



Outreach seminar for international collaboration, Buenos Aires, October 8-9, 2019

MULTIFOREVER

Towards intensification of conifer production through multi-varietal forestry based on somatic embryogenesis

MARIA ELENA GAUCHAT
INTA EEA Montecarlo, Misiones
gauchat.maria@inta.gob.ar

April 1, 2019 – March 31, 2022 (36 months)

➔ **Wood biomass / intensively managed plantations**

Topic A **ForestValue**

Innovative sustainable management of multifunctional forests



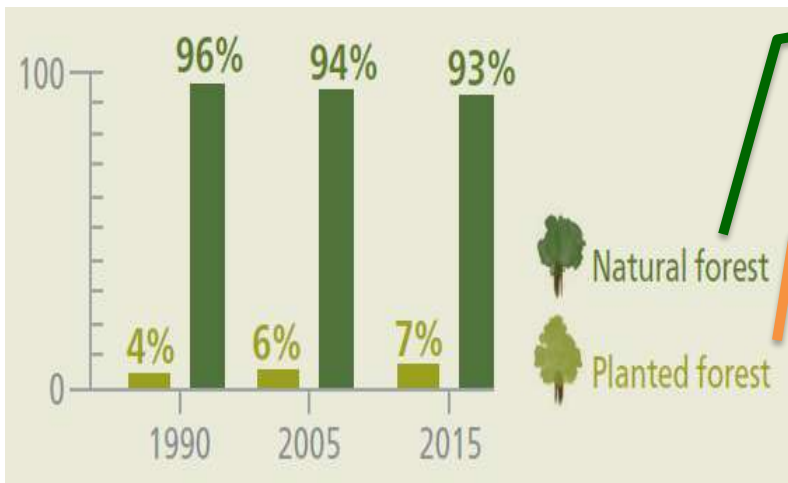
Project MULTIFOREVER is supported under the umbrella of ERA-NET Cofund ForestValue by ANR (FR), FNR (DE), MINCyT (AR), MINECO-AEI (ES), MMM (FI) and VINNOVA (SE). ForestValue has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773324.





ForestValue

State of the world's forests: **forest plantations are increasing**



3695 Mha
(-244 Mha since 1990)

Natural/assisted regeneration
Including **primary forests**

291 Mha
(+105 Mha since 1990)

Planting/deliberate seeding Including **plantation forests**

⇒ **Planted forests are becoming the main source of wood production** (currently 33%; projected 2030: 50%)

Plantation forest

- Intensively managed / short rotation
- Wood, fibre, energy
- 1-2 species at planting / stand maturity
- Even age class, regular spacing

Highly efficient wood production system





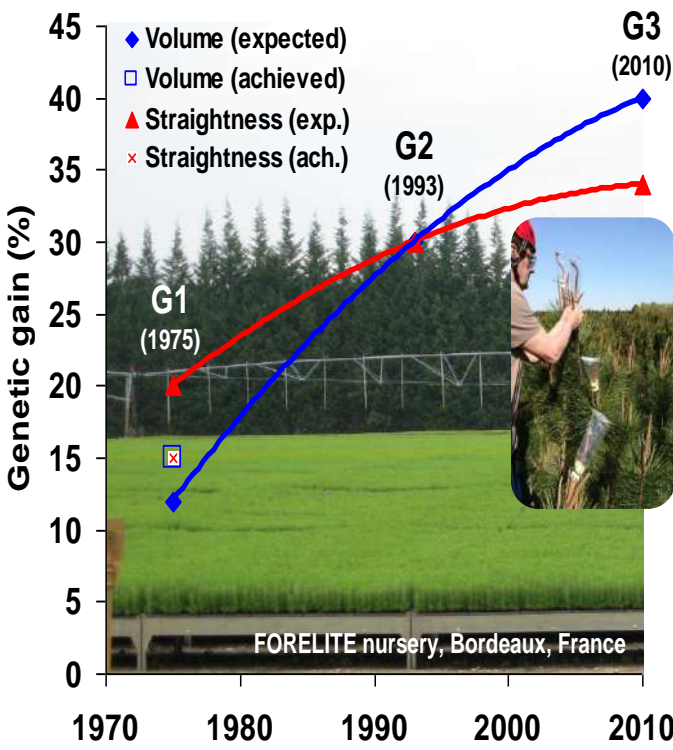
ForestValue

Sustained productivity: **breeding + efficient capture of genetic gain**

Investment in Tree Breeding

(typically 10-20% genetic gain/cycle)

