



**Can we maintain the services provided
by Europe's forest ecosystems in the
face of global change?**



The need for forest ecosystem adaptation & resilience



Climate
Air
Water
Soil

Market
Society
Policy

RISKS

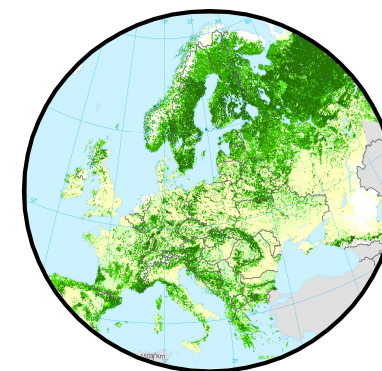
Drought
Heat, frost
Fire
Storms
Pollution
Pests & diseases

Management
Land use
Sanitary issues
Regulation

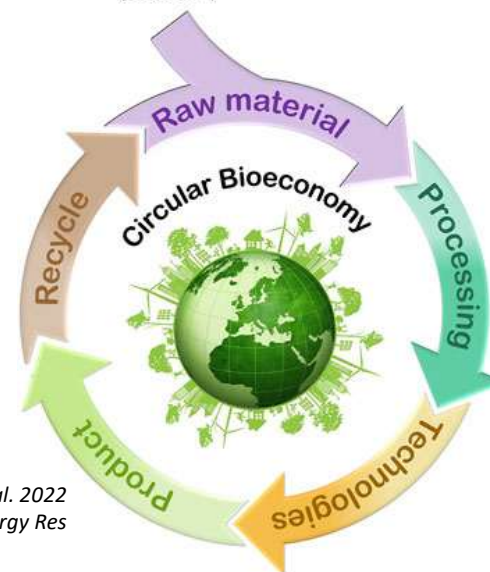
CHALLENGES

Biodiversity losses
Species at risk & migration
Reduced growth & reproduction
Drinkable water
Soil degradation
Disturbed biogeochemical cycles

Over-exploitation, malforestation
Mitigation of warming (CO₂ capture)
Healthy environment, zoonoses
Inspiring environment



Biomass
(Carbon)



