IN-SYLVA Europe : vers une infrastructure de recherche européenne pour la gestion adaptative des forêts

An EU Centre for the adaptation of forest ecosystems to climate and other global changes

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Keywords: Forest adaptation ↔ Biodiversity ↔ Carbon neutral strategies ↔ Holistic research ↔ in situ / in lab / in silico services ↔ Open & collaborative science ↔ Long-term research infrastructure ↔ Global changes

EU proposal:
HORIZON-INFRA-2024-DEV-01-01
RI Concept Development
IN-SYLVA Europe-CD

European Strategy Forum on RI:
Towards an ESFRI Project application

Forest adaptation: a gap in the European RI landscape (ESFRI)

LANDSCAPE ANALYSIS | HEALTH & FOOD

GAPS, CHALLENGES AND FUTURE NEEDS

Ecosystem carbon storage (ESFRI Roadmap 2021, p. 87).

European forests constitute a sink for 450 million tons of CO_2 per year, plus in addition 5 million tons stored in woody biomass and 30 million tons in forest soils (...).

However, forests are currently impacted by global change, and extended drought periods make their resistance to perturbation decrease, and less resistant to pathogens (...).

Improving (...) the adaptation of forests to global change pressures will result in preserving this important CO_2 sink.

ESFRI LANDSCAPE ANALYSIS 2024 - SECTION 1

ENVIRONMENT

IMPACT, GAPS AND NEEDS

Contribution of RIs to the Sustainable Development Goals (ESFRI Lansdcape Analysis, p. 56)

The mitigation of and adaptation to climate change, the prevention of environmental pollution, the conservation and the sustainable use of key natural resources and of ecosystem services are vital.

Three SDGs (SDG13 Climate action, SDG14 Life below water, SDG15 Life on land) are directly focused on sustainable management of resources (...).

A holistic approach will help define how to walk the delicate balance of utilising natural resources with minimum impact on the environment and ensure that today's actions do not impede the well-being of future generations.

ESFRI

IN SYLVA EUROPE

Key challenge | **To demonstrate the conceptual and technical feasibility of a thematic RI focused on forest ecosystem adaptation and resilience to global changes**

IN-SYLVA EUROPE explained

→ Accessing forest replicated experimentations at European scale (200,000 sites)

Target scientific forest communities (holding the RI)

[Meta] Ecology ↔ Genetics ↔ Biodiversity ↔ Forestry ↔ Soil sciences ↔ Economics ↔ Social sciences

Needs for a more holistic research with cross-disciplinary approaches on forest ecosystem adaptation

200K
EU forest sites

Forest experimentation & Intensive monitoring

- Genotype x Environment x Silviculture **interactions**
- **Adaptive forest management** to global changes
- Patterns not covered by National Forest Inventories