⇒ **Slow process**



Capture of heritable gains

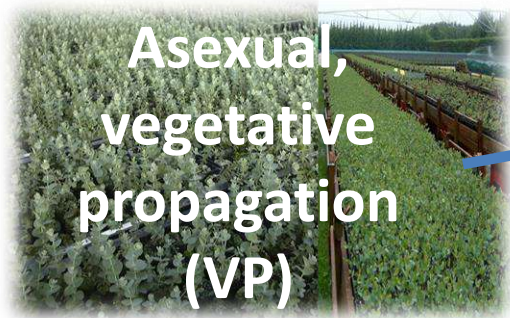
(production of improved varieties)

Seed production in orchards



Sexual reproduction

Clone production in nurseries



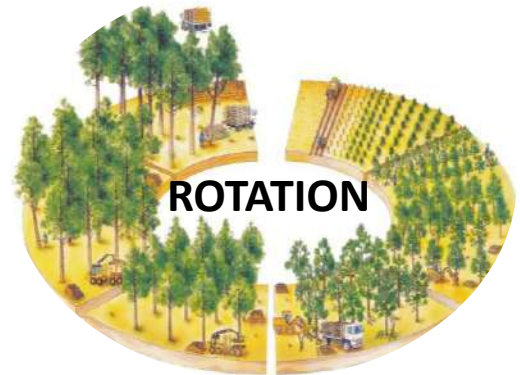
Asexual, vegetative propagation (VP)

Plantation forestry

(best-adapted sites, 4-40 m³/ha/yr)

Productivity > natural forests
+ Disease resistance, wood properties

SEED-BASED FORESTRY



ROTATION

MULTI-VARIETAL FORESTRY

Quick & uniform production
Easy harvesting, transport
High conversion to products



Micropropagation for scaling-up the industrial production

Somatic embryogenesis (SE) in conifers

Production of embryos from somatic cells
Complete ontogenetic rejuvenation
The most promising method for industrial
scale-up