Caetano et al. 2022
Front Energy Res



**No forest adaptation without biodiversity.
no biodiversity without forest adaptation**

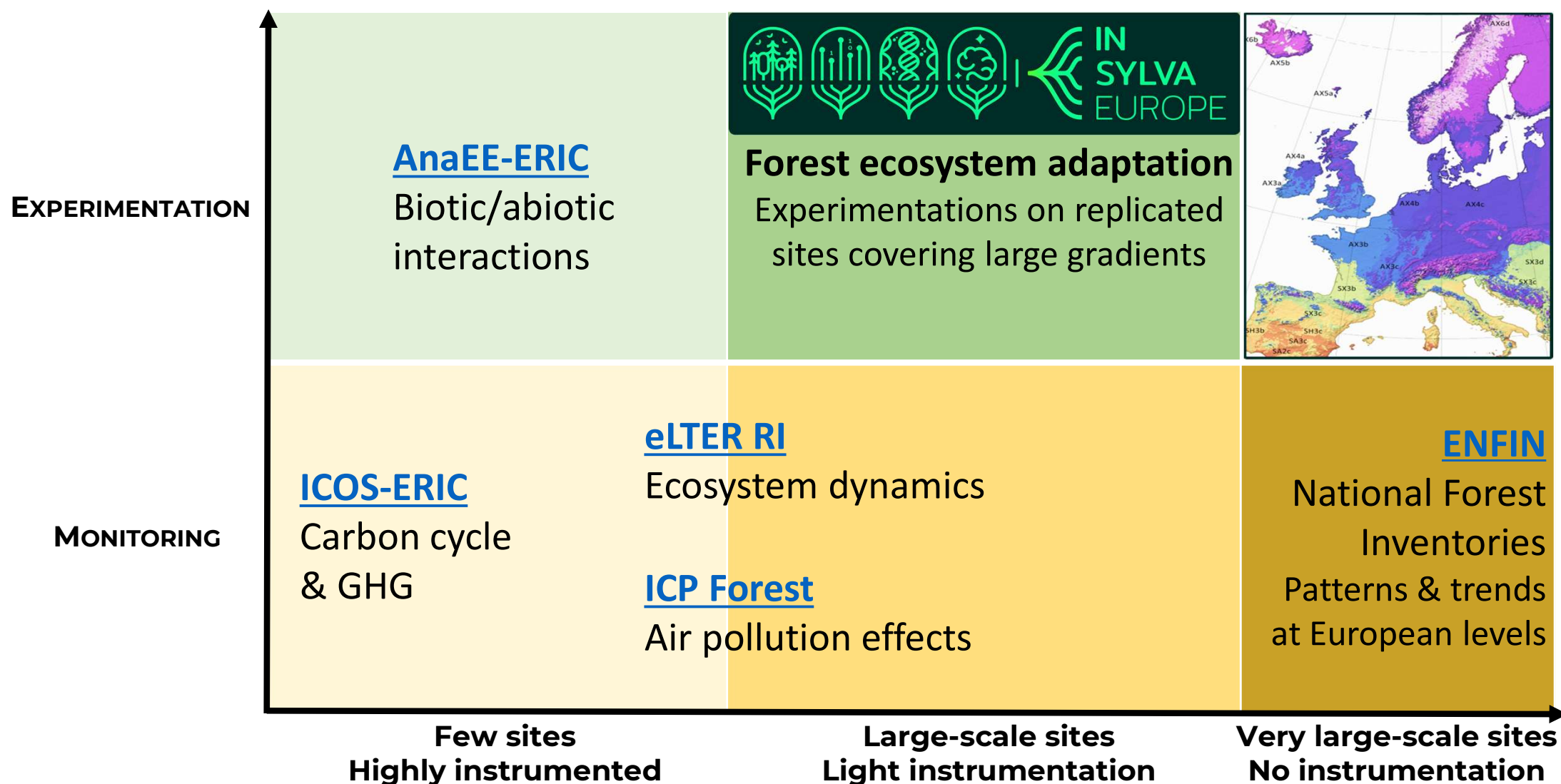
IN-SYLVA Vision & Mantra

*A long-term, forest-focused, pan-European and distributed RI
for
Tailoring adaptation strategies in the context of global change towards
sustainable forest management*



**No forest adaptation without biodiversity.
no biodiversity without forest adaptation**

IN-SYLVA Europe in the European landscape of forest monitoring and experimentation sites



None of other RIs and European networks can provide experimentation for forest adaptation at large-scale sites

Users needs at European level, besides national initiatives

Bottlenecks

Fragmentation, lack of harmonized procedures and pheno- & enviro-typing tools

Insufficient capacities for characterisation of genetic resources and their environment

Low integration of data and long term sharing in Europe
Insufficient science-based tools for stakeholders

Needs



Forest experimentation (ca. 200 k sites)

Genotype x Environment x Silviculture interactions
Remote access using modular, lightweight and low cost devices



High throughput and diversified analytical platforms

Forest ecosystem compartments and components, tree/wood and soil traits



Information systems

Long term access to FAIR metadata & data

Modelling & simulation (+ mobile Apps)

Integration of interdisciplinary data into diagnosis and modelling tools integrating climate change scenarios



Main aim

To set up an European RI with a multilateral, distributed design gathering **in situ**, **in lab** and **in silico** resources & services for the continuous adaptation of forest ecosystems to global change

IN-SYLVA EUROPE STRUCTURE

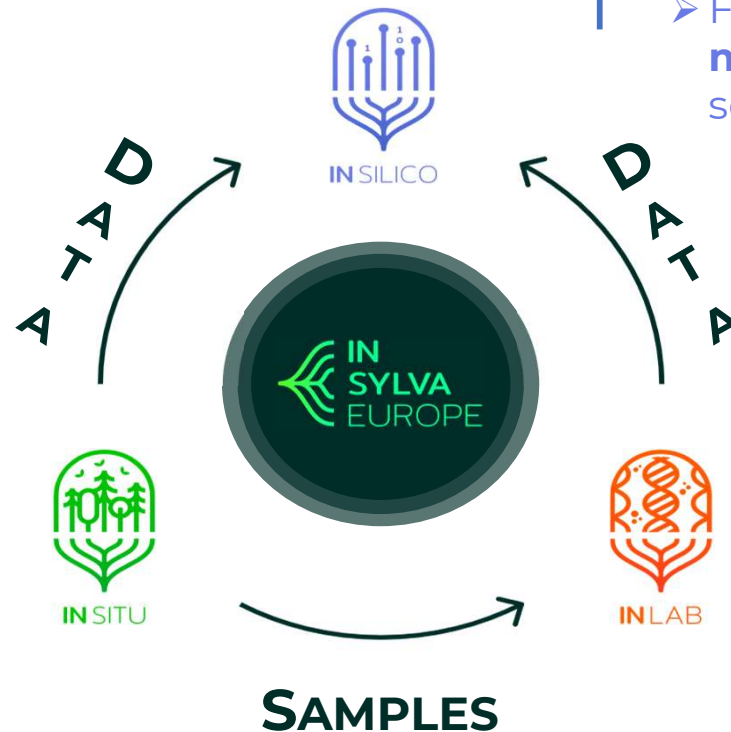
→ Accessing forest replicated experimentations at European scale

