



TREES4FUTURE: A success story and future perspectives: European Tree Breeding Centre

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New Wind ®

Trees4Future

Designing trees for the future

2012-2016

Research infrastructures for forestry research

Luc E. Pâques (INRA-AGPF)



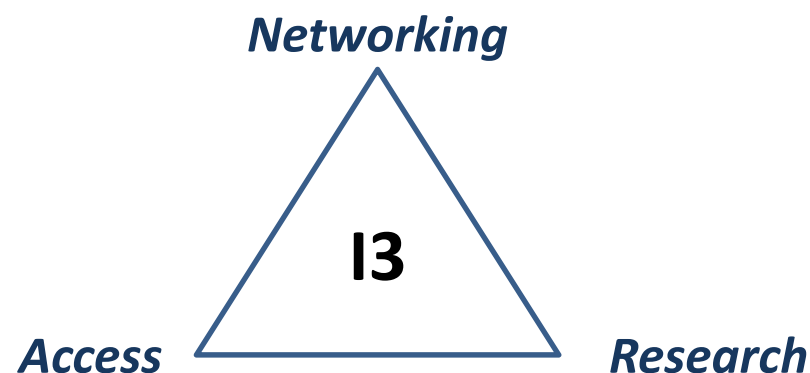
Final conference, Brussels April 4-6, 2016

Designing Trees for the Future

Research infrastructures for forestry research:

A project under this topic must **provide and facilitate** access to the key research infrastructures in Europe for **forestry** research. It should aim to **integrate** these facilities and resources with a **long term perspective**.

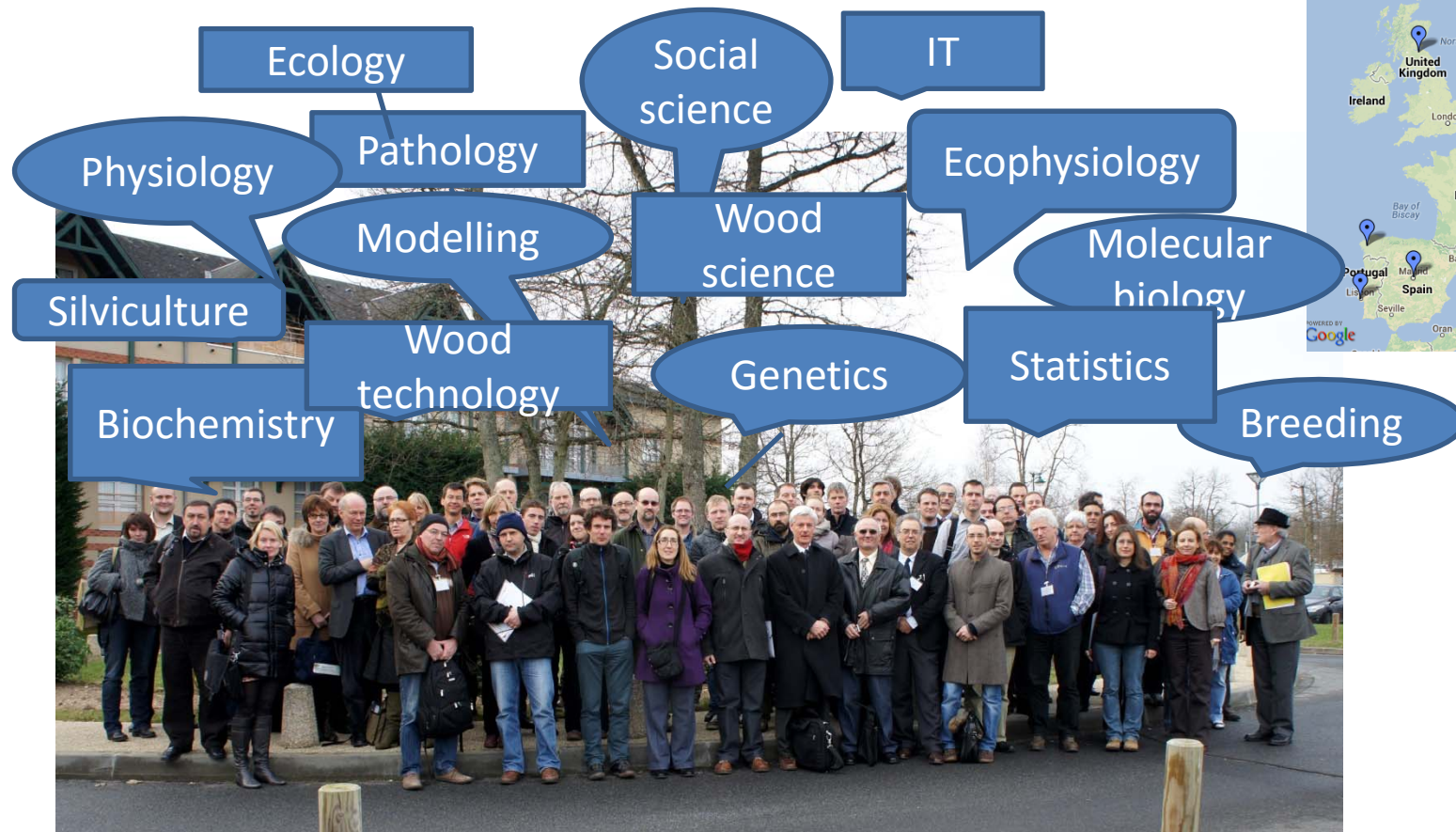
The overall objective should be to improve services for researchers



- sustained and multi-functional **production** of the forests goods and services
- as well as climate change **adaptation** and **mitigation** strategies,
- and preservation of **biodiversity** in industrial forests