T. Maruyama
FFPRI, Japon
Pinus thunbergii
Up to 15,000 embryos / g

Towards commercial implementation

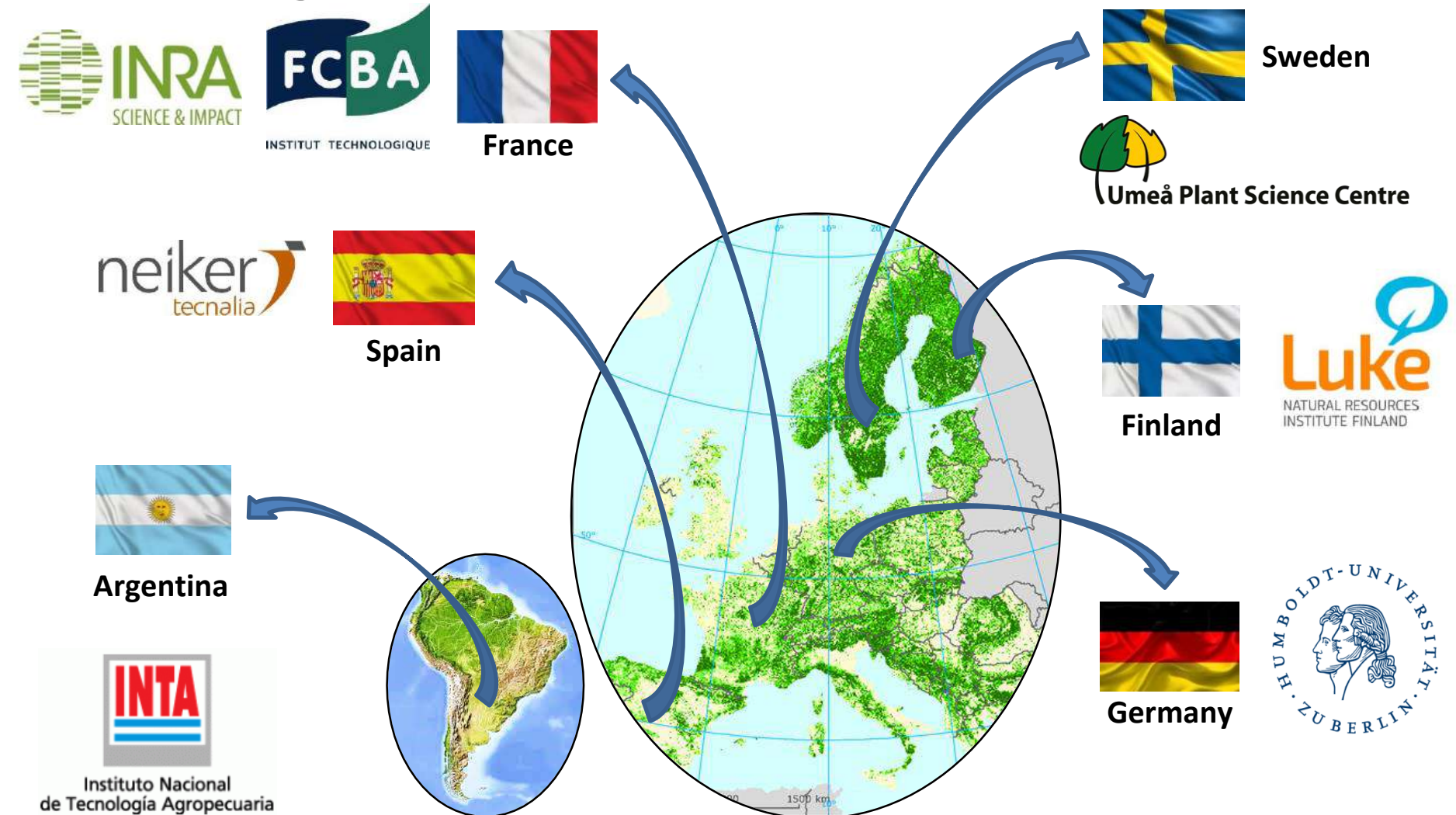
- ✓ **Radiata pine:** Scion, Radiata pine BC, Timberland (NZ)
- ✓ **Loblolly pine, Douglas-fir:** Weyerhaeuser, ArBorGen (USA)
- ✓ **White spruce:** JD Irving (Canada)
- ✓ **Nordmann fir:** Univ. Copenhagen (Danemark)
- ✓ **Norway spruce:** LUKE (Finland), UPSC (Sweden)



J.D Irving Ltd
***Picea glauca*, Canada**
600 000 plants/yr

7 expert teams in conifer somatic embryogenesis

Budget: total: 2,033,579 € (grant = 1,344,205 €; 66.1%)





How the project arises?

This multinational proposal was initiated considering:

- The cross-border nature of forestry;
- Advantages of collaboration and coordination for knowledge generation and optimal resource management;
- benefits from multi-site, more informative field trials;
- The need for efficient SE plant production at the EU scale as a future-oriented, complementary alternative to seed-based plantation forestry.



How emerged the international collaboration?

- Since 2008, collaboration between EU participants in the framework of IUFRO 2.09.02 Working Party about Somatic embryogenesis and other Vegetative Propagation Technologies. IUFRO Website: <https://www.iufro.org/science/divisions/division-2/20000/20900/20902/>
- 4th IUFRO 2.09.02 meeting organized in La Plata (Argentina) in 2016. Following this international event, IUFRO network significantly increased with scientists from Argentina and other countries in Latin America.
- EU ForestValue joint call for research proposal 2017 was opened to some non-UE countries. Argentina was the only country from Latin America participating in this call.

