

The set of indicators for *in situ* conservation of forest genetic resources

Lefèvre F (INRAE, France); Alia R (INIA, Spain);
Bakkebo Fjellstad K (NIBIO, Norway);
Graudal L (UCPH/ICRAF, Denmark); Oggioni SD (EFI),
Rusanen M (LUKE, Finland); Vendramin GG (CNR, Italy);
Bozzano M (EFI)

#EUGreenWeek

19–22 OCTOBER 2020

**A NEW BEGINNING
FOR PEOPLE AND NATURE**





The set of indicators for *in situ* conservation of forest genetic resources (FGR)

François LEFEVRE (INRAE, France)

- 1) Tree genetic diversity: what is it about, why does it matter?
- 2) FGR conservation in Europe: 30 years of shared experience and common actions
- 3) Revised sub-indicators to monitor *in situ* conservation
- 4) Conclusion: outreach and future perspective

1) Tree genetic diversity: what is it about, why does it matter?



Forests are not only trees,
trees alone do not make a forest.

Forests (in Europe) are not only ecosystems,
forests consist in complex socio-ecosystems.

Trees are the keystone components of the forests,
their genetic diversity determines forests' functions
and forests' dynamics.

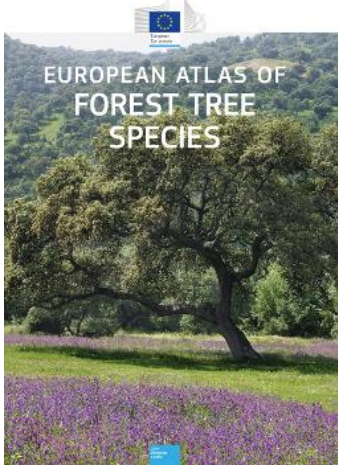


1) Tree genetic diversity: what is it about, why does it matter?

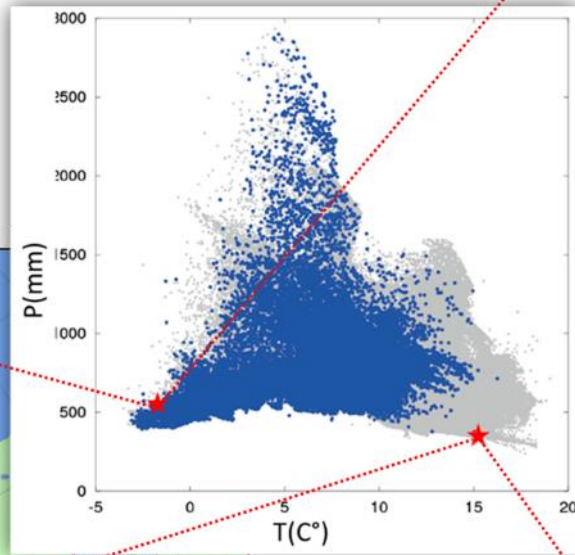
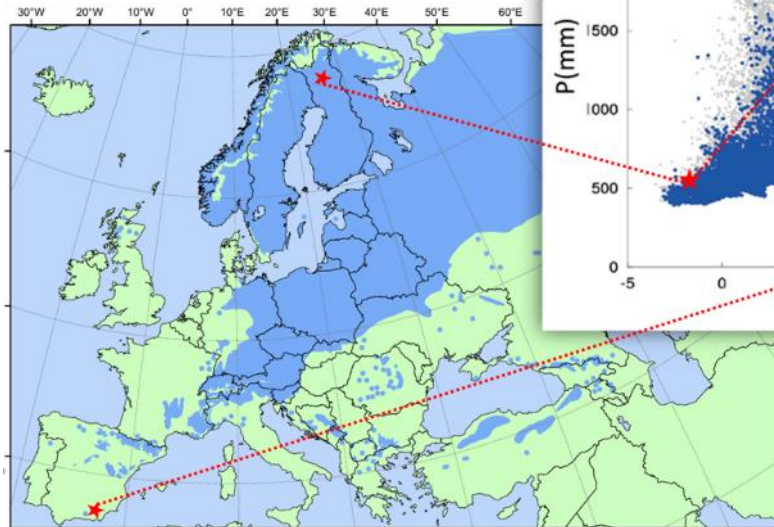


Each tree species has a **huge genetic diversity of adaptations to different environments** across large distribution range

Pinus sylvestris:
from the boreal to the Mediterranean



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Mean temperature & annual precipitation across species' range



© E Oksanen-LUKE



© GM Unger-INIA



Each locally adapted forest stand still harbours a huge genetic diversity, this **local genetic diversity is a factor of resilience of the forests**, driving short-term response to disturbance and long-term evolution towards new adaptations.