1st challenge: A multi-disciplinary consortium

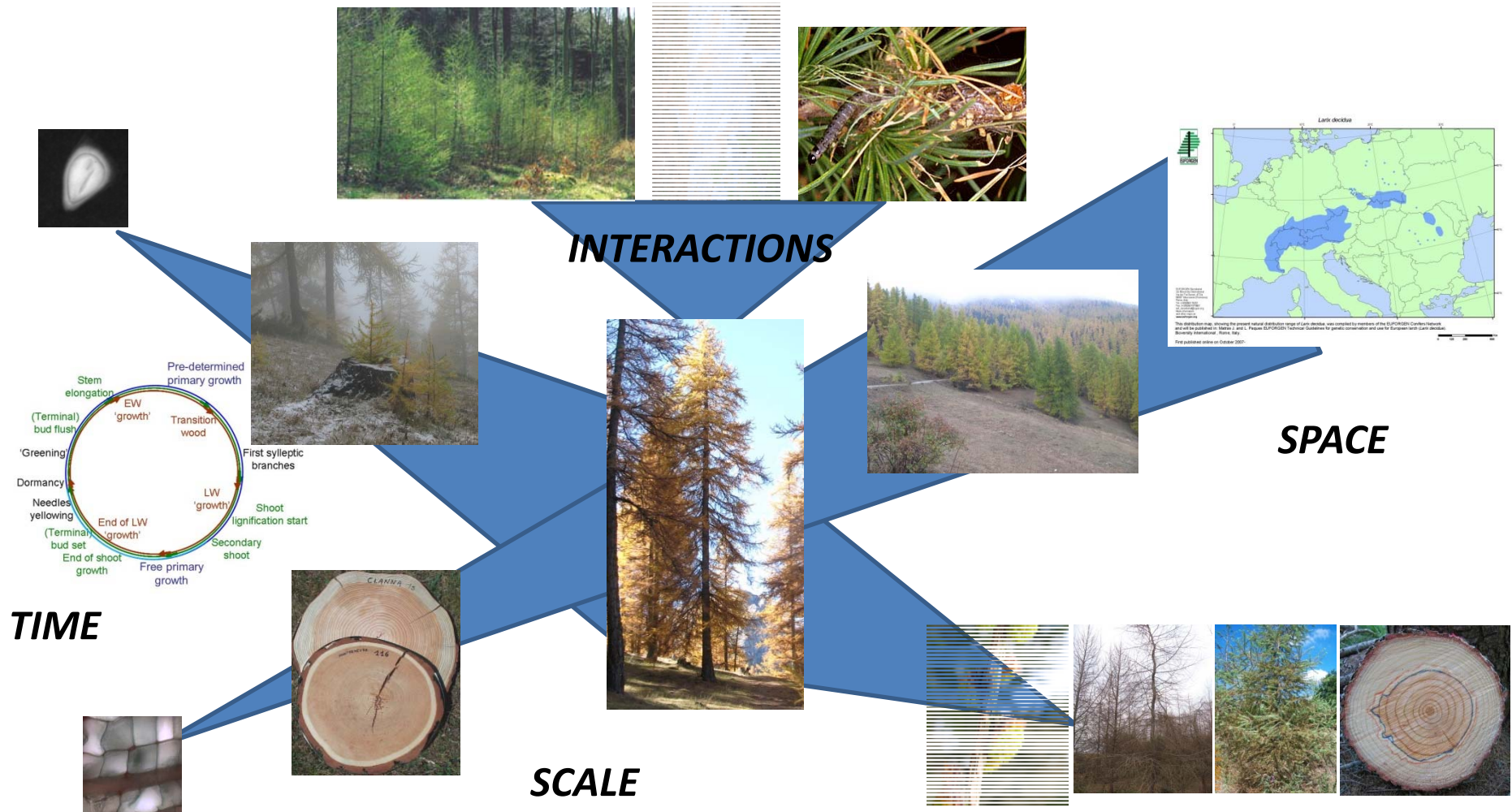


28 partners

Designing Trees for the Future



2nd challenge: The complexity of forestry research



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How to avoid this?



Designing trees for the future...

pro-active position to prepare research supports to develop better adapted, productive and quality trees in diversified forests

Native forests



Conservation of genetic resources

Exploration of genetic diversity

Biotechnology & Mass-propagation

Adaptation

Architecture of traits

Evaluation

Selection

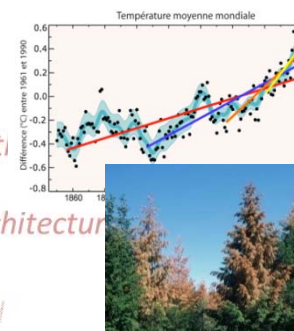
Forest tree breeding

Recombination

Selection

FRM production & deployment

Plantation forests



Designing Trees for the Future



Designing trees for the future... outcomes



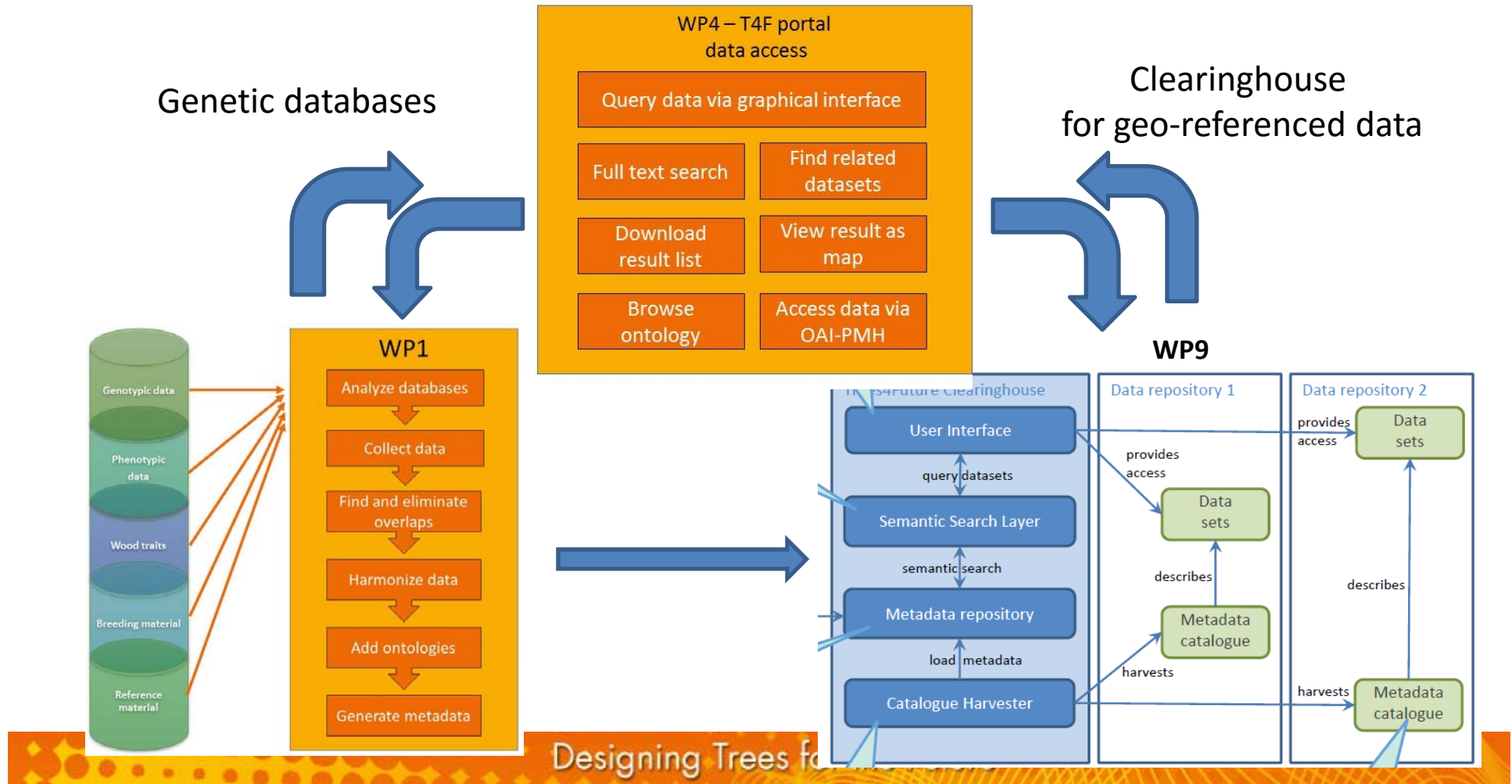
1. Access to resources and exchanges of expertise