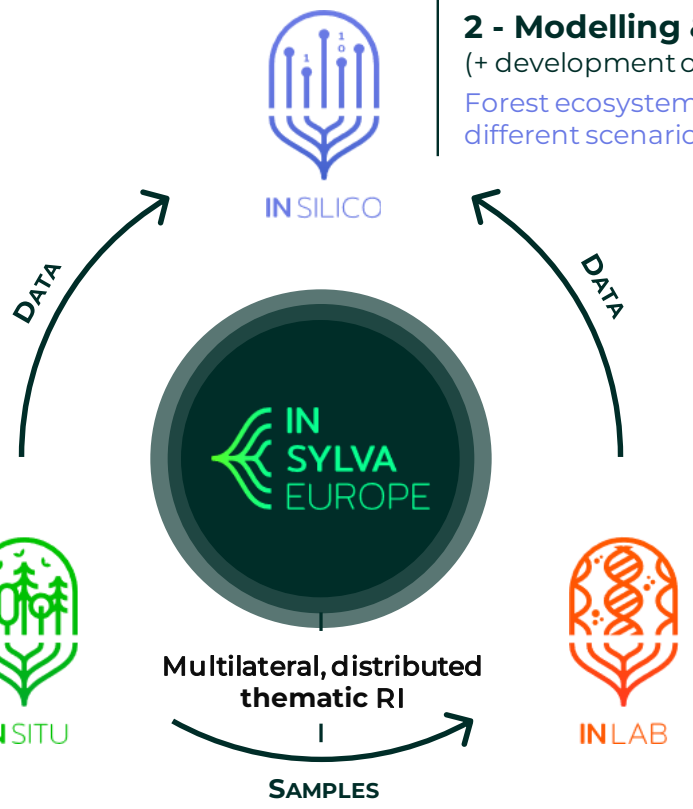
1 - Information systems

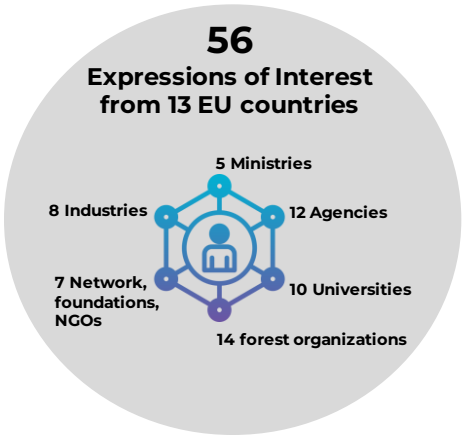
Access to **FAIR [meta]data**

2 - Modelling & simulation platforms

(+ development of mobile applications)

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





Analytical platforms Biological resources centres

Characterising forest ecosystem compartments, tree/wood and soil traits

1-2M
EU forest sites

ENFIN
National Forest Inventories
↗ Patterns & trends at regional and international levels

1 - Rationalise →
← Generalise - 2

← Formalise - 1
2 - Deepen →

ANAEE, ICOS, eLTER
Generic RIs, instrumented sites
↗ Processes driving ecosystem functioning, including forests

100
EU forest sites

Impact pathways of IN-SYLVA EUROPE

→ Mobilizing & improving the EU network of forest-focused living labs and lighthouses

---- IMPACTS

Forests policy | **Innovation in forest management** | **Ecosystem functioning**

---- OUTCOMES

→ Practical use cases & user-oriented tools

Implementing future forest trajectories (different scales)

Living lab facilities
Knowledge & innovation

Lighthouse facilities
Demonstration

Co-constructed solutions
EU landscape | Stakeholders involved

EU Strategies for 2030
The European Green Deal

+Biodiversity Strategy
+Forest Strategy
+Soil Strategy

EU Directives

+Habitats
+Drinking Water
+Soil Monitoring and Resilience

EU Missions

+Adaptation to Climate Change
+A Soil Deal for Europe

100 living labs and lighthouses to lead the transition towards healthy soils by 2030

---- IMPLEMENTATION

Forest monitoring
2D [Concept] & 3D [Object]

Science - society
interactions

Forest adaptation
4D [Evolution scenarios]

Innovative methods | **New approaches**

IN SITU IN SILICO IN LAB | IN SYLVA EUROPE

EU INFRA-TECH calls
IoT, mobile technologies, enviro-typing, high throughput phenotyping (e.g., PHENET project)

EU INFRA-SERV calls
Services to support health research, green & digital transformation, advance breakthrough knowledge

© EU INFRA-DEV calls
Developing & testing RI concepts (e.g., **IN-SYLVA EUROPE-CD** proposal)

EU RIA
E.g., BENCHMARKS project contributing to the EU mission "A soil Deal for Europe"

Target users of IN-SYLVA EUROPE services

↓ Scientific communities ↓

Forest researchers
(holding the RI)

- **[Meta] ecology**
- **Genetics**
- **Biodiversity**
- **Forestry**
- **Soil sciences**
- **Social sciences**
- **Economics**

Scientists directly involved in forest ecosystem adaptation and resilience

● DARK GREEN

Other researchers
(outside the RI)

- **Remote sensing**
- **Artificial intelligence**
- **Epidemiology**
- **Climatology**
- **Hydrology & Geomorphology**

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

● LIGHT GREEN

↓ Other stakeholders ↓

Stakeholders controlling and/or benefiting from forest ecosystem services

Decision makers
Actors regulating about forest ecosystem services provision

→ **Policy makers (EU & [inter] national + governmental organizations), municipalities, forest owners**

Ecosystem service providers
Actors taking decisions and implementing actions about forest ecosystem management

