptions: when information is available on a specific species
  - Provenance tests: effective but slow
  - Genetic information: more rapid

→ new regions of provenance
Case study

*Alnus glutinosa* (L.) Gaertn.

- Common species: still many autochthonous populations left
- Monoecious, wind-pollinated
- Dispersal by wind and water

- Populations genetics: cpDNA (King and Ferris, 1998 (Europe)), ISSR (King and Ferris, 2000 (Corsica and Italy)), isozymes (Prat et al., 1992 (France); Gömöry and Paule, 2002 (Slovakia))
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Seeds collected in 22 populations: always 2 in each others proximity (< 10 km)
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- Material: leaves of 10 seedlings per population
- Method:
  - AFLP (Amplified Fragment Length Polymorphism) → New
  - 24 PC’s tested: 6 PC’s used
- Result: 142 markers
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PCoA
(Simple matching)

Hybridization?
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Case study

Preliminary results:
- PCoA: one population is slightly different

Percentages of Molecular Variance

Among Pops
12%

Within Pops
88%
Conclusions (work in progress):
- Little genetic differentiation between populations
- No apparent geographic pattern
- Signs of hybridization with *Alnus incana*
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Future research:
- AFLP on European populations
- Closer look at possible hybrids: including *A. incana* samples of population 601 in AFLP
- morphological study
- Provenance test (2007)
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Practical implication:
Planting stock of alder originating from one region of provenance can probably be used in another region; in other words: Flanders is the region of provenance for *Alnus glutinosa*.

(needs further analyses!)
Consequences

- One seed orchard for *A. glutinosa* in Flanders
- Different provenances can be planted together
- Seed originating from different provenances can be mixed

(in case the preliminary findings are confirmed)
Communication

How do we communicate these findings for practical use?
- Informing Flemish Nature and Forest Agency (ANB)
- Informing other organisations using autochthonous planting stock
- List of recommended provenances
- Mandatory advice by reforestation/afforestation (subvention policy)
• *Carpinus betulus* (Coart, 2003)
• *Quercus robur, Quercus petraea* (Coart, 2003)
• *Rosa spp.* (De Cock, 2008)
• *Crataegus spp.* (Depypere et al., 2006; Coart, not published)
• *Prunus spinosa* (Depypere, Phd in progress)
• …
Thank you for your attention!