Holistic research with
cross-disciplinary
approaches on forest
ecosystem adaptation

Potential
of 200K
EU forest sites

Forest experimentation

- Genotype x Environment x Silviculture **interactions**
- **Adaptive forest management** to global changes



1- Information systems

Access to **FAIR metadata & data providers (e-RIs)**

2- Modelling & simulation platforms (+ mobile Apps)

- Forest ecosystem **diagnosis & modelling evolution** under different scenarios (climatic, socio-economical)

Analytical platforms

Characterizing forest ecosystem compartments and components, tree/wood and soil traits

Forestry information, education and training services

Internal/external training services and mobility (capacity-building programme)

High-quality Open Educational Resources (OERs) to meet education needs (knowledge, skills, technologies)



**1- Increase excellence of Partner's research facilities staff
(e.g., new professions with evolving technologies)**

**2-Development of new curricula for the future of forests
e.g., multicriteria analysis and illustrative learning environments
(practical and/or virtual forest showcase)**

3-Increase science-based forest knowledge in the Society

25 universities & high schools from 14 countries

Target users of IN-SYLVA EUROPE services

↓ Scientific communities ↓

G1- Scientists directly involved in forest ecosystem adaptation

G2- Scientists who can benefit from and further contribute to improving RI services

↓ Other stakeholders ↓

G3- Stakeholders controlling and/or benefiting from forest ecosystem services

G4- Stakeholders with needs in forest/forestry education & training

Forest publication corpus in EU	2002 2011	2009 2019
Tatry & Leiser 2012 Paivinen et al. 2023	141,326	>182,000

20 countries (50-80% international collaboration)

75 letters of interest from 15 EU countries
(including ministries, agencies, industry, universities, forest organisations, NGOs, etc.)