Strong collaboration EU-Argentina: International Associated Laboratory (LIA): **FORESTIA**



Instituto Nacional de
Tecnología Agropecuaria



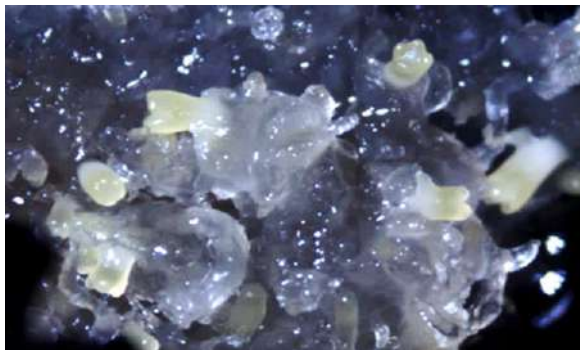
- *Collaborative research framework between INRA and INTA formalized, by mutual agreement, an international collaboration around a common scientific project, between an INRA Unit and INTA.*
- Scientific project: "Multidisciplinary study of adaptation of natural and planted forests to environmental variations (biotic and abiotic), in the context of global change"
- LIA is a "laboratory without walls". It has no legal entity. It implies the possibility of exchange, both of researchers and technicians.
- Successful active collaboration since 2004 by: European and Argentine projects, bilateral collaborations, postdoctoral scholarships.
 - 2016-2018 **"Dynawood"** CONSORTIUM STUDIUM: *Dynamic of wood formation and adaptation of forest trees to climate variation.*
 - 2015-2019 **"TOPWOOD"**, Horizon 2020 Sub-programme: H2020-MSCA-Marie Cure-RISE-2014, *Tools for Phenotyping Wood*



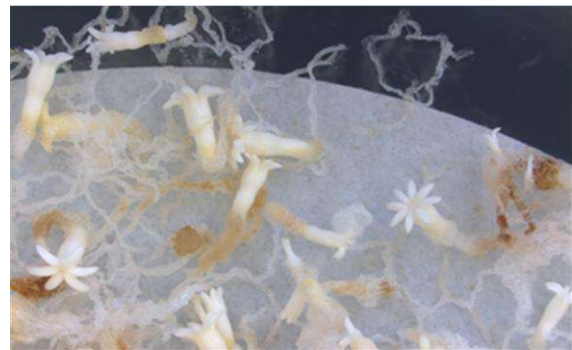
8 important conifer species in EU and Argentina



European larch
Hybrid larch
Douglas-fir



Loblolly pine
Hybrid pine



Radiata pine



Hybrid larch



Maritime pine
Loblolly pine
Douglas-fir



Norway spruce





Our 4 scientific & technical challenges



**Basic & applied
research (TRL 1-3)**



**Advanced research
(TRL 2-4)**



**Technological
demonstration (TRL 5)**



**Advanced research
& demonstration (TRL 3-5)**



« The Holy Grail »

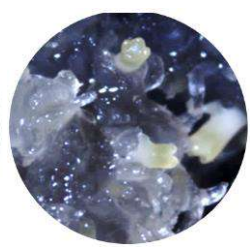
« Streamline the process! »

« It's the mix that matters! »

« Who will make the big bucks? »



