CRGF
COMMISSION DES RESSOURCES GENETIQUES FORESTIERES

French strategy for the conservation of forest genetic resources (FGR)

FGR diversity, key lever for the sustainability of forest ecosystems

A multiscale diversity

The FAO defines the forest genetic resources (FGR) as "*the heritable materials maintained within and among tree and other woody plant species that are of actual or potential economic, environmental, scientific or societal value*".

Thus, forest stands, trees, pollen, seeds or *in vitro* plants are different types of FGR that can be classified in **three levels of diversity :**

Interspecific diversity : genetic diversity between tree species due to their differences in evolutionary history, ecological niches, associated communities, roles in forest successions, or distribution ranges.

Intraspecific provenance diversity : genetic diversity between populations of various geographic origins (provenances), due their isolation of specific local adaptations. With this genetic differentiation, most tree species' distribution ranges cover a broad range of diverse environmental conditions at different spatial scales.

Intraspecific within-stand diversity : all trees within a forest are genetically distinct, except in the very particular case of monoclonal stands. Within-stand genetic diversity is needed for the process of adaptation, it continuously evolves in a complex cycle of erosion and restoration phases driven by demographic dynamics and selection.

Important resources for nature and people

The forest genetic resources carry **multiple values**. They directly influence the ecological functions and biodiversity of the forest ecosystems, they contribute to forest resilience and capacity of adaptation to environmental changes, they provide social and economic benefits (**Figure 1**).

Ecological value : The diversity of species and populations of trees and woody plants is a key component of forests biodiversity, many organisms depend on it.

Adaptive value : FGR diversity is a lever of adaptation to environmental changes, for sustaibale use and long term preservation of the forests.

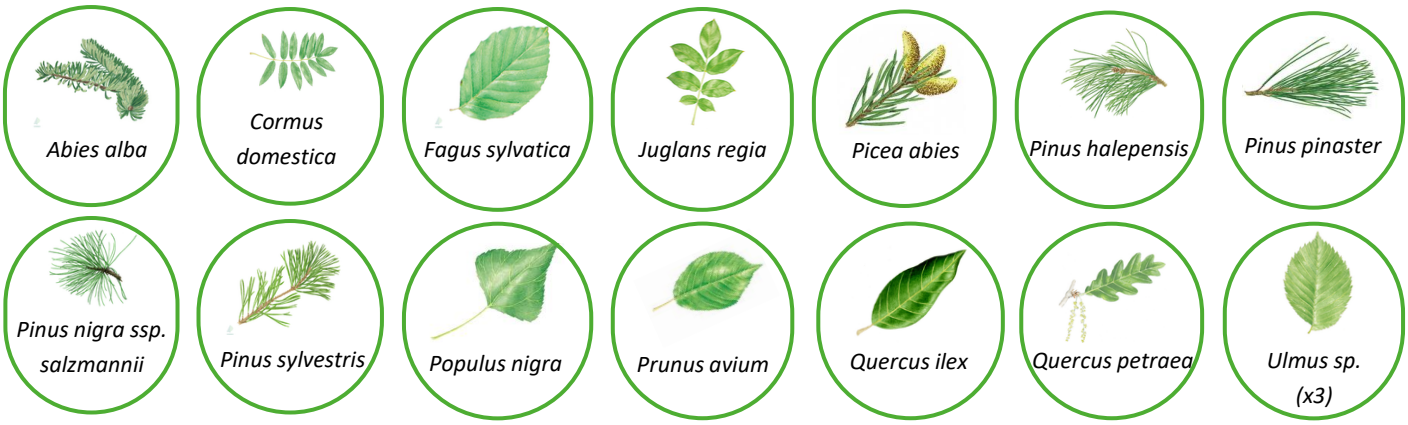
Economic value : The diversity of exploited tree species and the conservation of their capacity of evolution are required to ensure high quality production and sustainability of the wood sector.

Cultural value : The diversity of the forests in a country is a natural heritage (relict forests with original characteristics) and a human heritage (landscape identity).

Figure 1 : Ecological and human values of FGR diversity.

Target species in the French FGR conservation program

Sixteen species are currently targeted in the French FGR conservation program. FGR conservation actions are in project in French Guyana.



*** drawings taken from https://www.euforgen.org/species/ with contribution of artists G. Bernetti et C. Giordano*

A conservation adapted to FGR dynamics

The genetic diversity of trees and woody plants **varies in space and time**, driven by **natural evolutionary processes**, under the constraints and impacts of usual **forest management practices**. In the context of climate change and related uncertainties, preserving a high level of genetic diversity at all developmental stages, from seedlings to seed trees, is essential for the resilience and the capacity of future evolution of the forests. Therefore, considering the genetic diversity in a dynamic perspective and globally, not only the diversity of recognized interest but also the diversity without pre-identified benefit that could help to cope with future uncertainties, is essential to ensure long-term effectiveness of its conservation. To this aim, **specific management practices** can be used in the FGR conservation units whenever needed (**Figure 2**).