→ **Foresters, forest management organizations**

Beneficiaries
Actors with expectations regarding forest ecosystem services

→ **Citizens, consumers, forest industry, environmental organizations, local communities, investors and businesses**

● BLACK

Stakeholders with needs in forestry education & training

Early-career scientists
With expectations regarding forest ecosystem research

→ **PhD students, post-doctoral fellows, junior researchers**

Forest professionals
With expectations regarding science-based, user-oriented tools to manage forest ecosystems

→ **Forest ecosystem service providers**

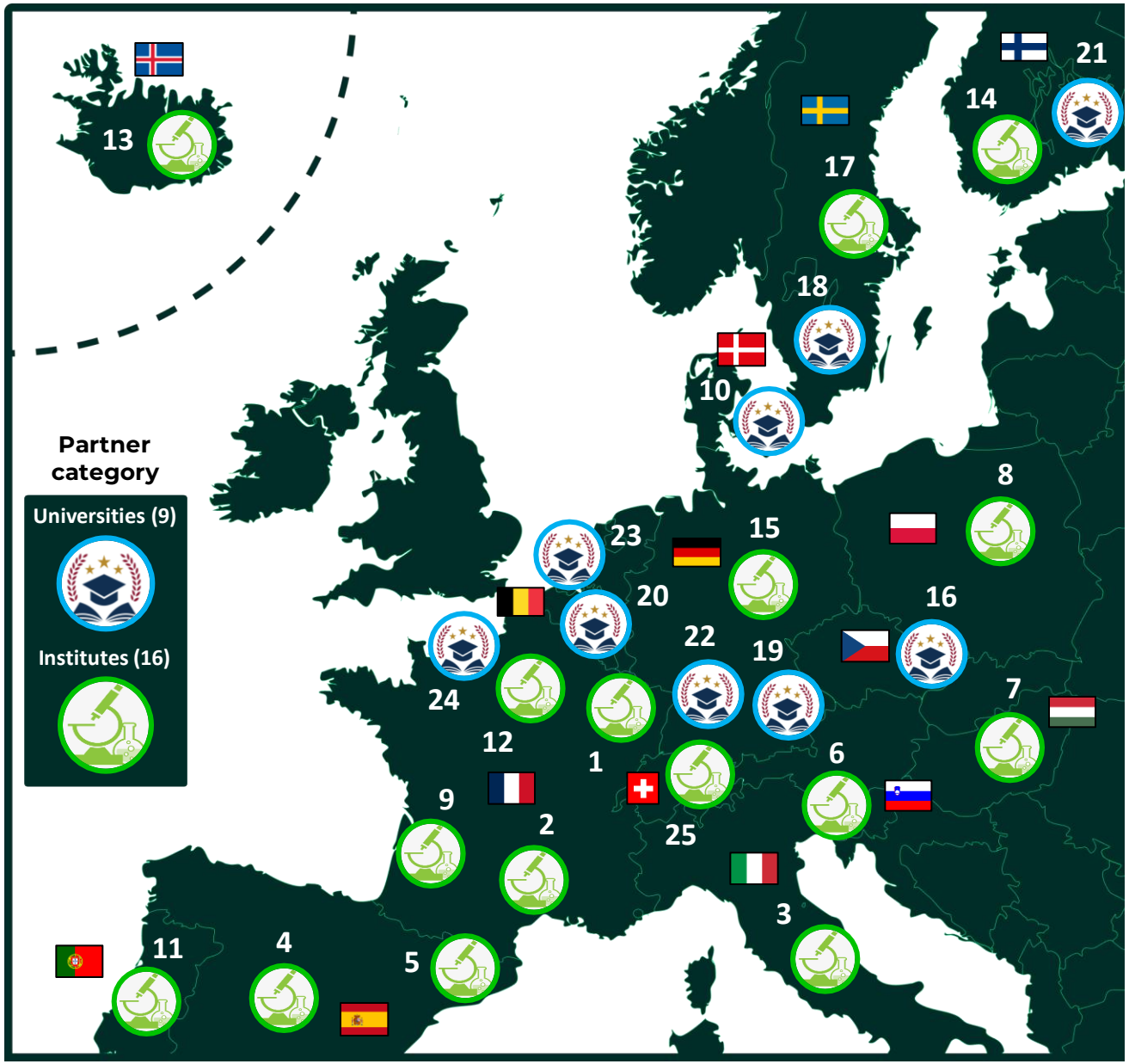
Society
With expectations regarding science-based forestry knowledge

