

KASP-based SNP genotyping as a tool for forest genetic resources: two applications compared

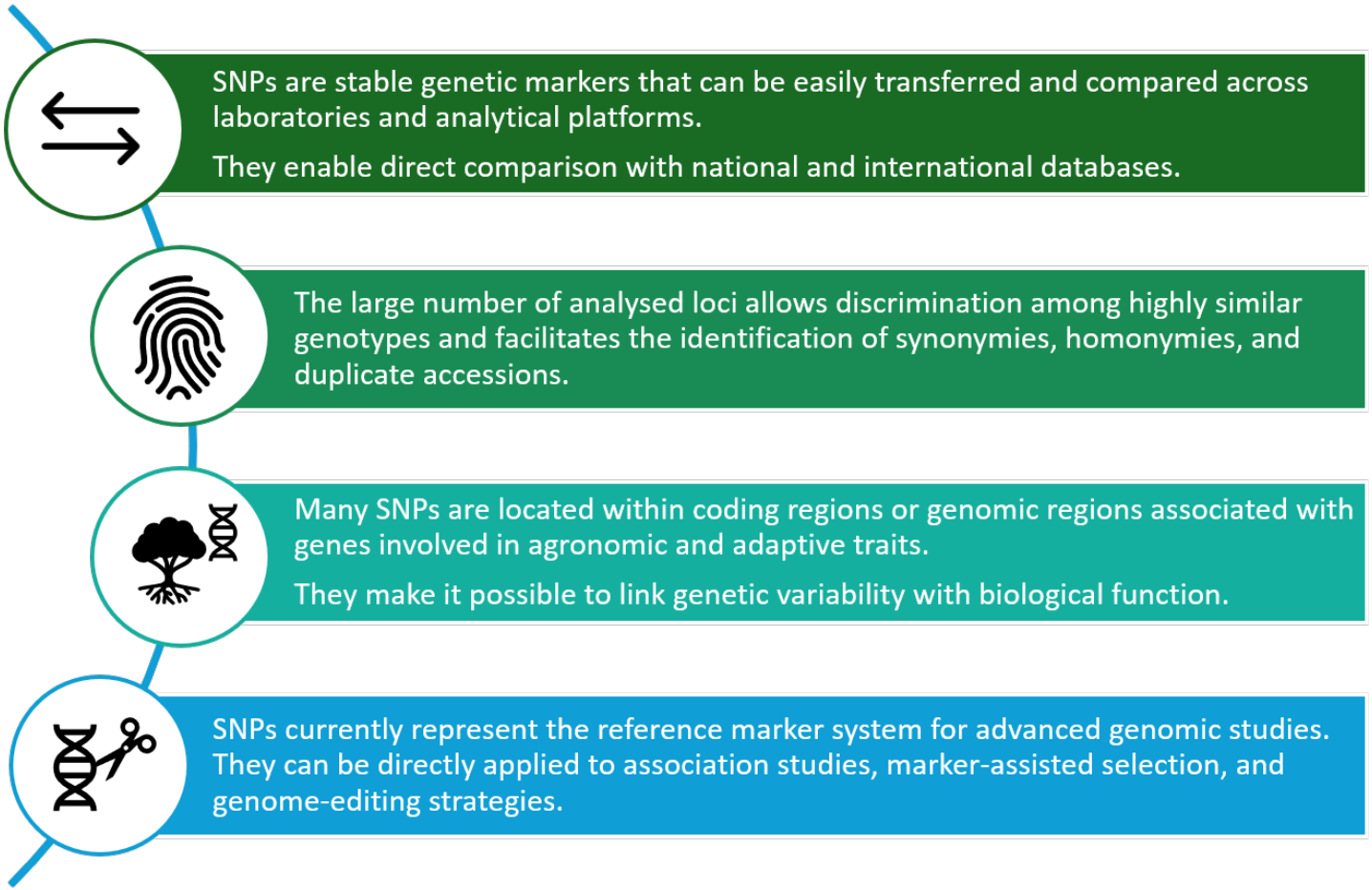
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A Unified Platform for Forest Genetic Resources Management

The KASP (Kompetitive Allele-Specific PCR) platform serves as a versatile, high-throughput bridge between fundamental genomic research and practical forest management. This dual-application framework demonstrates how a single technological pipeline addresses diverse ecological and economic objectives.

