COUNTRY REPORT ON THE STATE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

ITALY

SECOND COUNTRY REPORT TO THE FAO ON THE STATE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

ITALY

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EXECUTIVE SUMMARY

This second Report on the State of Italy's plant genetic resources for food and agriculture (PGRFA) aims to give an update on the development on national activities towards the conservation and sustainable utilization of these resources since 1995 when the first Report was produced.

The ratification of the Convention on Biological Diversity in the early nineties, of the Global Plan of Action in 1996 and of the International Treaty on PGRFA in 2004, have contributed to drive the attention of the media and to raise awareness among the public and decision-makers on the importance of PGRFA. This has resulted in concrete actions, carried out not only by specific Research Institutions, but also by other stakeholders, at regional and provincial levels.

Over the past twelve years, one of the most significant developments is represented by the increased number of institutions involved in PGRFA *ex situ* conservation activities and, along with it, by the enlarged gene pool conserved.

It is becoming more and more evident that an effective national coordination of all the initiatives which are currently being undertaken is urgently needed, not only for the sake of the germplasm itself, but also in order to be able to rationally manage the genetic material present on the Italian territory.

The establishment of safety duplications of existing germplasm collections, for instance, is one of the outstanding necessities to be targeted. So far, only the National Collection of Fruit Tree Germplasm and the National Olive Collection, both held by Institutions of the Council for Research in Agriculture, can be considered reliable facilities for the duplication of accessions.

Awareness has much risen on the importance to assess, conserve and manage PGR not only *ex situ*, but also on-farm and *in situ*, in the context of their agro- and natural ecosystems. As a consequence, surveys on local germplasm present on the Italian territory have augmented, and initiatives were developed to sustainably maintain the material in its original environments. Furthermore, protected areas have more than doubled during the last 13 years.

However, what is still needed is a comprehensive action plan to effectively manage landraces, crop wild relatives, and other PGRFA growing in their traditional surroundings.

From a legislative point of view, the ratification of the International Treaty on PGRFA has recently stimulated efforts and initiatives towards the sustainable management of PGRFA, both at national and regional levels, especially through the supervision of the Ministry of Agriculture, Alimentation and Forestry Policies, which is the main interlocutor on the implementation of the Treaty on the international floor.

The assessment, conservation, sustainable use and sharing of benefits arising from the utilization of PGRFA is more and more becoming an intersectorial issue, and the development of a clear strategy on how best to join efforts of all stakeholders, at national and international levels, is a priority target for the next future.

INTRODUCTION TO ITALY AND ITS AGRICULTURAL SECTOR

1. Geography and climate

Italy is located in Southern Europe, stretching in longitude from 5° to 18° E and in latitude from 35° to 47° N. In the North, the territory is limited by the Alps, whereas in the West, South and East the Mediterranean Sea forms the natural border of the peninsula. The largest islands are Sicily and Sardinia, located in the Southwest and West of Italy, respectively.

The climate is predominantly Mediterranean, characterized by hot and dry summers and mild and humid winters. Medium summer temperatures reach 26°C, while in winter, they usually do not fall under 5°C, so that throughout the year, medium temperatures are lying around 15°C. The Northern part of the peninsula, however, is exposed to a more continentally influenced, temperate climate, with lower average temperatures and higher temperature differences between summer and winter. Precipitation occurs mainly from autumn to early spring, and medium annual rates are about 650 mm.

The total national surface is 301 336 km^2, of which about one third consists of mountains and one quarter of plains, while the rest of the territory is covered by hills (see Table 1). Main mountainous massives are the Alpine ridge in the North and the Apennines mountains which stretch southwards for about 800 km in the centre of the peninsula. The Po valley and the Venetian plains in the South of the Alps form the largest plain land in Italy. Several smaller lowlands are scattered all over the peninsula.

The heterogeneous topography, in combination with the climatically manifold conditions, ranging from alpine-continental to subtropical-maritime, leads to the formation of many different microclimates which allow, for example, the cultivation of subtropical species also in the North of the country (for example, lemons in Liguria).

TABLE 1
Topographical division of Italy

	km^2	%
Mountains (> 600 m)	106 101	35
Hills (< 600 m)	125 419	42
Plains	69 807	23

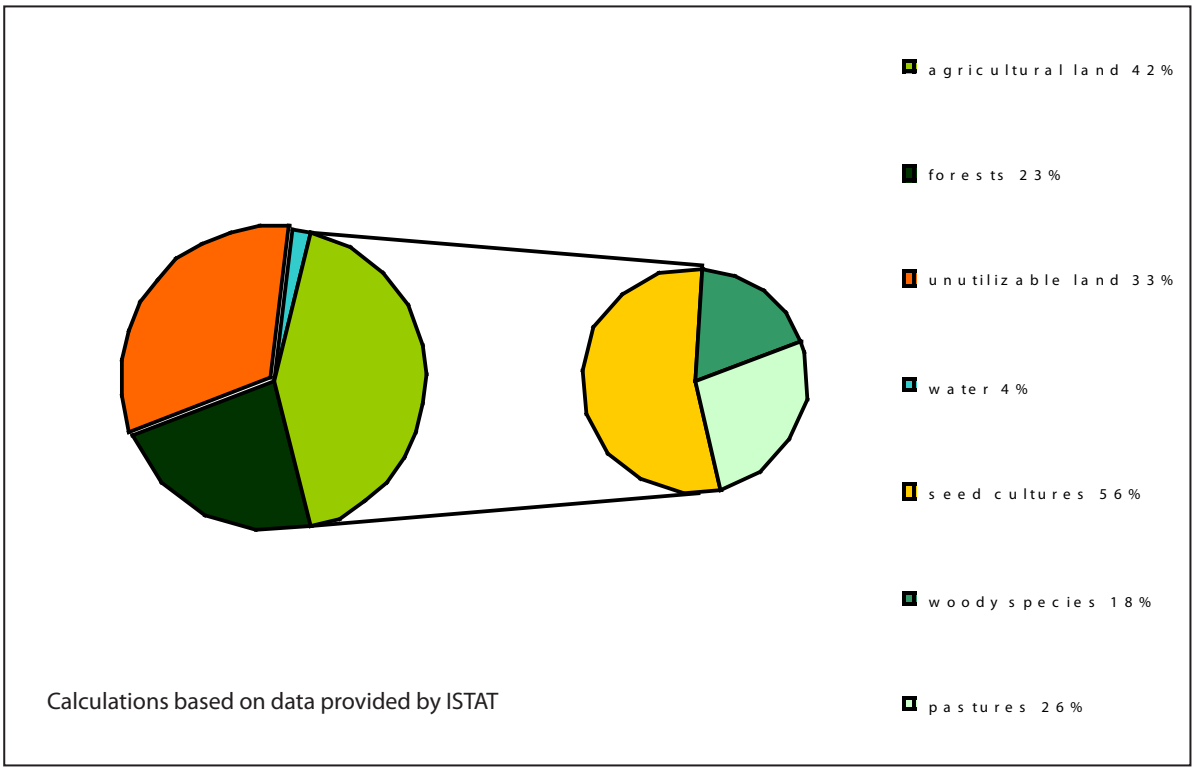
Source: ISTAT

FIGURE 1
The regions of Italy

2. Agriculture

Currently, about 40% of Italy's territory (127 079 km^2) is used for agriculture; seed cultures, mainly cereals, occupy more than half of this surface (7 075 224 ha), followed by pastures (3 346 951). Woody species (fruits, olive, grapevine, and forest species) are cultivated on 3 346 951 ha, which corresponds to 18% of the cultivated area.

FIGURE 2
Land use in Italy



Unutilizable land: human settlements, roads, service stations, bare rocks, etc.

As can be seen in tables 2 and 3, both the number of farms and the cultivated surface of all agricultural crops have slightly declined since the beginning of this century. This is due to the continuous numeric decrease of farmers and to the erosion of agricultural land for the extension of factories and service areas.

The variation in production (table 3) is strongly dependent on the crops and on the predominant market tendency. Increasing rates (cereals, fruit trees and other woody species), for example, are mainly due to the improvement of genetic material (higher yields) and growing techniques (dwarfing rootstocks, training systems).

TABLE 2
Development of agricultural farms and cultivated surface (2000-2005)

	2000	2003	2005
No. agricultural farms	2 153 724	1 963 817	1 728 532
Total hectares	13 062 256	13 115 810	12 707 846
Ø ha per farm	6.1	6.7	7.4

Source: ISTAT

TABLE 3

Cultivated area and production of agricultural crops: development during the last ten years

Crop Group	Area harvested (ha)		Production (MT)		Main crops
	Ø1997-99	Ø 2005-07	Ø 1997-99	Ø 2005-07	
Cereals	4 150 457	3 899 040	20 571 738	20 709 667	Maize, Wheat, Rice
Fruits	324 294	302 543	5 461 040	5 908 135	Peach and Nectarine, Apple, Pear
Nuts	192 075	183 713	302 309	310 064	Almond, Hazelnut, Chestnut
Vegetables incl. melons	596 193	563 283	14 842 182	14 586 907	Tomatoes, Lettuce and Chicory, Carrots and Turnips
Tubers	88 804	71 444	2 094 205	1 791 392	Potatoes
Citrus	178 515	170 666	2 633 725	3 581 066	Oranges, Lemons, Tangerines
Grape	877 037	770 429	8 892 088	8 466 294	Grapevine
Olive	1 122 562	1 157 781	3 301 565	3 557 291	Olive

Source: FAO

CHAPTER 1

THE STATE OF DIVERSITY

Basic considerations

Even though the Mediterranean Basin was classified a "hot spot" for plant biodiversity by Vavilov (1927), Italy cannot be considered a primary gene pool for many agriculturally relevant crops (an overview on PGRFA indigenous to Italy has been provided in the first "Country Report").

Most species which nowadays play an essential economical and cultural role in the Italian agricultural sector were introduced to the country in the course of human migration and mercantilism since pre-Roman times; these species derive mainly from primary centres of origin located in different parts of Asia (pome and stone fruits, citrus, kiwi, almond, Pistacia vera and others) and in South America (potatoes, tomatoes, Cucumis spp. etc). The above described ecoclimatic situations provided favourable conditions to many of these species, and during centuries or even millennia of cultivation local forms were obtained by man, or ecotypes evolved in adaptation to environmental conditions and got naturalized by today (for example Cactus pear).