Diversity of flushing date in a Beech forest at the Southern margin of species' range

© F Jean, INRAE

1) Tree genetic diversity: what is it about, why does it matter?



Forest genetic resources (FGR),
i.e. tree genetic diversity and
evolutionary potential, provide
solutions for today and options
for the future.



2) FGR conservation in Europe: 30 years of experience



FP5, FP6, FP7, H2020, H-Europe



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- FGR conservation is part of the engagement for sustainable management of forests in Europe.
- European countries have coordinated their conservation activities, developed guidelines and generated tools through the **European forest genetic resources programme EUFORGEN** over the past 30 years
- European FGR conservation is based on the most recent scientific knowledge and pan-European collaboration through the EU framework programs FP5, FP6, FP7, H2020, H-Europe,
- EVOLTREE, EUFGIS, FORGER, TREEBREEDX, TREES4FUTURE, B4EST, GENTREE, FORGENIUS...

2) FGR conservation in Europe: 30 years of experience



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Forest policy and governance

1. National Forest Programmes or equivalent
2. Institutional frameworks
3. Legal/regulatory framework: National (and/or Sub-National) and International commitments
4. Financial and economic instruments
5. Information and communication

Criterion 1: Forest Resources & Carbon Cycles

- C.1 Related policies, institutions & instruments
- 1.1 Forest area
 - 1.2 Growing stock
 - 1.3 Age structure &/or diameter distribution
 - 1.4 Forest carbon

Criterion 2: Forest Health and Vitality

- C.2 Related policies, institutions & instruments
- 2.1 Deposition & concentration of air pollutants
 - 2.2 Soil condition
 - 2.3 Defoliation
 - 2.4 Forest damage
 - 2.5 Forest land degradation

Updated set of Pan-European Indicators for SFM 2015

34 quantitative 11 qualitative

Criterion 3: Productive Functions

- C.3 Related policies, institutions & instruments
- 3.1 Increment and fellings
 - 3.2 Roundwood
 - 3.3 Non-wood goods
 - 3.4 Services

Criterion 4: Biological Diversity

- C.4 Related policies, institutions & instruments
- 4.1 Diversity of tree species
 - 4.2 Regeneration
 - 4.3 Naturalness
 - 4.4 Introduced tree species
 - 4.5 Deadwood
 - 4.6 Genetic resources
 - 4.7 Forest fragmentation
 - 4.8 Threatened forest species
 - 4.9 Protected forests
 - 4.10 Common forest bird species

Criterion 5: Protective Functions

- C.5 Related policies, institutions and instruments
- 5.1 Protective forests – soil, water and other ecosystem functions - infrastructure and managed natural resources