FEATURE	APPLICATION A: SWEET CHESTNUT (*C. SATIVA*)	APPLICATION B: DOUGLAS FIR (*P. MENZIESII*)
Primary Goal	Varietal Identification & Conservation	Marker-Assisted Selection (MAS)
Marker Focus	Neutral SNPs for Fingerprinting	Trait-related SNPs (Growth)
Key Output	Genetic Database & Traceability	Selection Index for Breeding
Strategic Utility	Biodiversity Valorization	Reforestation Efficiency



Step 1: Collection
Buds, leaves, or wood cores

Step 2: Extraction
Isolating high-quality genomic DNA

Step 3: KASP Assay
Competitive allele-specific labeling

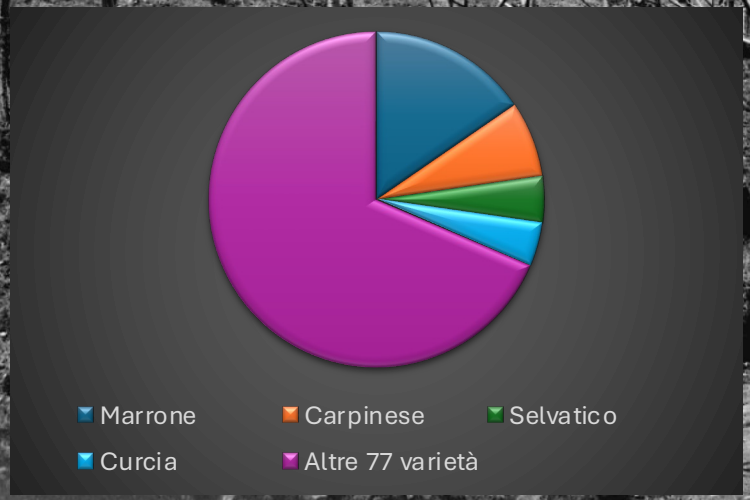
Step 4: Genotype Call
Automated visualization & plots

APPLICATION A: SWEET CHESTNUT (*C. SATIVA*)

In the 1950s, the former *Experimental Institute for Silviculture*, now the Research Centre for Forestry and wood (CREA FL) in Arezzo, established an **ex situ collection** of numerous Italian sweet chestnut cultivars (approximately 400 accessions) in the State Forest of Vallombrosa (Florence, Italy).

Since 2020, activities related to the maintenance, genetic characterization, and propagation of the sweet chestnut plant material have been included in the **FAO National Programme for Conservation, Use and Valorisation of Plant Genetic Resources for Food and Agriculture**

The clonal collections of **Pozzacce** and **Pian della Lama** (Vallombrosa, Florence). have been enriched and renewed through rejuvenation activities.