→ **Beneficiaries of forest ecosystem services**

● GREY

The IN-SYLVA Europe-CD multinational Consortium

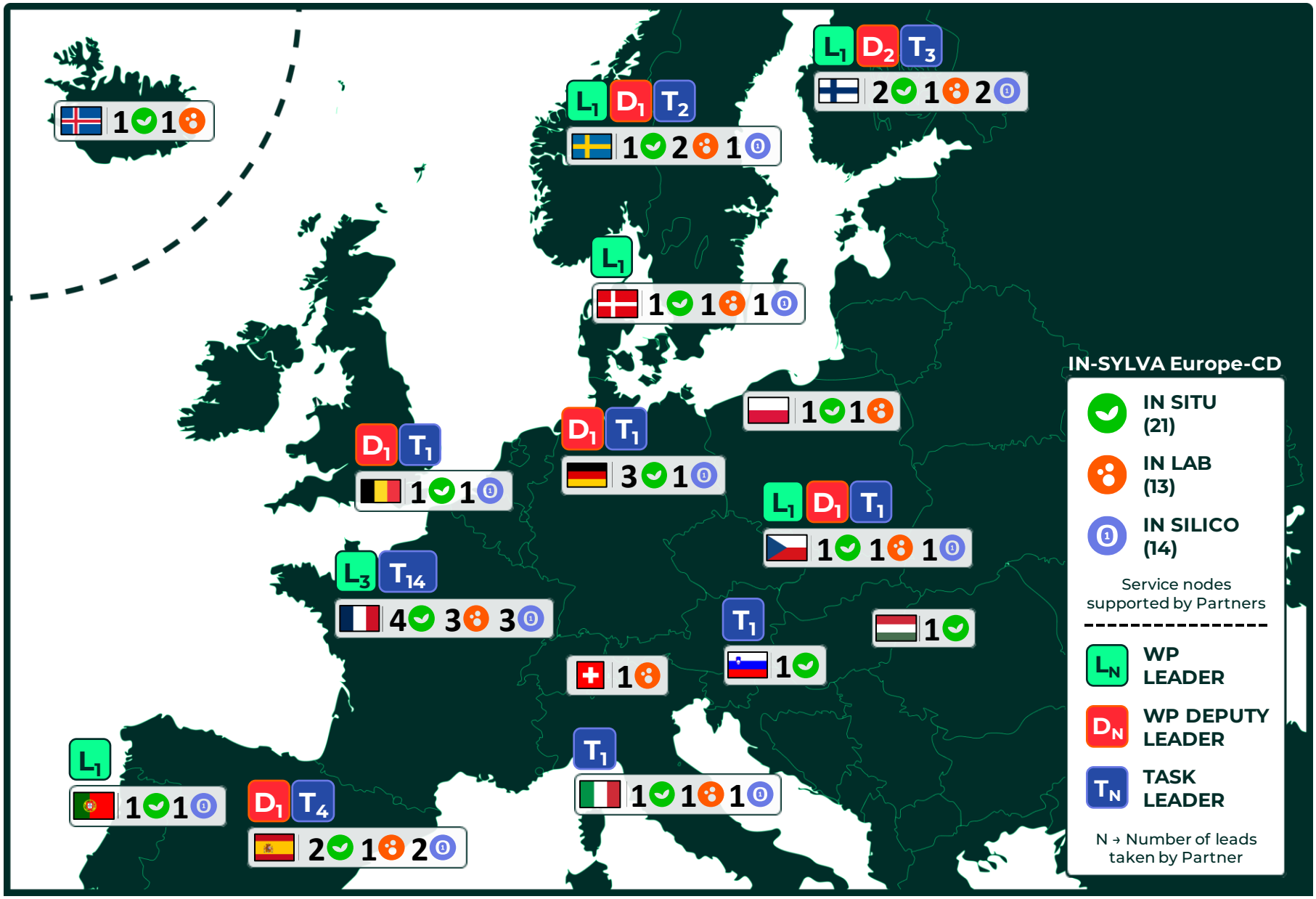
→ 9 universities and 16 R&D&I institutes involved in forest research