Criterion 6: Socio-economic

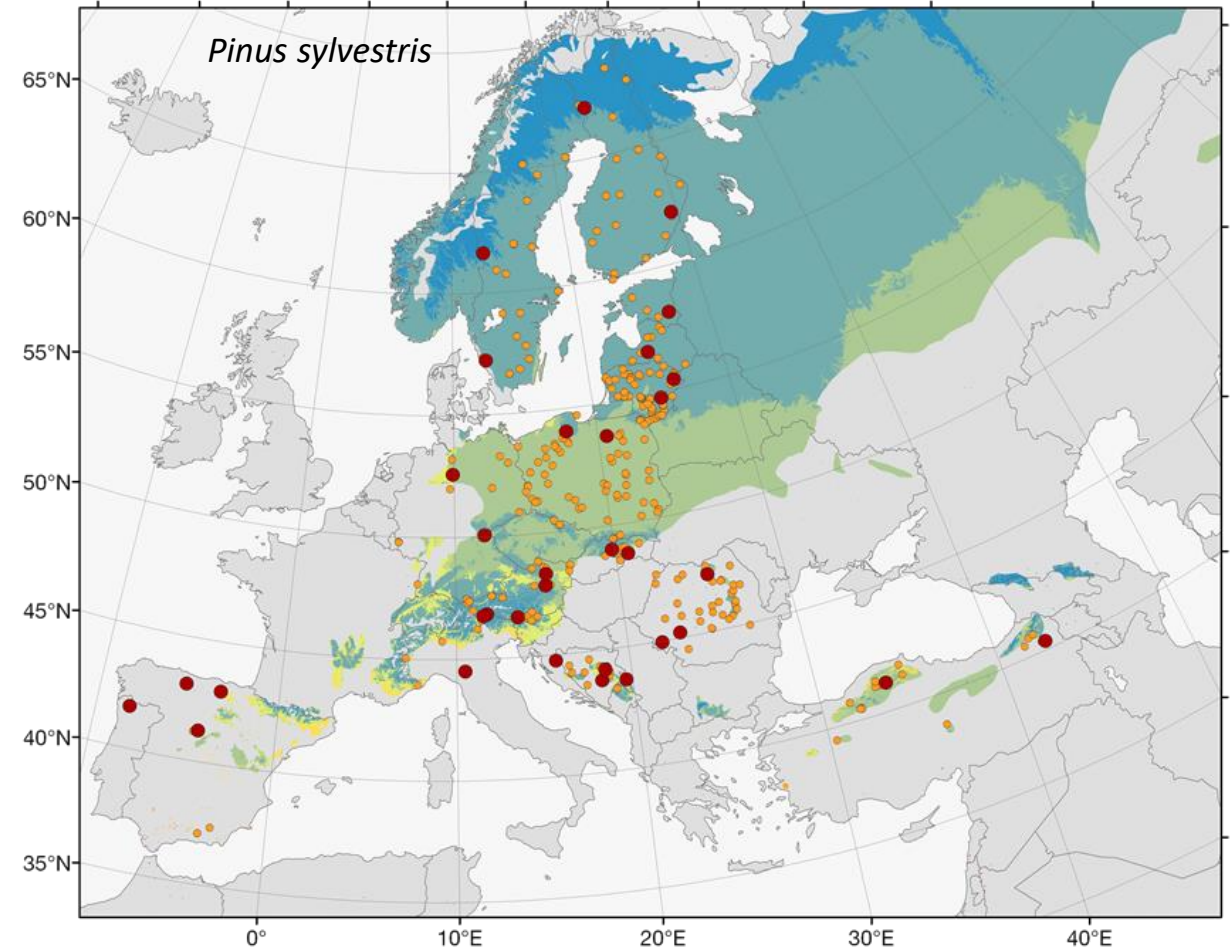
- C.6 Related policies, institutions & instruments
- 6.1 Forest holdings
 - 6.2 Contribution of forest sector to GDP
 - 6.3 Net revenue
 - 6.4 Investments in forests and forestry
 - 6.5 Forest sector workforce
 - 6.6 Occupational safety and health
 - 6.7 Wood consumption
 - 6.8 Trade in wood
 - 6.9 Wood energy
 - 6.10 Recreation in forests

2) FGR conservation in Europe: 30 years of experience

Three FGR conservation methods are combined:

- **dynamic conservation *in situ***, where populations evolve in their native environment
- **dynamic conservation *ex situ***, where populations evolve in a new environment
- **static conservation *ex situ***, i.e. genebanks and collections

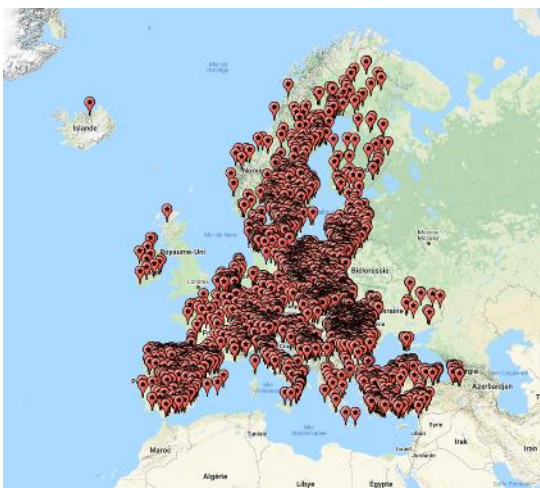
Priority is given to **dynamic *in situ* conservation**:
networks of forest stands dedicated to FGR
conservation for one or several target tree species




2) FGR conservation in Europe: 30 years of experience

EUFGIS, innovative information system dedicated to *in situ* conservation:

- *standard requirements & descriptors*
- *35 countries*
- *109 species*
- *4377 genetic conservation units (GCU)*



Establishment of EUFGIS was financially supported by the European Commission under Council Regulation (EC) 870/2004.