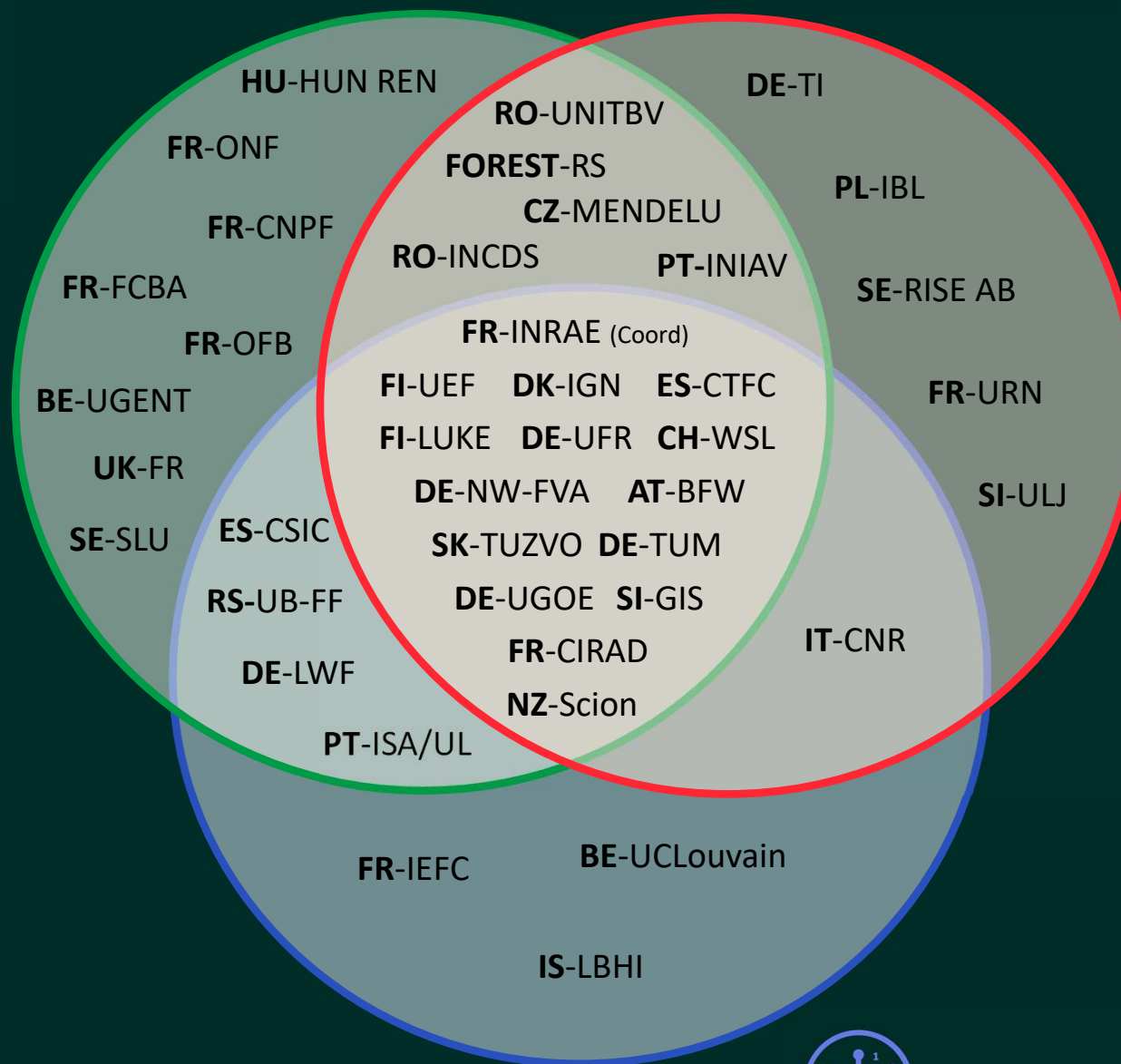
The growing IN-SYLVA multinational partnership

→ 41 Partners from 21 countries providing **in situ**/**in lab**/**in silico** Services



-  **AT**-Austria
-  **BE**-Belgium
-  **CZ**-Czech Rep.
-  **DK**-Denmark
-  **FI**-Finland
-  **FR**-France
-  **DE**-Germany
-  **HU**-Hungary
-  **IS**-Iceland

-  **NZ**-New Zealand
-  **IT**-Italy
-  **PL**-Poland
-  **PT**-Portugal
-  **RO**-Romania
-  **RS**-Serbia
-  **SK**-Slovak Rep
-  **SI**-Slovenia
-  **ES**-Spain
-  **SE**-Sweden
-  **CH**-Switzerland
-  **UK**-United Kingdom



HeadQuarters



Internationalisation (outside EU)

- **Forest experimentation** (RFEL, 8 countries)
- **Forest Living Labs** (Task Force proposal, > 30 countries)
- **Resilient Planted Forests** (Task Force, 19 countries)



