THE SECOND REPORT ON THE STATE OF THE WORLD'S FOREST GENETIC RESOURCES

COUNTRY REPORT

SPAIN

This country report was prepared as a contribution to the FAO publication, *The Second Report on the State of the World's Forest Genetic Resources*.

The country reports had two elements: (1) an online questionnaire to gather data and information on forest genetic resources; and (2) a complementary written report. For the written reports, countries were invited to follow the structure of the global report and reporting guidelines adopted by the Commission on Genetic Resources for Food and Agriculture at its Seventeenth Regular Session in 2019.

COMPLEMENTARY REPORT

THE SECOND REPORT ON

THE STATE OF THE WORLD'S FOREST GENETIC RESOURCES

SPAIN

NOVEMBER 2021

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Abbreviations and Acronyms

EU: European Union

EUFORGEN: European Forest Genetic Conservation Program

FGR: Forest genetic resources

FRM: Forest reproductive material

MITECO. Ministry for the Ecological Transition and the Demographic Challenge (Including Forestry)

RP: regions of provenance

RD: Royal Decree

Executive summary

This report reviews the state of forest genetic resources in Spain. A major change since the first report, is the approval of a new regulation on conservation of forest genetic resources and wild plant that is implemented through a national plan for conservation of forest genetic resources and a national breeding program depending on the Ministry for Ecological Transition and the Demographic Challenge (MITECO). The actions for in situ conservation are a main responsibility of the Autonomous Regions and the Ministry is coordinating and promoting in situ and ex situ conservation, and the sustainable use of forest genetic resources. The National Committee on Forest Genetic Resources is the coordination body among the different administrations involved in the conservation and sustainable use of forest genetic resources. Spain presents a high number of species of interest for marketing of reproductive material and genetic conservation, and also present a high level of intraspecific genetic diversity. During the last years, there have been an increment in the actions related to the conservation and use of forest genetic resources, and there is a need for continuing the actions related to definition of in situ conservation units, ex situ conservation activities, characterization of genetic diversity (especially in face of climate change) and capacity and training in new emerging technologies. Due to the high amount of species and populations of interest, it is necessary to coordinate and prioritize the actions for the next future.

Part 1: The contributions of forest genetic resources to sustainable development

Chapter 1. Value and importance of forest genetic resources

The Iberian Peninsula is located in the Southwestern part of the European continent, between the Atlantic Ocean and the Mediterranean Sea. Its massive shape, resembling a pentagon, covers an area of 584,193 km2. This territory is shared by two large countries, in addition to the small Principality of Andorra and Gibraltar, which are Portugal and Spain. Portugal occupies almost the entire Atlantic coastal strip, from the mouth of the Miño River to Cape St. Vincent, extending over an area of 88,944 km^2. Spain belongs most of the peninsular surface, 493,846 km^2, its geodesic limits being located between 36 00' N and 43 48' N latitude and 3 13' E and 9 17' W longitude. In addition to peninsular Spain, there is also island Spain, made up of two archipelagos: the Balearic Islands and the Canary Islands.

The Balearic Islands are located in the Mediterranean Sea, east of the Iberian Peninsula. Their geodesic limits are 38 39' N and 40 06' N, latitude, and 1 18' E and 4 18' E longitude. In addition to numerous islets, they are made up of five main islands: Mallorca, Menorca, Ibiza, Formentera, and Cabrera. The total area of the archipelago is 4,992 km2. The Canary Islands are located to the west of the African continent, but geologically they are not part of it. Its main islands are Tenerife, Gran Canaria, Fuerteventura, Lanzarote, La Palma, La Gomera, and El Hierro, and contains numerous surrounding islets. Together they occupy an area of 7,447 km^2, and their geodetic limits are 27 38' N and 29 25' N latitude, and 13 20' W and 18 09' W longitude.

Spain also has sovereignty over the Autonomous Cities of Ceuta and Melilla, located on the North African coast. Ceuta occupies an area of 18 km2, and has its geodesic position at 35 53' N latitude and 5 19' W longitude. Melilla has an area of 14 km2 and a geodesic position of 35 26' N latitude and 2 58' W longitude. Administratively is divided in 17 autonomous regions (Figue 1.1), which are the responsible of managing forest lands and forest genetic resources.

In terms of physiography, peninsular Spain is very complex, due to its geographical location between two major tectonic plates: the Eurasian and African. The highest altitudes in the peninsula are found in the Sierras Penibéticas (peaks Mulhacén - 3478 m- and Veleta -3396 m), and in the Pyrenees (peaks Aneto - 3404 m-, Posets - 3375 m- and Monte Perdido - 3355 m). The highest altitude in Spain, however, is the Pico del Teide (3718 m), located on the island of Tenerife.

The geographical situation of the Iberian Peninsula, and its physiographic complexity, determine a climatic variability in which are represented from the temperate and humid climates of mid-latitudes to the tropical desert climates of the Sahara. However, it is the Mediterranean climates that have a greater representation in the Spanish territory. These climates, typical of the middle latitudes of the west coast of the continents, are characterized by a more or less extensive summer dry period. For its part, the archipelago of the Canary Islands has special climatic conditions generated by its latitudinal position, the high altitude of some of its islands, and its proximity to the African Sahara desert.

The Spanish forest area (non-agricultural) is 27,664,674 hectares, of which 67.1% is wooded forest area (18,571,404 hectares), which is made up of a total of 18,571,404 hectares. 404 hectares), 47 % of which is made up of hardwoods, 34 % of conifers and 19 % of mixed species, 52 % of which is harvested as high forest, 46 % as medium forest and 2 % as low forest.

The variety of climates and environments of the Spanish territory allows for a high diversity of animal and plant species. The main forest types are Atlantic, Mediterranean and subtropical, distributed in three biogeographic regions (Eurosiberian, Mediterranean, and Macaronesian), and five superprovinces (Central European Alpine, Atlantic, Ibero-Levantine Mediterranean, Ibero-Atlantic Mediterranean, and Canary Islands). This variaiblity is shown in Figure 1.2 of the environmental zones in Europe, where Spain include most of the types considered in the EUFORGEN classification.

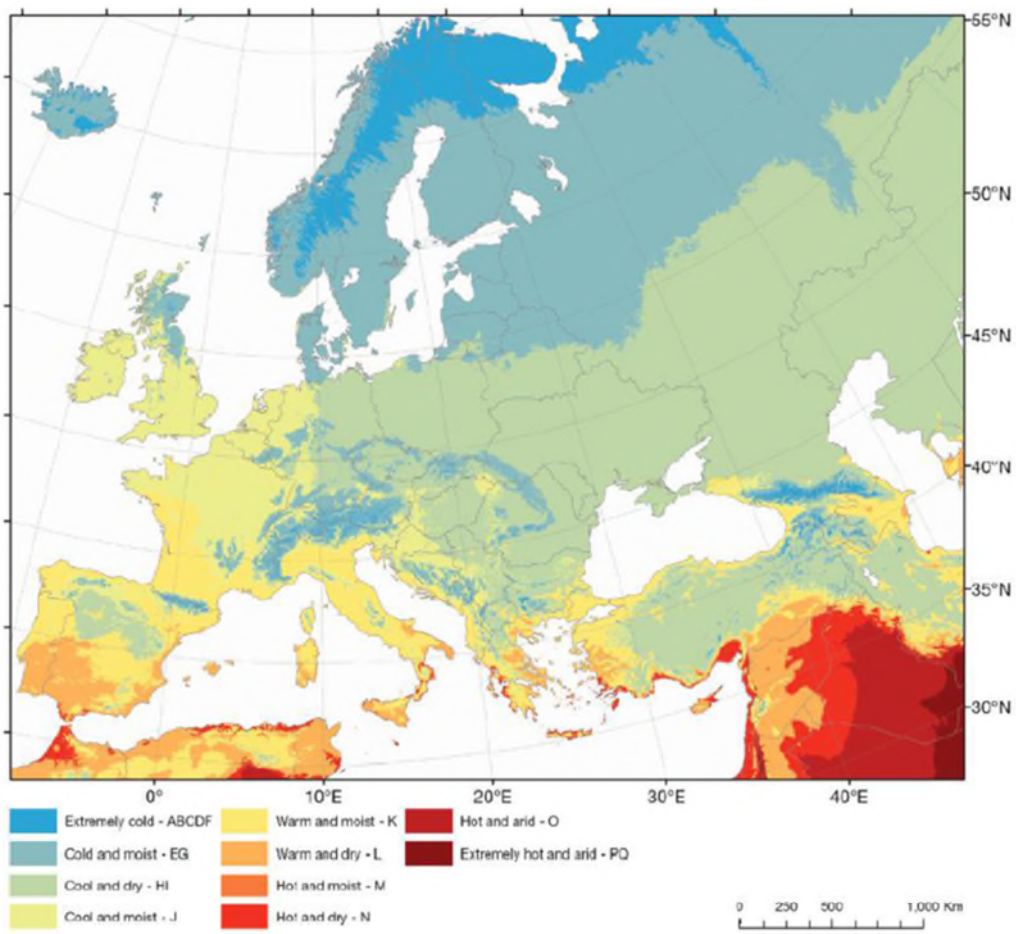

Figura 1.2. Environmental zones in Europe. [Metzger et al. (2013), modified by de Vries et al. (2015)].

The value of the functions and environmental services provided by the natural resources have been approached at the national scale (MITECO, 2008).

Table 1.1 Value of ecosystem services in Spain (source MITECO 2008).

Group	**Ecosystem service**	**Value (€/ha año)**
Food and raw material production		
	Wood production	46.73
	Firewood production	1.26
	Pine nut production	8.60
	Cork production	66.07
	Mushroom production	8.37
	Agricultural production	177.82
	Forest livestock production	5.07
	Fish production caught in the ocean	0.67
	Maximum ocean fishing option	1.41
	Minimum ocean fishing option	0.35
	Ocean farmed fish production	118.26
	Ocean commodity production	9.52
Water supply		
	Agricultural water supply	154.95
	Water supply for industrial use	16.31
	Domestic water supply	180.95
	Water supply for energy use	8.93
Recreational services		
	Resident coastal recreational service	285.72
	Non-resident coastal recreational service	1,401.28
	Inland recreational service	11.53
Hunting and sport fishing		
	Small game hunting	1.75
	Big game hunting	1.32
	Inland water fishing	27.27
	Erosion control Erosion control	11.45
Effluent treatment		
	Inland water discharge treatment	7.59
	Treatment of discharges into the ocean	0.82
Carbon sequestration		
	Carbon sequestration by trees	107.02
	Carbon sequestration by scrubland	30.26
	Carbon sequestration in agricultural soil	14.70
	Carbon sequestration in the ocean	40.30
Biodiversity conservation		
	Biodiversity conservation	14.77

Part 2: State of diversity in forests and woodlands

Chapter 2. State of forests

FOREST ECOSYSTEMS have a special relevance in Spain, since 37 % of its territory is wooded forest area (forests, dehesas), and 19 % is wooded forest area (scrublands, wastelands, cliffs, sandbanks, etc.) (Figure 2.1), with the trend stable in the last years (Table 2.1).