2. New or improved methodologies and tools

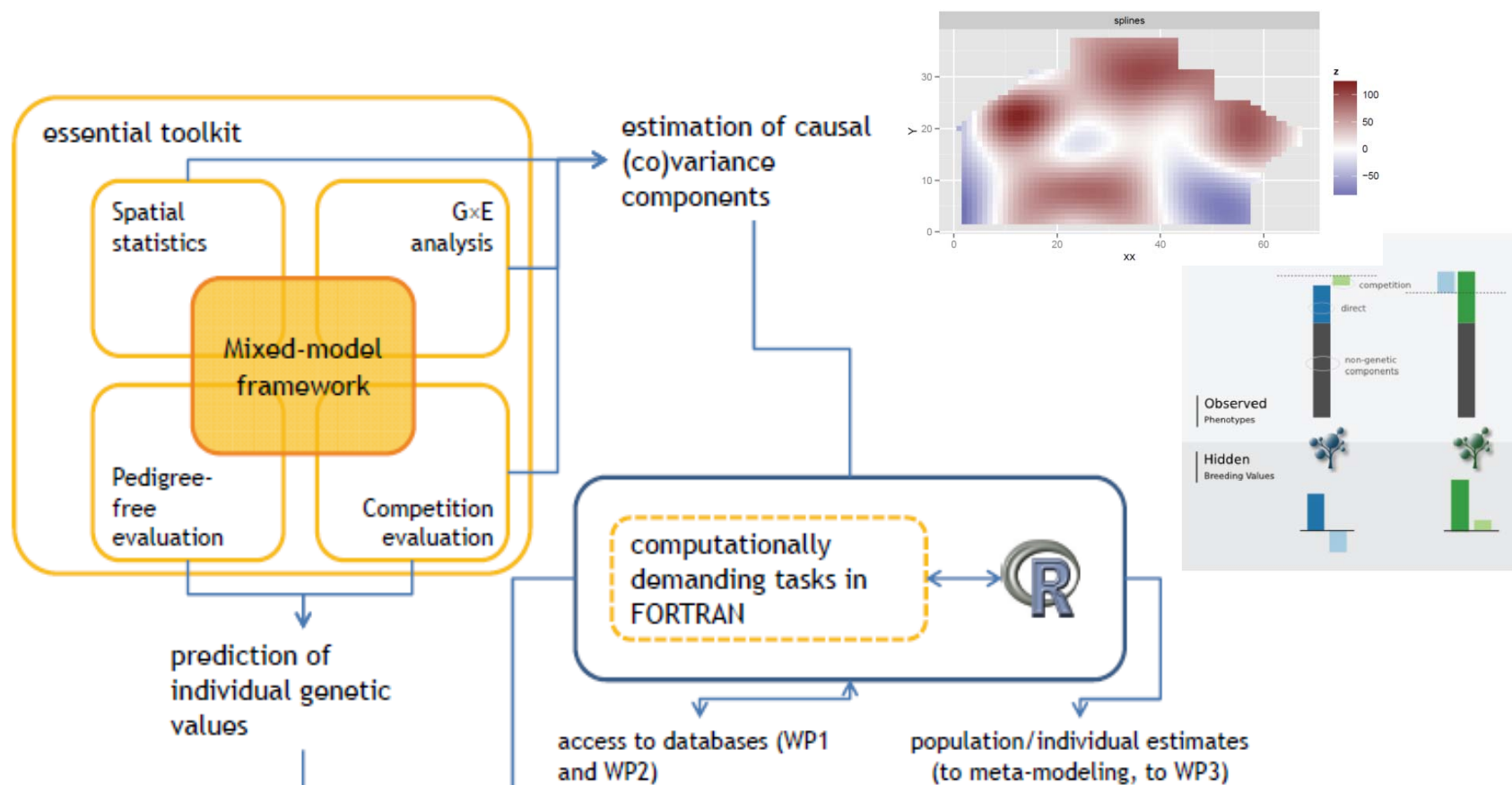
- To information (genetics – environment)
- Better or new ways to generate data (WP1, WP4, WP9)
 - **International information systems** (WP2)
 - **Standardisation of methodologies** (WP2)
- To biological material (MTA) (WP11)
- **High-throughput phenotyping** methods (WP11)
- To diversified forestry **research infrastructures** (WP5, WP7)
- Molecular markers for **traceability** of FRM (WP7, WP11)
- To services from some **key-laboratories** (molecular, NIRS) (WP7, WP11)
- = From emergent **scientific thematic communities** (WP3)
 - **Statistical/genetic analysis tools** for genetic experiments (WP6)
 - Analysis of **tree reaction to environment** (WP3, WP8, WP11)
 - Planification of **breeding/deployment zones** (WP8)
 - **Models to simulate** impacts of environmental/human practices changes on forestry resources and services (WP10)

TREES4FUTURE WEB-PORTAL:

the gate to genetic and environmental data in forestry



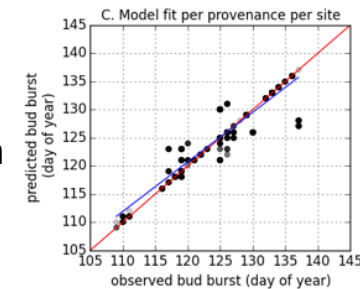
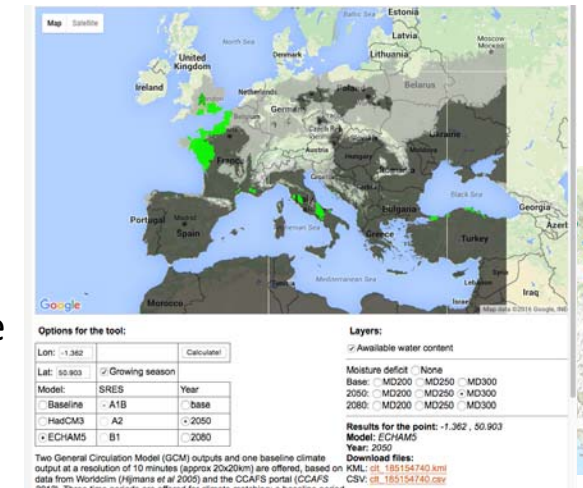
breedR: a powerful open-access suite of statistical tools for forest genetic resources analysis