As a consequence of this rich secondary biological diversity, it was proposed to consider Italy a centre of origin of new crops. In this sense, Italy is particularly rich in plant diversity at European level. Nevertheless, a series of omnipresent factors severely threatens this diversity, in the agricultural context as well as in natural environments, leading to a massive reduction of inter-and intraspecific variability in the Italian flora.

In agriculture, modern, highly productive and often standardized cultivars are introduced which supplant locally adapted varieties from their traditional farmland. This genetic erosion is a serious phenomenon within all primary crop groups of agricultural importance. Programmes of on-farm conservation of landraces are being developed in order to prevent the remaining germplasm from disappearing.

Concerning the situation in natural or semi-natural habitats, increasing demand for land by man is one of the main reasons for the loss of biodiversity. Land use for urbanization leads, in most cases, to an irreversible decrease in habitats. On the other hand, the abandonment of agriculturally utilized surface offers the opportunity to non-agricultural species to re-conquer the land, but the process might be lengthy depending on the degree of degradation in which these lands were left to themselves. During the last 20 years, many of these areas have been planted with forest species (trees and shrubs), in response to EU regulations set up to halter pollution of the atmosphere and climate change. Also in this scenario, however, the risk of replacement of native species by introduced ones is high.

A comprehensive, updated survey on the flora of Italy (2005) counts a total of more than 6 700 species belonging to 1 260 genera within 196 families. Of these, however, 10% are made up of alien, allochthonous species which were introduced in the course of human trade and travel activities and which often assume invasive traits in the Italian landscape, hindering native species from settling.

The species-specific analysis on today's diversity within PGR for Food and Agriculture, presented below, includes information obtained from a recent survey on the vegetation identified in 156 Protected Areas (for further detail see Chapter 2). The Tables in Annex II show all species of cultivated crops which are reported to occur in these Protected Areas.

1.1 Cereals

Avena

The individuation, collection and conservation of genetic diversity in *Avena* has recently become an argument of international interest, very likely due to the progressive decrease of the gene pool represented in cultivated varieties. This is particularly true for Italy, where, compared to other countries, the number of genotypes of *A. sativa* (the only cultivated species) available on the market is quite low (about 20). In non-agricultural areas, specimens of *A. barbata*, *A. fatua*, *A. sativa* and *A. sterilis* can be found. Furthermore, in 1998 a distinct tetraploid *Avena* species was identified in Sicily, and named *A. insularis*.

Barley
All species considered of agricultural interest and conserved in Italy can be found in the wild. Furthermore, also *Hordeum bulbosum*, *H. leporinum*, *H. murinum* and *H. secalinum* are grow self-sown.

Rye
The cultivated species Secale cereale has been identified in the wild in Italy.

Wheat
Compared to the large number of cultivated species of *Triticum*, only few species are nowadays growing spontaneously in non-agricultural areas in Italy, namely *T. aestivum*, *T. neglectum* and *T. ovatum*.

Rice
Even though this species is not native to Italy, the country has become one of the most important producers in Europe. Climatic restrictions limit rice cultivation to varieties which belong to the species *Oryza sativa* ssp. *japonica*, but during the last hundred years breeding programmes have permitted the development of a high number of varieties; in fact, the National Register counts 140 varieties which differ considerably in morphologic, agronomic and qualitative aspects. Specimens of *Oryza sativa* are nowadays also spreading outside agricultural sites and might therefore be developing specific ecotypes. The weedy rice (*O. sativa* ssp. *sylvatica*) is one of the main weeds in rice plantations; the plant resembles very much the ones of cultivated *Oryza* (genetically and morphologically) but does not produce grains. The species is known in Italy since at least 1800. There are no studies on the genetic variability of weedy rice and no genebank holds its germplasm.

Maize
There are no wild related species of the genus *Zea* in Italy. The plant was introduced into Italian cultivation systems approximately 400 years ago and has become one of the most important cereals. Today, it is grown mainly for animal feeding. In the last decades, the Italian agricultural scenery has changed and the system of mixed farming for subsistence, operating on a more or less closed circuit system, has been transformed into a "green factory" of monocultures. This development is highly dangerous for the traditional Italian varieties which have been cultivated for centuries for human consumption and are now getting lost. Concerning cultivated varieties, the basic germplasm currently grown in Italy does not differ from the US Corn Belt hybrids and US ancestral varieties; genetic distribution of local European or even "exotic" germplasm is very limited.

1.2 Vegetables

Potatoes
Though potatoes were only introduced to Italian cultivation systems in 1580, they spread quickly over the whole peninsula, getting adapted to the most different geo-climatic conditions and developed, over the centuries, many locally adapted ecotypes which became traditional varieties. The protection and commercialization of landraces typical of the Genovese Mountains (in the Region of Liguria), for example, is the aim of a Non-Governmental Organization.

Asparagus
The genus *Asparagus* was already known in Italy during the time of the Roman Empire. A spontaneous population of *A. officinalis* occurring in the pine forests of Ravenna and from which probably all cultivated varieties of *A. officinalis* derive is the only example of wild, and still occurring, *A. officinalis* in the whole of Europe. Other wild populations along the Italian Tyrrhenian and Adriatic coasts were identified as *A. acutifolius*, *A. albus*, *A. scaber* and *A. stipularis*. Also *A. tenuifolius* can be found in the wild.

Brassica spp
Wild Brassica germplasm has been identified all over Italy, for example *B. montana* in Northern Italy, *B. incana* in Southern Italy, *B. insularis* only on the islands of Sardinia and Sicily, *B. villosa*, *B. villosa* ssp. *drepanensis* and *B. tinei* only in Sicily, and *B. macrocarpa* only on two small islands close to Sicily.

Tomatoes and peppers

Throughout the country, farmers have developed a high number of landraces and varieties, many of which are commercialized either at regional or national level, and for many of these, labels of protected provenance have been released (e.g, "Pepper of Senise").

1.3 Fruits and nuts

Species belonging to many of these crops either have wild ancestors in Europe and in part on the Italian territory or got naturalized in Italy already before Roman times.

Two of the main fruit crops, apple and pear, can be considered native to Europe including parts of the Italian territory. The cultivated apple varieties belong to the species *Malus x domestica* deriving from natural hybridization of species native to Central Asia and Europe.

Pyrus communis is the species of the cultivated pear, native to all Europe including Italy, as are some other *Pyrus* species like *P. nivalis* (Alps), *P. amygdaliformis* and its ancestor *P. pyraster* (Southern Italy). In 2004, a so far unknown pear species was found in the Nebrodi mountains in Sicily, and named *Pyrus vallis-demonis*.

Peach (*Prunus persica*) and Apricot (*Prunus armeniaca*) were introduced to Italy from China through Persia and Greece, while the plum species *Prunus domestica* and *P. insistitia* are native to Europe and of the Mediterranean Basin, as are *P. avium*, the sweet cherry, and the nut species *Prunus dulcis* (almond), *Corylus avellana* (hazelnut), *Castanea sativa* (chestnut), *Pistacia* spp. (Pistachio).

Since ancient times, cultivation and evolutionary adaptation to the environment led to the development of an elevated number of local varieties within the different crops.

The first survey on autochthonous fruit tree germplasm present in Italy, carried out in 1981 by experts of the CNR, counted several hundred autochthonous varieties of fruit species.

Recently stimulated interest in the recovery of local germplasm has lead to the identification of even more varieties of local origin. Nevertheless, it has become evident that many of these are threatened by extinction due to the extreme marginalization of their occurrence, often in not more than three or four locations, and to the restricted knowledge about these varieties which is nearly exclusively limited to individual persons who maintain the trees.

Citrus and related crops

The citron (*Citrus medica* L.) arrived in Italy from Southeastern Asia via Greece already before Christ, and the other species were introduced by the Arabs between the 10th and 13th century. The plants are widely cultivated, mainly in the Southern part of the peninsula, but also in climatically favourable mild zones of the North, like in Liguria and around the Lakes Maggiore and Garda. Selection carried out by farmers, in combination with traditional and locally adapted cultivation systems led to the development of several new varieties, mainly of lemon, some of which nowadays are considered "local", being attributed the EU label DPO, as for example the "Limone di Sorrento" and the "Limone di Amalfi".

A rich source of "ancient" germplasm are the parks and gardens (so-called "villas") established all over Italy by noble people during the 18th and 19th centuries, who appreciated the many different varieties and forms for their ornamental values and of which some trees can still be found.

Olea

Concerning the wild species related to the cultivated one (*Olea europea* ssp. *sativa*), only *O. europea* ssp. *oleaster* occurs spontaneously in the areas of the Mediterranean Maquis Shrubland. On the island of Sardinia, a protected area has been established, with the aim safeguard majestic and pluri-secular exemplars of *O. europea oleaster*. Of these individuals, 16 have already been characterized genetically, and comparisons with local varieties will help to understand better the development of the genus *Olea* in Sardinia, where a high density of *O. europea* ssp. *oleaster* can still be noted in semi-rural and natural environments. Currently, there are at least ten other specimens worth a molecular characterization.

Botanic Gardens also conserve specimens of other species like *O. laparrini* and *O. cuspidata*.

Vitis

In Italy, the wild genepool is limited to the occurrence of *V. vinifera* ssp. *sylvestris*, diffused only in few some forestal zones.

Further to the recovery and conservation of local varieties of fruit species, molecular analysis plays a crucial role in the definition of the genetic variation expressed in clones or ecotypes of the same variety and in the clarification of cases of heteronym and synonymy.

1.4 Forage crops

Genetic resources of major forage species are still present in the wild, such as the Ladino type of white clover (*Trifolium repens*) and the Italian ryegrass (*Lolium multiflorum* var. *italicum*), which originated from the irrigated natural meadows of the Northern Italian lowlands; tall festuca (*Festuca arundinacea*) and cocksfoot (*Dactylis glomerata*), major perennial grasses in the sub-Appenine and Mediterranean areas; *Lolium rigidum* and *Phalaris* spp., widespread grasses in Mediterranean areas; subterranean clover (*Trifolium subterraneum*), for which the genetic diversity found in Sardinia can be considered unique compared to other Mediterranean areas; red clover (*Trifolium pratense*), French honeysuckle (*Hedysarum coronarium*), sainfoin (*Onobrychis viciifolia*), birdsfoot trefoil (*Lotus corniculatus*), various vetches (*Vicia* spp) and other perennial or annual legumes.