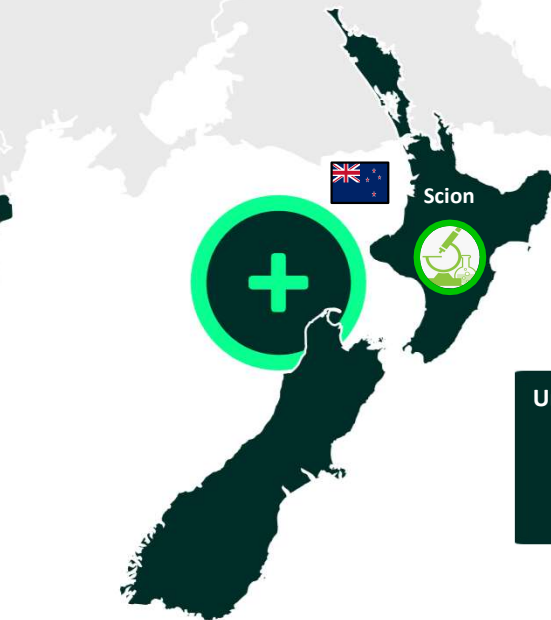
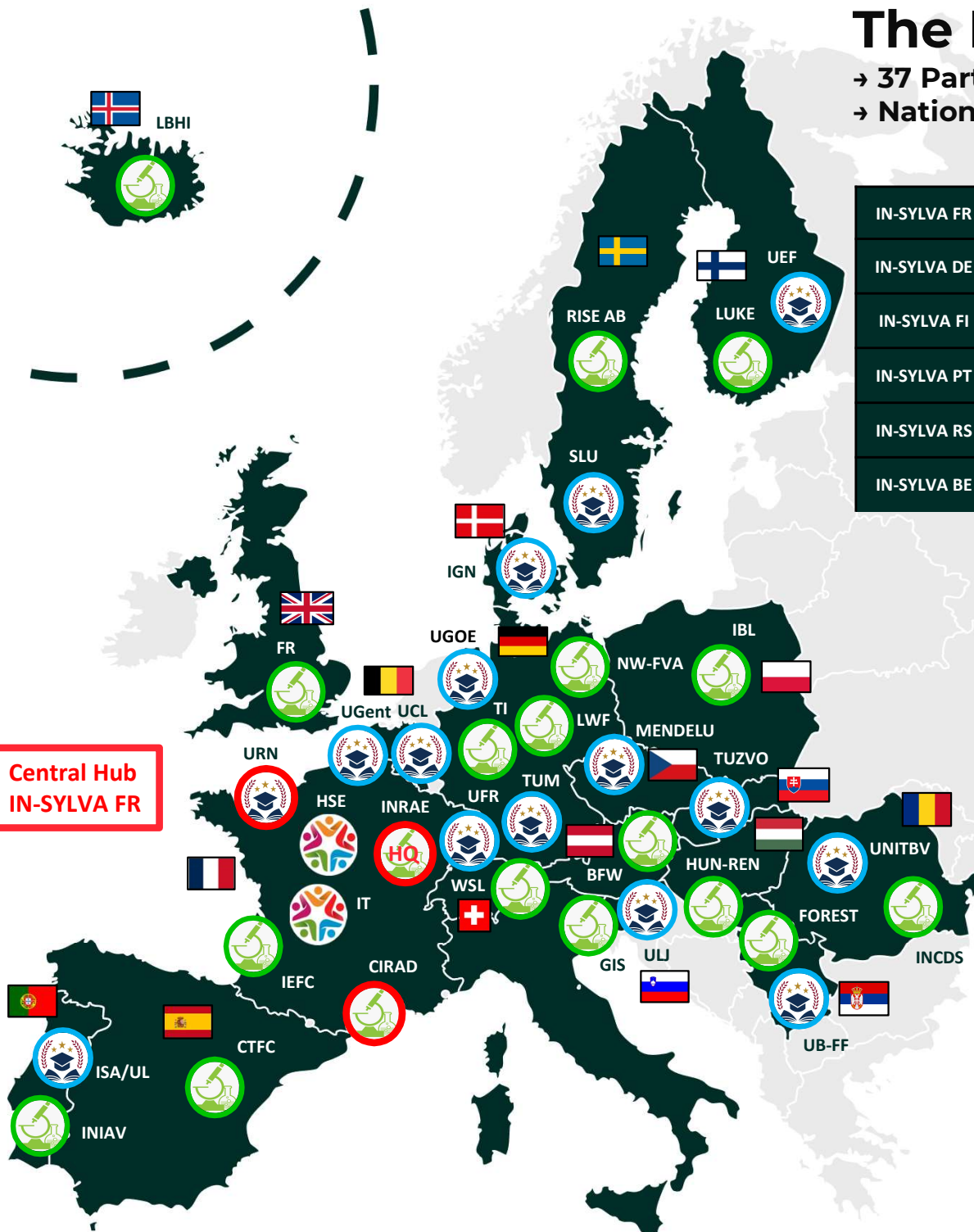
The IN-SYLVA Europe Consortium

→ 37 Partners from 20 countries (signing the MoU)

→ National nodes in progress

IN-SYLVA FR						
IN-SYLVA DE						
IN-SYLVA FI			IN-SYLVA SE			
IN-SYLVA PT			IN-SYLVA RO			
IN-SYLVA RS			IN-SYLVA SI			
IN-SYLVA BE			IN-SYLVA CZ		IN-SYLVA DK	
IN-SYLVA UK		IN-SYLVA ES		IN-SYLVA AT		
IN-SYLVA HU		IN-SYLVA CH		IN-SYLVA SK		
IN-SYLVA IS		IN-SYLVA PL		IN-SYLVA NZ		