European Information System on Forest Genetic Resources

DATA
MAPS
SEARCH
UPLOAD

Home > Search

Detail page for Unit number: FRA00015 and Target species: *Abies alba*

[Go back to the previous page](#) - [Go back to the Search page](#)

Genetic conservation units

Data standards

Data providers

EUFGIS project

Tools

Links

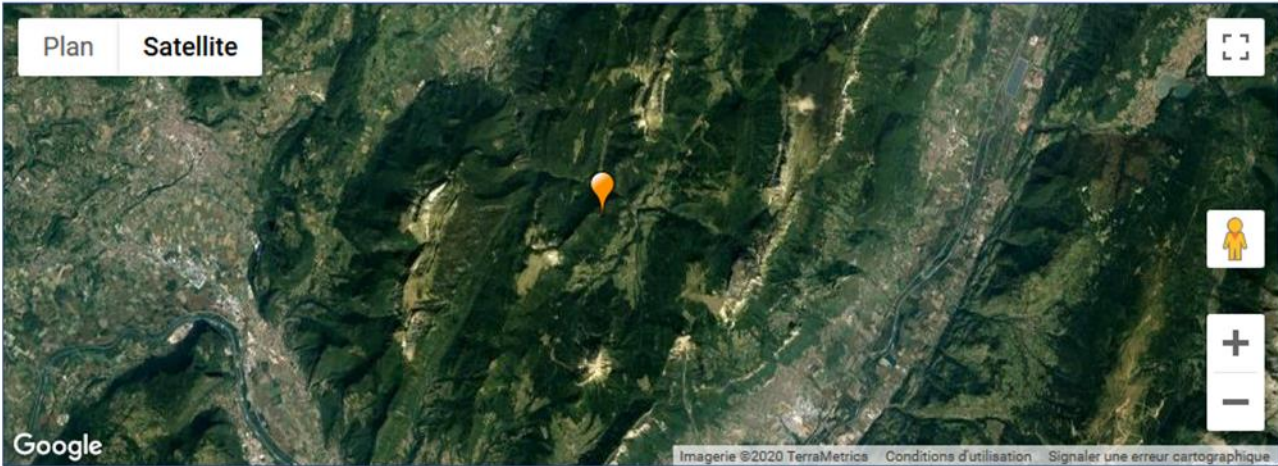
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Country of the unit :	France
Unit number:	FRA00015
National gene conservation unit number:	La Grande Chartreuse
Province or state:	AUVERGNE-RHONE-ALPES
Department or county:	ISERE
Municipality:	SAINT-PIERRE-DE-CHARTREUSE

3) Revised sub-indicators to monitor *in situ* conservation



EUROPEAN FOREST GENETIC RESOURCES PROGRAMME

EUFORGEN

Dynamic conservation and utilization of forest tree genetic resources

Indicators for *in situ* and *ex situ* genetic conservation and forest reproductive material

INDICES

- Picea abies (670)
- Fagus sylvatica (529)
- Pinus sylvestris (445)
- Quercus robur (345)
- Abies alba (333)
- Quercus petraea (287)
- Pinus uncinata (130)
- Populus nigra (42)
- Castanea sativa (38)

Country involvement index

Ecozone diversity index

Insurance index

François Lefèvre, Ricardo Alia, Kjersti Bakkebø Fjellstad, Lars Graudal, Silvio Daniele Oggioni, Mari Rusanen, Giovanni Giuseppe Vendramin, Michele Bozzano

EFI

Purpose uses of the sub-indicators:

- to monitor the effectiveness of FGR conservation at the pan-European level
- to support harmonized and coordinated national FGR conservation actions towards a pan-European strategy