Figure 2.1. Forest area in Spain (source MITECO, 2020)

Table 2.1. Forest area in Spain (source MITECO, 2020)

	2009		2015		2019		2020	
	ha	%	ha	%	ha	%	ha	%
Forestry Woodland	18.273.211	36,1	18.392.441	36,3	18.467.134	36,5	18.623.437	36,8
Deforested Forest	9.395.057	18,6	9.345.564	18,5	9.498.674	18,8	9.459.527	18,7
Total Forest	27.668.268	54,7	27.738.005	54,8	27.965.808	55,2	28.082.964	55,5
Non-forest area	22.949.074	45,3	22.878.818	45,2	22.651.240	44,8	22.534.084	44,5

Despite conservation efforts, further action is needed to reduce pressures and threats to biodiversity, which have continued to increase over the past six years. Threats to biodiversity, which have continued to increase over the last six years.

Among the main pressures are changes in land use. In Spain, there has been an increase in the area devoted to settlements has increased from 1.2 million ha in 2000 to 1.7 million ha in 2015. 2015. On the other hand, the area of forests has increased by 0.8 million ha and that of crops has decreased by 1.2 million ha during this period. Changes among these major ecosystem types have been minor within the network of protected areas. The changes between these major types of ecosystems have been minor within the network of protected areas, which has acted as a stabilizing element for changes in land use.

Changes in land occupation includes the phenomenon of fragmentation, which, in addition to land occupation, produces a disconnection between ecosystems. Our knowledge of this phenomenon in Spain is outdated and it is urgent to monitor it in coordination with the identification and design of green infrastructure, The new National Strategy for Green Infrastructure and Ecological Connectivity and Restoration.

Forest fires constitute the main element of degradation of forest ecosystems, although the increase in the effectiveness of forest fire management in the last six years has counteracted their impact.

On the other hand, the problem of desertification is of enormous relevance in Spain, being the EU country where this risk is the highest in the world. The United Nations Convention to Combat Desertification (UNCCD) defines the desertification process as the degradation of land in arid, semi-arid and dry sub-humid areas by a variety of factors. In Spain, 18% of the territory is under high or very high risk of desertification.

Invasive alien species are a growing problem, both in the marine and terrestrial environment has counteracted their impact.

In addition, progress has been made in recent years at the European level in reducing water and air pollution, although the levels of pollutants remain high. In application of Directive (EU) 2016/2284, which establishes the need to monitor the effects of atmospheric pollution on ecosystems, Spain has a monitoring network with 45 stations, whose data come from different monitoring programs such as ICP Forests (Level II) and ICP Integrated Monitoring, as well as data from the Water Framework Directive. At Spain, about 34 % of the peninsular surface has high exceedances of critical loads of nitrogen, indicating a high risk of eutrophication for those ecosystems located in these areas. The use of phytosanitary products is also an important source of contamination.

Climate change directly or indirectly influences all the pressures described above. For example, the problem of desertification could be aggravated in the context of climate change, since the increase in the period of drought period, high temperatures and the frequency and intensity of extreme events increase the risk of desertification.

In addition, climate change has been identified as one of the five main drivers of biodiversity loss.

It is important to highlight that Spain has advanced in the knowledge and integration in its planning of the convergences between biodiversity conservation and climate change, which are two of the great environmental challenges at this time. The EU Biodiversity Strategy up to 2030 recognizes that the biodiversity crisis and the climate crisis are intrinsically related, also stressing the potential of shared solutions. In this respect, the National Adaptation Plan for

2020, the National Plan for Adaptation to Climate Change (2021-2030) was launched in September 2020, which constitutes the basic planning instrument to promote coordinated and coherent action on adaptation, in different sectors and at different territorial scales, was launched in September 2020. This Plan includes among its areas of work the "Natural Heritage, Biodiversity and Areas". Natural Heritage, Biodiversity and Protected Areas". The 5 lines of action proposed in this area of the plan, the aim is to develop and transfer, in a coordinated manner, the knowledge and tools necessary for the implementation of adaptation measures in the region. the implementation of adaptation measures in natural heritage and biodiversity.

As a specific tool to advance in the knowledge of the effects of climate change in the forestry area, since 2005 the "Monitoring of forest species indicative of climate change" has been developed in the National Parks

Network, by which deviations have been observed towards lower precipitation and higher average temperatures, with biotic factors increasing (basically pathogens, hemi parasites, boring insects) in parallel with an appreciable deterioration, even decay, of some species in their current distribution area, where they may not find the ecological requirements necessary for their correct development. The Level I and II Forest Damage Networks also provide information on the state of health and vitality of forests, on the impact of pollution and climate change on the main Spanish tree formations, as well as on the relationship between the different stress factors acting on the forest ecosystem and the water and nutrient balance. The results show that the general condition of the tree stands is experiencing a process of decline, with a decrease in the percentage of healthy trees, and that the majority of the damage is associated with abiotic causes, mainly damage attributed to drought.

Chapter 3. State of other wooded lands

Other wooded lands and trees outside of forests represent an important component of biodiversity in Spain, but minor from the point of view of the forest trees genetic diversity. Treeless areas (scrub and forest grassland) and sparse woodland (degree of coverage between 5% and 10%) represent around 9.39 million hectares in the national FRA 2020 report. There is a lot of sparse wooded pasture, for example. Moreover, dehesa-like landscapes represent an important source of genetic resources for some *Quercus* and *Fraxinus* species.

Other areas with trees outside forest would include urban parks, urban forests and ornamental trees in the villages and agricultural lands. Some of the species important in these areas are included in the list of species under consideration for *in situ* and *ex situ* conservation (*Juglans, Ulmus*). Other ornamental species are not considered in the actions, especially those from allochthonous origin.

Chapter 4. State of diversity between trees and other woody plant species

The information concerning the species considered as forest genetic resources in our country is summarized in table 4.1. We include all the species with trading of forest genetic resources in Spain, or those species being used in forestry plantations, and also those included in the regulation for marketing of forest reproductive material (EU Directive 1999/105/EC or Spanish RD289/03) or for the conservation of forest genetic resources (RD 159/2022).

Table 4.1. Information of the species considered for forest genetic resources in Spain. *We include if the species is regulated for marketing of FRM, in situ conservation. Also if the species is authoctonus in Spain, and the basic material already registered for the production of FRM source identified or selected (MBIS) or qualified or tested (MBQT), and if there is production of source identified or selected FRM (MFRIS), or qualified/tested (MFRQT).*

	Species	Regulation FRM	In situ conservation	Authoc-tonous	RP	MBIS	MFRIS	MBQT	MFRQT
1	*Abies alba* Mill.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
2	*Abies cephalonica* Loud.	Directive EU		N	Y	0	0	0	0
3	*Abies grandis* Lindl.	Directive EU		N	Y	0	1	0	0
4	*Abies pinsapo* Boiss.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
5	*Acer campestre* L.		RD 159/2022	Y	N	0	1	0	0
6	*Acer monspessulanum* L.		RD 159/2022	Y	N	0	1	0	0
7	*Acer opalus* Mill.		RD 159/2022	Y	N	0	0	0	0
8	*Acer platanoides* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
9	*Acer pseudoplatanus* L.	Directive EU	RD 159/2022	Y	Y	1	1	1	0
10	*Alnus glutinosa* (L.) Gaertn.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
11	*Alnus incana* Moench.	Directive EU		N	Y	0	1	0	0
12	*Arbutus canariensis* Veill	RD289/03	RD 159/2022	Y	Y	1	1	0	0
13	*Arbutus unedo* L.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
14	*Betula pendula* Roth	Directive EU	RD 159/2022	Y	Y	1	1	0	1
15	*Betula pubescens* Ehrh.	Directive EU	RD 159/2022	Y	Y	1	1	0	1
16	*Carpinus betulus* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
17	*Castanea sativa* Mill.	Directive EU	RD 159/2022	Y	Y	1	1	0	1

	Species	Regulation FRM	In situ conservation	Authoc-tonous	RP	MBIS	MFRIS	MBQT	MFRQT
18	*Castanea sativa* spp. Hibridos artificiales	RD289/03		N	Y	1	1	1	1
19	*Cedrus atlantica* Carr.	Directive EU		N	Y	0	1	0	1
20	*Cedrus libani* A. Richard.	Directive EU		N	Y	0	1	0	0
21	*Celtis australis* L.				N	0	1	0	0
22	*Corylus avellana* L.		RD 159/2022	Y	N	0	0	0	0
23	*Fagus sylvatica* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
24	*Frangula alnus* Mill.		RD 159/2022	Y	N	0	0	0	0
25	*Fraxinus angustifolia* Vahl.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
26	*Fraxinus excelsior* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	1
27	*Fraxinus ornus* L.		RD 159/2022	Y	N	0	0	0	0
28	*Fraxinus spp.*			N	N	0	1	0	0
29	*Ilex aquifolium* L.	RD289/03	RD 159/2022	Y	Y	1	1	0	1
30	*Juglans nigra* L.	RD289/03		N	Y	1	1	1	1
31	*Juglans regia* L.	*RD289/03*	RD 159/2022	Y	Y	1	1	1	1
32	*Juniperus communis* L.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
33	*Juniperus oxycedrus* L.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
34	*Juniperus phoenicea* L.	RD289/03	RD 159/2022	Y	Y	1	1	0	1
35	*Juniperus thurifera* L.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
36	*Juniperus spp.*			N	N	0	1	0	0
37	*Larix decidua* Mill.	Directive EU		N	Y	1	1	0	0
38	*Larix kaempferi* Carr.	Directive EU		N	Y	1	1	0	1
39	*Larix sibirica* Ledeb.	Directive EU		N	Y	0	0	0	0
40	*Larix x eurolepis* Henry.	Directive EU		Y	Y	0	1	0	1
41	*Malus sylvestris* Mill.		RD 159/2022	Y	N	0	0	0	0
42	*Olea europea* var. *sylvestris* Brot.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
43	*Phoenix canariensis* Hort.	RD289/03	RD 159/2022	N	Y	1	1	0	0
44	*Picea abies* Karst.	Directive EU		N	Y	0	1	0	0
45	*Picea sitchensis* Carr.	Directive EU		N	Y	1	1	0	0
46	*Pinus brutia* Ten.	Directive EU		Y	Y	0	1	0	0
47	*Pinus canariensis* C. Smith.	Directive EU	RD 159/2022	N	Y	1	1	0	0
48	*Pinus cembra* L.	Directive EU		N	Y	0	0	0	0
49	*Pinus contorta* Loud.	Directive EU		Y	Y	0	0	0	0
50	*Pinus halepensis* Mill.	Directive EU	RD 159/2022	Y	Y	1	1	1	1
51	Pinus leucodermis Antoine.	Directive EU		N	N	0	1	0	0
52	*Pinus nigra* subsp. n*igra* Dunal) Franco	Directive EU		Y	Y	0	0	1	0
53	*Pinus nigra* subsp. *salzmannii* (Dunal) Franco	Directive EU	RD 159/2022	Y	Y	1	1	1	1
54	*Pinus nigra* subsp. *corsicana* Dunal) Franco	Directive EU		N	N	1	1	0	1
55	*Pinus pinaster* Aiton.	Directive EU	RD 159/2022	Y	Y	1	1	1	1
56	*Pinus pinea* L.	Directive EU	RD 159/2022	Y	Y	1	1	1	1
57	Pinus radiata D. Don.	Directive EU		N	Y	1	1	1	1
58	*Pinus sylvestris* L.	Directive EU	RD 159/2022	Y	Y	1	1	1	1
59	*Pinus uncinata Ramond* ex DC.	RD289/03	RD 159/2022	Y	Y	1	1	1	1
60	*Pistacia atlantica* Desf.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
61	*Pistacia spp.*			N	N	0	1	0	0
62	*Platanus spp.*			N	N	0	1	0	0
63	*Populus alba* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	1
64	*Populus alba* var.canescens L.				Y	1	0	0	0
65	*Populus deltoides* Bartram ex Marshall				N	0	0	0	0
66	*Populus nigra* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	1
67	*Populus tremula* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	1
68	Populus spp. e hibridos artificiales	Directive EU		Y	N	0	1	1	1
69	*Prunus avium* L.	Directive EU	RD 159/2022	Y	Y	1	1	1	1
70	*Prunus padus* L.		RD 159/2022	N	N	0	0	0	0
71	Pseudotsuga menziesii Franco.	Directive EU		N	N	1	1	1	1
72	*Quercus canariensis* Willd.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
73	*Quercus cerris* L.	Directive EU		Y	N	0	1	0	0