Grain legumes of forage interest are rarely present in the wild, with a few exceptions, e.g. blue lupin (*Lupinus angustifolium*).

1.5 Species of industrial use

The most important species for Italian agriculture is sugar beet. The genus ***Beta*** is made up of 11 species, whose wild forms are distributed mainly along the Mediterranean and Atlantic coastal lines. In Italy, only *B. vulgaris* ssp. *marittima* occurs in the wild, for example on the whole Adriatic coast and along the coast of Tuscany.

All beet species, cultivated for different purposes (sugar, vegetable, forage), descend from *B. vulgaris* ssp. *marittima*, with which they easily cross-pollinate.

Another species which in the past was very important is hemp (*Cannabis sativa*). The main activity on this species is is the selection of varieties which have a low content in cannabinoids, in order to allow the cultivation for fibre production without risk of incorrect use of the raw material. No wild ancestors of this species can be found in Italy. It was introduced to Europe from Central Asia where it got naturalized. However, in the course of time, some local races have developed which underwent a certain grade of diversification, being cultivated and seed propagated by several farmers and research stations. Recent analyses suggest that the gene pool within these races has remained relatively stable. The material conserved at CRA-CIN represents quite well the genetic diversification within this species, especially concerning its main characteristics which are monoecism/dioecism, the number of chemotypes and quantity/quality of the produced fibres.

Genetic diversity of **flax** (*Linum* spp.) is represented in Italy by more than ten different species related to the cultivated one, L. *usitatissimum*, such as L. *bienne*, L. *carthaticum* and L. *strictum*, including several subspecies.

***Morus*:** Wild individuals represent a wide range of heterocygoteous genotypes which can be ascrived to the genus, but their species affiliation is often difficult to determine. In most cases, they can be classified as *M. alba* o *M. nigra*. Variability among these trees is considerable, in terms of growth habit, productivity and resistance to biotic and abiotic stresses.

These wild seedlings occur in nearly all hilly areas of Italy. Trees of *M. alba* and *M. nigra* also grow in other countries of the Mediterranean Basin, as well as in the Near and the Far East. Due to centuries of intensive commercial exchange of material between Europe and the East in the course of silkworm growing, it is nowadays not easy to attribute the species to a determined geographic region.

1.6 Ornamental species

Plant genetic resources used for ornamental purposes and growing spontaneously in Italy belong mainly to the genera *Euphorbia*, *Helichrysum*, *Lilium*, *Limonium* and *Ranunculus*. Species of these genera are either native to Italy or to the Mediterranean Basin, or were introduced from other parts of the world already long times ago. Nowadays, also many of these introduced species can be found growing self-sown in Italy.

Furthermore, Italy is particularly rich in orchids (mainly of the genera *Ophrys* and *Orchis*) but due to the strict limitations of their collection from the wild and difficulties linked to their propagation, they are not included in any *ex situ* conservation programme.

Ornamentally used bushes and shrubs, such as for example *Genista*, *Cistus, Cytisus*, *Myrtus*, *Viburnum*, Oleander and others, can be found in the Mediterranean Maquis Shrubland.

Concerning Oleander, specimens with simple flowers already grew spontaneously in the zones of temperate-warm Mediterranean climates during the times of the Roman Empire. They were the only ones known in Europe until the end of

the 17th century, when exemplars with double flowers were introduced from India. At present, both forms are attributed to one single species, *Nerium oleander*. In Italy, they can be found along the coasts and in the inland up to altitudes of 500-600 m asl.

The genus *Viburnum* is represented by two species of European origin (*V. opulus*, *V. tinus*) which grow spontaneously in Italy; furthermore also *V. lantana*, introduced from China, is quite common.

1.7 Medicinal and aromatic plants (MAPs)

Among the plants utilized by man, one can generally say that the medicinal and aromatic ones have the closest relationship with their wild ancestors; this is due to the fact that they were -and still are- mainly collected from the wild and therefore have not been subject to intense breeding and selection processes.

Concerning cultivated MAPs in Italy, which comprise more than 100 species, the relationship between cultivated varieties and their wild relatives can, however, differ considerably. In the case of Bergamot orange (*Citrus bergamia*), for example, which occupies nearly half of the national surface cultivated with MAPs (3 000 ha), these are traditional varieties or landraces selected long times ago in the Region of Calabria which dominates about 95% of the world's production of this fruit. In the case of Menta of Piedmont (*Mentha piperita* ssp. *officinalis*), the second important cultivated MAP in Italy, exclusively one hybrid is cultivated, *M. viridis* x *M. spicata*, which can only be reproduced vegetatively and is not found in the wild.

With regard to the two species which are maybe the most characteristic of the Mediterranean flora, origanum (*Origanum vulgare* ssp. *hirtum*) and myrtle (*Myrtus communis*), commercialization is largely based on plants collected from spontaneous, wild stands.

The majority of MAPs commercialized in Italy derives from the vegetative multiplication of mother plants maintained in nurseries which are located mainly in the floriculturally important Region of Liguria.

1.8 Forest species

The national territory covered by forests decreased by 6% (from 29% to 23%) from 1995 to now (see first "Country Report"). Human land use, mainly for the expansion of urban settlements and industrial areas, together with fires are the main reasons for this reduction. From 1993 to 2006, fires have destroyed on average nearly 34 000 ha of forest land per year. In view of reforestation activities, however, this destruction offers the opportunity to direct the composition of new forests towards the settlement of autochthonous and environmentally sustainable species (see Chapters 3 and 4).

During the same period, the total surface of Protected Areas has more than doubled (see Chapter 2), and they can be considered the only territories left for continuous forest areas not grown for anthropogenic purposes.

Thanks to the manifold climates and topographies, many different broadleaves and conifers are growing in Italy, largely representing autochthonous species (*Quercus* spp., *Pinus* spp.). Introduced species, however, are also quite frequent (*Eucalyptus, Robinia* and others) which influence the composition of the vegetation of associated forest ecosystems.

CHAPTER 2

THE STATE OF *IN SITU* MANAGEMENT

Basic considerations

The *in situ* conservation of PGR, i.e. in their natural habitats and in interaction with their surrounding biotic and abiotic factors, is an interdisciplinary argument which concerns, amongst others, botanists, forest scientists and ecologists and involves territorial decision makers in the development of appropriate strategies. It allows the natural evolution of species in response to environmental influences.

Effective *in situ* conservation requires periodic monitoring of the species, their frequency and distribution, as well as the development of populations, in order to evaluate the changes of biodiversity and to be able to react, *inter alia*, also with *ex situ* conservation strategies.

Up to now, no comprehensive strategy for the assessment, monitoring and sustainable *in situ* conservation has been elaborated at national level.

2.1 Protected Areas

Protected Areas, established in the context of national or international legislation for their natural and/or socio-cultural importance, are one of the main instruments to promote the undisturbed development of PGR in their surrounding environment and often target at the maintenance of entire ecosystems like natural forests, marine ecosystems, etc.

With respect to the situation outlined in the first "Country Report", a noteworthy increase in Protected Areas in Italy can be stated: spread all over the national territory, there are today 1 046 such sites, varying in size between 1.0 and 181 000 ha. Their total surface amounts to 57 325 km^2 (2006), which corresponds to 19% of the total national territory. This is more than twice the surface reported for 1995 (9%). According to the specific purposes and administrations of the Protected Areas, they are distinguished in National Parks, Regional Parks, State Reserves, Regional Reserves, Areas protected by national and international environmental organizations, and others (private parks, villas, dune systems along coastal lines, etc). A survey on the flora growing in the 156 most significant Protected Areas in Italy, carried out in 2008, revealed the presence of about 4 000 different taxa belonging to 953 genera. Available information on the species present in these Protected Areas is far from complete, but in some cases, updated official inventories or checklists are published, sometimes enriched by lists of endemic flora, spontaneous species, protected species and those species whose introduction is forbidden.

TABLE 4

Publicly accessible official documentation of the vegetation present in Protected Areas in Italy

Protected Area	Documentation
Parco del Delta del Po (Emilia-Romagna)	Checklist
Parco dei Sassi di Roccamaladina (Emilia-Romagna)	List of spontaneous vegetation
Parco dei Monti Aurunci (Latium)	Inventory
Parco del Beigua (Liguria)	Checklist
Parco della Pineta di Appiano Gentile e Tradate (Lombardy)	List of flora and herbaceous species
Parco di Montevecchia e della Valle del Curone (Lombardy)	Complete inventory; list of protected and "forbidden" species; database
Parco delle Orobie Valtellinesi (Lombardy)	List of flora and herbaceous species
Riserva Naturale Montagna di Torricchio (Marche)	Inventory of flora and herbaceous species
Riserva Naturale Capanne di Monterolo (Piedmont)	Checklist
Parco Orsiera Rocciavrè (Piedmont)	Inventory
Parco del Sacro Monte di Crea (Piedmont)	Inventory including cartographic references
Aree Protette della Provincia di Arezzo (Tuscany)	Complete inventory, database
Area Naturalistica delle Balze (Tuscany)	List of spontaneous vegetation

2.2 Crop Wild Relatives (CWR)

In situ conservation regards to a large extent the Crop Wild Relatives, which, maintained in their natural habitats, can be considered a reservoir for useful characteristics for cultivated plants (for example disease resistance).

In the course of the triennial (2003-2005) EU financed project "European Crop Wild Relative Diversity Assessment and Conservation Forum" (PGR Forum), CWR were identified as "taxa related to a species of direct socio-economic importance. These include food, fodder and forage crops, medicinal plants, condiments, ornamental and forestry species, as well as plants used for industrial purposes, such as oils and fibres."

PGR Forum elaborated a list of agricultural and horticultural crops, forestry and ornamental species as well as medicinal and aromatic plants and their wild relatives growing in the Euro Mediterranean Region, including related information (PGR Forum Crop Wild Relative Information System, available online at http://www.pgrforum.org/cwris/cwris.asp).