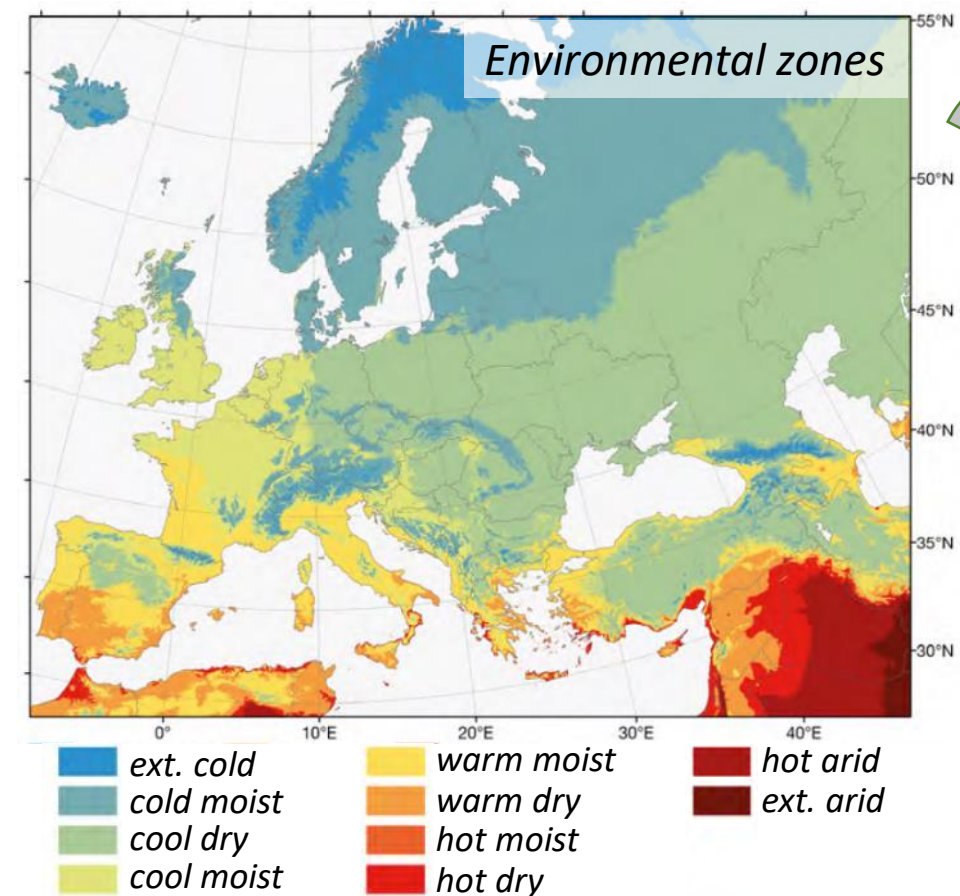
Quality of the sub-indicators:

- reliable: based on common standards
- specific: expected tree genetic diversity conserved
- simple: automatically derived from EUFGIS data
- relevant: conservation effort, expected neutral and adaptive genetic diversity, robustness of the network
- useful: at both pan-European and national levels

Non-uses of the sub-indicators:

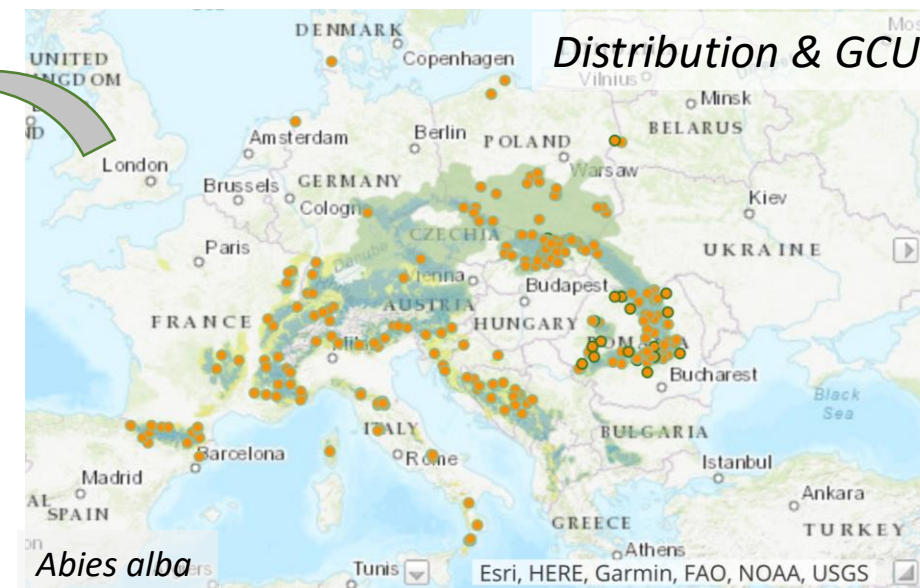
- to set-up priorities in the national conservation strategies.
- to fine-tune national strategies based on specific information.