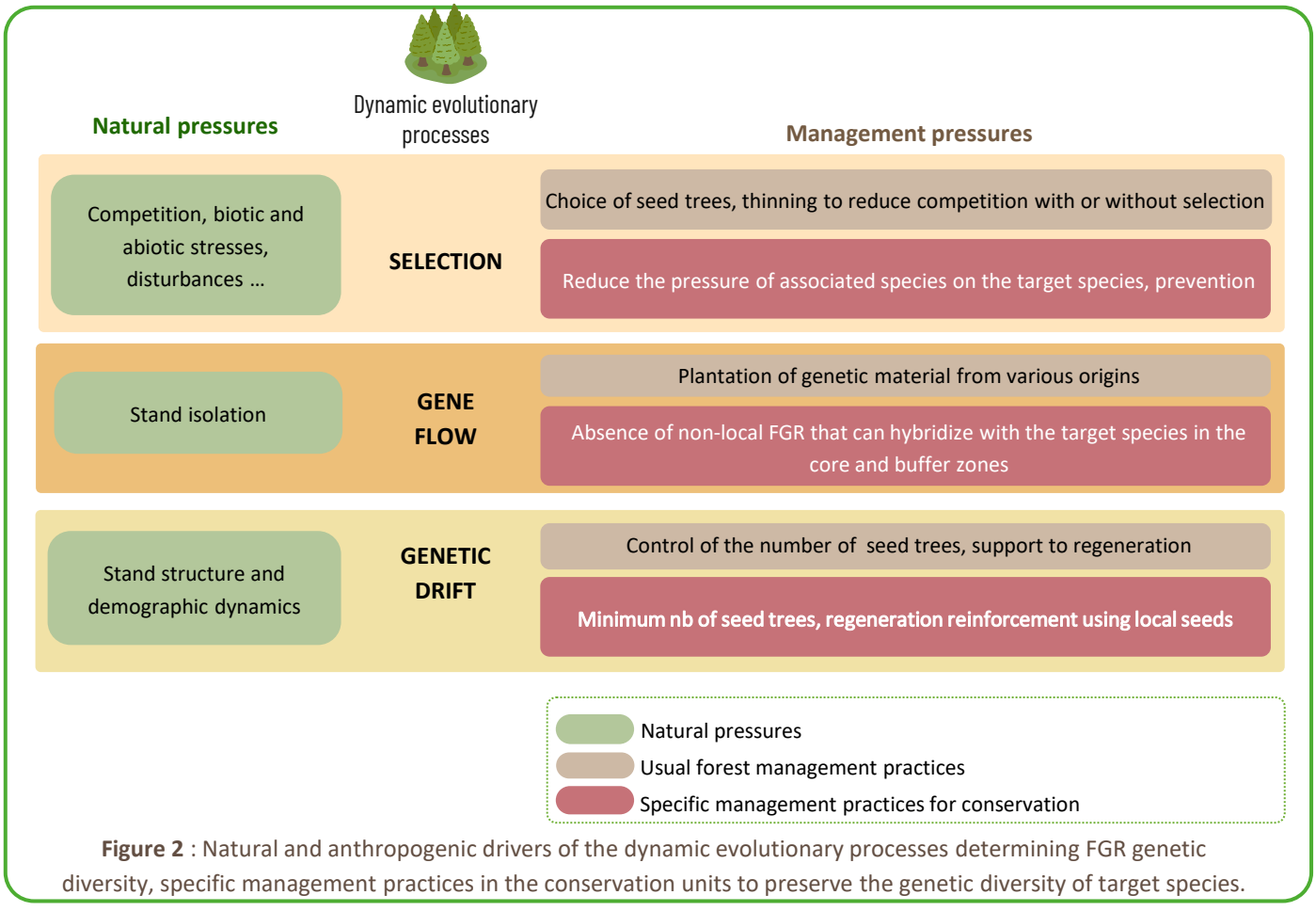


Figure 2 : Natural and anthropogenic drivers of the dynamic evolutionary processes determining FGR genetic diversity, specific management practices in the conservation units to preserve the genetic diversity of target species.

In France, **four FGR conservation methods** are used, specifically adapted to the reproductive biology and distribution range of the target species in the national territory: (1) national networks of *in situ* conservation units, (2) dynamic *ex situ* conservation units, (3) populations of interest for the genetic diversity, and (4) national *ex situ* collections. For the three conservation methods in forest, there is long-term designation of the conservation status and the objective of FGR conservation is written in the forest management documents.

DYNAMIC CONSERVATION

1 National networks of *in situ* conservation units

Sample of populations representative of the **diversity of ecological conditions** and **phenotypic/genetic diversity** of the target species over the national territory, including marginal populations

For each conservation unit, a **management charter** is signed by the owner, the forest manager and CRGF to ensure long-term maintenance of the conservation objective, sufficient within-population genetic diversity, and effective generation turn-over in accordance with the requirementsla made by **EUFORGEN**.