	Species	Regulation FRM	In situ conservation	Authoc-tonous	RP	MBIS	MFRIS	MBQT	MFRQT
74	*Quercus coccifera* L.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
75	*Quercus faginea* Lam.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
76	*Quercus ilex* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
77	*Quercus petraea* (Matt.) Liebl.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
78	*Quercus pubescens* Willd.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
79	*Quercus pyrenaica* Willd.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
80	*Quercus robur* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
81	*Quercus rubra* L.	Directive EU		N	Y	1	1	0	1
82	*Quercus suber* L.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
83	*Robinia pseudoacacia* L.	Directive EU		Y	Y	1	1	0	0
84	*Sorbus aria* (L.) Crantz	RD289/03	RD 159/2022	Y	Y	1	1	0	0
85	*Sorbus aucuparia* L.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
86	*Sorbus domestica* L.		RD 159/2022	Y	N	0	1	0	1
87	*Sorbus torminalis*(L.) Crantz		RD 159/2022	Y	N	0	0	0	0
88	*Tamarix africana* Poir.			N	N	0	1	0	0
89	*Tamarix gallica* L.	RD289/03		Y	Y	1	1	0	0
90	*Taxus baccata* L.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
91	*Tetraclinis articulata* Masters.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
92	*Tilia cordata* Mill.	Directive EU	RD 159/2022	Y	Y	1	1	0	0
93	*Tilia platyphyllos* Scop	Directive EU	RD 159/2022	Y	Y	1	1	0	0
94	*Ulmus glabra* Huds.	RD289/03	RD 159/2022	Y	Y	1	1	0	0
95	*Ulmus laevis* Pall.		RD 159/2022	Y	N	0	0	0	0
96	*Ulmus minor* Mill. *s.l.*	RD289/03	RD 159/2022	Y	Y	1	1	1	1

The trends in the number of species in Spain, in terms of use of FRM is stable since the last report. The number of species considered for genetic conservation have increased.

The drivers of change affecting these species in Spain are the diversification of plantation, with higher importance of mixed plantations.

The species considered as threatened in Spain from the list included in Table 4.1 (www.iucnredlist.org/) are *Abies pinsapo* (EN), *Fraxinus excelsior* (NT) and *Pistacia atlantica* (NT). Beside those species, *Juniperus cedrus* (EN), *Dracaena draco* (EN), *Arbutus canariensis* (NT) and *Salix canariensis* (NT) are also included in the red list.

Regarding the Spanish legislation on endangered species, the only tree species at national level included in the List of wild species in special protection regime is *Tetraclinis articulata*, although there are more included in catalogues of endangered species regulated by Autonomous regions.

Chapter 5. State of diversity within trees and other woody plants species

Characterization of genetic diversity of forest tree species have been made usually in the context of research projects implemented by different research organizations (both at the national and regional level). Also, some actions have been developed by programs financed directly by the Ministry to implement actions in some forest tree species. The studies are based both in genetic trials (provenance, families or clones), and also in molecular characterization of natural and breeding populations. Information on genetic test is available in the Spanish network of genetic tests (Genfored), and the molecular characterization is available for different species from scientific publications (table 5.1).

Tabla 5.1- Characterization of genetic diversity..

Especie	N Pob	isoenz	CpSSR	SNPs	Genetic trials
Abies alba Mill.	2	0	0	2	0
Betula pendula Roth.	2	0	0	2	0

Especie	N Pob	isoenz	CpSSR	SNPs	Genetic trials
Castanea sativa Mill.	17	17	0	0	5
Fagus sylvatica L.	2			2	6
Fraxinus excelsior L.			10		0
Juniperus thurifera L.	13	13	0	0	0
Pinus halepensis Mill.	46	15	13	6	9
Pinus nigra Arn.	24	8	18	4	5
Pinus pinaster Ait.	86	32	36	38	12
Pinus pinea L.	18	7	5	0	7
Pinus sylvestris L.	30	14	29	2	8
Pinus uncinata Mill.	6	6	0	6	0
Populus alba L.	7	7	0	0	1
Populus nigra L.	2			2	2
Quercus ilex L.	65	8	0	57	2
Quercus petraea Liebl.	2			2	0
Quercus pubescens Willd.			40		0
Quercus pyrenaica Willd.			50		0
Quercus robur L.			15		0
Quercus suber L.	27	27	0	0	4
Taxus baccata L.	28	0	0	28	0

N Pob: # of puopulations analysed, Characterized by: Isoenz: allozyme markers, CPSSR: chloroplast microsatellites, SNPs: single nucletotide polymorphisms, Genetic trials: in provenance tests.

Pattern of variation for the different major species have obtained, related to different genetic groups or climatic trends. There are not meta-analysis to infer general trends for the species.

At present both high throughput phenotyping techniques (aerial and terrestrial lidar, multispectral cameras9 are being implemented, and also high throughput genotyping techniques mainly based in SNPs markers. Spain is participating in differnet European projects (Gentree, B4EST, Forgenius) that have charactereized the genetic resources of different natural and improved populations of different forest tree species.

Within the Spanish Plan for the Conservation of Forest Genetic Resources there are special actions to promote the characterization of genetic resources, based in developing tools, financing characterization of strategic resources and also by training and capacity building. There is a lack of extensive studies for most of the species, and also for non-priority forest tree species (see annex 4 for the specific actions being implemented),

Part 3: State of forest genetic resources conservation

Chapter 6. *In situ* conservation of forest genetic resources

The state of *in situ* conservation of forest genetic resources is assessed by different criteria and indicators that follows the ones proposed by EUFORGEN to the Forest Europe process. A periodic report should be presented to the Committee on Forest Genetic Resources with an updated information (see Annex 1).

The approaches used for in situ conservation of forest genetic resources are the ones established in the European program (EUFORGEN) and adopted in the Spanish Strategy for the conservation and sustainable use of forest genetic resources, and in the royal decree on the conservation of forest genetic resources and wild flora (RD 159/2022). *In situ* conservation is aimed to preserve the adaptive capacity of the populations at the long term by defining a network of genetic conservation units for each forest tree species considered.

In situ conservation of forest genetic resources is responsibility of each region. The Ministry (MITECO) is responsible of the coordination, the implementation of national programs, and the reporting actions to other national and international organizations. The network include at present a proposal of 310 *in situ* conservation units (Figure 6.1)

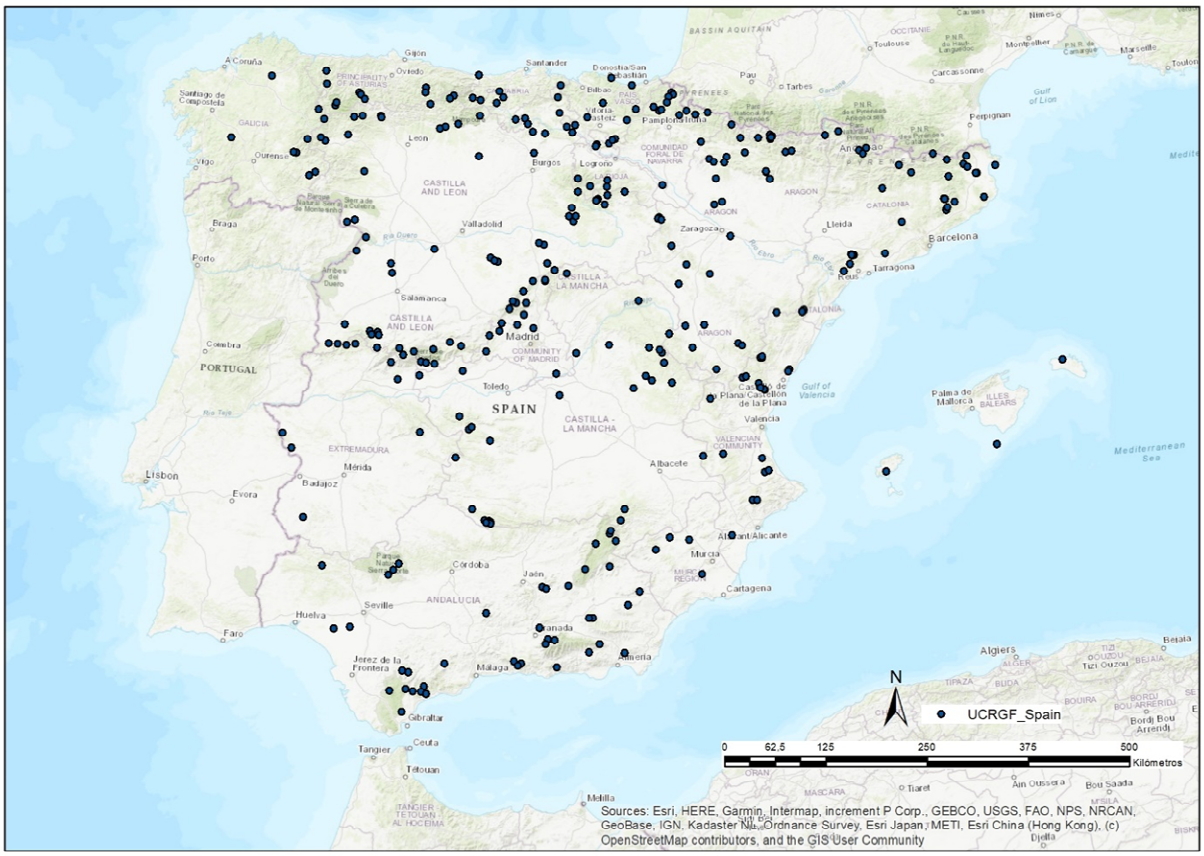

Figure 6.1. Proposed network of in situ conservation units.

The main players / stakeholders of *in situ* conservation are the forest owners in which the *in situ* unit is established, the regional authorities are responsible of the approval of the unit, the management and supervision of the unit, and the Ministry is responsible of the coordination and the national register of genetic conservation units.