The results of show that approximately 79% of the Euro-Mediterranean flora consists of CWR, including the crops themselves, which means that more than three-quarters of the plant species in the region have a current or potential direct use to humankind.

In the above-mentioned Italian Protected Areas, a total of 3 267 taxa of CWR belonging to 620 genera were found; Box 1 gives an overview on the most important genera represented by more than one taxon.

BOX 1
Main CWR growing in Italian Protected Areas (in brackets number of taxa)

Cereals and Grasses

Carex (95), *Festuca* (37), *Juncus* (24), *Bromus* (24), *Poa* (17), *Agrostis* (9), *Phleum* (10), *Lolium* (8), *Calamagrostis* (7), *Hordeum* (7), *Agropyron* (6), *Avena* (4), *Aegilops* (4), *Triticum* (3), *Dactylis* (2)

Vegetables

Allium (24), *Cirsium* (20), *Brassica* (6), *Lactuca* (6), *Solanum* (5), *Asparagus* (4), *Sinapis* (3), *Daucus* (2), *Apium* (2), *Beta* (2), *Foeniculum* (2)

Fruits and Nuts

Prunus (16); *Rubus* (10), *Crataegus* (7), *Ribes* (7), *Sorbus* (6), *Fragaria* (3), *Vaccinium* (4), *Malus* (3), *Pyrus* (3), *Sambucus* (3), *Corylus* (2), *Juglans* (2), *Pistacia* (2)

Leguminous species (pulses and forage crops)

Trifolium (44), *Vicia* (34), Lathyrus (24), Medicago (12), Ononis (12), Lupinus (2)

Ornamentals, aromatic and industrial species

Centaurea (50), *Ranunculus* (41), *Saxifraga* (43), *Euphorbia* (39), *Campanula* (38), *Viola* (38), *Orchis* (30), *Primula* (23), *Gentiana* (20), *Ophrys* (22), *Limonium* (21), *Geranium* (20), *Dianthus* (19), *Mentha* (16), *Thymus* (16), *Achillea* (15), *Linum* (14), *Anemone* (12), *Salvia* (10), *Cytisus* (8), *Cistus* (7), *Cyclamen* (6), *Helichrysum* (5), *Helianthus* (4), *Origanum* (4), *Viburnum* (4), *Lavandula* (3), *Humulus* (3)

Forest and other woody species

Salix (37), *Rosa* (22), *Quercus* (19), *Pinus* (16), *Acer* (13), *Juniperus* (8), *Populus* (8), *Erica* (7), *Vitis* (6), *Ulmus* (5), *Tilia* (5), *Alnus* (4), *Fraxinus* (4), *Abies* (3), *Fagus* (3), *Hibiscus* (3), *Phillyrea* (3), *Betula* (2), *Carpinus* (2), *Cedrus* (2), *Larix* (2), *Olea* (2), *Picea* (2), *Platanus* (2), *Rhododendron* (2)

2.3 On-farm conservation

The dynamic conservation of populations or traditional varieties (landraces) of agriculturally utilized species directly on the farm located in their original environments is a specific way of *in situ* conservation. By regularly cultivating and propagating the landraces, which in most cases belong to seed propagated species, the farmer allows the plants to evolve in regular adaptation to the surrounding environmental conditions.

Home Gardens are also mentioned in the context of on-farm conservation and have a significance especially for woody species (fruits, nuts, grapevine and citrus). Both forms of *in situ* conservation depend nearly exclusively on the knowledge and enthusiasm of single private persons and little is known yet on the real amount of traditional germplasm which is being conserved thanks to these people. The first initiatives aiming at the identification and threat assessment of landraces were undertaken about 20 years ago by experts of the University of Perugia. The work concentrated on Central Italy, where more than 300 landraces of different crops (cereals, vegetables, pulses and forage crops, fruits and aromatic plants) were found. In most cases, these landraces are maintained by small farmers who grow them for reasons of taste, tradition, agronomic aspects or as a hobby, and the products are destined to family consumption and commercialization on local markets.

Several other programmes towards the identification and utilization of traditional varieties have been initiated during the last years. Information is available on some regional activities, conducted jointly with Protected Areas (for example in the Abruzzi region, in collaboration with the National Park of Majella) or in the context of crop-specific investigations carried out at regional levels. An example of the latter is a project financed by the Agency for Agricultural Development and Innovation of the Region of Latium, initiated in 2003 and involving CRA-FRU and the University of Viterbo: within two years, it has been possible to find 128 different local fruit tree species in Home Gardens all over Latium.

The landraces identified in the course of these activities have also been transferred to *ex situ* collections managed by the responsible Regions or collaborating institutions. In spite of a rising number of these single well-coordinated and successful initiatives, no comprehensive nationwide survey on PGRFA conserved on-farm has been undertaken yet.

Box 2 below provides a list of the species conserved on-farm in Central Italy (i.e. in the Regions Abruzzi, Latium, Marche, Tuscany and Umbria) identified within the framework of the three above-mentioned activities.

Box 2
On-farm conservation of local ecotypes and/or landraces in Central Italy

Cereals

Avena sativa, Hordeum vulgare, Secale cereale, Sorghum saccheratum, Triticum aestivum, Triticum dicoccum, T. durum, Triticum spelta, Zea mays

Vegetables

Allium cepa, Beta vulgaris, Brassica napus, B. oleracea, B. rapa, Capsicum annuum, Cichorium intybus, Citrullus lanatus, Cucumis melo, C. sativus, Cucurbita maxima, C. pepo, Lactuca sativa, Lycopersicon esculentum, Salsola soda, Spinacia oleracea

Fruit species

Castanea sativa, Corylus avellana, Malus domestica, M. pumila, Olea europea, Prunus amydgalus P. armeniaca, P. avium, P. cerasus, P. domestica, P. insistitia, P. persica, Pyrus communis, Pyrus nivalis, Punica granatum, Vitis vinifera.

Leguminous species (pulses and forage crops)

Cicer arietinum, Hedysarum coronarium, Lathyrus cicera, L. *sativus, Lens culinaris, Medicago arabica, M. disciformis, M. lupulina, M. minima, M. orbicularis, M. polymorpha, M. rigidula, M. sativa, Onobrychis viciifolia, Phaseolus coccineus, Ph. vulgaris, Pisum sativum, Trifolium angustifolium, T. campestre, T. fragiferum, T. incarnatum, T. montanum, T. pratense, T. repens, T. resupinatum, T. scabrum, T. stellatum, T. squarrosum, Vicia faba, Vigna unguiculata, V. unguiculata cv gr. sesquipedalis, V. unguiculata* ssp. *unguiculata cv gr. unguiculata*

Aromatic species

Ocymum basilicum, Petroselinum crispum

2.4 Non Governmental Organizations

The conservation of traditional varieties on-farm, their assessment and conservation at regional and national level is also carried out by non-governmental organizations which have formed during the last 15 years. The promotion of organic and sustainable farming, as well as the strenghthening of farmers' rights, is central concerns which drive the single partners.

Box 3 below gives basic information on the NGOs associated in the "Rural Seeds Net" (Rete Semi Rurali), some of which are also partners of international associations operating in the sector of biological agriculture (Mediterranean Association of Biological Agriculture-AMAB; International federation of Agriculture Movement-IFOAM).

BOX 3
NGOs of the Rural Seeds Net concerned with the conservation and utilization of PGRFA

Associazione Italiana Agricola Biologica
Facilitation of activities carried out by the partners, by providing technical and legal support

Associazione Rurale Italiana
Sustainable production in rural environments; on-farm conservation of some landraces of vegetables (pumpkin, *Brassica, Cichorium*)

Associazione per la Solidarietà per la Campagna italiana
Safeguard of traditional environments by promoting the plantation, cultivation and production of autochthonous species and products

Centro Internazionale Crocevia
Education and communication in agriculture, with the aim to promote fair and sustainable development

Archeologia Arborea
Collection of local varieties of fruit species (Central Italy)

Associazione veneta dei produttori biologici
Technical support to local farmers concerning biological production; recovery and conservation of local fruit varieties (North Eastern Italy)

Consorzio della Quarantina
Safeguard and promotion of local potato varieties (North Western Italy)

Civiltà Contadina
Recovery, safeguard and diffusion of ancient traditional varieties of plant and animal species of agricultural interest

Cordinamento Toscano Produttori Biologici
Promotion of organic farming in Tuscany, member of Mediterranean and International associations for applied sustainable agriculture

World Wide Opportunities on Organic Farms, Italia
Assessment of biologically operating farms and private persons and promotion of their inclusion in national and international networks of sustainable agriculture; conservation and use of traditional *Durum* wheat varieties.

CHAPTER 3

THE STATE OF *EX SITU* MANAGEMENT

Basic considerations

The management of PGR conserved *ex situ* in Italy is not carried out in a centralized way; on the contrary, a number of institutions, organizations and initiatives, of private and public nature, are involved in related activities, and sometimes it is difficult to individuate them all and to define their position in the national context. The information given in this chapter is therefore probably incomplete due to the difficulty to identify, contact and interact with all different stakeholders.

Main Institutions

The main organisms holding permanent, well documented *ex situ* collections are the Research Institutions belonging to the **Council for Research in Agriculture (CRA)**, some Institutions of the **National Research Council (CNR)**, as well as **University Departments** involved in research related to PGR and environmental studies.

Also **Regional specified administrations** are getting dedicated to the conservation and documentation of plant germplasm, which is usually of regional origin.

Eight Non Governmental Organizations (NGOs) have recently joint to the "**Rural Seeds Network**" and are also carrying out activities targeted at the conservation and utilization of plant germplasm.

Concerning Forest genetic resources, also the "**Corpo Forestale dello Stato**" (National Forest Service) of the Ministry of Agriculture, Alimentation and Forestry Policies (MiPAAF) plays an important role in the conservation and distribution of germplasm.

Several local **research stations**, which collaborate with the private and the public sector in breeding activities, also hold collections. However, these are rather working collections, not having the specific target of long-term conservation. The collections held by these institutions are therefore not included in the present report.