**Initiation
Multiplication**



**Cryopreservation
Maturation**



**Germination
Acclimatization**



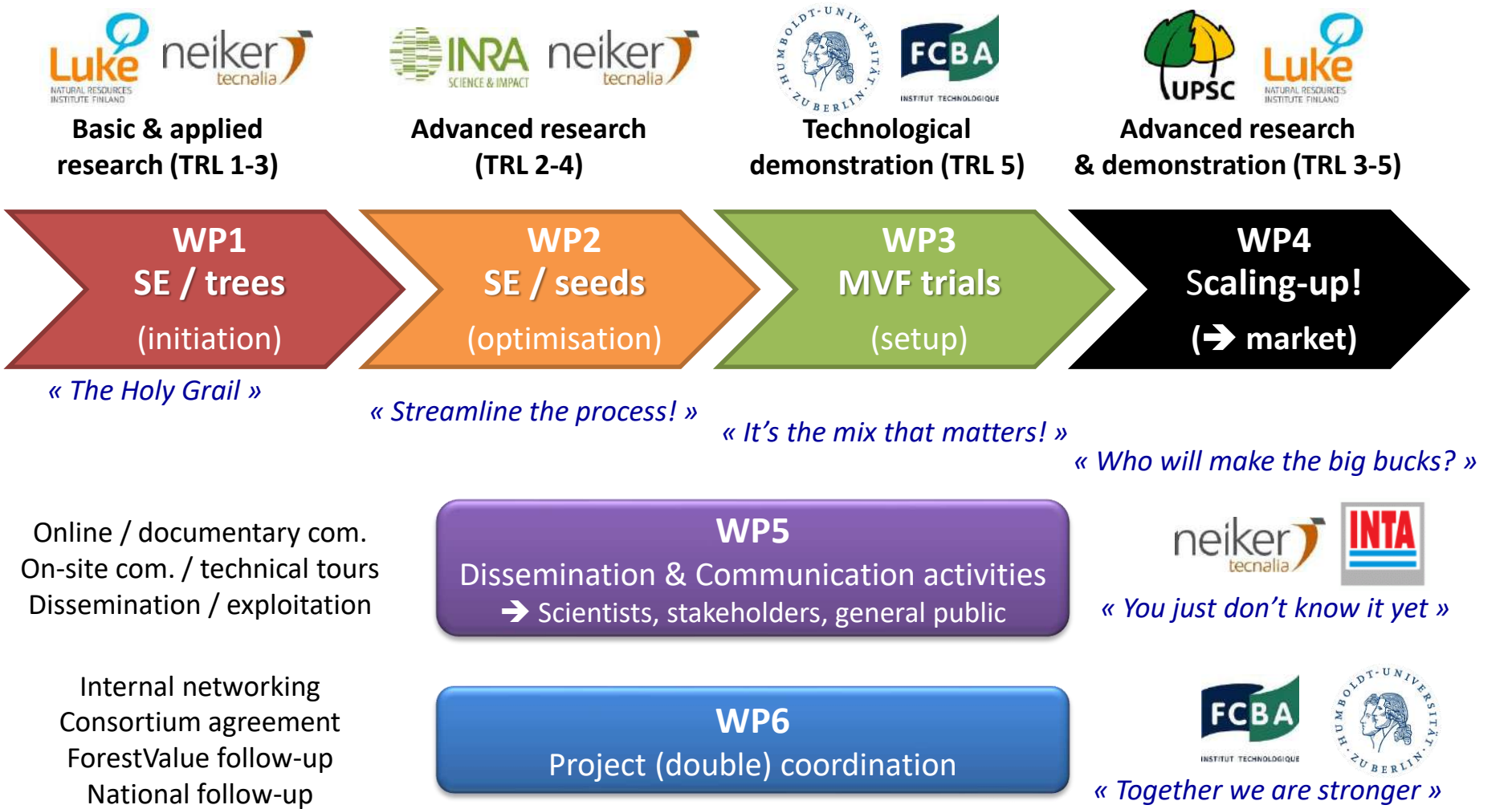
**Field trials
MVF demo**



**Scale-up
Automation
Cost-efficiency**



Our communication & coordination plans





Our transnational support



Stakeholders (8 organizations from 5 countries)