The criteria applied for identifying or establishing new *in situ* units for the conservation of forest genetic resources follow the ones defined in the EUFORGEN program, and are specified in the Royal Decree on conservation of forest genetic resources and wild flora (RD 159/2022)

The needs for improving *in situ* conservation of forest genetic resources are related to improve training, capacity building and human resources of the different actors involved in *in situ* conservation and providing financial resources for implementing the actions. Moreover, supplying additional resources for the characterization and monitoring of *in situ* conservation. Challenges and opportunities are related to define efficient methods for management and characterization of *in situ* conservation.

The priorities for capacity-building and research are related to the monitoring of the network, detecting gaps, redundancies, and also to assess the adaptability of the units under different scenarios. This is essential to define the priorities in conservation for the different species.

Chapter 7. *Ex situ* conservation of forest genetic resources

There is a list of priority species established for *ex situ* conservation (see Annex 2) including 158 species. Also the species included in the list of wild flora under special protection or the Spanish catalogue of threaten species should be considered.

The assessment of the state of *ex situ* conservation of forest genetic resources is still not made in Spain, and it is one priority action for the next phase of the national conservation plan.

The approaches used for *ex situ* conservation of forest genetic resources in Spain are based in collections established in genebanks, mainly of seed and fruit collections. Some plantations are also important for *ex situ* conservation (clonal banks, progeny tests, etc).

Ex situ conservation is based in the gene banks that should be integrated in the network of forest gene bank, coordinated by the National Forest Gene Bank depending on the MITECO. This gene banks was defined by the Spanish Strategy for the conservation and sustainable use of forest genetic resources (in 2006), but it was not formally regulated until recently (2022). Therefore, the existing collections depend on the priorities of the different organisms in charge of the gene banks and do not still correspond to any national strategic plan.

The main players and stakeholders of *ex situ* conservation are those included in the Network of Gene Banks: Regional administrations, MITECO, Ministry with competences in forest (responsible of the National Forest Gene Bank and the database of *ex situ* collections), Research Institutes (in charge of programs for specific species or group of species), and Botanical Gardens.

The criteria applied for establishing new *ex situ* units or collecting new accessions are still not implemented in the National Conservation Plan.

Transfers of tree germplasm within and/or outside Spain are still not under regulation in Spain are they are based on bilateral cooperation.

The needs, challenges and opportunities for improving *ex situ* conservation of forest genetic resources are related to the implementation of the National regulation for *ex situ* conservation. Mainly those related to the coordination of activities, developing guidelines for *ex situ* conservation and collection, prioritization of population for *ex situ* conservation, complementarity among *in situ* and *ex situ* conservation.

The priorities for capacity-building and research are the improvement of facilities for *ex situ* conservation, training of technician for *ex situ* collection and management of collections. For research it is necessary to improve the technologies, characterization of collections, and prioritization of collections for *ex situ* conservation.

Part 4: State of use, development and management of forest genetic resources

Chapter 8. The state of use

Forest genetic resources are used in Spain for different purposes. There are near 95 species from which forest reproductive material (FRM) is used in our country, many of them under regulation but other species are not covered by the EU or Spanish regulation on marketing of forest reproductive material. The use of many of these species are limited in term of amount of FRM or area in the afforestation, and most of the reforestations and afforestations are classified as protection. Only for a reduced number of species and provenances the use is classified as productive.

The guidelines and recommendations for using forest genetic resources are implemented for some species (eg. riparian species) and some areas (Castille and Leon). There are general recommendations for all the species

under regulation (link general recommendations) and there are some guidelines for local seed sourcing for 45 species in Spain (DOI: 10.5281/zenodo.7157589).

The Ministry coordinates all the activities on the production of FRM in Spain with the regional governments, by using the Committee of forest genetic resources. Each regional government has special programs.

Forest reproductive material is produced following the standards of the EU, and with different types of basic materials (stands, seed orchards, parent of families, clones and clonal mixtures) and different categories (source identified, selected, qualified and tested). Source identified and selected FRM are the most extensively used in most of the species (representing more than 95% of all the FRM).

Grant schemes or other incentive mechanisms promote the use of local material in most of the cases.

The role of registered seed stands, seed orchards and other sources in the supply of forest reproductive material is minimal (annex 3) except for some species. Qualified and tested materials are important for few species or regions (*Populus* spp., *Juglans* sp. *Castanea* spp., *Pinus pinaster, P. radiata*).

The supply of forest reproductive material meet the demand, but depending of the year there are problems for some species or regions of provenance related to the irregularity of seed or fruit production.

The trends in the demand for forest reproductive material has been stable in the last 15 years, after a great reduction from previous periods (see annex 3).

The information on forest reproductive material certified for national and international trade is available in the annual report on forestry statistics (link annual report). Spain follows the UE and OCDE schemes.

Exports and/or imports of forest reproductive material in Spain is quite limited, taking into account data reported to OECD annually.

The national tree seed programme is included in the National Breeding Plan. The Committee of FGR is in charge of the coordination of the actions, and the MITECO in implementing the Plan.

Needs, challenges and opportunities for increasing the use of forest genetic resources are related to the actions on restoration of ecosystems, protection of the forest, and for increasing the production of specific products (see chapter 9).

The priorities for capacity-building and research in this area are the conservation of recalcitrant seeds species and the production of FRM for different purposed, by using low-input breeding strategies (see chapter 9) related to emerging pest and diseases of important species (Mediterranean oaks, Mediterranean pines, chestnut, etc.).

Chapter 9. The state of genetic improvement and breeding programmes

The approaches used for tree improvement and breeding in Spain differs among species and areas. Mainly they are focused in the deployment of improved material by seed orchards, and clonal material in special cases. Nowadays, there is a focus in low-input breeding strategies, to take advantage of genomic and phenotyping tools, that can be used to select material according to the different objectives. The description of the existing activities are included in the national breeding program.

The uses and traits prioritized in tree improvement and breeding are also summarized in this table. Briefly, growth (all the species), cone production (*Pinus pinea*), diseases resistance (Elms, Mediterranean oaks, chestnut, *P. pinaster*), resin production (*P. pinaster*) and adaptability (all the species).

Tree improvement and breeding programmes are organized by different research centres and administration. The MITECO is in charge of the National Breeding Plan, and implements different actions at the national level (Elm breeding program, Mediterranean Oaks, *Pinus pinea*, Seed orchards of pine species).

The current and emerging technologies used in tree improvement and breeding are based in clonal propagation (grafting, cuttings), selection (early testing for resistance trait) and genotyping (identification of material). Genomics and high throughput phenotyping using drones, NIRs and other technologies are being implemented.

The amount tree germplasm transferred within and outside of the country for research and development purposes is quite limited, as most of the breeding programs are based in local genetic resources.

As regards access and benefit sharing, Spain have regulated the access to genetic resources and it affects directly to FGR (Royal Decree 124/2017 and Royal Decree 429/2020), and breeding is considered as "use of genetic resources" in the scope of Nagoya Protocol. Therefore, it is required to apply for access of the genetic resources if a breeding activity is going to be carried out and to issue a establish mutual agreed terms (MAT) with regional authority when the results of breeding are going to provide any benefit. Furthermore, for the approval of new basic materials for the production of FRM of the categories qualified and tested it is compulsory for the applicant to present the due diligence, that indicates the breeder has fulfilled with the legislation.

The needs, challenges and opportunities for tree improvement and breeding have been identified to implement the National Breeding Plan: coordination, phenotyping, genotyping and developing low-input strategies.

The priorities for capacity-building and research in this area are related to the new technologies and strategies, and also in training for breeders.

Chapter 10. Management of forest genetic resources

Genetic considerations are taken into account, at practical level, in managing natural and planted forests, in different aspects. The most important one are related to plantation forests. The Committee on Forest Genetic Resources provides updated information of the regions of provenance (https://www.miteco.gob.es/es/biodiversidad/temas/recursos-geneticos/geneticos-forestales/rgf_regiones_procedencia.aspx), the national register of basic material for the production of forest reproductive material (https://www.miteco.gob.es/es/biodiversidad/temas/recursos-geneticos/geneticos-forestales/rgf_catalogo_materiales_base.aspx). The Committee approved the regions for deployment of forest reproductive material and some transfer guidelines (https://www.miteco.gob.es/es/biodiversidad/temas/recursos-geneticos/geneticos-forestales/rgf_uso_material_repr.aspx), and finally different criteria and guidelines to coordinate the actions on management of forest genetic resources (https://www.miteco.gob.es/es/biodiversidad/temas/recursos-geneticos/geneticos-forestales/rgf_comite_co_mejora_conservacion.aspx) among which there are two of them for reforestation of riparian species, and for reforestation and afforestation.

The current and emerging technologies used in the management of forest genetic resources are related to the characterization of genetic resources. Mainly those derived from –omics technologies (genomics for fingerprinting, genomic prediction and selection), and those from sensors and drones for the evaluation of genetic tests. These technologies would be applied to the national breeding and conservation programs, by new and low-input strategies for breeding and conservation, and for the sustainable use of FRM (traceability, transfer guidelines).

The main actors/ stakeholders for managing natural and planted forests are public regional administration (as they are in charge of the management of public lands), and private owners (under the supervision of public regional administration).

The needs for improving the management of forest genetic resources are related to the implementation of measures to support the forest owners in applying measures for the conservation and sustainable use of forest genetic resources, and also in elaborating guidelines (already implemented for some aspects). Challenges and opportunities are related to the application of new technologies that would reduce the costs of characterization of genetic resources, and also allow the monitoring of some actions related to the management of forest genetic

resources. We need to develop more precise and cost-efficient methods for monitoring of the actions in breeding and conservation in order to an effective implementation of the national programs for breeding and conservation of genetic resources.

The priorities for capacity-building and research in this area are related to formation on the new technologies, and also to develop efficient methods for phenotyping and genotyping. The research needs are related to the application of the methods to a high number of species, and different programs that can operate at different scales (national, regional), and therefore the information should be applied by different actors. For the next phase of the national programs of breeding and conservation one of the proposal is to harmonize the methods and provide a basal funding for coordinating these actions at the national level.

Part 5: State of capacities and polices

Chapter 11. Institutional framework for the conservation, use and development of forest genetic resources

The Spanish Committee on forest genetic resources (REGENFOR) is the coordination body established among the administrations (Central and autonomous regions) on conservation and use of forest genetic resources. This Committee meets regularly (one or twice per year) to discuss and review the actions, and to propose measures related to the main objectives. Since the last reporting period, this Committee has developed a National regulation on the *in situ* and *ex situ* conservation of forest genetic resources (finally approved on 2022 by Royal Decree 159/2022). One main topic of activity is the coordination and standardization of protocols for approval of basic material, and for the marketing of FRM in Spain. It is also in charge of the development of the Spanish strategy on sustainable use of forest genetic resources, and the national plans included in this strategy.

The main institutions and stakeholders involved in the conservation, use and development of forest genetic resources in Spain are the regional authorities, as they are responsible of registering basic materials and *in situ* genetic conservation units. The Ministry is responsible of the coordination, and reporting to the international authorities. Research Institutions and Universities are in charge of most of the actions on characterization of genetic resources, and different gene banks (public funding) are in charge of *ex situ* conservation actions. Forest owners and regional administration are in charge of *in situ* conservation activities.

Spain developed a Strategy on conservation and sustainable use of forest genetic resources (MIMAM, 2006). This Strategy, after more than 15 years, should be updated in the next years.