Botanical Gardens are also increasingly focussing on the conservation of PGRFA. Around 100 Botanic Gardens of different administrations exist in Italy; most of them belong to Universities or are under municipal administration.

Furthermore, there are several Alpine or Mountain Gardens, especially in the North of Italy, which are dedicated to the collection of mountainous species from all over the world, prioritizing autochthonous and endemic species. Some thematic gardens are specialized in collecting specific crops groups (for example, medicinal and aromatic plants). The Italian Botanical Society, with the support of the Ministry of Cultural Heritage, is currently elaborating an Inventory on all accessions present in Italian Botanic Gardens. (www.societàitalianabotanica.it).

Many Botanic Gardens publish annual catalogues of exchangeable seeds ("*Index Seminum*") which are available upon request.

Duplication of the material

Usually, the material of foreign origin is present also in the collections of the institutions from which the material had been requested; also in the case of material obtained from international collection missions, this germplasm is present in the collections of all participating partners. Furthermore, parts of this material are also conserved in the collections of the CG-Centres (ICRISAT, ICARDA, CIMMYT).

The status of safety duplication of autochthonous wild material collected in Italy is less clear; it can be assumed that most of the material is not conserved in collections other than the one indicated.

Documentation

The single collections are documented in electronic catalogues managed within the respective conserving Institution; information on the accessions comprises the internationally agreed and standardized Multicrop Passport Data as well as species-specific descriptors. In some cases, also information on molecular characterization is included.

One central aim of the National Inventory on PGRFA conserved *ex situ* in Italy, managed by CRA-FRU, is to unite the data collected in the various information systems, in order to facilitate access to these resources to the different stakeholders through the consultation of this database (www.rgv-politicheagricole-cra.it).

The following section provides information on plant germplasm conserved *ex situ* in Italy. In the included tables, the Institutions holding the single collections are indicated by a numeric code. This code is explained in Annex 1 which lists all mentioned Institutions.

3.1 Cereals

The seeds present in Italian cereal collections are mainly stored for medium term, i.e. conserved in plastic bags or cans, at temperatures ranging between 0°-4°C and at relative air humidity between 30% (wheat) to 60% (rice), according to the species. The accessions are periodically reproduced (every 4-6 years) to ensure seed germinability and quality and thus the preservation of the genetic material.

Long-term conservation of wheat accessions is carried out at CNR-IGV, where seeds are dried to 5% humidity and kept in vacuum conditions at -20°C.

Systematic controls of the sanitary status of the stored accessions are quite rare, due to lack of staff and financial resources, but regular reproduction of the material has not evidenced any significant phytosanitary problems so far.

Generally, the material is available at sample-size upon request. Most collections are not duplicated in other places, with the exception of 264 wheat accessions of foreign origin held at CRA institutions which are duplicated at CNR-IGV. The wheat collection maintained by CNR-IGV, in turn, is duplicated at three genebanks abroad: at Fort Collins (USA), in Kyoto (Japan) and at the Vavilov Institute (St. Petersburg, Russian Federation).

Avena (CRA)

Collection and characterization of oat landraces in Italy have always been very scarce, due to the poor economic importance given to this species. Recently, a marked development of new genotypes has been observed, as a result of specific breeding programmes. The collection held at CRA-MAC comprises mostly breeding lines and cultivars, whereas only 12 landraces are present. Large parts of the material conserved are used as fodder.

Maize

The most important *ex situ* collection of maize in Italy (in terms of genetic origin, agronomic and morphologic differentiation, as well as concerning quantity) is held by CRA-MAC in Bergamo. The cultivars mostly inbred and obtained both in Italy and in the rest of the world, are destined to animal and human alimentation. The accessions stored at CNR-IGV instead, are to a large part used as fodder.

Wheat (CRA)

Recently, interest in the collection of old Italian varieties of *Triticum aestivum* and *T. durum* was re-born, resulting in the identification and introduction in the collections of about 4 000 varieties which were constituted during the first decades of the last century, many of which are still in cultivation not only in Italy but also in many other countries in the world.

CNR-IGV holds one of the most important wheat collections worldwide, with more than 28 000 accessions representing wild and cultivated material coming from all over the world, mainly Asia, Europe, North America and the Middle East.

The collections held at CRA institutions include old and new Italian and foreign varieties, populations of Sicilian wild wheat, material collected around the Mediterranean Basin as well as accessions obtained from ICARDA.

Rice

Rice genetic resources in Italy are conserved both at public and at private level. The material conserved belongs all to *Oryza sativa* ssp. *japonica*, the only species adapt to Italian climate. Exchange of material between the public collections (mainly CRA-RIS, Ente RISI), is quite frequent (see table below). Collections comprise Italian and foreign varieties, the ones listed in the National Register of new varieties as well as the old cultivars which are no longer in cultivation.

Concerning the private sector, working collections are currently held by seven breeding companies.

TABLE 5
Cereal *ex situ* collections held in Italy

Species	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Avena	723	54	668	13	5
Barley	1 288	739	86	46	4-41-50-63-64-65
Maize	7 109	2 319	2 793	1 285	5-41-57-62-63-64-65
Rye	806	185	nn	7	41-47-50-64
Rice	2 787	822	1 684	nn	6-47-67
Sorghum	350	11	nn	nn	39(b)-41-65
Wheat	37 957	2 779	30 000	3 541	3-7-8-9(a)-41-47-50-57-64-65

3.2 Vegetables

Vegetable genetic resources are usually stored as seeds, with the exception of artichoke, which is conserved *in vivo*, and part of the potato germplasm which is stored and propagated *in vitro*. The seed storage period is medium-term, under species-specific low temperature and humidity regimes. Reproduction of the material is carried out periodically, and in the case of outcrossing species (e.g. sugar beet), this is done in isolated greenhouses, in order to avoid uncontrolled open pollination.

Vegetable accessions at CNR-IGV are also stored under long-term conditions, at temperatures around -20°C.

No problematic incidences on the sanitary status of the material have been signalled and the material is generally available at sample-size upon request.

Potato

Nowadays, it is considered a very important agricultural crop. However, one of the factors which limit the Italian commercial potato production is the relatively restricted number of varieties available, many of which were already selected decades ago. Breeders have made only very little use of the genetic potential of potatoes. The extension of the genetic resources to be incorporated in breeding programmes has therefore become a central aspect, and collecting missions to the countries of the centre of origin of the species (mainly Chile) during the last decade of the past century led to the collection and conservation of a large number of species (see Annex to Chapter 3).

Several Italian institutions have now their own germplasm collection, constituted by various wild *Solanum* species.

Brassica spp.

In Italy, *Brassica* germplasm is mainly conserved at CNR-IGV, as well as by three institutions in Sicily, one in Umbria and one in the Marche. The University of Palermo and IGV Bari hold the largest collection with 460 and 629 accessions, respectively, mainly landraces and wild species. The national Core Collection of *Brassica oleracea* is maintained at the University of Palermo.

TABLE 6
Vegetable *ex situ* collections held in Italy

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Artichoke	5	5	0	5	21-57
Asparagus	25	20	5	11	20
Bean	378	427	309	575	11-43
Beta	7	7	0	7	41-60-63-64
Brassica spp. (except cauliflower)	1 585	854	199	500	20-33-38-41-47-60-64-65
Carrot	1	1	0	1	63
Celery	4	4	0	4	57-60-64
Cauliflower	33	33	0	33	21

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Chickpea	73	73	0	73	21-41-50-57-63
Cichory	14	14	0	14	41-63-65
Cowpea	86	86	0	86	41-52-64
Cucumbers	37	33	3	35	19-20-21-41-57-60-63-64
Dipsacus	3	3	0	3	60-63
Eggplant	24	24	0	1	20-21-41-63
Faba bean	20	20	0	20	21-41-63-64
Garlic	4	4	0	4	57-63-64
Lathyrus	25	25	0	25	41-50-64
Leek	4	4	0	4	21-60
Lentil	101	78	23	98	41-50-57-64
Lettuce	20	20	0	20	41-63-64
Melon and alike	96	80	15	83	20-21-41-63-64
Nasturtium	1	1	0	1	19
Onion	37	21	1	21	20-21-41-60-63-64
Pea	11	11	0	11	41-63-64
Peppers	416	348	41	221	20-21-41-47-50-54-60-64
Potato	237	15	nn	19	11-63-65-68
Pumpkin and alike	38	34	3	19	19-20-21-41-60-61
Soya	1	nn	nn	nn	41
Spinach	1	1	0	1	41
Tomato	710	694	16	634	19-20-21-41-47-50-57-63-64

3.3 Fruits and nuts

Collections of fruit species are amongst the most frequent ones in Italy. At least 28 Institutions of different administrations conserve germplasm of all economically important fruit crops, in addition to the numerous collections of citrus, olive and grapevine germplasm. Also minor collections of underutilized species exist.

The plants are generally conserved *in vivo* and every accession is represented, according to the space available, by 2-5 trees. Few institutions, amongst them CRA-FRU, also maintain *in vitro* collections of some species. Periodic controls for the most important diseases (e.g. Sharka virus for stone fruits) are carried out.

According to a survey carried out in 2003, about 12 000 different fruit tree accessions are currently conserved all over the Italian territory (excluding Citrus, Olive and Grapevine).

In 1995, the MiPAAF had nominated the Experimental Institute for Fruit Tree Research in Rome (today CRA-FRU) as focal institution for the coordination of activities on PGRFA, either at national and at international level.

Amongst the initiatives proposed in this context by the Institute was the establishment of the National Collection of Fruit Trees (NCFT) to conserve the germplasm present in the different collections, with particular attention to those accessions autochthonous to Italy and at risk of extinction. To realize this aim, the MiPAAF financed the acquisition of 30 ha adjacent to the working collections of the Institute.

The NCFT was inaugurated in 2006, and by now, about 6 000 different accessions have already been planted, with the objective to collect and plant the remaining 6 000 within the next 2-3 years. For reasons of limited space, every accession is represented by only two trees.

The initiative is not only aimed at the conservation of fruit germplasm and the scientific evaluation of its agronomical, morphological and economical potential. Further objectives are of socio-cultural nature and include

- the distribution of propagative material to various interested stakeholders (breeders, cultivators, landscapists, hobbyists) to promote the re-introduction of the material in its traditional environments;
- the promotion of the cultivation of local varieties, also for economic purposes, for example through the commercialization of the products on niche markets;
- raising public awareness on biodiversity by organizing open days to the public, including schools, and offering them guided tours in the collection.