3) Revised sub-indicators to monitor *in situ* conservation



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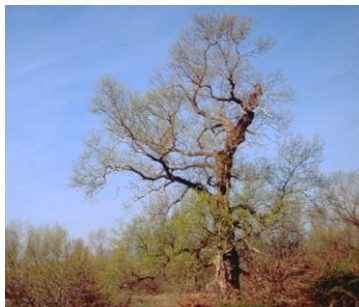
Environmental zones in Europe
from Metzger et al. (2013)
modified by de Vries et al. (2015)



The indicators combine two types of data:

- 1) proxys of genetic diversity (neutral, adaptive)
 - distribution range per species
 - ecozones = environments within range
- 2) characterization of conservation units

3) Revised sub-indicators to monitor *in situ* conservation



Species-level sub-indicators (pan-european scale)

Country involvement index	nb countries ≥ 1 GCU / nb countries in range
Ecozones diversity index	nb ecozones ≥ 1 GCU / nb ecozones in range
Insurance index	nb ecozones ≥ 2 GCU / nb ecozones in range



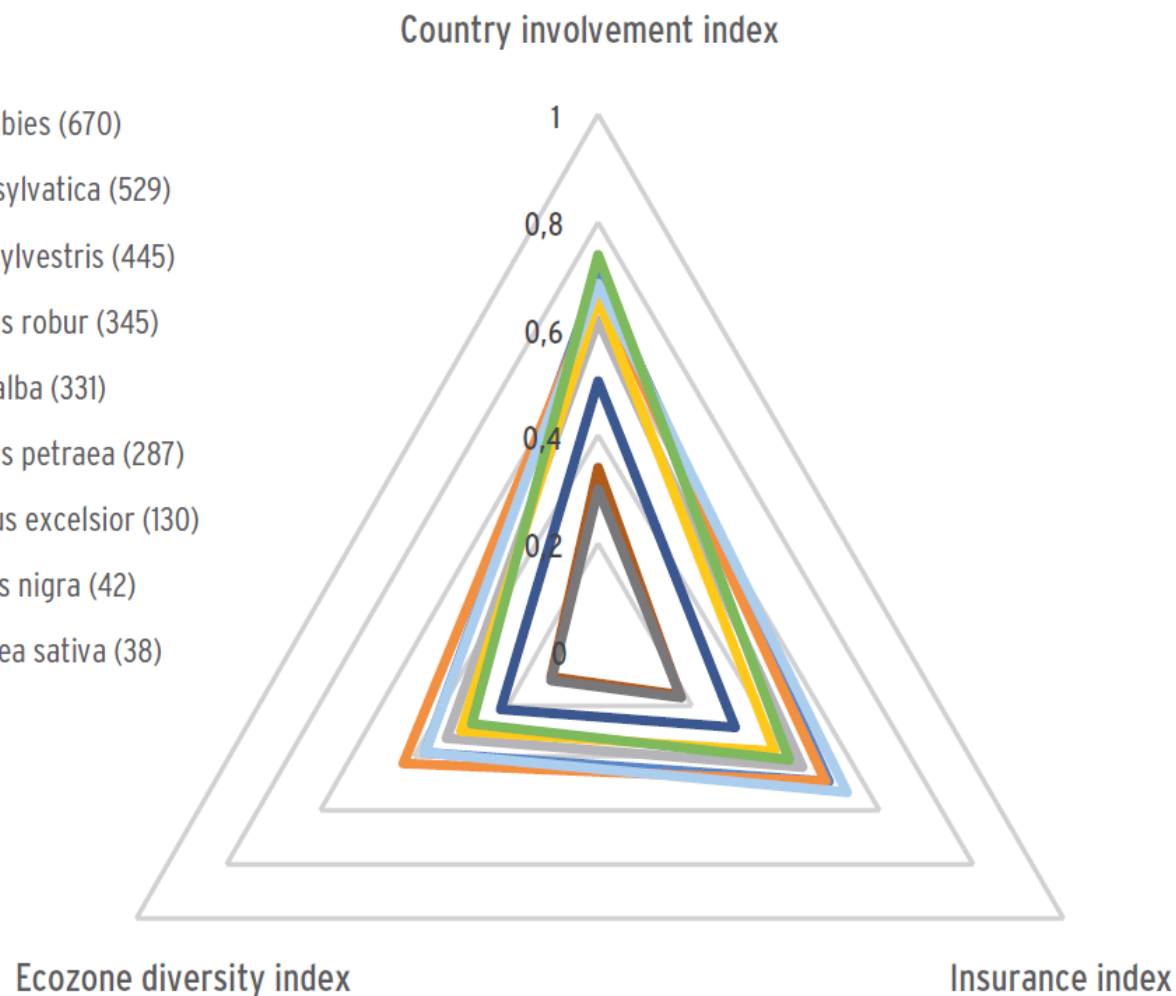
Country-level sub-indicators (all species)