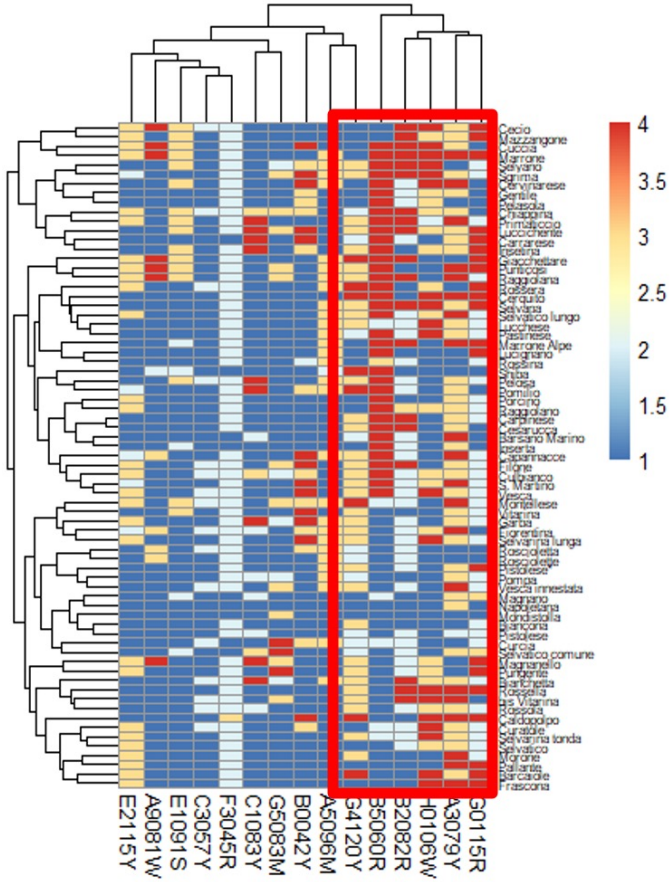
RGV/FAO
National Programme for Conservation, Characterisation, Use and Valorisation of Plant Genetic Resources for Food and Agriculture

The Pozzacce clonal collection includes:

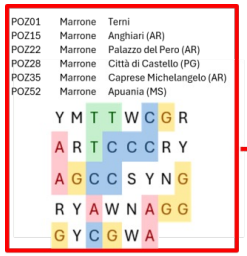
- 81 cultivars (41 registered in EURISCO)
- 86 provenances
- Approximately 100 unidentified individuals

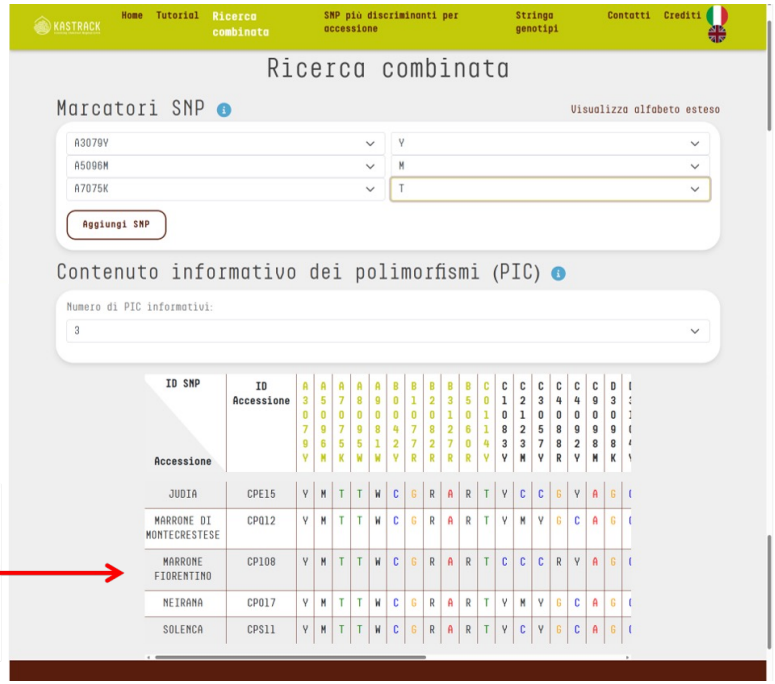
APPLICATION A - Sweet chestnut: SNP panel and strategy

The strategy employs a dual-panel approach to balance cost-efficiency with high resolution: first, screening the entire collection (184 individuals) using a reduced 15-SNP panel to prioritize accessions for the complete 38-SNP analysis (94 individuals) aligned with the KASTRACKdb standard.