Citrus

The collection maintained by CRA-ACM is the largest one in Italy specifically of *Citrus*; most of the accessions belong to this genus. Furthermore, accessions of related genera such as *Poncirus*, *Fortunella*, *Eremocitrus*, *Microcitrus*, *Severinia*, *Citropsis* and *Murraya* are conserved. The germplasm represents accessions of Italian and foreign origin. Since recently, one of the criteria for the collection and acquisition of germplasm is its content in anthocyanins; Italy possesses the largest variety worldwide in pigmented oranges. The various genotypes which synthesize anthocyanins vary extremely in terms of pigment quantity in skin and pulp, ripening period, fruit shape etc.

Concerning the importation of material from collections held abroad, EU Directive 2000/29/CE has modified the existing regulations imposing more severe restrictions concerning the introduction of plant genetic material from non-EU countries. As a result, importation of material from main countries holding Citrus germplasm (especially the USA) has diminished considerably.

The accessions are conserved *in vivo*, either in the open or in screen-houses.

Olive

In Italy, 13 collections under different administrations (CRA, CNR, Universities and Regions) conserve olive germplasm. The number of accessions is not well defined, which is mainly due to the widely existing problem of homonyms and synonyms which is very present in the case of olive germplasm.

The most important collection on the Italian territory is held by the CRA, in two different locations (in Cosenza, in the Region of Calabria, and in Pescara, in the Abruzzi Region), which together conserve more than 700 accessions, most of these of Italian origin. Emphasis is given to the conservation of local varieties which are only found very rarely nowadays. The collection in Calabria concentrates on material native to the South of Italy, while in Abruzzi Region, varieties from Central Italy are conserved. The accessions are conserved *in vivo* in the National Olive germplasm collection of the CRA, and every accession is represented by a number of individual trees.

There is no institution which explicitly holds safety duplications of the material, but several varieties are present in more than one collection.

Concerning the sanitary status of the collections, some sporadic presence of *Pseudomonas savastanoi*, *Verticillium dahliae* and *Spilocaea* as well as some viruses can be noted.

Vitis

Vitis germplasm is currently conserved in 59 public and private collections throughout Italy, and it is estimated that about 24 000 accessions are totally held. This large number is due, on the one hand, to an elevated quantity of clones derived from single varieties; on the other hand, many regional agencies concentrate on the recovery of traditional local ecotypes. However, it is quite difficult to obtain precise information either on the status of the single institutions and agencies and on the exact extension of their collections.

In most cases, the accessions are conserved *in vivo*, and only a small part of the material present in public collections is conserved *in vitro*. There is no official location holding a safety collection, but several accessions are present in more than one collection.

TABLE 7

Fruit germplasm conserved *ex situ* in Italy

Crops	Total number accessions	Italian origin	Foreign origin	Wild or local	Number of different accessions	Of which duplicated	Institutions
Actinidia	164	57	54	nn	94	7%	16-45
Apple	4 589	2 222	149	1 554	2 541	31%	16-17-18-31-34-33-36-37-38-39(a)-40-41-42-44-45-46-48-49-50-57-58-59-60-62-63-64-65-68
Apricot	1 253	492	455	164	520	39%	16-17-31-34-37-38-42-44-51-54-57-59-63
Avocado	32	10	nn	4	nn	nn	17-33
Blackberry	56	nn	48	0	35	57%	16-31-44
Blueberry	129	nn	113		71	50%	16-44
Cactus Pear	800	incl. seedlings from free impollination			nn	partly	33-43
Cherry	1 604	811	608	565	920	23%	16-17-18-31-32-33-34-39(a)-44-48-49-51-54-57-59-63

Crops	Total number accessions	Italian origin	Foreign origin	Wild or local	Number of different accessions	Of which duplicated	Institutions
Citrus and related species	548	157	153	nn	nn	nn	9(b)-34-52
Currant	95	nn	74	nn	66	28%	16-44
Feijoa	99	38	11	nn	51	49%	16-51
Fig	194	191	3	172	64	13%	17-32-43-49-60-61-65
Gooseberry	43	nn	33	0	29	50%	16-44
Hawthorn	6	6	0	6	nn	nn	46-55
Medlar	63	33	24	8	44	38%	17-46-51
Nashi	75	0	75	nn	55	41%	16-17-35(a)-48
Olive	883	720	77	154	578	27%	12(a)-12(b)- 41-43-59-61-63-64-65
Paw Paw	15	0	15	0	15	0	16
Peach/ Nectarine	2 925	1 428	1 301	127	2 020	19%	16-17-18-31-32-35(a)-37-38-40-44-48-51-57-63-64-65-68
Pear	2 252	1 176	852	559	1 140	41%	16-17-18-31-32-33-37-38-39(a)-40-44-46-48-49-50-57-58-60-63-64-65-68
Persimmon	206	25	175	9	109	67%	17-35(a)-37-48
Pomegranate	39	17	nn	11	nn	nn	17-33-63
Plum	1 181	454	718	173	551	37%	16-17-18-31-34-37-38-44-51-57-63-64-68
Quince	66	28	34	23	37	59%	17-34-39(a)-46-48-63
Raspberry	149	nn	111	nn	109	34%	16-31-44
Strawberry	272	46	179	2	247	46%	18-31-51-57
Vitis	7 410	3 762	1 924	1 395	5 169	16%	25-26-27-28-29-34-42-43-51-52-53-54-57-60-61-62-63-64-65-68

TABLE 8

Nuts germplasm conserved *ex situ* in Italy

Crops	Total number accessions	Italian origin	Foreign origin	Wild or local	Number of different accessions	Of which duplicated	Institutions
Almond	604	277	84	11	335	55%	1-16-17-33-42-50-61
Breadfruit	18	nn	nn	nn	18	partly	33
Chestnut	89	68	21	20	82	6%	16-17-44-55-60
Hazelnut	214	147	36	3	117	46%	16-17-44-39(b)-48-55
Pecan nut	28	0	28	nn	28	0%	16
Pistachio	142 (incl. seedlings)	128	nn	120	nn	nn	16-43
Walnut	108	82	22	nn	95	27%	16-17-37-44

3.4 Forage crops

Forage germplasm collection activities in Italy have usually been targeted at the exploitation of genetic resources for breeding. Therefore, germplasm conservation has mostly had a short-term or mid-term perspective, rarely contemplating the perspective of seed exchange with other institutions.

As a consequence to the absence of a reference institution for *ex situ* conservation of forage crops and the emphasis on working collections, many forage accessions went lost during the last three or four decades. The loss has been especially severe for farm landraces of less cultivated crops, such as French honeysuckle and red clover, which were the first to be replaced by varieties of major forage crops (e.g. lucerne, Italian ryegrass and maize for silage).

In the course of several initiatives to safeguard and utilize autochthonous germplasm, recent efforts directed towards the regeneration of existing collections and the long-term germplasm storage have allowed to safeguard some material which was near to be lost (e.g. farm landraces of *Medicago sativa*, *Trifolium pratense* and *Lupinus albus*). At the same time,

new responsibilities have been assigned for long-term conservation of forage accessions.

The main collections of forage species which contemplate, as a target, also the long-term storage (at -18°C, 6-8% seed moisture) and the exchange of genetic resources are held by CRA-FLC and the University of Perugia.

Also CNR-IGV holds a vast collection of grain legume accessions either for human and animal nutrition, such as pea or faba bean, while it has substantially excluded the grassland crops from the list of its target species.

In total, 238 forage species are conserved *ex situ* in Italy; most species belong to the genera *Vicia* (74), *Trifolium* (43) and *Medicago* (39).

TABLE 9

Forage legumes conserved *ex situ* in Italy

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Anthyllis	12	10	2	10	41-43-47
Argryolobium	1	1	0	nn	41
Astragalus	26	9	nn	8	41-43-47
Biserrula	2	2	0	2	43
Coronilla	39	24	11	23	41
Dorycnium	29	29	0	14	41-47
Galega	2	2	0	2	41
Hedysarum	202	182	1	38	10-41-47
Hippocrepis	9	5	4	5	41-47
Lathyrus	342	100	2	8	41-43-47
Lotus	315	244	58	181	10-41-43-47
Lupinus	367	114	150	129	10-41-47
Medicago	2 802	1 710	218	447	10-41-43-47-50-64
Melilotus	34	11	15	4	41-43-47
Onobrychis	251	236	11	160	10-41-47-50-64
Ononis	3	3	0	2	41
Ornithopus	7	6	1	6	41-43
Pisum	671	7	664	470	10
Psophocarpus	1	0	1	nn	47
Scorpiurus	51	38	9	6	41-43-47
Securigera	8	8	0	6	41
Trifolium	3 005	2 827	93	2 297	10-41-43-47-50-64
Trigonella	100	12	12	nn	41-47
Vicia	5 196	1 331	925	530	10-41-43-47

TABLE 10

Forage grasses conserved *ex situ* in Italy

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Aegilops	1 617	181	nn	nn	41-47
Aegilotrictum	2	2	0	nn	47
Agropyron	80	74	nn	nn	47
Agrostis	29	11	nn	8	10-41-47
Aleopecurus	4	3	nn	nn	47
Ammophila	4	3	nn	nn	47
Ampelodesma	2	2	0	nn	47
Brachypodium	25	19	nn	4	41-47
Bromus	17	4	3	nn	10-41-47
Chenrus	1	nn	nn	nn	41
Cynodon	21	18	3	18	10-41-47
Cynosurus	4	4	0	nn	47

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Dactylis	434	312	36	6	10-41-47
Dasypyrum	156	143	nn	nn	41-47
Eleusine	1	0	1	nn	47
Eragrostis	12	1	11	nn	47
Elymus	3	0	3	nn	47
Festuca	470	372	54	221	10-41-47
Hainaldia	1	1	0	nn	47
Holcus	1	1	0	nn	47
Koeleria	2	2	0	nn	47
Lagurus	1	1	0	nn	47
Lolium	1 090	447	438	233	10-41-47
Melica	1	1	0	nn	47
Milium	1	1	0	nn	47
Oryzopsis	2	1	1	nn	41-47
Panicum	100	4	nn	nn	47
Paspalum	2	0	2	0	41
Pennisetum	53	0	53	nn	47
Phalaris	195	97	11	nn	41-47
Phleum	46	33	2	15	10-41-47
Poa	109	103	4	100	10-41-47
Polypogon	1	1	0	nn	47
Setaria	5	2	nn	nn	47
Stipa	3	2	nn	nn	47
Vulpia	2	2	0	nn	47
x Festucololium	3	1	2	0	10

TABLE 11
Other forage crops conserved ex situ in Italy

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Amaranthus	46	nn	nn	nn	47
Atriplex halymus	>8	nn	nn	nn	43-47

3.5 Industrial crops

Flax and hemp are the "classical" species which are investigated for their fibre content. Their genetic origin has not always been identified yet.