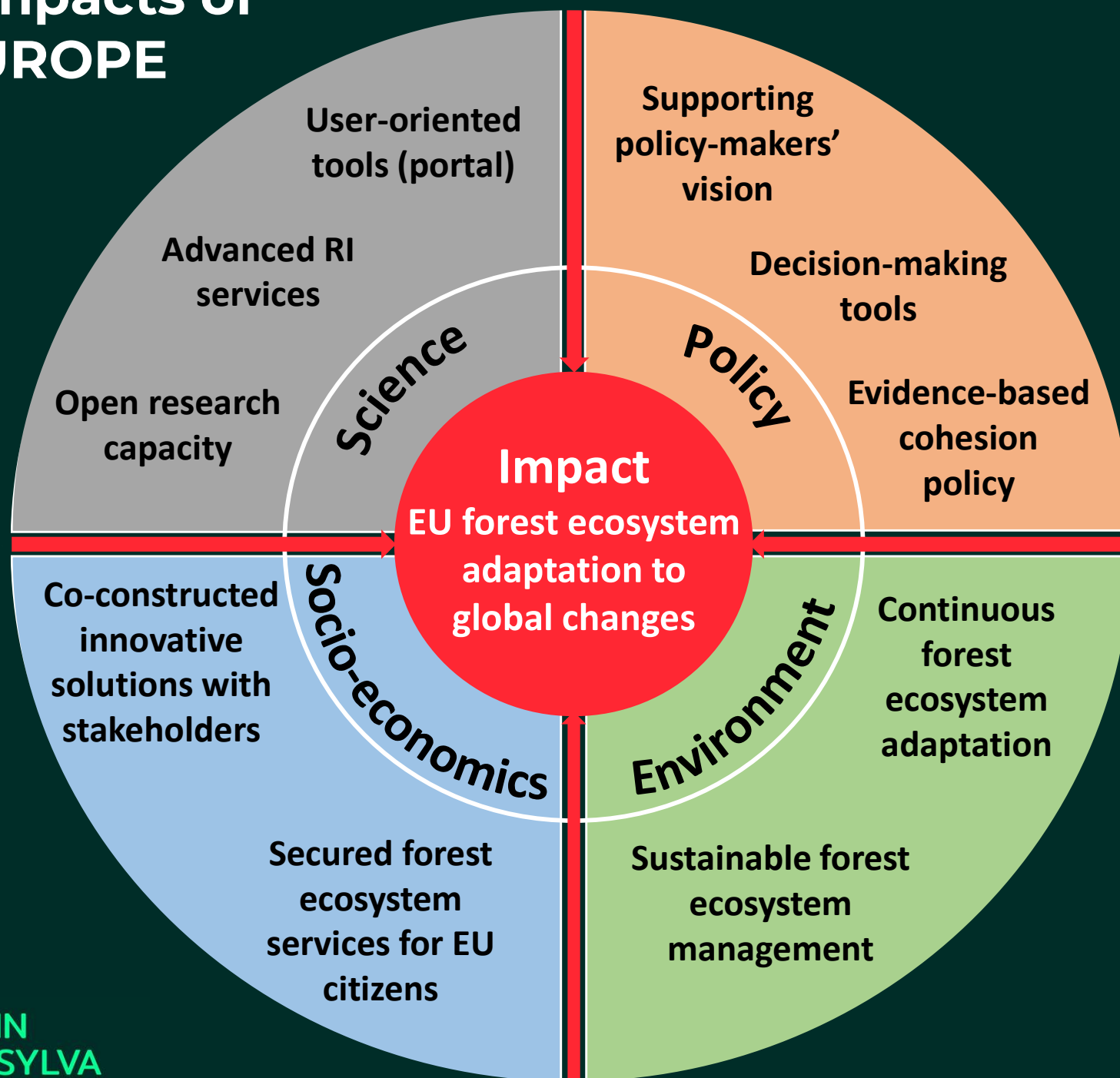
Central Hub
IN-SYLVA FR



Universities (15)	Institutes (19)	Support (2)

Long term Impacts of IN-SYLVA EUROPE

An integrated vision of impacts promoted by science-based knowledge



Two-way collaboration strategy with 13 ESFRI Research Infrastructures

Towards enhanced inter- and trans-disciplinary collaborative EU projects on forest adaptation