Spatial modelling tools for deployment of Forest Reproductive Material

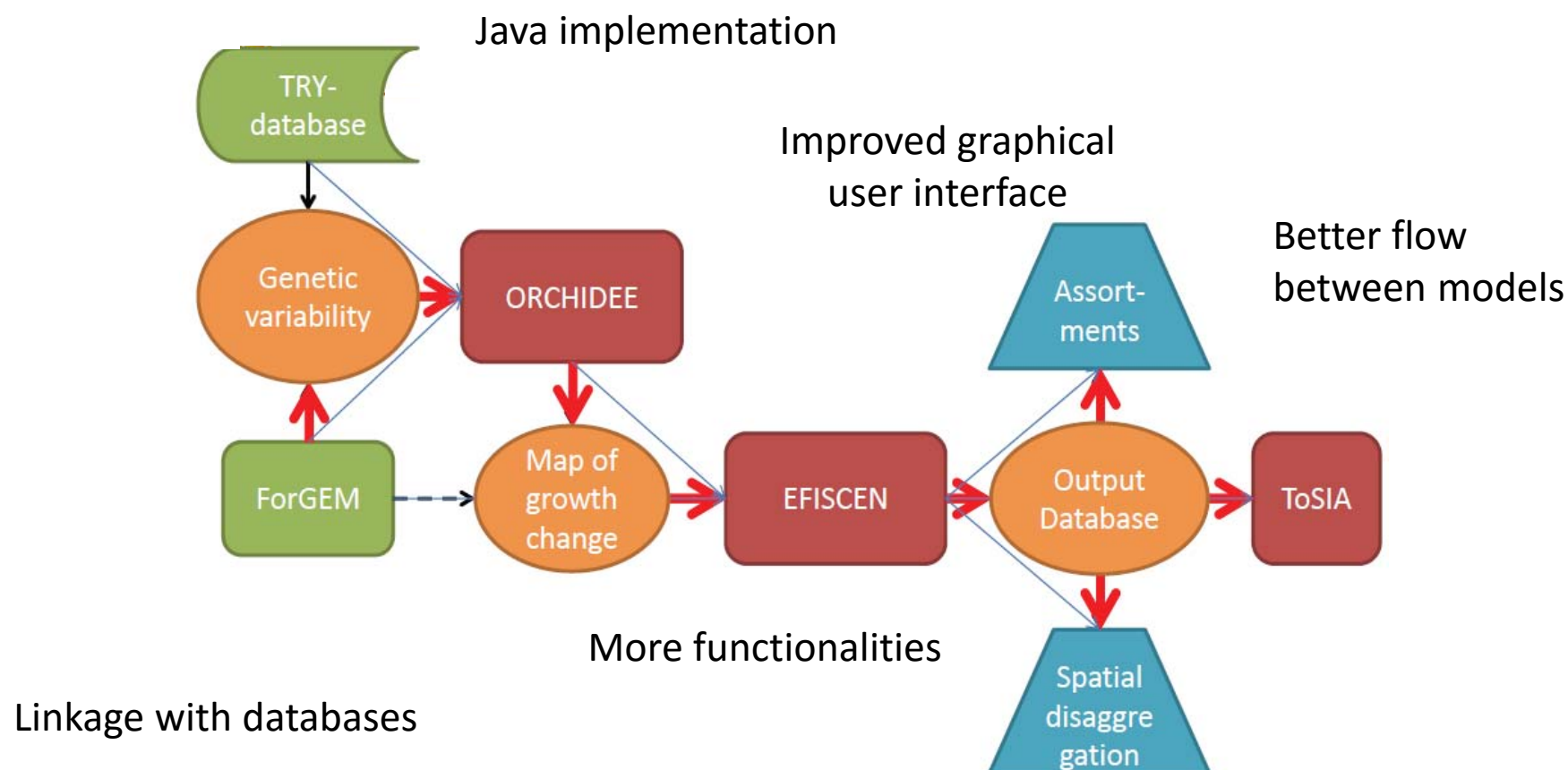


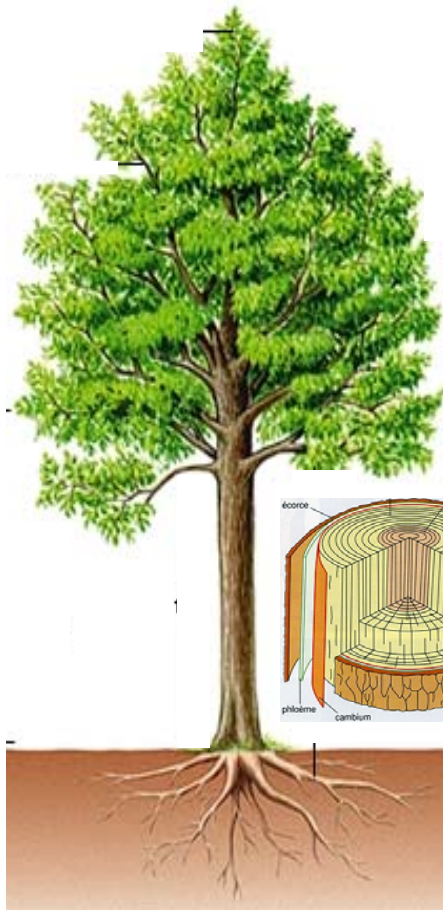
- **Climate matching tool web application**
- **Provenance zone suitability in Europe: Douglas-fir and beech**
Used bioclimatic multivariate and ensemble models
Douglas-fir: greater genetic adaptation and plasticity to cope with site types outside its niche
Beech: net loss in area excepted in one bioclimatic zone
- **Beech provenance flushing at European test sites**
Provenances able to adapt to new conditions
Phenotypic plastic response observed in flushing time far from site of origin
- **Provenance trial design should be more thorough**
Test all material at all sites: survival, growth, phenology
Pool empirical trial data in Europe – hence the need for a European Tree Breeding Centre