1-INRAE	INRAE	14-Luke	Luke LUONNONVARAKESKUS
2-CIRAD	cirad	15-LWF	Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten
3-CNR	Consiglio Nazionale delle Ricerche	16-MENDELU	Mendelova univerzita v Brně
4-CSIC	CSIC	17-RISE AB	RI SE
5-CTFC	CTFC	18-SLU	SLU
6-GIS	GOZDARSKI INŠTITUT SLOVENIJE SLOVENIAN FORESTRY INSTITUTE	19-TUM	Technische Universität München
7-HUN-REN CER	ÖKOLÓGIAI KUTATÓKÖZPONT	20-UC Louvain	UCLouvain
8-IBL	IBL INSTYTUT BADAWCZY LEŚNICTWA	21-UEF	UNIVERSITY OF EASTERN FINLAND
9-IEFC	iefc Institut Européen de la Forêt Cultivée	22-UFR	universität freiburg
10-IGN	UNIVERSITY OF COPENHAGEN	23-UGent	GHENT UNIVERSITY
11-ISA / UL	INSTITUTO SUPERIOR DE AGRONOMIA Universidade de Lisboa	24-URN	UNIVERSITÉ DE ROUEN NORMANDIE
12-IT	INRAE › transfert	25-WSL	WSL
13-LBHI	Landbúnaðarháskóli Íslands	HORIZON EUROPE	EUROPEAN UNION #HorizonEU THE EU RESEARCH & INNOVATION PROGRAMME 2021 - 2027

Distribution of partner service nodes and project lead roles

→ 48 in situ/in lab/in silico service nodes supported by IN-SYLVA Europe-CD Partners



IN-SYLVA France : le nœud français d'IN-SYLVA Europe

→ Trois grands types de services in situ/lab/silico – Des synergies avec les projets du PEPR FORESTT

Enjeux pour les socio-écosystèmes forestiers

#Adaptation aux changements globaux
#Gestion durable #Services écosystémiques
#Régulation des grands cycles biogéochimiques
#Transitions #Ravageurs #Bioéconomie

Attentes des gestionnaires & innovations

#Choix d'espèces #Création variétale
#Renouvellement & structure des peuplements
#Itinéraires & trajectoires des systèmes sylvicoles
#Intensité de récoltes

RECHERCHE & DÉVELOPPEMENT
Connaissances fondamentales et appliquées
Stratégies de gestion multi-échelles
Innovations technologiques
Scenarios prospectifs

PEPR FORESTT HUB

APPROCHE « LIVING LABS »
Dialogue science – gestion – gouvernance
Co-création de solutions innovantes
Démonstrations in situ
Formation interdisciplinaire

PEPR FORESTT REGE-ADAPT

27 Réseaux d'essais

Génétique
Sylviculture
Cycles biogéochimiques
Ecophysiologie
Biodiversité

Services IN SITU
#Expérimenter
#Observer

Instruments légers de haute technologie

5 000 sites
4 000 ha

ECHANTILLONS

DONNÉES

DONNÉES FORESTIÈRES À GRANDE ÉCHELLE

DONNÉES

Silva TECH

PHENOBOIS

Services IN LAB
#Mesurer #Caractériser
#Multiplier #Conserver
#Modifier #Protéger

Presen
Plateforme de Recherche en Sciences de l'Environnement Normande

BEF
Biogéochimie des Écosystèmes Forestiers

xylobiotech
LICA
Laboratoire d'Ingénierie Cellulaire de l'Arbre

Logiciels d'analyse

BDD des réseaux et ressources associées

Services IN SILICO
#Analyser
#Modéliser
#Simuler

Modèles & Simulateurs
Physiologie
Démographie
Génétique
Sylviculture

PEPR FORESTT MONITOR

PEPR FORESTT X-RISKS

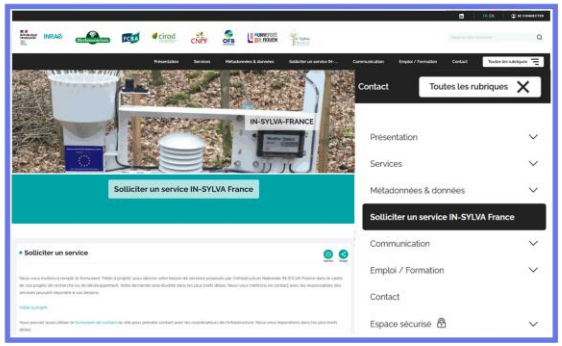
IN-SYLVA France : le nœud français d'IN-SYLVA Europe