Spain has developed specific legislation for important forest tree species following the Directive on marketing of FRM (transposed in Spain by Royal Decree 289/2003 on marketing of FRM), and recently it has been published a Royal Decree for *in situ* and *ex situ* conservation of forest genetic resources. (. Spain has regulated at national level the access to genetic resources (Royal Decree 124/2017 and Royal Decree 429/2020), where forest genetic resources for breeding activities are inherently included.

Research and development on forest genetic resources is depending on the collaboration of Research institutions and Universities, with national and regional administrations. There are different actions on characterization of genetic resources, selection of material, breeding activities and transfer of FRM (see annex for the list of institutions related to research on forest genetic resources). Development of forest genetic resources are made in collaboration with different private and public companies (the public company TRAGSA is the most important one), and recently different GO have been established related to this topic.

The main actors in education and training on forest genetic resources are the Universities, with formal studies in different grades. However, there are not a master on conservation and use of forest genetic resources. Training is also made by the Ministry (focused to public employees) and by research centres (for students) but this training is not formally organized. This is one of the priorities identified for the next phase of the national programs of conservation and breeding.

One major need for strengthening the institutions and policies on forest genetic resources is the incorporation of talent with a more formal training in new technologies of interest for the conservation and use of forest genetic resources. This question opens the filed for challenges and opportunities derived from these new technologies (genomic selection, fingerprinting and prediction, new methods of phenotyping based on sensors and drones, new and low input strategies) that should be properly addressed in the near future according to the priorities of the national programs already established.

The priorities for capacity-building in this area are, therefore, based on the applications of these new topics for the implementation of breeding and conservation activities, new genetic tests with different species and environments to address future adaptation of the genetic resources, and also new facilities for the conservation (genebanks) and characterization of forest genetic resources (phenotyping and genotyping platforms).

Chapter 12. International and regional cooperation on forest genetic resources

Spain is member of the European Program on Forest Genetic Resources (EUFORGEN-https://www.euforgen.org). In this context, Spain has participated in updating the Forest Genetic Resources Strategy for Europe published in 2021 (https://www.euforgen.org/publications/publication/forest-genetic-resources-strategy-for-europe/) and in different working groups created by EUFORGEN. A main outcome of this collaboration is updating the information of *in* situ conservation units in the EUFGIS database (www.eufgis.org), according to the standards established by the program and for different species (*Abies alba* -6-, *Betula pendula* -4-, *Castanea sativa* -20-, *Fagus sylvatica* -24-, *Fraxinus excelsior* -13-, *Pinus halepensis* -19-, *Pinus nigra* -19-, *Pinus pinaster* -44-, *Pinus sylvestris* -25-, *Pinus uncinata* -7-, *Populus nigra* -17-, *Prunus avium* -17-, *Quercus ilex* -27-, *Quercus petraea* -17-, *Quercus robur* -9-, *Quercus suber* -21- and *Taxus baccata* -19). The development of the EUFORGEN program has influence the activities in Spain for the conservation of forest genetic resources, in order to define standards for *in situ* conservation similar to the established in the European program. These standards have influenced the national regulation on conservation of forest genetic resources.

At the international context, Spain is reporting periodically to Forest Europe (https://foresteurope.org) on criteria and indicators for sustainable forest management. Spain has participated in updating these criteria (Dynamic conservation and utilization of forest tree genetic resources: indicators for *in situ* and *ex situ* genetic conservation and forest reproductive material, 2020. https://www.euforgen.org/fileadmin/templates/euforgen.org/upload/Publications/Thematic_publications/EUFORGEN_IGR_4.6.pdf).

Spain, as member of the EU, is following the regulations on marketing of FRM in Europe, and other Directives related to conservation of Biodiversity. Spain reported the Basic material units to the common database (www.forematis.eu). The different activities developed for the conservation and sustainable use of forest genetic resources takes into account these EU regulations, and they are adapted by national regulations and actions. We have recently defined the national programs for the conservation of genetic resources and for breeding.

Also, Spain is member of the OCDE and follows the rules on marketing of FRM in the international context, and report periodically on this subject.

Regarding FAO activities, Spain has been participating as an observer in the meetings of the last years of the Intergovernmental Technical Working Group (ITWG) on Forest Genetic Resources of the Commission on Genetic Resources for Food and Agriculture and it has recently become as member of the European group of the ITWG.

Since the last reporting period to FAO, Spain has decreased the collaboration with other regions (SAFORGEN and LAFORGEN networks), due to different financial restrictions. We expect to increase the activities in the next future, related to the strategic collaboration with these regions.

Part 6: Challenges and opportunities

Chapter 13. Recommended actions for the future

The new national regulation for *in situ* and *ex situ* conservation have been recently approved, and now Spain has a basis for implementing conservation and breeding programs. The MITECO is coordinating the National Breeding and Conservation Plans with all the actors at the national level, and some priorities have been established. The actions for the future are related to new environmental conditions for the plantations and genetic resources. Therefore, an effort in establishing new genetic test to analyse transfer and adaptability of genetic resources under climate change scenario have been identified. Also, a future action to facilitate the access to all the information already available have been identified (new web platform) and also the implementation of the *in situ* conservation network (as the units have to be approved by the regional governments) (see Annex 4).

There is an initiative to update the Spanish Strategy for the conservation and sustainable use of the forest genetic resources in the following years that will take into consideration all the changes since the first Strategy, in accordance with the new regulation and the European and other international initiatives.

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Annexes

Annex 1. Seguimiento de los recursos genéticos forestales en España. Indicadores de Recursos genéticos forestales. Informe para su presentación al Comité Nacional de Recursos Genéticos Forestales

Forest Europe ha definido una serie de indicadores para la gestión forestal sostenible, entre los que se encuentra el indicador correspondiente a los Recursos Genéticos Forestales. EUFORGEN a través de un grupo de trabajo ha realizado una modificación de este indicador (Lefevre et al. 2020). Asimismo dentro del Plan Nacional de Conservación de Recursos Genéticos Forestales estos indicadores se contemplan como una herramienta de evaluación del progreso de las actividades realizadas en la conservación de los recursos genéticos en España. El desarrollo de estos indicadores se encontraba recogido en la Estrategia Española para la Conservación y el Uso Sostenible de los Recursos Genéticos Forestales.

Con objeto de conseguir una monitorización a largo plazo de los recursos genéticos se plantea la realización de informes periódicos que permitan hacer un seguimiento de los indicadores sobre Recursos Genéticos Forestales, que serán presentados al Comité Nacional de Recursos Genéticos Forestales para su valoración en las reuniones anuales celebradas por dicho Comité.

Indicadores sobre recursos genéticos forestales

Los indicadores utilizados son los cuatro aceptados por EUFORGEN para monitorizar el progreso dentro del marco de *Forest Europe*, incluyéndose a su vez 11 verificadores.

1. Conservación dinámica (*in situ* y *ex situ*) de poblaciones de las especies nativas
2. Conservación dinámica *ex situ* de poblaciones de especies no nativas.
3. Conservación estática *ex situ*
4. Material forestal de reproducción

Adicionalmente en España se han definido tres indicadores con 7 verificadores.

5. Amenazas a los recursos genéticos forestales
6. Poblaciones marginales y periféricas de especies forestales
7. Diversidad Genética

1. Conservación dinámica (in situ y ex situ) de poblaciones de las especies nativas (*Dynamic conservation (in situ and ex situ) of native species' populations*)

1.1. Esfuerzo en conservación dinámica (*Dynamic conservation effort*): **nb_units.** Número total de poblaciones (Unidades de conservación genética) establecidas en el país. Este valor es un elemento importante para monitorizar las actividades de conservación a nivel nacional, puesto que no están influenciadas por la clasificación y priorización Pan-europea.

1.2. Índice de diversidad de especies (Species diversity index): **ind_species.** Número de especies listadas como especies objetivo en las unidades de conservación genética / número de especies presentes en el país. Este índice se calcula a partir de las especies incluidas en el listado del anexo 1 de este documento, que están presentes en el país.

1.3. Índice de diversidad por ecozona (Ecozones diversity index): **ind_ecozones.** Número de ecozonas representadas en la red nacional de conservación / número de ecozonas que existen en el país (sumadas solo para las especies conservadas). El índice se calculará basado en las especies conservadas en el país y por las zonas ambientales existentes por especie en el país.

1.4. Índice de seguridad (Insurance index): **ind_insurance.** Número de ecozonas representadas en la red nacional de conservación con un número mínimo de 2 unidades / número de ecozonas que existen en el país (sumadas solo para las especies conservadas). El índice se calculará basado en las especies conservadas en Unidades de conservación en el país y por las zonas ambientales existentes por especie en el país.

Las "ecozonas" se utilizan en el contexto de EUFORGEN como zonas ambientales distintas donde las diferentes especies se encuentran en cada país (e.g. dos especies que se encuentran en dos zonas ambientales, respectivamente, representan un total de cuatro ecotipos). A nivel Europeo se utiliza un mapa de zonas ambientales de Europa que sigue la clasificación de Metzger et al. (2013) modificada por de Vries et al. (2015).

Tabla 1. *Verificadores de conservación dinámica en España y comparación con distintos países europeos* (Fuente EUFORGEN).

Paises	**Esfuerzo en Conservación Dinámica** Número total de poblaciones (Unidades de conservación genética) establecidas en el país	**Número de especies presentes en el país** (basado en la lista Pan-europea de especies prioritarias,)	**Número de ecozonas por país**	**Número de especies objetivo en las Unidades de Conservación (i.e., especies conservadas)**	**Índice de diversidad de especies** Número de especies listadas como especies objetivos en las unidades de conservación genética / número de especies presentes en el país	**Número de ecozonas presentes en el país (sumada sobre todas las especies conservadas)**	**Número de ecozonas en las Unidades de conservación**	**Número de ecozonas conservadas con un número mínimo de 2 unidades de Conservación**	**Índice de diversidad de Ecozonas** Número de ecozonas representadas en la red nacional de conservación / número de ecozonas que existen en el país (sumadas solo para las especies conservadas)	**Índice de seguridad** Número de ecozonas representadas en la red nacional de conservación con un número mínimo de 2 unidades / número de ecozonas que existen en el país (sumadas solo para las especies conservadas)
Dinamarca	**218**	44	3	21	**0.477**	39	29	22	**0.744**	**0.564**
Estonia	**10**	36	1	3	**0.083**	3	3	2	**1**	**0.667**
Finlandia	**63**	33	2	10	**0.303**	14	14	12	**1**	**0.857**
Francia	**101**	94	5	10	**0.106**	37	19	11	**0.514**	**0.297**
Islandia	**1**	3	2	1	**0.333**	2	1	0	**0.5**	**0**
Italia	**222**	104	7	32	**0.308**	129	60	38	**0.465**	**0.295**
Noruega	**38**	23	3	10	**0.435**	20	12	11	**0.6**	**0.55**
Polonia	**537**	63	4	23	**0.365**	63	39	33	**0.619**	**0.524**
Eslovenia	**39**	72	5	22	**0.306**	56	27	9	**0.482**	**0.161**
España	**308**	80	8	17	**0.213**	75	59	51	**0.787**	**0.680**

A nivel español, se utiliza la clasificación de RIUS (García del Barrio et al. 2001, García del Barrio et al. 2005) por ser un mapa adecuado a la utilización de MFR. Además coinciden con las regiones de procedencia del método divisivo de muchas especies. Para las estadísticas por especie se utilizan las regiones de procedencia definidas para dichas especies.