Structure of the conservation units

Buffer zone: protection against genetic pollution

Core area: contains a sufficient nb of reproducing trees, depending on the conservation objective

- **500 adults** for the conservation of global diversity in large populations
- **50 adults** for the conservation of specific characteristics in marginal populations
- **15 adults** for endangered species (with complement in an *ex-situ* collection)

Trees in a conservation unit must be autochtonous.

2 Dynamic *ex situ* conservation units

This solution is used for species that cannot be conserved *in situ* with the previous criteria, such as disseminated species or species with frequent vegetative propagation. It consists in planting a **synthetic population** with high genetic diversity, created from seeds collected in various autochtonous populations of the target species. The synthetic population is allowed to evolve by **natural regeneration**, ensuring that sexual reproduction operates to favor genetic mixing.

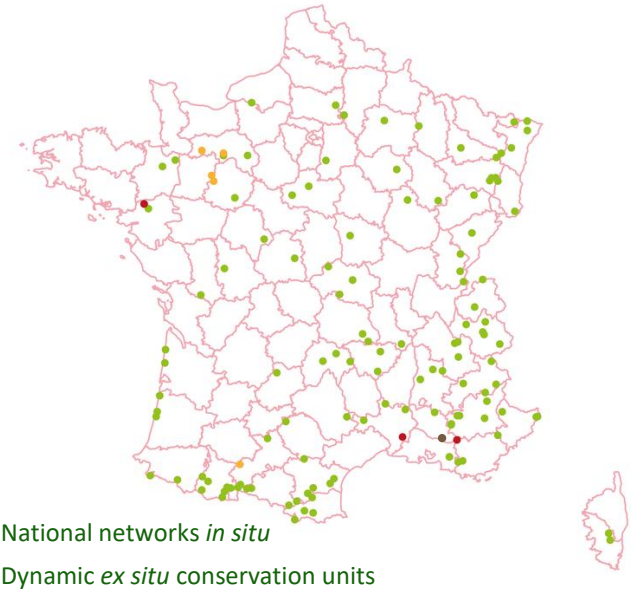
3 Populations of interest for the genetic diversity

Complementary ***in situ* conservation** system for species not already conserved in national networks, allowing to integrate additional tree species in the FGR conservation program through one or few independent population(s) without the network-scale of management, in response to two types of solicitation:

International sollicitation: conservation of target species of European interest identified in the EUFORGEN strategy.

Regional/local sollicitation: conservation of populations in singular ecological conditions or particularly threatened.

Distribution of the different FGR conservation in France (2025)



STATIC CONSERVATION

4 National *ex situ* collections

This system is used for species which demographic characteristics do not allow *in situ* conservation, such as disseminated species, or species threatened by lack of natural regeneration. Trees are sampled in autochtonous populations representing the **diversity of ecological conditions** and **phenotypic/genetic diversity** over the territory. The material may be conserved in stoolbeds, annually trimmed and regenerated after few decades, or in seed orchards, or in cryoconservation of buds.

The actors of FGR conservation

France established its **National program for the conservation of forest genetic resources**[1] and the **National Commission for Forest Genetic Resources** (CRGF)[2] in 1991. CRGF builds upon the engagement of multiple actors, represented through their logos below: ministries, research organisations, forest managers of public and private forests, nature protection organisations. CRGF proposes the main strategy of the National program and priorities to the ministry in charge of the forests. CRGF also contributes to disseminating knowledge and raising awareness of actors involved in FGR conservation. CRGF works in tight collaboration with the forest tree section of the "Comité Technique Permanent de Sélection" (CTPS)[3] regarding FGR sustainable use issues.

FGR conservation : an international issue

The French strategy for FGR conservation fits into the European program on forest genetic resources EUFORGEN[4], which brings together more than **3200** units *in situ* and *ex situ*, for more than **100 tree species** conserved in more than **35 partner countries**. The main characteristics of these conservation units are publicly available through the dedicated information system **EUFGIS**[5]. At global scale, the French strategy for FGR conservation fits into the Global Plan of Action adopted by **FAO** in 2013[6], and it is compatible with the 4th category of protected areas of the International Union for Conservation of nature IUCN[7].

Conservation units of Abies alba in Europe throughout its distribution range (in blue), in situ conservation (yellow dots) and ex situ conservation (black dots).
Map obtained from the EUFGIS portal.

Resources

More information:

1 https://agriculture.gouv.fr/la-politique-nationale-de-conservation-des-ressources-genetiques-forestieres
2 https://crgf.efno.fr/
3 https://www.geves.fr/qui-sommes-nous/ctps/
4 https://www.euforgen.org/
5 http://eufgis.org/
6 https://www.fao.org/forest-genetic-resources/plan-daction-mondial/fr/
7 https://uicn.fr/wp-content/uploads/2016/08/Diversite_genetique_forestiere.pdf

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