→ Un portail d'accès aux services, des enjeux de gestion de données partagés avec le PEPR FORESTT

Portail Web – avec formulaire (FR/EN)

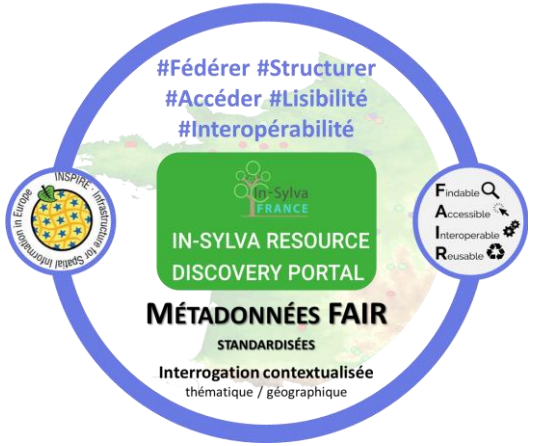
https://in-sylva-france.hub.inrae.fr/

Chercheurs
Gestionnaires
Décideurs



PEPR FORESTT
NUM-DATA

Système d'information



Collection HAL IN-SYLVA France

https://hal.inrae.fr/IN-SYLVA-FRANCE/

Entrepôt de données IN-SYLVA France

https://entrepot.recherche.data.gouv.fr/dataverse/IN-SYLVA-France

In-Sylva FRANCE

IN-SYLVA France : le noeud français d'IN-SYLVA Europe

→ Des interactions avec les IR nationales, des objectifs partagés avec le PEPR FORESTT

Interactions avec les IR nationales

Monitoring

Inventaire Forestier National — GIS Sol RMQS — Renecofor

Structure & Fonctionnement des écosystèmes (sites ateliers)

ICOS National Network France — OZCAR eLTER France — AnaEE Analysis and Experimentation on Ecosystems France — ACTRIS France

Phénotypage Envirotypage Télédétection

PHENOME EMPHASIS France — DATATERRA DINAMIS — Theia

Génotypage Génomique Biotech

France Genomique — elixir France — IBISBA.fr

Conservation des ressources

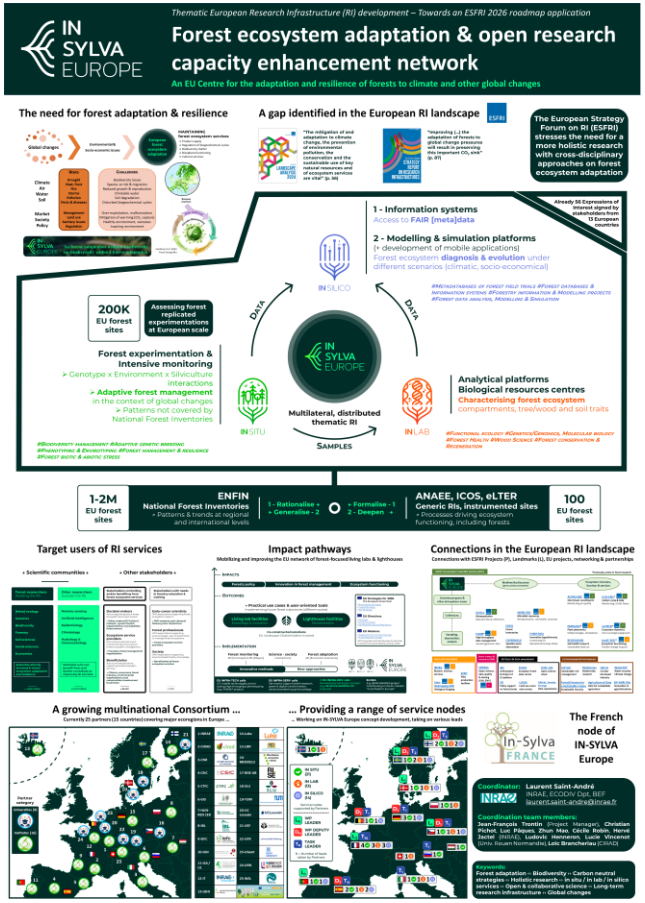
RARe Ressources agronomiques pour la recherche — RARe Pôle Forêt