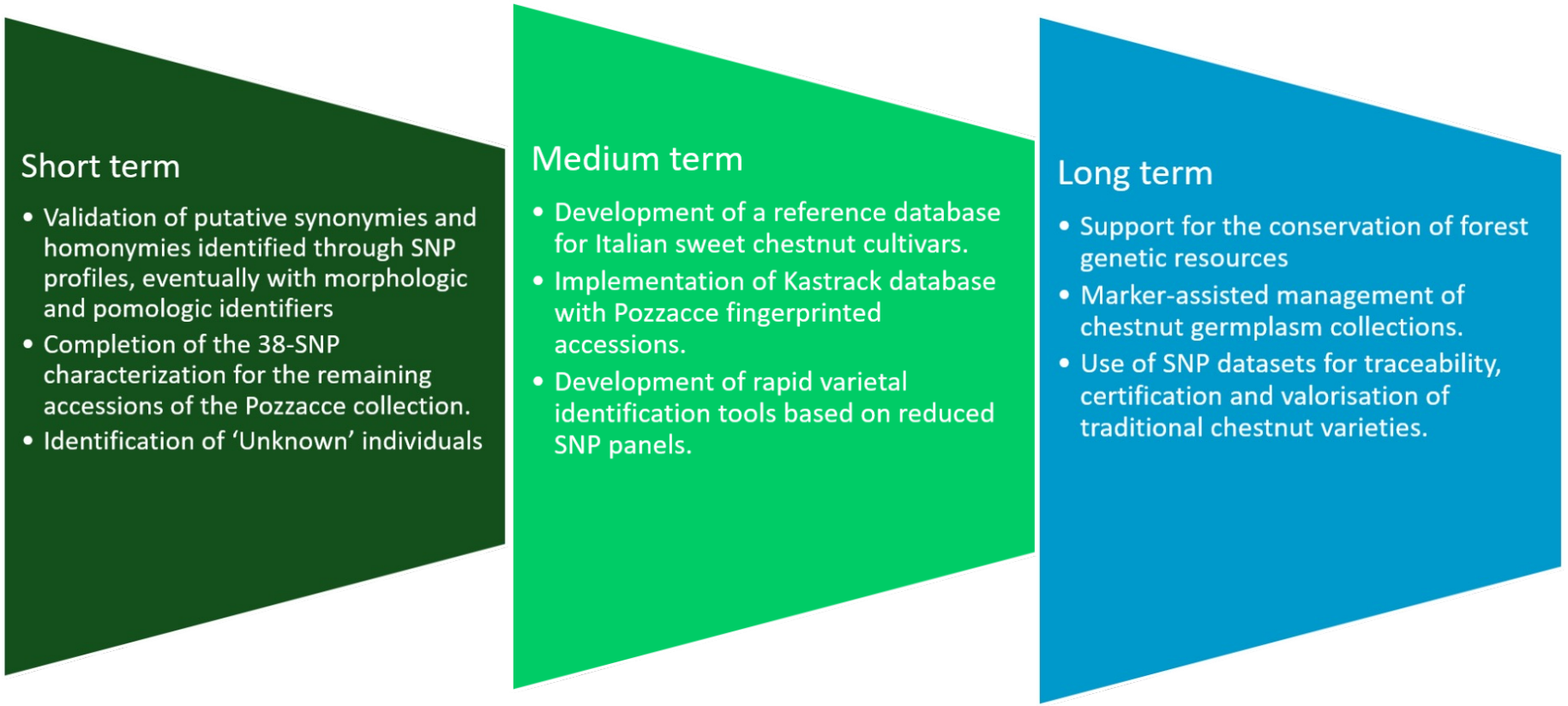








APPLICATION A - Sweet chestnut: Perspectives and outcomes



APPLICATION B - Douglas fir: Background and Objectives

Revitalisation of the Tuscan Douglas fir Nursery Supply Chain for the Production of High-Quality Forest Reproductive Material (WP6)

Do.Na.To.
Douglasiete Naturali Toscane


Scion collection from selected plus trees


Grafiting


Vegetative propagation


Seed orchard establishment

Improving innovation and quality in the Tuscan Douglas-fir nursery supply chain and plantation management practices.