Increasing knowledge on forest adaptation

Contribution (OUTPUTS to RIs): deepen ecosystem knowledge

Benefits (INPUTS from RIs): formalised forest research



Fostering technological innovation

Contribution (OUTPUTS to RIs): enhanced technologies

Benefits (INPUTS from RIs): formalised technological deployment

GHG AND OTHER ATMOSPHERE ISSUES

ICOS-ERIC (L)

- ❖ Carbon cycle
- ❖ GHG monitoring
- ❖ Intensive instrumentation

ACTRIS-ERIC (L)

- ❖ Short-lived constituents
- ❖ Air quality monitoring

ECOSYSTEM STRUCTURE/FUNCTION

ANAEE-ERIC (L)

- | | |
|-----|---|
| IN | Ecosystem functioning; Biotic and abiotic interactions; Intensive instrumentation |
| OUT | Testing/modelling (large gradients)
Thesaurus/ontology (forest ecosystems) |

eLTER RI (P)

- ❖ Ecosystem dynamics
- ❖ Socio-ecological approach
- ❖ Integrated standard observation
- ❖ Intensive instrumentation

COLLECTIONS

DISSCO (P)

- ❖ Biorepositories
- ❖ Natural collections
- ❖ Digitisation services

MIRRI-ERIC (L)

- ❖ Microbial resources
- ❖ Ecosystem biomonitoring (e.g., soil health, zoonoses)

SAMPLING - PHENOTYPING - DATA

ELIXIR (L)

- ❖ High-throughput data management & analysis
- ❖ Chemistry, genetics/ genomics

LIFEWATCH-ERIC (L)

- ❖ Biodiversity & ecosystem research
- ❖ Massive data computing
- ❖ Advanced modelling

EMPHASIS (P)

- | | |
|-----|---|
| IN | Lean, efficient phenotyping <ul style="list-style-type: none">- IoT sensors- High-resolution wireless networks- Remotely operated autonomous system |
| OUT | Field plots across large gradients
Experimental datasets for modelling |

GRACE (C)

- | | |
|-----|---|
| IN | PGR conservation
Breeding technologies |
| OUT | PGR experimentation |

EU-IBISBA (P)

- | | |
|-----|--------------------|
| IN | Envirotyping tools |
| OUT | Forest biotechs |

Euro-BioImaging-ERIC (L)

- | | |
|-----|---|
| IN | Time-lapse imaging for phenotyping & envirotyping in vivo (e.g. PET) |
| OUT | Field plots for Proof-of-Concept of new imaging technology in the field |

OPERAS (P)

- | | |
|-----|---|
| IN | Methodologies for open and collaborative citizen science
Transnational access of resources and integration in EOSC
Analytics of open access content |
| OUT | Participatory forest research in citizen science with a focus on social sciences and humanities |

IN-SYLVA EUROPE in the EU forest framework

EU INITIATIVES TOWARDS SUSTAINABLE FOREST RESEARCH & INNOVATION

SCARForest

(working group)
Forest R&I

EUFORGEN

(programme)
Forest genetic resources

Forest Partn.

(partnership)
Sustainable forestry

Biodiversa+

(partnership)
Biodiversity research

EXISTING RESEARCH INFRASTRUCTURE (PREVIOUS SLIDE)

EU RESOURCES, INFO & DATA MANAGEMENT

EFDAC

Forest data

EFFIS

Forest fire info

FISE

Forest data & info

LUCAS

Land use cover area survey

EOSC-Life

Open science cloud



EU USER-ORIENTED TOOLS

ENoLL

(network)
Living Labs
Lighthouses

EPPN

(network)
Pilot prod. facilities

Thematic, multilateral, and distributed RI

» Large network of replicated experimental sites across Europe (potential of 200k)

Testing solutions for the adaptation of EU forest to global changes

EU POLICY

DG ENV

EC policies env.

EEA

Env. & climate policies

JRC

Anticipation & impact of EU policies

EFI

Forest policy issues

MONITORING OF EUROPEAN FORESTS



ENFIN

National Forest Inventories

» Patterns & trends at regional and European levels



ICP Forest

» International Co-operative Program on Assessment and Monitoring of Air Pollution Effects on Forests

IN-SYLVA EUROPE application to the ESFRI Roadmap 2026



Thanks for your attention!



*Small seed embryos to become well-adapted trees
in a changing environment!*

*IN-SYLVA Europe RI development towards sustainable
forest ecosystem management!*

© J.-F. Trontin