adaptive differences
between
provenances +
phenotypic
plasticity

Better integration and greater power of forest resources models

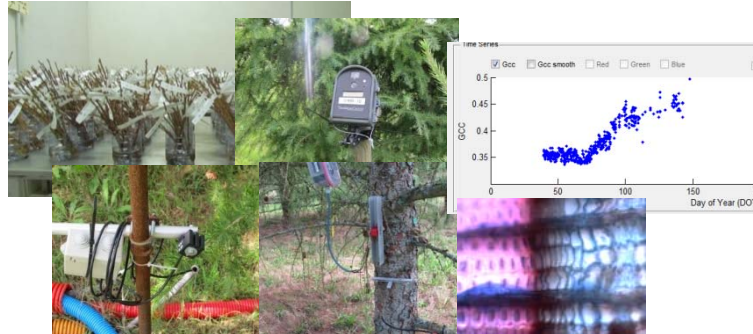




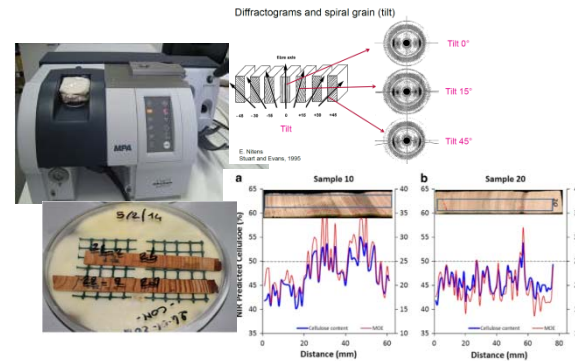
Phenology

Wood properties

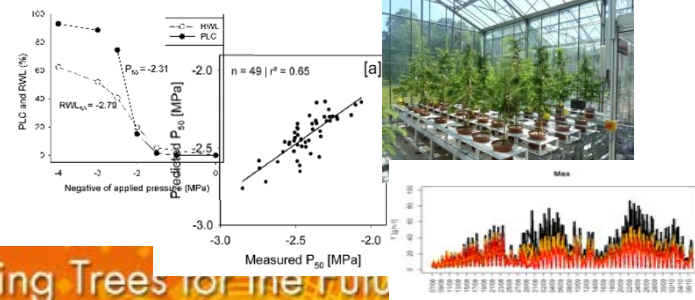
Tree hydraulics



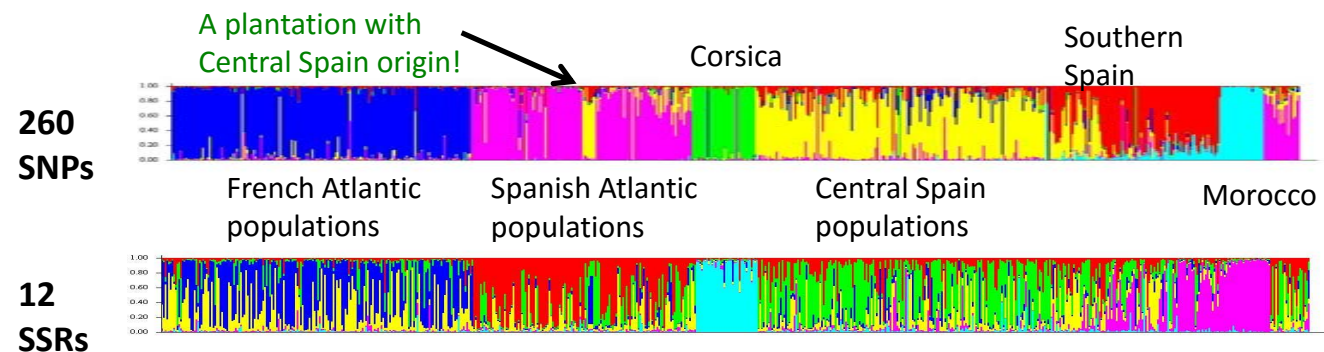
Flushing
Senescence
Dormancy



Lignin/cellulose
Extractives
Durability
Collapse
MOE
Spiral grain

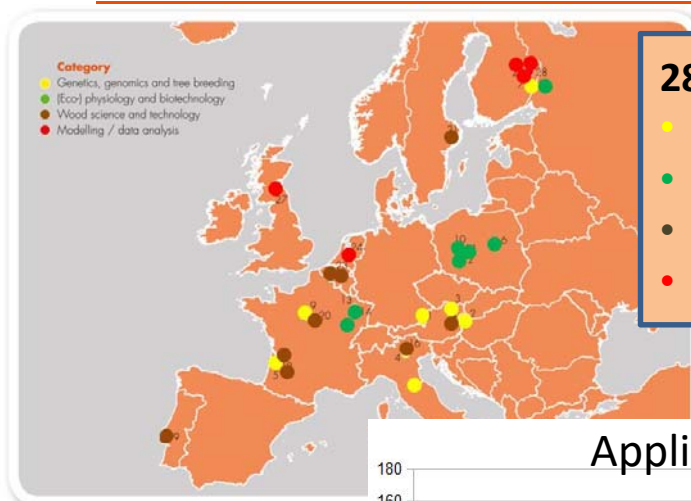


Conductivity
Cavitation
WUE



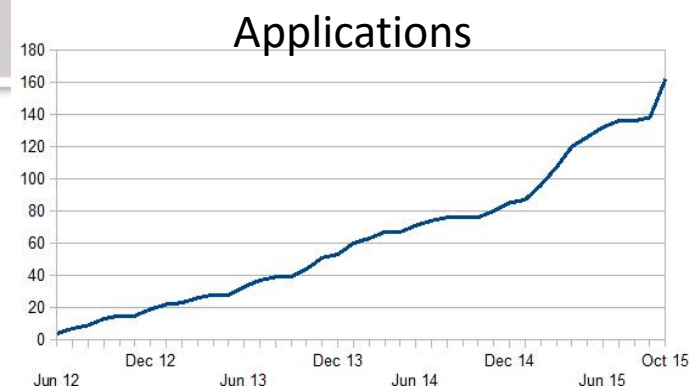


TNA programme: how to bring fresh air to research...?



28 infrastructures

- Genetics, genomics & breeding
- (Eco) physiology & biotechnology
- Wood science & technology
- Modelling

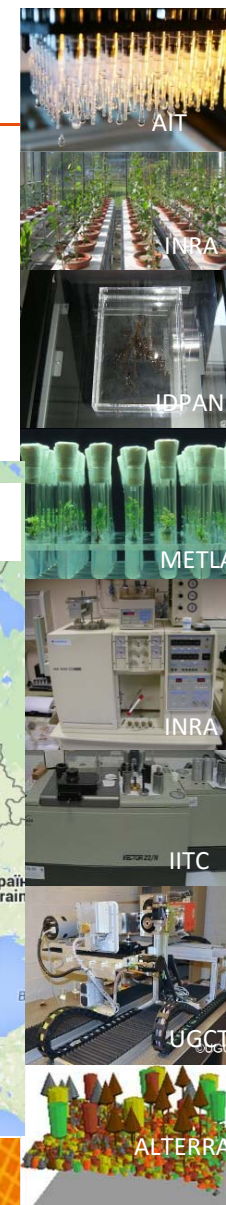


'I admire and appreciate the support provided. Through this programme I could establish new networks and links with experts which will be an important milestone in future research work'.