Conservation effort	total nb of GCUs
Species diversity index	nb species ≥ 1 GCU / nb species in country
Ecozones diversity index	nb ecozones ≥ 1 GCU / nb ecozones* in country
Insurance index	nb ecozones ≥ 2 GCU / nb ecozones in country

3) Revised sub-indicators to monitor *in situ* conservation

Species-level sub-indicators are used at pan-European scale to characterize the global conservation effort for each European tree species, and to identify possible gaps with the national experts

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3) Revised sub-indicators to monitor *in situ* conservation

Country-level sub-indicators are used at pan-European scale to characterize the diversity of FGR situations and the diversity of national conservation strategies, based on harmonized information.

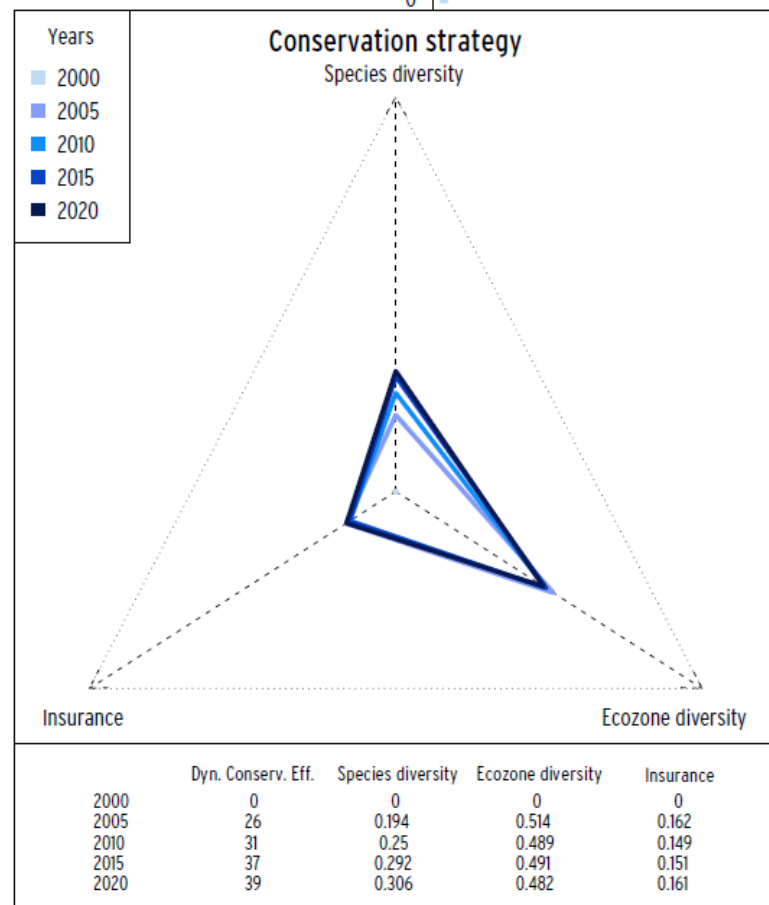
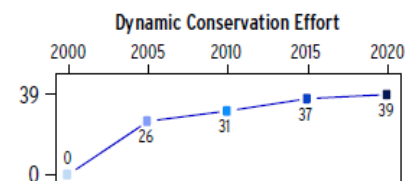
	Finland	Spain
<i>nb species occurring</i>	33	80
<i>nb ecozones occurring</i>	14	75
Conservation effort	63	308
Species diversity index	0.30	0.21
Ecozones diversity index	1.00	0.79
Insurance index	0.86	0.68

3) Revised sub-indicators to monitor *in situ* conservation

Country-level sub-indicators are used at national level to refine national objectives and monitor progress, based on common standards, while national priorities are set-up based on specific expertise about local FGR genetic diversity.