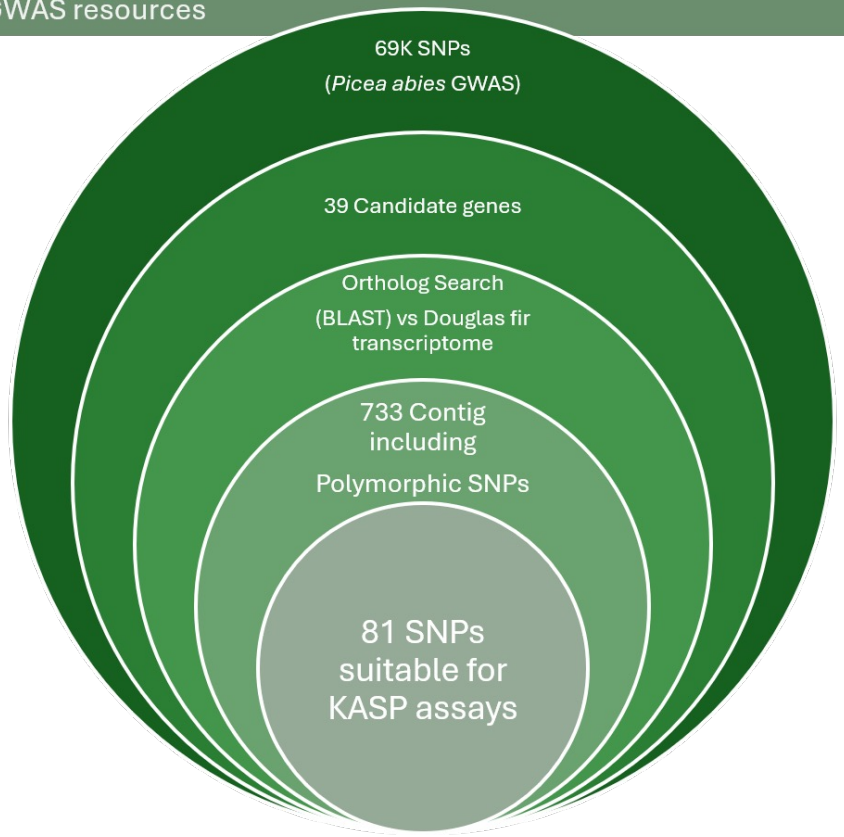
PSR Programma di Sviluppo Rurale
Regione Toscana
REPUBBLICA ITALIANA
Unione Europea
DoNaTo beneficia di sostegno finanziario nell'ambito del PSR 2014-2020 misura 16.2, 1.1, 1.2, 1.3

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APPLICATION B - Douglas fir: SNP discovery and KASP screening