Origins of 114 TNA visitors

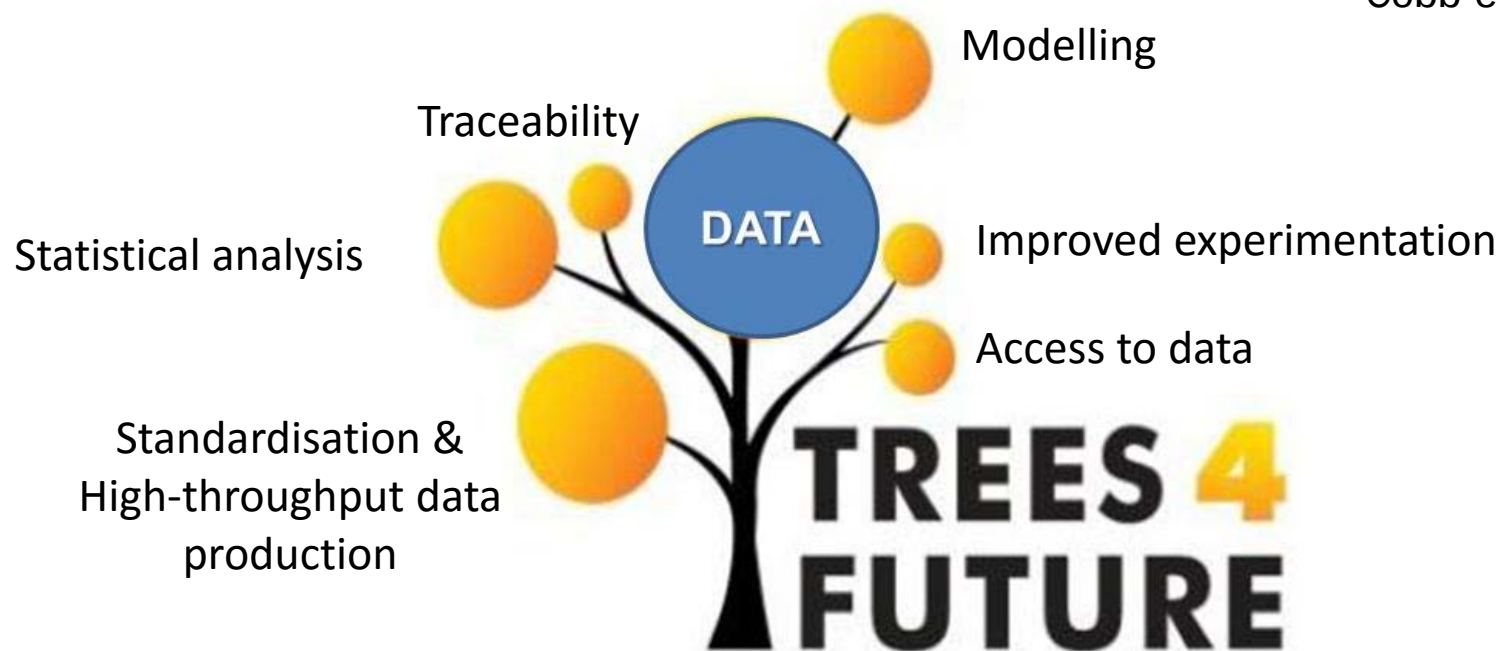


Designing Trees for the Future



*‘Move from a **data-starved**, largely **observational** discipline...
to a **data-rich** science capable of **prediction**’*

Cobb et al. 2013

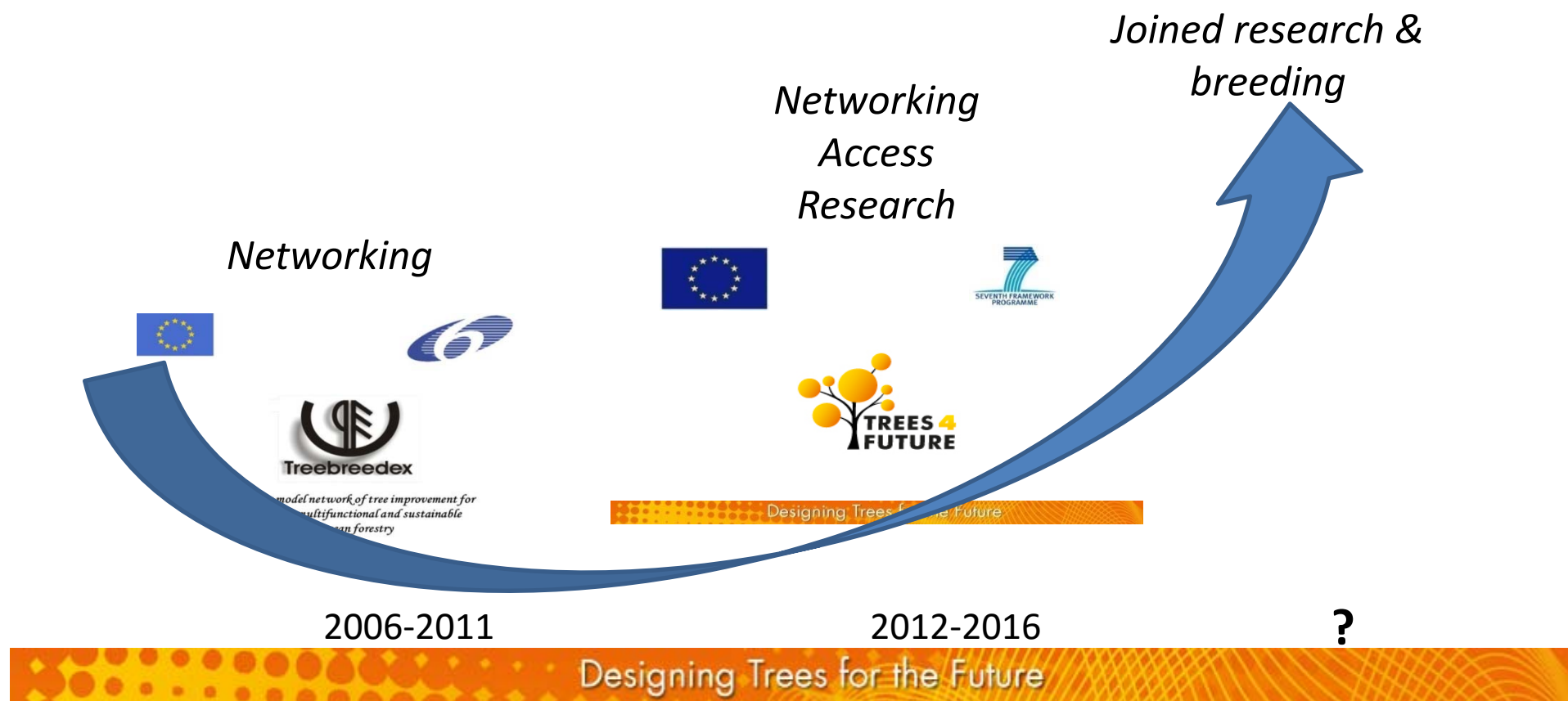


Which vision for the future?