The situation is completely different concerning **sugar beet**: The collection held at CRA-CIN is exclusively composed of germplasm constituted within the institution's breeding programmes. It is composed of diploid plurigerm families, monogerm O-Type lines and tetraploid plurigerm families. Consequently, the germplasm stored here has a presumably quite narrow genetic base but on the other hand has some unique characters and cannot be present anywhere else in the world. Some of the oldest breeding lines can be traced back to the first half of the past century.

Morus: The collection held by CRA-API seems to be the only one explicitly dedicated to accessions of the genus *Morus* in Italy. The collection is held in vivo, and accessions are repeated several times. The sanitary status is generally good.

All species are conserved as seeds, except for *Morus* (*in vivo*).

TABLE12
Germplasm of industrial crops conserved *ex situ* in Italy

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Coringia	2	nn	nn	nn	41
Euphorbia	2	nn	1	nn	41
Flax	402	43	nn	nn	11
Hemp	85	60	25	nn	11
Isatis	1	1	0	1	63
Lesquerella	17	nn	14	nn	41
Lunaria	2	nn	nn	nn	41
Morus	49	19	30	19	31
Stokesia	1	nn	nn	nn	41
Sugar Beet	265	265	0	0	11
Sunflower	2	2	0	2	41
Tobacco	1 422	301	940	1 139	24
Vernonia	8	nn	5	nn	41

3.6 Ornamental species

The CRA disposes of three specialized Institutions dedicated to the conservation and utilization of ornamental PGR which are of importance for the national and international markets. The species included are either of Italian or Mediterranean origin (especially *Limonium* and *Myrtus*), but also comprise exotic species of high ornamental value (*Passiflora*).

No explicit safety collections of the accessions in question exist; it is probable that part of the accessions is held by plant nurseries, but no specific information is available. In the case of *Passiflora*, however, it is known that 100% of the material is conserved also at a specialized botanic garden (Giardini Hanbury) in Liguria, and also collections of Euphorbia are present in different nurseries. Concerning *Viburnum*, there is no other significant collection of *Viburnum* in Italy, and Europe-wide, only three private collections are known. Some Universities hold species-specific collections (*Nerium* at Florence, *Myrtus* at Sassari), and the Region of Tuscany has initiated the recovery of varieties of Italian or exotic species (*Ranunculus, Camellia*) which had been obtained by Italian breeders centuries ago and which are now risking to disappear.

The collections are usually managed *in vivo* (in greenhouses or in the field); an exception is made for the ornamental tobacco varieties which are held as seeds, and Euphorbia, for which also *in vitro* propagation is applied.

Ornamental plants are represented by 103 species, most of which belong to the species *Limonium* (52).

TABLE 13
Germplasm of ornamental species conserved *ex situ* in Italy

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Anemone	5	5	0	0	63
Calla	3	3	0	0	63
Camellia	40	40	0	0	63
Euphorbia	11	0	11	11	15
Hebe	68	8	60	nn	13
Iris	15	15	0	0	63
Limonium	231	68	83	65	13-14
Myrtus	105	60	0	nn	13-43
Nerium	54	30	19	nn	35(b)-63
Nicotiana	151	23	83	151	24
Passiflora	40	10	30	nn	13
Ranunculus	14	14	0	0	63
Salvia	54	nn	nn	nn	13
Viburnum	80	4	76	nn	13

3.7 Medicinal and Aromatic Plants (MAPs)

The *ex situ* conservation of MAPs has originally been carried out by monastery gardens, whose concept was later taken over by Botanic Gardens. At present, we count 38 University Botanic Gardens, 31 Alpine Botanic Gardens and twelve Thematic Botanic Gardens of which two are explicitly dedicated to the conservation of MAPs. Even though electronic information systems facilitate the documentation of conserved MAPs, it is not easy to define the material present in the various Botanic Gardens because the predominant criterion of catalogation is of botanic character instead of medicinal/ aromatic.

A study carried out in 2003 revealed that 1 228 MAP species are conserved at the 15 most representative Botanic Gardens. These species belong to 600 genera and 140 families.

As it is characteristic of Botanic Gardens (in contrast to genebanks), they do not dispose of many exemplars per species- often, they are represented by only one specimen per taxon. The plants are conserved *in vivo*, and their sanitary status is often unknown.

Concerning the existence of safety duplications, the above-mentioned research led to the conclusion that a bit more than half (56%) of the accessions are present in more than one Botanic Garden.

The collection held by CRA-MPF (*in vivo* and as seeds) comprises the most representative species for the Italian peninsula (Mediterranean as well as Alpine zones) and the most important ones in terms of research and commercialization. Most part of the material has been collected on the Italian territory or in adjacent regions of the alpine ridge. All species are present in one or more of the mentioned Botanic Gardens.

The accessions represent autochthonous ecotypes of the respective species, collected in the wild.

In the case of *Chamomila recutita*, the collection of the University of Perugia also contains 4 accessions representing breeders' lines and/or advanced cultivars, and the University of Sassari holds 30 cultivars of *Rosmarinus* in its collection.

TABLE 15
MAP germplasm conserved *ex situ* in Italy

Species	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
130 species	130	103	73	Autoct: 29; pop: 119 selv: 30	2
Basil	8	8	0	8	41
Borage	10	nn	nn	nn	41
Chamomile	13	8	3	4	41
Fennel	5	5	0	5	41
Gentiana lutea	10	8	1	10	41
Malva	1	1	0	1	41
Parsil	2	2	0	2	41
Rosmary	30	nn	nn	nn	41, 43
Saffron	3	3	0	3	63, 64
1 228 MAP species	1 228	nn	nn	nn	69

3.8 Forest species

Further to the mere purpose of germplasm safeguard and preservation, forest genetic resources in Italy are conserved either at accession level and at species level, according to their utilization: research institutions, like the ones of the CRA or at Universities, hold large amounts of genotypes within the species, which are employed in research and breeding targeted at industrial and/ or environmental applications.

Seed forests play an important role in environmentally sustainable reforestation and re-qualification programmes; the trees growing in these locations are of guaranteed Italian provenance, being most adapted to the predominant eco-climatic conditions.

Information on the presence of seed forests propagating the different species and established in line with the provisions set out in the EU Directive 105/99/CE is available on a recently established internet website managed by CRA-SEL (http://www.ricercaforestale.it/modules.php?op=modload&name=BoschiDaSeme&file=index), under the responsibility of the MiPAAF (see Tab. 16 below).

TABLE 16
Seed forests present in Italy and propagated material

Region and number of seed forests	Main species
Abruzzi (4)	*Pinus nigra*
Apulia (10)	*Pinus halepensis*
Aosta Valley (2)	*Larix decidua*
Calabria (22)	*Abies alba, Pinus nigra*
Campania (2)	*Pinus pinea*
Emilia Romagna (3)	*Abies alba*
Friuli-Venezia Giulia (3)	*Abies alba, Pinus nigra*
Latium (2)	*Abies alba*
Liguria (9)	*Abies alba, Pinus halepensis, Pinus pinaster*
Lombardia (21)	*Abies alba, Quercus petraea, Picea abies, Larix decidua*
Molise (3)	*Abies alba*
Piedmont (18)	*Abies alba, Picea abies, Larix decidua*
Trentino-Alto Adige (37)	*Abies alba, Picea abies, Larix decidua, Pinus nigra*
Tuscany (27)	*Abies alba, Pinus pinea, Pinus pinaster*
Umbria (3)	*Pinus halepensis*
Veneto (9)	*Abies alba, Picea abies, Larix decidua*

The Corpo Forestale dello Stato (CFS), instead of single genotypes conserves species of forest interest, which are considered beneficial in reforestation and other environmentally oriented activities. Of each species, the most representative ecotypes of all Italian climatic zones (alpine, appenninic, islands), plants are derived from forests which are registered in the National Book of Forests for Seed Production and are conserved *in vivo* in seed forests located in two different places in Northern and Southern Italy, in order to ensure their environmentally sustainable development and utilization. Seeds are collected every year and are either sold to whoever is interested in utilizing this germplasm for reforestation or are conserved for medium term (7-10 years) as a reserve for years of low seed production.

Some Regions (Marche, Tuscany) also conserve forest species of local provenience, to be used in reforestation and related activities. The germplasm is multiplied by specialized tree nurseries who guarantee, on behalf of the Regions, high seed and plant quality to whom the material is provided.

Further important didactic institutions for the conservation of forest species are the four arboreta present in Italy which concentrate on Mediterranean species (Arboreto mediterraneo del Limbara, Sardinia) and on vegetation typical of the Apennines (Arboreto appenninico dell'Università Camerino, Macerata; Arboreto appenninico del Parco Nazionale dell'Abruzzo). The complex of arboreta (Arboreti di Vallombrosa, Florence, Tuscany) is directed and managed by CRA-SEL; currently, more than 700 tree and shrub species of Italian and foreign origin are conserved.

In total, 221 forest species are present in Italian *ex situ* collections; most represented genera are *Salix* (20 + hybrids) and *Pinus* (15).