Tabla 2. *Verificadores de conservación dinámica por especie a partir de las Regiones de procedencia*.

		Conservación dinámica		
Especie	RP	UC	Ratio UC	Respaldo
Abies alba Mill.	6	6	1.000	0.000
Betula pendula Roth.	20	4	0.200	0.000
Castanea sativa Mill.	42	20	0.476	0.000
Fagus sylvatica L.	18	24	1.333	0.000
Fraxinus excelsior L.	17	13	0.765	0.000
Juniperus thurifera L.	28			
Pinus halepensis Mill.	20	19	0.950	0.000
Pinus nigra Arn.	14	16	1.143	2.000
Pinus pinaster Ait.	28	44	1.571	16.000
Pinus pinea L.	12	12	1.000	0.000
Pinus sylvestris L.	19	22	1.158	3.000
Pinus uncinata Mill.	5			
Populus alba L.	48			
Populus nigra L.	46	17	0.370	0.000
Quercus ilex L.	28	27	0.964	0.000
Quercus petraea Liebl.	14	14	1.000	0.000
Quercus pubescens Willd.	6	0	0.000	0.000
Quercus pyrenaica Willd.	28	25	0.893	0.000
Quercus robur L.	12	9	0.750	0.000
Quercus suber L.	26	21	0.808	0.000
Taxus baccata L.	26	19	0.731	0.000

2. Conservación dinámica ex situ de poblaciones de especies no nativas. (*Dynamic conservation ex situ of populations of non-native species*)

2.1 Número de poblaciones de conservacion dinámica *ex situ* de especies no nativas (*Number of dynamic conservation populations of non-native species*): **nb_units_non_native**

Actualmente no se cuenta en España con unidades de conservación dinámica ex situ de especies no nativas. El Banco de Germoplasma Forestal en Red está definiendo su protocolo de actuación. Por tanto no se ha implementado este indicador.

3. Conservación estática *ex situ* (*Static ex situ conservation*)

3.1 Número de colecciones (incluyendo archivos clonales y colecciones de germoplasma que reúnen los requisitos mínimos). (*Number of collections -including clonal archives and genebank collections meeting the minimum requirements*): **nb_collections**

Actualmente EUFORGEN no ha definido los requisitos mínimos, y en España el Banco de Germoplasma Forestal en Red está definiendo su protocolo de actuación. Por tanto no se ha implementado este indicador.

4. Material forestal de reproducción (Forest reproductive material production)

- El MFR identificado proviene de un material de base que es bien una fuente semillera o un rodal localizado en una única región de procedencia, sin una calidad superior reconocida.
- El MFR seleccionado proviene de rodales registrados que han sido seleccionados en base a sus

características fenotípicas superiores, e.g. mejor forma, crecimiento, estado sanitario.

- El MFR cualificado procede de poblaciones registradas (huertos semilleros, progenitores e familias, mezclas de clones) o clones, cuyos individuos han sido seleccionados fenotípicamente por sus características superiores.
- El MFR controlado, proviene de poblaciones registradas o clones donde los componentes han sido evaluados genéticamente y han demostrado su superioridad. Alternativamente, se puede haber demostrado la superioridad del mismo material de reproducción mediante ensayos comparativos.

Se utilizan los siguientes verificadores:

- Número total de unidades de producción de MFR (para cada categoría) *(Total number of FRM production units -for each of the 4 categories)*

4.1 Nb_Ident
4.2 Nb_Selec
4.3 Nb_Cual
4.4 Nb_Cont

- Número total de especies para las que hay al menos una unidad de Materiales de Base.

4.5 Nb_especies_FRM

Los verificadores 4.1 a 4.4. se calculan para cada especie. En la tabla 3 se recogen los valores por especie. El Área de Recursos Genéticos del MAPA elabora un informe específico sobre el Registro Nacional de Materiales de Base con información más completa. Se plantea la necesidad de armonizar los informes para facilitar el seguimiento y análisis de las necesidades de conservación y mejora de Recursos Genéticos.

Tabla 3. *Verificadores de material forestal de reproducción.* (N_RP: número de regiones de procedencia de la especie, Nb_ident, Nb_selec, Nb_cual y Nb_Cont: número de unidades de Materiales de base para producir materiales de base de las categorías identificada, seleccionada, cualificada y controlada respectivamente)

Especie	Regulacion FRM	N RP	Nb_Ident	Nb_Selec	Nb_Cual	Nb_Cont
Abies alba Mill.	Directive EU	6	18	2		
Abies cephalonica Loud.	Directive EU	na	0	0		
Abies grandis Lindl.	Directive EU	na	0	0		
Abies pinsapo Boiss.	Directive EU	3	5	0		
Acer campestre		na	0	0		
Acer monspessulanum		na	0	0		
Acer opalus		na	0	0		
Acer platanoides L.	Directive EU	6	2	0		
Acer pseudoplatanus L.	Directive EU	19	44	0	3	0
Alnus glutinosa Gaertn.	Directive EU	34	263	0		
Alnus incana Moench	Directive EU	na	0	0		
Arbutus canariensis Veill.	RD289/03	5	5	0		
Arbutus unedo L.	RD289/03	47	158	0		
Betula pendula Roth.	Directive EU	20	6	0		
Betula pubescens Ehrh.	Directive EU	23	132	0		
Carpinus betulus L.	Directive EU	1	1	0		
Castanea sativa Mill.	Directive EU	42	433	5		
Castanea sativa hibrid	RD289/03	na	0	1	23	16
Cedrus atlantica	Directive EU	na	0	0		
Cedrus libani	Directive EU	na	0	0		
Celtis australis		na	0	0		

Especie	Regulacion FRM	N RP	Nb_Ident	Nb_Selec	Nb_Cual	Nb_Cont
Corylus avellana		na	0	0		
Fagus sylvatica L.	Directive EU	18	279	20		
Frangula alnus		na	0	0		
Fraxinus angustifolia Vahl.	Directive EU	46	385	0		
Fraxinus excelsior L.	Directive EU	17	78	0		
Fraxinus ornus		na	0	0		
Ilex aquifolium L.	RD289/03	30	157	0		
Juglans nigra	RD289/03	na	3	0	7	0
Juglans regia L.	RD289/03	42	72	0	6	0
Juglans sp. (Hibridos)	RD289/03	na	0	0	9	0
Juniperus communis L.	RD289/03	31	196	0		
J*uniperus oxycedrus* L.	RD289/03	45	278	0		
Juniperus phoenicea L.	RD289/03	41	158	0		
Juniperus thurifera L.	RD289/03	28	212	0		
Juniperus spp.	genus	na	0	0		
Larix decidua Mill.	Directive EU	6	1	0		
Larix kaempferi	Directive EU	na	1	0		
Larix sibirica	Directive EU	na	0	0		
Larix x eurolepis	Directive EU	na	0	0		
Malus sylvestris		na	0	0		
Olea europea Brot.	RD289/03	50	60	0		
Phoenix canariensis Hort.	RD289/03	5	4	0		
Picea abies	Directive EU	na	0	0		
Picea sitchensis	Directive EU	na	2	0		
Pinus brutia	Directive EU	na	0	0		
Pinus canariensis Mill.	Directive EU	6	22	11		
Pinus cembra L.	Directive EU	na	0	0		
Pinus contorta Loud.	Directive EU	na	0	0		
Pinus halepensis Mill.	Directive EU	20	356	13	1	0
Pinus leucodermis	Directive EU	na	0	0		
Pinus nigra subsp. nigra	Directive EU	na	0	0	2	0
Pinus nigra subsp. salzmannii	Directive EU	14	197	25	2	0
Pinus nigra Arn. ssp corsicana	Directive EU	na	3	0		
Pinus pinaster Ait.	Directive EU	28	321	41	4	3
Pinus pinea L.	Directive EU	12	99	12	10	5
Pinus radiata D. Don.	Directive EU	27	23	27	31	5
Pinus sylvestris L.	Directive EU	19	210	59	4	0
Pinus uncinata Mill.	RD289/03	5	28	3	1	0
Pistacia atlantica Desf.	RD289/03	4	5	0		
Populus alba L.	Directive EU	48	264	0		
Populus alba var.canescens	Directive EU	na	2	0		
Populus deltoides	Directive EU	na	0	0	0	2
Populus nigra L.	Directive EU	46	291	0	0	3
Populus tremula L.	Directive EU	24	107	0		

Especie	Regulacion FRM	N RP	Nb_Ident	Nb_Selec	Nb_Cual	Nb_Cont
Populus spp. híbridos artificiales	Directive EU	na	0	0	1	20
Prunus avium L.	Directive EU	34	198	0	13	0
Prunus padus		na	0	0		
Pseudotsuga menziesii Franco	Directive EU	24	15	5	2	0
Quercus canariensis Willd.	RD289/03	5	15	0		
Quercus cerris	Directive EU	na	0	0		
Quercus coccifera L.	RD289/03	35	194	0		
Quercus faginea Lam.	RD289/03	26	282	0		
Quercus ilex L.	Directive EU	28	735	0		
Quercus petraea Liebl.	Directive EU	14	97	9		
Quercus pubescens Willd.	Directive EU	6	21	0		
Quercus pyrenaica Willd.	RD289/03	28	362	0		
Quercus robur L.	Directive EU	12	107	20		
Quercus rubra L.	Directive EU	13	14	14		
Quercus suber L.	Directive EU	26	178	123		
Robinia pseudoacacia L.	Directive EU	32	3	0		
Sorbus aria Crantz.	RD289/03	32	151	0		
Sorbus aucuparia L.	RD289/03	22	152	0		
Sorbus domestica		na	0	0		
Sorbus torminalis		na	0	0		
Tamarix africana		na	0	0		
Tamarix gallica L.	RD289/03	28	42	0		
Taxus baccata L.	RD289/03	26	100	0		
Tetraclinis articulata Masters.	RD289/03	1	6	0		
Tilia cordata Mill.	Directive EU	14	5	0		
Tilia platyphyllos Scop.	Directive EU	18	38	0		
Ulmus glabra Huds	RD289/03	19	25	0		
Ulmus laevis		na	0	0		
Ulmus minor Mill.	RD289/03	47	103	0	7	0

En cuando al número de especies: **Nb_especies_FRM= 67**

13 especies incluidas en la Directiva del Consejo 1999/105/CE y con consumo de MFR en España, no tienen registrados Materiales de Base.

5. Amenazas a los recursos genéticos forestales

Este es un indicador de la presión a la que están sometidos los recursos genéticos, y en general está relacionado con acciones de otros sectores (por ej., urbanismo, agricultura, etc.):

5.1 Poblaciones cuya presencia está amenazada según predicciones climáticas: **N_Rp**

5.2 Riesgo de introgresión de unidades de conservación por materiales alóctonos. Se calcula el porcentaje de RIUS en la que la especie tiene poblaciones con riesgo de introgresión. **%_Intro**

El indicador 5.1., no se ha implementado al no disponer de las proyecciones climáticas para la mayoría de las especies.