From TREEBREEDEX and Trees4Future RI projects to...

*the idea of a **European Tree Breeding Centre***

From TREEBREEDEX and TREES4FUTURE RI projects to...
*the idea of a **European Tree Breeding Centre***

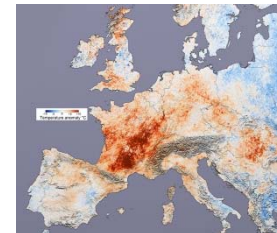


FOREST TREE BREEDING

*Makes value of native/exotic genetic resources
to create, mass-produce and deploy improved material*

European-wide range:
(native/cultivated) of species
and other organisms

European-wide challenges:
climatic, pest & disease,
industrial, societal



Breeding → Huge impact: 50% of European forests are planted forests

Designing Trees for the Future



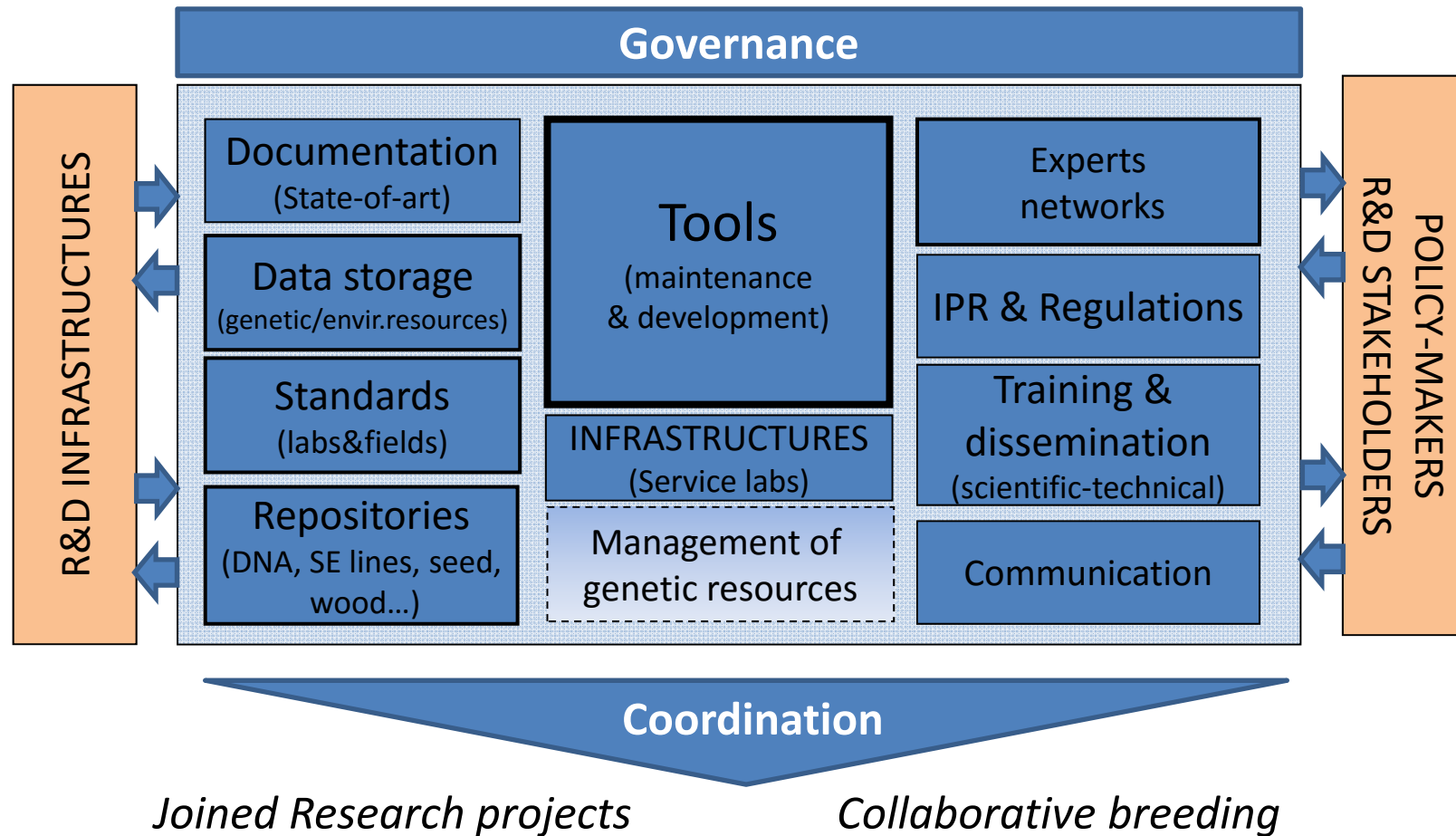
Towards a European Tree Breeding Centre: Rationale



	Constraints	Needs
European-wide range of species	Genetic diversity Constrasted environments	Accessibility
Multi-species	Focus on 3-4 species	Diversification
Perennial species	Long-term perspectives	Continuity
Multi-objectives	Increased complexity (multi-traits, diversity...)	Multi-disciplinary
Breeding activities	Ups and downs	Continuity, critical mass
Breeding process	Scattered R&D expertise	Chain-process
Breeding expertise	Highly heterogeneous	Exchange, training
Urgency of some challenges	Time is 'against' breeding	Join forces!

More reactive, more efficient, more cost-effective, broader scope

Towards a European Tree Breeding Centre?



Designing Trees for the Future

Joined breeding programmes...

Why not in Europe?