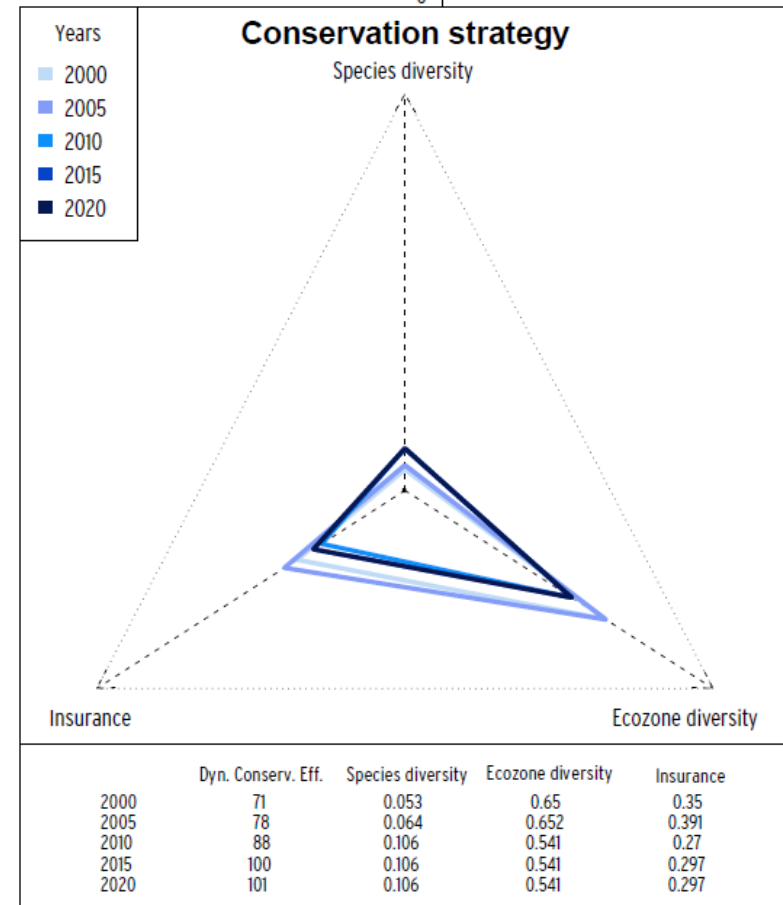
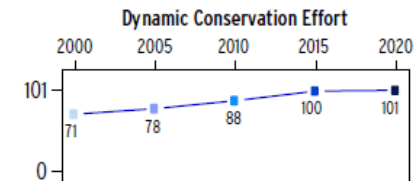
Slovenia

Dynamic conservation of populations of native forest tree species as genetic resources



France


Dynamic conservation of populations of native forest tree species as genetic resources



3) Revised sub-indicators to monitor *in situ* conservation

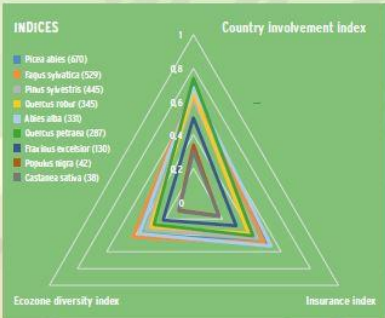


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The SFM indicator **4.6 Genetic resources** has four sub-indicators:

- Dynamic conservation (*in situ* and *ex situ*) of native populations;
- Dynamic conservation (*ex situ*) of populations of non-native species;
- Static *ex situ* conservation;
- Forest reproductive material production.

4) Conclusion: outreach and future perspective



- The information system specifically dedicated to *in situ* conservation of genetic resources and the set of sub-indicators are true **innovations** that may inspire other domains of genetic resources.
- The set of sub-indicators will be **used in the next Forest Europe reports**.
- The sub-indicators **can be retrieved retrospectively** as far back as 2010 from the EUFGIS database.
- The sub-indicators are **evolvable while keeping the same structure**: e.g., the « *ecozones diversity index* » may evolve when the knowledge on the global distribution of genetic diversity increases, or the « *insurance index* » may better account for local threats on GCU once assessed over the continent.