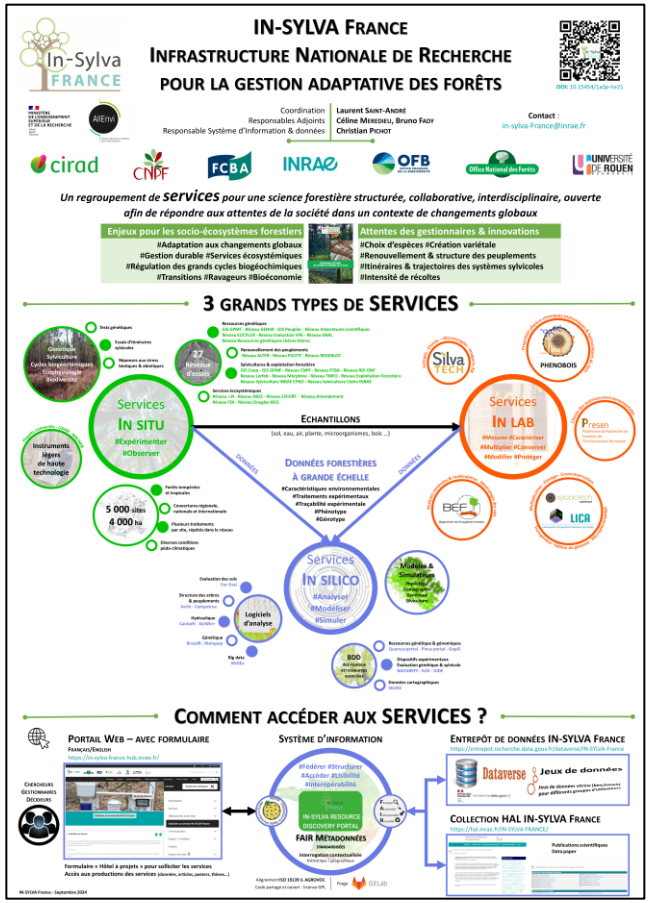
Des objectifs partagés

In-Sylva France — Programme de Recherche FORESTT

Gouvernance	# Vision intégrée de la sylviculture	# Compromis dans les stratégies de gestion
	# Interopérabilité des SI, accès aux données	# Prise de décision en contexte d'incertitude
	# Fédérer/adapter les réseaux	# Evolution des pratiques
	# Gouvernance adaptée	# Gestion & gouvernance
Bioeconomie	# Conserver, gérer, valoriser les ressources forestières	# Valoriser qualités et usages de la matière première
	# Critères de sélection	# Valorisation durable du bois
	# Rayonnement économique	# Performance économique
	# Services R&D, formation	# Bioéconomie circulaire
Risques multiples	# Durabilité des écosystèmes et services associés	# Fonctionnement multi-échelles des écosystèmes
	# Interactions G x E et avec les pratiques sylvicoles	# Processus écologiques et évolutifs
	# Itinéraires sylvicoles et systèmes de production	# Itinéraires sylvicoles diversifiés
	# Espèces/variétés adaptées	# Adaptation/atténuation
Monitoring	# Instrumentation légère à haut débit (in situ, in lab)	# Surveillance haute résolution biomasse/santé/biodiversité
	# Modèles intégrant génétique et biogéochimie	# Comprendre et prédire les trajectoires des forêts

Pour en savoir plus :





Merci de votre attention !

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Lancement scientifique
18-19 Septembre 2024
Centre de congrès Cité Mondiale
Bordeaux

IN SYLVA EUROPE

In-Sylva FRANCE

MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR ET DE LA RECHERCHE
Liberté Égalité Fraternité

AllEnvi
Alliance nationale de recherche pour l'Environnement