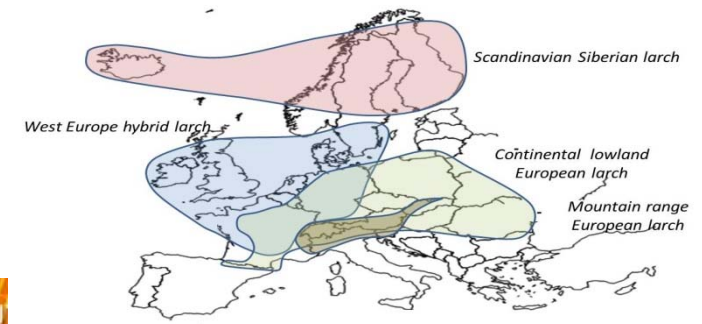
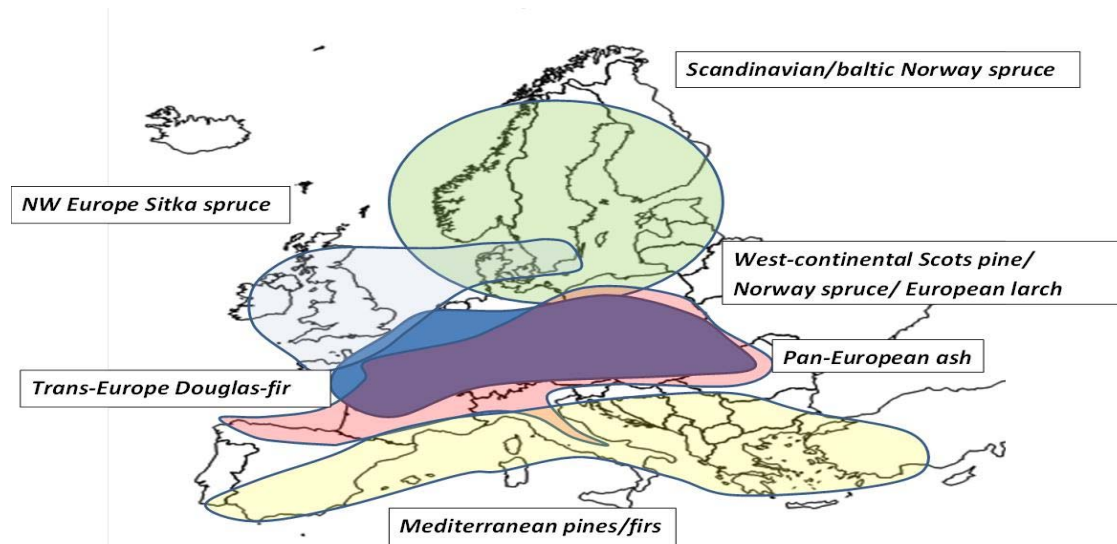
Ex. Norway spruce breeding programmes: 21!

NOW



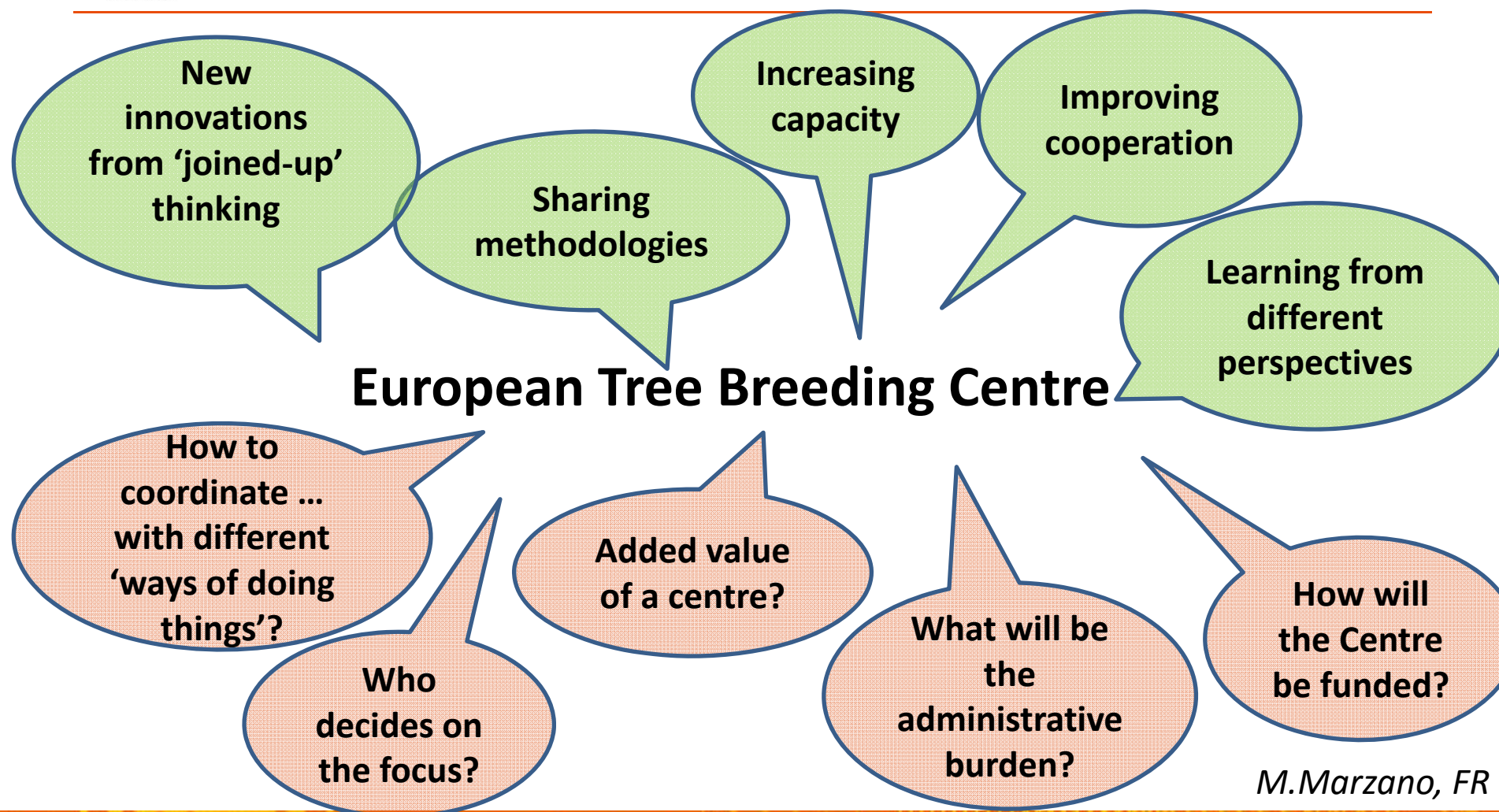
TO MORROW?

Designing Trees for the Fu





European Tree Breeding Centre: stakeholders' perception



M.Marzano, FR



ACKNOWLEDGMENTS



Co-coordination: G-J.Nabuurs (ALTErrA, NL)

WP leaders

S.Flusch (AIT-AU) (S.Gaubitzer)	WP1	L.Sanchez (INRA, FR)	WP6
B.De Cuyper (INBO, BE) (M.Steenackers)	WP2	B.Heinze (BFW, AU)	WP7
J.Climent (INIA, SP)	WP3	D.Ray (FR, UK)	WP8
J.Van Brusselen (EFI, FI) (L.Salminen)	WP4	R.Lockers (ALTErrA, NL)	WP9
F.Miglietta, P.Rosà (FEM, IT)	WP5	G.J.Nabuurs (ALTErrA, NL)	W10
Y.Lecuona (IT, FR) (A.Bakker, L.Premvardhan)	WP12	L.E.Pâques (INRA, FR)	WP11

28 TNA site managers and **114 TNA visitors** + **Panel of reviewers**
& all participants

Conference organisation

A.Pignard and I.Viriot (IT, FR), M.Korhonen and N.Valbuena (EFI, FI)



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SAAT- UND PFLANZENZUCHT



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