El indicador 5.2 se incluye en la tabla 4.

Tabla 4. *Riesgo de introgresión.*

Especie	**%_Int**	Especie	**%_Int**
Abies alba Mill.	33.33	*Pinus nigra* Arn.	0.00
Abies pinsapo Boiss.	50.00	*Pinus pinaster* Ait.	26.47
Acer platanoides L.	0.00	*Pinus pinea* L.	33.33

Especie	**%_Int**	Especie	**%_Int**
Acer pseudoplatanus L.	26.32	*Pinus sylvestris* L.	0.00
Alnus glutinosa Gaertn.	0.00	*Pinus uncinata* Mill.	80.00
Arbutus canariensis Veill.	0.00	*Pistacia atlantica* Desf.	0.00
Arbutus unedo L.	0.00	*Prunus avium* L.	0.00
Betula pendula Roth.	0.00	*Quercus canariensis* Willd.	55.56
Betula pubescens Ehrh.	17.39	*Quercus coccifera* L.	0.00
Carpinus betulus L.	0.00	*Quercus faginea* Lam.	32.56
Castanea sativa Mill.	0.00	*Quercus ilex* L.	35.42
Fagus sylvatica L.	0.00	*Quercus petraea* Liebl.	35.29
Fraxinus angustifolia Vahl.	0.00	*Quercus pubescens* Willd.	62.50
Fraxinus excelsior L.	0.00	*Quercus pyrenaica* Willd.	41.67
Ilex aquifolium L.	0.00	*Quercus robur* L.	26.67
Juglans regia L.	0.00	*Quercus suber* L.	55.56
Juniperus communis L.	0.00	*Sorbus aria* Crantz.	0.00
Juniperus oxycedrus L.	0.00	*Sorbus aucuparia* L.	0.00
Juniperus phoenicea L.	0.00	*Tamarix gallica* L.	0.00
Juniperus thurifera L.	0.00	*Taxus baccata* L.	0.00
Olea europea Brot.	0.00	*Tilia cordata* Mill.	0.00
Phoenix canariensis Hort.	0.00	*Tilia platyphyllos* Scop.	0.00
Pinus canariensis C. Smith.	40.00	*Ulmus glabra* Huds	0.00
Pinus halepensis Mill.	0.00	*Ulmus minor* Mill.	0.00

6. Poblaciones marginales y periféricas de especies forestales

Forest Europe incluye un indicador (4.6) sobre especies amenazadas. Sin embargo, el indicador que definimos está relacionado con los recursos genéticos forestales, pero al nivel poblacional. Como primera aproximación se incluye para las especies con regiones de procedencia establecidas por el método aglomerativo, el número de regiones de procedencia

6.1 Numero de poblaciones marginales y periféricas. **Nb_marginales**

Tabla 5. *Poblaciones marginales y periféricas*.

Especie	Nb_marginales	RP
Abies alba Mill.	3	6
Abies pinsapo Boiss.*	3	3
Fagus sylvatica L.*	5	18
Pinus canariensis Sm.	2	6
Pinus halepensis Mill.*	3	20
Pinus nigra Arn.*	5	14
Pinus pinaster Ait.	7	27
Pinus pinea L.	4	11
Pinus sylvestris L.*	5	19
Pinus uncinata Ram.	3	5
Quercus canariensis Will.	4	5
Quercus faginea Lamk.	8	26
Quercus ilex L.	11	28
Quercus pyrenaica Wild.	11	27
Quercus robur L.	5	14
Quercus petraea Liebl.	5	14
Quercus pubescens *	1	6
Quercus suber L.	15	24
Total	100	273

* No se definieron en las monografías de regiones de procedencia, pero se consideran aquellas con características similares.

7. Diversidad Genética

7.1 Poblaciones con estudios con marcadores genéticos (se incluye información sobre el tipo de marcadores): **N_marc**

7.2 Poblaciones presentes en ensayos genéticos (Genfored): **N_ens**

Tabla 6. *Indicadores de diversidad genética*.

	Diversidad Genética				
Especie	N Pob	isoenz	CpSSR	SNPs	ratio gen
Abies alba Mill.	2	0	0	2	0.333
Betula pendula Roth.	2	0	0	2	0.100
Castanea sativa Mill.	17	17	0	0	0.405
Fagus sylvatica L.	2			2	0.111
Fraxinus excelsior L.					0.000
Juniperus thurifera L.	13	13	0	0	0.464
Pinus halepensis Mill.	46	15	13	6	2.300
Pinus nigra Arn.	24	8	18	4	1.714
Pinus pinaster Ait.	86	32	36	38	3.071
Pinus pinea L.	18	7	5	0	1.500
Pinus sylvestris L.	30	14	29	2	1.579
Pinus uncinata Mill.	6	6	0	6	1.200
Populus alba L.	7	7	0	0	0.146
Populus nigra L.	2			2	0.043
Quercus ilex L.	65	8	0	57	2.321
Quercus petraea Liebl.	2			2	0.143
Quercus pubescens Willd.					0.000
Quercus pyrenaica Willd.					0.000
Quercus robur L.					0.000
Quercus suber L.	27	27	0	0	1.038
Taxus baccata L.	28	0	0	28	1.077

Annex 2. List of species for *ex situ* conservation.

List of forest species for ex situ conservation.

Abies alba Mill.	*Ephedra fragilis* Desf. subsp. *fragilis*
Abies pinsapo Boiss.	*Ephedra nebrodensis* Tineo ex Guss. subsp. *nebrodensis*
Acer campestre L.	*Erica* spp.
Acer monspessulanum L.	*Euonymus* spp.
Acer opalus Mill.	*Fagus sylvatica* L.
Acer platanoides L.	*Frangula alnus* Mill.
Acer pseudoplatanus L.	*Fraxinus angustifolia* Vahl.
Adenocarpus spp.	*Fraxinus excelsior* L.
Alnus glutinosa (L.) Gaertn.	*Fraxinus ornus* L.
Amelanchier ovalis Medik.	*Genista* spp.
Anthyllis cytisoides L.	*Halimium* spp.
Apollonias barbujana (Cav.) Bornm.	*Heberdenia excelsa* (Ait.) Banksex DC.
Arbutus canariensis Veill.	*Ilex aquifolium* L.
Arbutus unedo L. (**)	*Ilex canariensis* Poir.
Arctostaphylos uva-ursi (L.) Spreng.	*Ilex perado* Ait.
Atriplex halimus L.	*Jasminum fruticans* L.
Berberis vulgaris L.	*Juglans* spp.
Betula pendula Roth	*Juniperus cedrus* Webb & Berth.
Betula pubescens Ehrh.	*Juniperus communis* L.
Buxus balearica Lam.	*Juniperus navicularis* Gand.
Buxus sempervirens L.	*Juniperus oxycedrus*L.
Calicotome spp.	*Juniperus phoenicea*L.
Calluna vulgaris (L.) Hull	*Juniperus sabina* L.
Carpinus betulus L.	*Juniperus thurifera* L.
Castanea crenata Seibold&Zucc.	*Laurus azorica* (Seub.) Franco
Castanea sativa Mill.	*Laurus nobilis* L.
Celtis australis L.	*Lavandula* spp.
Ceratonia siliqua L.	*Ligustrum vulgare* L.
Chamaerops humilis L.	*Lonicera* spp.
Cistus spp.	*Lycium* spp.
Cneorum tricoccon L.	*Malus sylvestris* Mill.
Colutea arborescens L.	*Maytenus senegalensis* (Lam.) Exell
Colutea brevialata Lange	*Morus alba* L.
Colutea hispanica Talavera & Arista	*Morus nigra* L.

Cornus sanguinea L. subsp. *sanguinea*	*Myrica faya* Aiton
Coronilla juncea L.	*Myrica gale* L.
Corylus avellana L.	*Myricaria germanica* (L.) Desv.
Cotoneaster spp.	*Myrtus communis* L.
Crataegus spp.	*Nerium oleander* L.
Cytisus spp.	*Ocotea foetenes*(Ait.) Baill.
Daphne spp.	*Olea europea* var.*sylvestris* Brot.
Dorycnium pentaphyllum Scop.	*Osyris alba* L.
Dracaena draco L.	*Quercus robur* L.
Ephedra distachya L. subsp. *distachya*	*Quercus rubra* L.
Persea indica (L.) K. Spreng.	*Quercus suber* L.
Phillyrea angustifolia L.	*Retama sphaerocarpa* (L.) Boiss.
Phillyrea latifolia L.	*Rhamnus* spp.
Phoenix canariensis Hort.	*Rhus coriaria* L.
Picconia excelsa (Ait.) DC.	*Osyris lanceolata* Hochst. &Steud.
Pinus canariensis C. Smith	*Periploca angustifolia* Labill.
Pinus halepensis Mill.	*Ribes* spp.
Pinus nigra subsp. *salzmannii* (Dunal) Franco	*Rosmarinus officinalis* L.
Pinus nigra J.F. Arnold (subsp. no autóctonas)	*Rubus* spp.
Pinus pinaster Aiton.	*Salix* spp.
Pinus pinea L.	*Sambucus nigra* L.
Pinus radiata D. Don	*Sideroxylon marmulano* Banks ex Lowe
Pinus sylvestris L.	*Sorbus* spp.
Pinus uncinata Ramond ex DC.	*Spartium junceum* L. (**)
Pistacia atlantica Desf.	*Tamarix* spp.
Pistacia lentiscus L.	*Taxus baccata* L.
Pistacia terebinthus L.	*Tetraclinis articulata* (Vahl) Mast.
Platanus spp.	*Teucrium* spp.
Pleiomeris canariensis (Willd.) A.DC.	*Thymbra capitata* (L.) Cav.
Populus alba L.	*Thymus* spp.
Populus nigra L.	*Tilia cordata* Mill.
Populus tremula L.	*Tilia platyphyllos* Scop. subsp. *Platyphyllos*
Populus spp. no autóctonos	*Ulmus glabra* Huds.
Prunus spp.	*Ulmus laevis* Pall.
Pseudotsuga menziesii Franco	*Ulmus minor* Mill. *s.l.*
Punica granatum L.	*Vaccinium myrtillus*L.
Pyrus spp.	*Viburnum lantana* L.

Quercus canariensis Willd.	*Viburnum opulus* L.
Quercus coccifera L.	*Viburnum tinus* L.
Quercus faginea Lam.	*Visnea mocanera* L.
Quercus ilex L.	*Vitex agnus-castus* L.
Quercus lusitanica Lam.	*Vitis vinifera* subsp. *sylvestris* (C.C.Gmel.) Beger&Hegi
Quercus petraea (Matt.) Liebl.	*Withania frutescens* (L.) Pauquy
Quercus pubescens Willd.	*Ziziphus jujuba* Mill.
Quercus pyrenaica Willd.	*Ziziphus lotus* (L.) Lam.

(**) Invasive species in the Canary islands, and the ex situ conservation should not be promoted in the region.

List of wild flora species for *ex situ* conservation.

Beside the species included in the former list, the species included in the list of wild flora under special protection or the Spanish catalogue of threaten species should be considered.

Annex 3. Use of forest reproductive material.

Surface planted in Spain by species or mixture of species. Mean (in ha), for the period 2006-2015. The plantations are established for production, protection or under the abandoned agrarian lands schemes.