Funding agencies

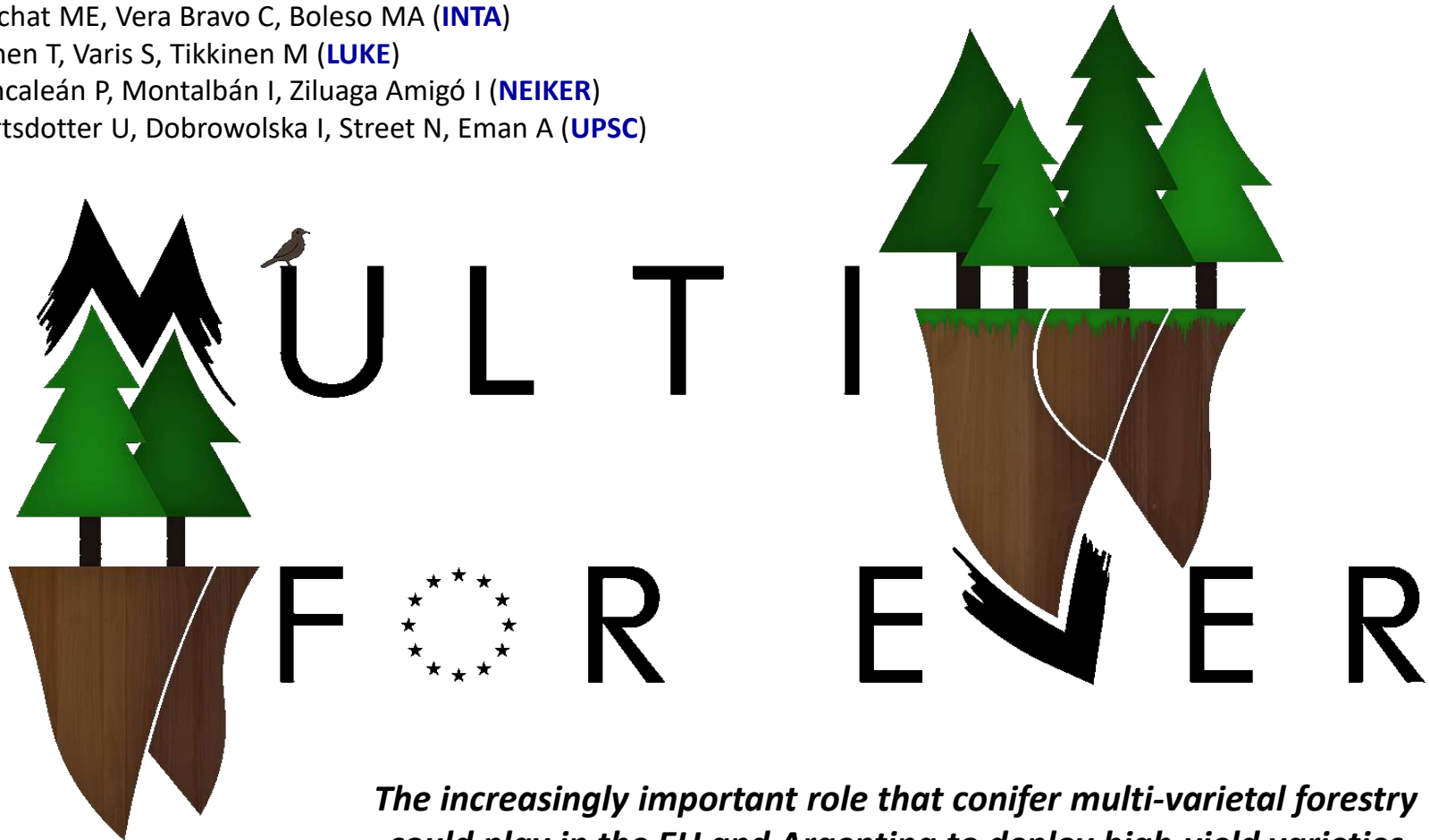


Thank you for your attention!

- P1** - Trontin JF, Gallou A (**FCBA**) COORDINATOR
P2 - Rupps A, Raschke J (**HUB**) CORRINATOR
P3 - Lelu-Walter MA, Teyssier C, Poitelon C (**INRA**)
P4 - Gauchat ME, Vera Bravo C, Boleso MA (**INTA**)
P5 - Aronen T, Varis S, Tikkinen M (**LUKE**)
P6 - Moncaleán P, Montalbán I, Ziluaga Amigó I (**NEIKER**)
P7 - Egertsdotter U, Dobrowolska I, Street N, Eman A (**UPSC**)

Multi-varietal forestry
Vegetative propagation
Somatic embryogenesis
Demonstration trial

Cost efficiency
Scaling-up
Market analysis
Commercialization concept



*The increasingly important role that conifer multi-varietal forestry
could play in the EU and Argentina to deploy high-yield varieties
adapted to environmental and socio-economic constraints*