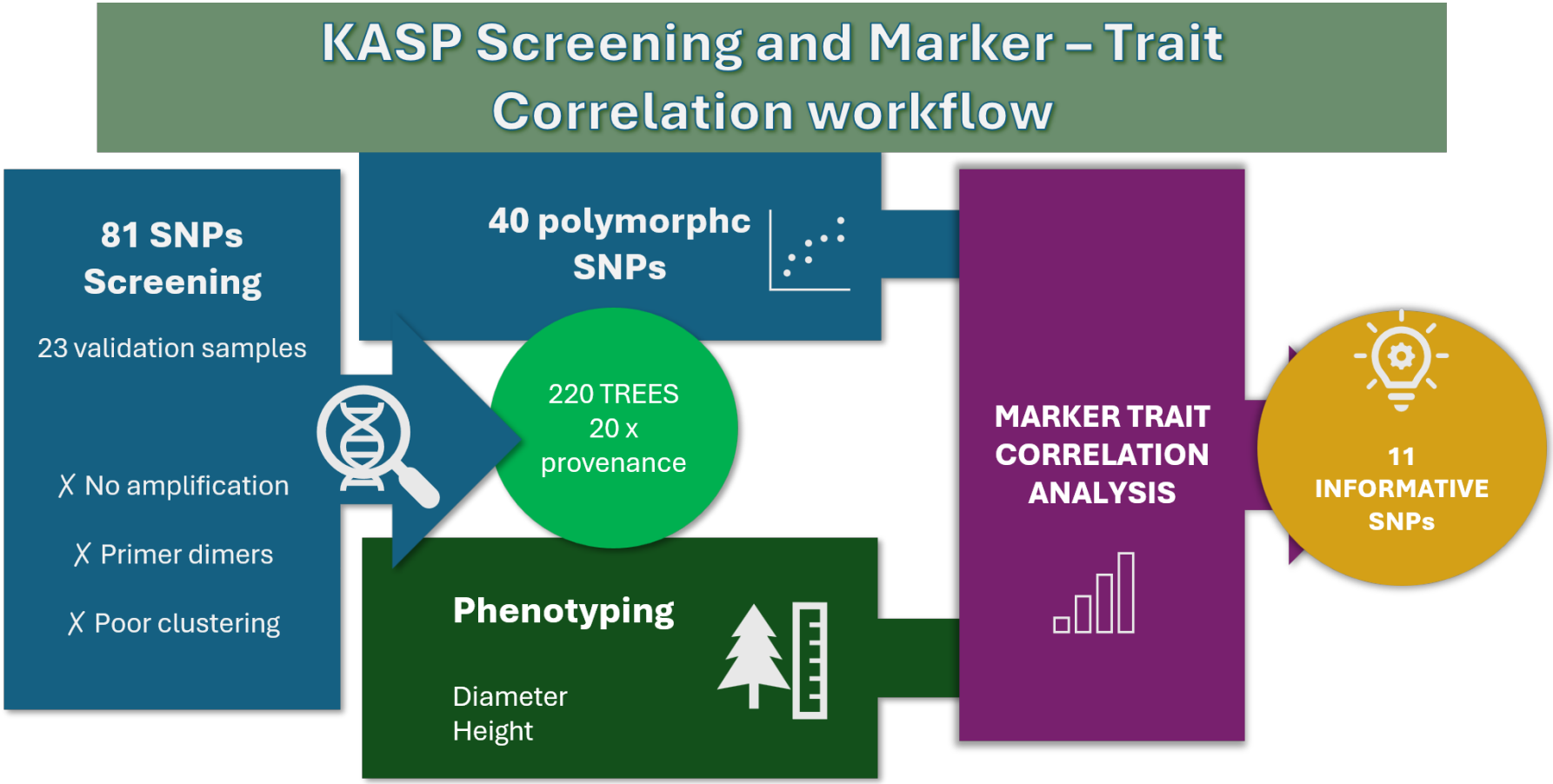
SNPs Discovery Pipeline

To investigate genetic factors underlying growth variation among provenances, a candidate-gene approach was developed using previously validated GWAS resources



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APPLICATION B - Douglas fir: SNP discovery and KASP screening



APPLICATION B - Douglas fir: Strategies for Marker Assited Selection

Validation of Candidate loci	• Large scale validation of the 11 informative SNPs
Functional genomics	• Annotation of Douglas fir orthologs associated with growth traits • Identification of the functional effects of SNP polymorphisms
New Marker Discovery	• Expansion of markers panel • Identification of addictional loci explaining the phenotypic behaviour of other Provenances
Breeding applications	• Developing of a Markers Assisted Selection Index • Early selection of superior reproductive material

Compared Conclusions and Perspectives

One KASP Platform, Two Complementary Applications

Application Focus	Key Results & Impacts	Strategic Value
Sweet Chestnut (Conservation)	15/38-SNP panels identified unique profiles & synonymies; effective varietal identification.	Supporting agrobiodiversity, traceability, and valorization.
Douglas Fir (Improvement)	SNPz linked to growth; significant phenotypic variation.	Early selection index for superior reproductive material.

Future Perspectives

- **Versatility:** A unified tool for management, conservation, and improvement.
- **Scaling:** Integration with global databases using standardized SNP assays