Especie	Abandoned agrarian lands	Production	Protection	Total
Abies alba	0,000	0,000	0,254	0,254
Acer campestre	2,097	0,000	0,617	2,714
Acer monspessulanum	0,070	0,000	2,978	3,048
Acer pseudoplatanus	0,000	3,809	1,766	5,575
Alnus glutinosa	0,000	2,600	2,086	4,686
Arbutus unedo	0,000	0,000	4,539	4,539
Betula pendula	30,619	0,000	0,200	30,819
Betula pubescens	0,923	29,279	16,882	47,084
Castanea sativa	16,421	56,625	25,166	98,212
Castanea sativa Hibridos artificiales	5,109	185,253	0,000	190,362
Celtis australis	0,135	0,000	0,882	1,017
Ceratonia siliqua	0,000	0,000	1,127	1,127
Coronilla juncea	0,000	0,000	12,558	12,558
Crataegus monogyna	0,000	0,000	10,274	10,274
Ephedra fragilis	0,000	0,000	7,642	7,642
Fagus sylvatica	10,312	6,979	71,107	88,398
Ficus carica	0,000	0,000	1,322	1,322
Fraxinus angustifolia	3,027	1,890	27,293	32,210
Fraxinus excelsior	0,362	2,097	2,090	4,549
Ilex aquifolium	0,500	0,000	4,264	4,764
Juglans nigra	0,710	1,011	0,317	2,038
Juglans regia	8,581	3,638	6,574	18,792
Juniperus communis	0,000	0,000	0,591	0,591
Juniperus oxycedrus	0,000	0,000	12,498	12,498
Juniperus phoenicea	0,000	0,000	10,922	10,922
Juniperus thurifera	0,117	0,783	10,393	11,293
Juniperus turbinata	0,000	0,000	0,200	0,200
Myrica faya	0,000	0,000	0,700	0,700
Olea europaea	1,035	0,000	53,650	54,685
Periploca laevigata	0,000	0,000	8,930	8,930
Pinus canariensis	0,000	0,000	43,173	43,173
Pinus halepensis	35,330	4,117	512,349	551,796
Pinus nigra	116,246	49,556	315,154	480,956
Pinus pinaster	322,958	1721,786	739,840	2784,584
Pinus pinea	187,970	2,498	266,581	457,049
Pinus radiata	139,583	1109,010	94,842	1343,435
Pinus sylvestris	105,307	364,158	748,305	1217,770
Pinus uncinata	0,000	0,000	42,186	42,186
Platanus hispanica	0,000	0,000	0,150	0,150
Populus alba	0,190	0,000	17,560	17,751
Populus canescens	0,000	0,000	0,140	0,140
Populus nigra	1,001	0,150	18,071	19,222

Especie	Abandoned agrarian lands	Production	Protection	Total
Populus sp. Hibridos artificiales	0,435	166,128	0,000	166,563
Populus tremula	0,000	0,000	0,125	0,125
Prunus avium	16,958	14,452	11,963	43,373
Prunus dulcis	0,000	3,457	10,771	14,228
Pseudotsuga menziesii	9,527	105,074	10,018	124,619
Quercus coccifera	6,085	0,000	25,351	31,436
Quercus faginea	5,322	0,600	40,645	46,567
Quercus ilex	281,812	36,680	406,599	725,091
Quercus petraea	8,143	1,811	36,712	46,666
Quercus pubescens	0,000	0,076	0,008	0,084
Quercus pyrenaica	6,606	0,000	78,157	84,763
Quercus robur	0,353	79,209	40,981	120,543
Quercus suber	137,538	15,888	661,468	814,894
Salix alba	0,000	0,000	2,801	2,801
Salix atrocinerea	0,000	0,000	0,194	0,194
Salix eleagnos	0,000	0,000	1,970	1,970
Sorbus aria	0,000	0,000	5,592	5,592
Sorbus aucuparia	0,146	0,000	5,139	5,285
Sorbus domestica	3,024	0,000	2,955	5,979
Sorbus torminalis	0,000	0,000	0,561	0,561
Tamarix africana	0,000	0,000	0,149	0,149
Tamarix gallica	6,647	0,000	6,235	12,882
Taxus baccata	0,603	0,000	4,505	5,108
Tetraclinis articulata	0,000	0,000	2,500	2,500
Tilia cordata	0,000	0,000	0,232	0,232
Tilia platyphillos	0,000	0,040	0,302	0,342
Ulmus laevis	0,000	0,000	0,135	0,135
Ulmus minor	0,000	0,000	0,127	0,127
Abies grandis	0,000	0,150	0,000	0,150
Cedrus atlantica	0,000	3,455	0,757	4,212
Chamaecyparis lawsoniana	0,000	0,795	0,000	0,795
Chamaecyparis lawsoniana	0,000	0,795	0,000	0,795
Cupressus semprevirens	0,000	0,000	0,256	0,256
Cupressus semprevirens	0,000	0,000	0,256	0,256
Fraxinus ornus	0,000	0,000	2,825	2,825
Larix decidua	0,000	2,943	0,000	2,943
Larix kaempferi	0,000	6,122	0,000	6,122
Malus sylvestris	0,000	0,000	0,882	0,882
Picea abies	0,000	2,583	0,000	2,583
Pinus nigra var. corsicana	0,000	3,687	0,000	3,687
Pinus taeda	0,000	6,913	0,000	6,913
Pinus taeda	0,000	6,913	0,000	6,913
Platanus hybrida	0,000	0,021	0,000	0,021
Platanus hybrida	0,000	0,021	0,000	0,021
Prunus padus	0,000	0,000	0,060	0,060
Quercus rubra	2,541	119,493	3,686	125,720

Especie	Abandoned agrarian lands	Production	Protection	Total
Robinia pseudoacacia	0,000	1,837	0,000	1,837
Sequoia sempervirens	0,000	18,063	0,000	18,063
Sequoia sempervirens	0,000	18,063	0,000	18,063
Eucalyptus globulus	7,419	61,782	0,000	69,201
Eucalyptus sp.	0,000	195,704	18,632	214,336
Híbridos artificiales *Populus* sp..	0,000	388,553	0,390	388,943
Populus sp.	25,817	193,674	20,523	240,013
Populus x *canadensis*	1,689	7,555	0,000	9,244
Abies sp.	0,097	0,000	0,000	0,097
Acer sp.	0,000	0,000	0,749	0,749
Betula sp.	0,000	18,687	22,513	41,200
Fraxinus sp.	0,096	0,537	1,284	1,917
Juniperus sp.	0,000	0,000	4,880	4,880
Larix sp.	0,000	0,421	8,495	8,916
Prunus sp.	0,149	4,113	2,402	6,664
Pyrus sp.	0,000	0,000	1,345	1,345
Quercus sp.	0,194	2,649	137,357	140,200
Rhamnus sp.	0,074	0,000	3,125	3,199
Salix sp.	0,027	0,000	1,921	1,949
Sambucus sp.	0,000	0,000	0,887	0,887
Ulmus sp.	0,000	0,000	3,544	3,544
Pinus sp.	4,979	12,023	0,500	17,502
Sorbus sp.	0,000	0,439	0,466	0,905
Pistacia sp.	0,000	0,000	56,678	56,678
Coníferas- otras	4,205	23,399	17,491	45,095
Coníferas sin identificar	0,000	1,270	174,911	176,181
Frondosas - otras	19,284	5,242	122,347	146,873
Frondosas nobles de turno medio	0,000	42,356	1,500	43,856
Frondosas sin identificar	0,000	4,912	83,079	87,991
Laurisilva	0,000	1,693	31,610	33,303
Matorrales	2,099	0,000	84,794	86,893
Mezcla de coníferas	79,115	60,057	76,179	215,351
Mezcla de frondosas	435,303	270,927	2827,309	3533,539
Mezclas	1124,193	36,543	4453,743	5614,479
Sin identificar	0,000	146,025	1323,316	1469,341
Total general	3179,267	5616,400	13947,287	22742,954

Annex 4. Spanish Plan for Conservation of Forest Genetic Resources, and Spanish Forest Breeding Plan.

El plan de conservación genética se ha organizado (Figura 1) definiendo:

- ✓ Marco temporal
- ✓ Objetivos
- ✓ Metas
- ✓ Líneas de actuación y acciones recomendadas
- ✓ Verificadores
- ✓ Medidas presupuestarias y otros tipos de ayudas
- ✓ Participantes

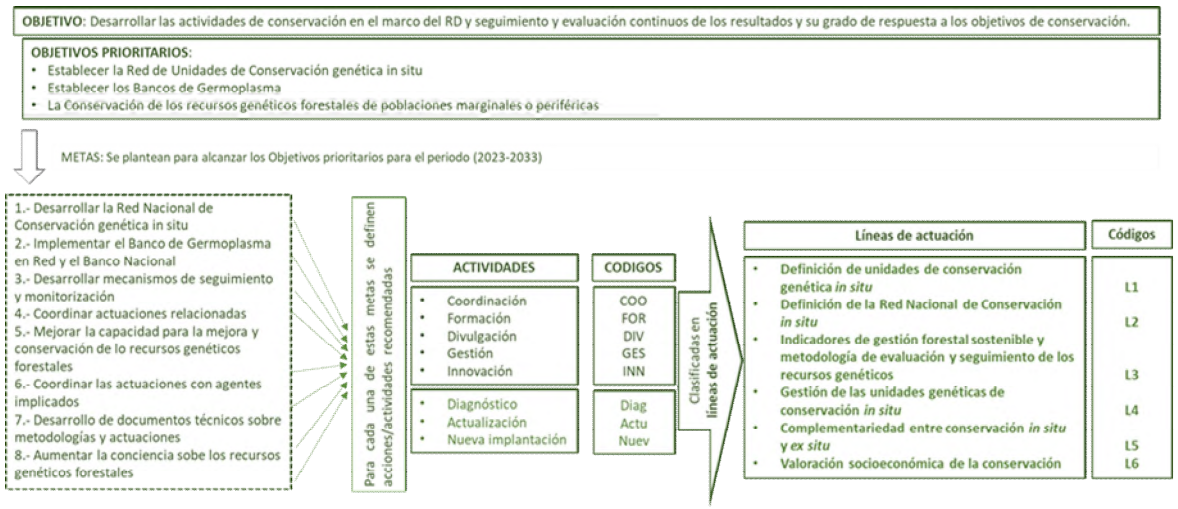

Figura 1. Esquema del Plan Nacional de Conservación de Recursos Genéticos Forestales

El Plan Nacional de Mejora Genética Forestal tiene como objetivos:

- Crear programas nacionales de mejora genética sobre especies del Anexo I de la Directiva 1999/105/CE.
- Coordinar las actividades de distintas administraciones y promover acciones para la obtención de materiales forestales de reproducción mejorados de modo que se garantice el cumplimiento de las funciones económicas, sociales y/o ecológicas de los montes.

Los objetivos prioritarios para el primer periodo de vigencia del Plan (2022-2031) son los siguientes:

- Creación de programas nacionales de mejora genética
- Caracterización de materiales de base y de reproducción.
- Caracterización de recursos genéticos poco utilizados para su uso en programas de mejora frente al cambio global y aumento de la biodiversidad.