TABLE 17
Forest genetic material conserved *ex situ* in Italy

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Abies	111	8	nn	8	23-59-63-66
Acer	9	9	0	9	50-66
Adenocarpus	1	1	0	1	66
Alnus	4	4	0	4	66
Amelanchier	3	3	0	3	59-66
Amorpha	1	1	0	1	66

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Arbutus	1	1	0	1	66
Arctostaphylos	1	1	0	1	66
Berberis	1	1	0	1	66
Betula	1	1	0	1	66
Buxus	1	1	0	1	66
Calicotome	1	1	0	1	66
Carpinus	3	3	0	3	63-66
Castanea	226	8	nn	8	23-63-64-66
Cedrus	3	3	0	3	66
Celtis	1	1	0	1	66
Cercis	1	1	0	1	66
Ceratonia	1	1	0	1	66
Chamaecyparis	1	1	0	1	66
Cherry	253	27	nn	27	22-23-63
Cistus	5	5	0	5	57-63-66
Colutea	2	2	0	2	59-66
Coriaria	1	1	0	1	66
Cornus	2	2	0	2	66
Corylus	1	1	0	1	66
Cotinus	1	1	0	1	66
Cotoneaster	1	1	0	1	66
Crataegus	6	6	0	6	59-66
Cytisus	6	6	0	6	59-66
Elaegnus	1	1	0	1	66
Erica	1	1	0	1	66
Eucalyptus					22
Euonymus	5	5	0	5	59-66
Fagus	1	1	0	1	66
Frangula	2	2	0	2	66
Fraxinus	4	4	0	4	63-66
Genista	5	5	0	5	66
Gingko	1	1	0	1	66
Gleditsia	1	1	0	1	66
Hippophae	1	1	0	1	66
Ilex	1	1	0	1	66
Juglans	3 151	2	nn	2	22-23-66
Juniperus	5	5	0	5	59-66
Laburnum	4	4	0	4	59-66
Larix	1	1	0	1	66
Lonicera	5	5	0	5	59-66
Ligustrum	1	1	0	1	66
Lunaria	1	1	0	1	59
Malus	6	6	0	6	59-66
Mespilus	1	1	0	1	66
Morus	2	2	0	2	66
Myrtus	1	1	0	1	66
Ostrya	3	3	0	3	59-66
Osyris	1	1	0	1	66
Paliurus	1	1	0	1	66
Paulownia	1	1	0	1	66
Phillyrea	2	2	0	2	66
Picea	2	2	0	2	23-66

Crops	Number of accessions	Italian origin	Foreign origin	Wild or local	Institutions
Pinus	51	10	nn	10	23-59-63-66
Pistacia	2	2	0	2	66
Platanus	2	2	0	2	66
Populus	3 000	500	nn	500	22-46
Prunus spp	10	10	0	10	59-66
Pyrus	3	3	0	3	59-66
Quercus	40	40	0	40	43-63-66
Rhamnus	6	6	0	6	59-66
Ribes	5	5	0	5	57-63-66
Robinia	161	15	146	1	22-66
Rosa	8	8	0	8	66
Ruscus	1	1	0	1	66
Salix	577	nn	nn	nn	22
Sambucus	3	3	0	3	66
Sequoiadendron	1	1	0	1	66
Sorbus	13	13	0	13	59-66
Spartium	4	4	0	4	59-66
Staphylea	1	1	0	1	66
Taxus	4	4	0	4	3-66
Teline	1	1	0	1	66
Tilia	3	3	0	3	66
Ulmus	3	3	0	3	66
Viburnum	3	3	0	3	66

CHAPTER 4

THE STATE OF USE

It is difficult to give precise indications on how the conserved germplasm is utilized within the single institutions; however, a broad distinction between the categories "Research and Breeding", "Exchange with the private and public sector" and "No use" can be made.

TABLE 18
Utilization (in %) of PGR held in Italian collections

Crop group	R&B	Exchange	Only conservation
Cereals	51	25	14
Vegetables	80	10	10
Fruits and Nuts	69	13	18
Forage crops	75	20	5
Industrial crops	62	9	29
Ornamentals	90	5	5
MAPs	20	80	0
Other woody species for alimentation	65	8	27
Forest species	nn	nn	nn
Total	**64**	**22**	**14**

Research is mainly targeted at four priority areas indispensable for the efficient management and utilization of PGRFA. These comprise the safeguard of biodiversity and its natural habitats, the identification of breeding targets and opportunities, the promotion of the cultivation and consumption especially of local varieties and landraces and the definition of alternative conservation methodologies, such as the establishment of core collections or *in vitro* techniques.

Concerning breeding objectives, the development of new cultivars, in response to changing market demands, cultivation practices as well as climatic and ecologic challenges, is a central aim of scientists and producers in the agro-alimentary and horticultural sector. Horticultural, technological and/or environmental traits, resistance to biotic and abiotic stresses as well as high nutraceutic value of food products are among the most important targets in the Italian breeding sector.

Recently, the rising awareness on local varieties has led to an enhanced request from nurseries and seed companies who intend to commercialize the material (mainly of fruits, vegetables and cereals) at regional scale.

Table19 below gives an overview on the different fields of utilization of the germplasm conserved.

TABLE 19
Sectorial repartition of utilization of PGR

Crop	Human cons. fresh	Human cons. processed	Animal nutrition	Pharmacy, cosmetics	Industrial use	Ornamental use	Timber	Landscape/ sustainable land use
Cereals		X	X		X			
Vegetables	X	X						X
Fruits and Nuts	X	X					X	X
Forage crops			X	X				X
Industrial species					X			
Ornamentals						X		X

Crop	Human cons. fresh	Human cons. processed	Animal nutrition	Pharmacy, cosmetics	Industrial use	Ornamental use	Timber	Landscape/ sustainable land use
Tobacco					X	X		
MAP	X	X		X				
Grape	X	X						
Olive		X						
Citrus	X	X				X		X
Mulberry	X		X	X	X		X	
Forest species			X		X	X	X	X

CHAPTER 5

THE STATE OF NATIONAL PROGRAMMES, TRAINING AND LEGISLATION

As can be seen from the analysis in Chapter 3, activities regarding the conservation and utilization of PGR in Italy are not coordinated within a centralized national framework, but are rather carried out within different administrations which have developed specific approaches, according to their respective responsibility.

However, all these provisions are in harmony with existing national laws on the implementation of the various international agreements and Treaties (CBD, GPA, International Treaty) to which Italy is a partner country.

National laws regard the implementation, amongst other international agreements, of the CBD and the FAO International Treaty on PGRFA and result in a series of regulations and provisions issued by responsible subordinate organisms.

5.1 Ministry of Environment

Following Italy's ratification of the CBD on February 14, 1994, the Ministry of Environment, together with the Interministerial Conference for Economical Programmation, has developed a National Action Plan on Biodiversity, which, however, has not become operational yet. The only document approved so far which refers to this Action Plan is the "Strategic Guidelines and Preliminary Actions for the implementation of the CBD in Italy" This paper defines a series of approaches and actions towards the safeguard of biodiversity in general, and the sustainable use of PGRFA and ecosystems. Art. 7 of this document, for example, foresee the establishment of coordinated network of conservation centres for PGRFA, while Art. 4 sets out measures for the *in situ* conservation of biodiversity, giving a central role to Protected Areas (see Chapter 2). A detailed summary of this document has been provided in the first "Country Report".

5.2 Ministry of Agriculture, Alimentation and Forestry Policies (MiPAAF)

Since 1997, the MiPAAF is in charge of implementing tasks of national coordination targeted at the safeguard and protection of plant diversity and their related genetic heritage.

For this purpose, a first project called "Plant Genetic Resources", conducted by 15 Research Institutes belonging to the MiPAAF and coordinated by the Experimental Institute for Fruit Trees in Rome (nowadays CRA-FRU), was set up, with the aim to systematically collect, conserve, document and sustainabily utilize PGRFA.

Main outcomes of the project were (a) a census of all accessions of PGRFA held within the 15 Institutions belonging to the MiPAAF and the CNR-IGV and (b) a census of all accessions of fruit species conserved *ex situ* in Italy, including not only the institutions of the MiPAAF but also Universities, the CNR and experimental stations (see Chapter 3-Fruits and Nuts).

In 2004, this project was adapted to the provisions established by the FAO International Treaty, with particular regard to the implementation of the following articles:

- **Art. 5:** Promotion of an integrated approach to the collection and conservation of PGRFA (*ex situ* and *in situ*);
- **Art. 6:** Promotion of the utilization of local varieties and strengthening of on-farm conservation;
- **Art. 9:** Safeguard of local traditions and support of local farmers;
- **Art. 11:** Adoption of measures to ensure the inclusion of Annex I crops in the conservation programmes;
- **Art. 12:** Facilitation of the access to the conserved material.

Chapter 7 provides more details on this project.

5.3 Regional administrations

Also the Regions have developed (or are developing) regional laws aiming at the safeguard and utilization of plant (and animal) resources, with particular attention to those autochthonous and at risk of extinction or genetic erosion.
Common issues and provisions of these regional laws are:

- the inclusion of identified autochthonous varieties and ecotypes in regional catalogues of germplasm to be protected;
- the institution of scientific commissions to survey and coordinate the composition of these catalogues and to decide on priority measures for the protection of the single accessions;
- the establishment of a regional network of existing *in situ* and *ex situ* facilities for the conservation of the material identified (regional gene banks, Guardian Farmers, etc);
- the collection, conservation, propagation and utilization of this material.

TABLE 20
Regional laws on the safeguard of local biodiversity, in chronological order of ratification

Region	Regional Law
Veneto	**L.R. 18/04/1995 n. 33**, "Safeguard of the genetic heritage of woody species autochthonous to Veneto"
Abruzzi	**L.R. 9/04/1997, n. 35**, "Safeguad of plant diversity and management of botanical gardens"
Molise	**L.R. 23/02/1999, n. 9**, "Regulations for the protection of autochthonous plants and those at risk of extinction, and incentives for the cultivation of medicinal and other plants growing in the wild"
Latium	**L.R. 1/03/2000, n. 15**, "Safeguard of autochthonous genetic resources of agricultural interest"
Umbria	**L.R. 4/09/2001, n. 25**, "Safeguard of autochthonous genetic resources of agricultural interest"
Friuli Venezia Giulia	**L.R. 22/04/2002, n. 11**, "Safeguard of autochthonous genetic resources of agrarian and forestal interest"
Marche	**L.R. 3/06/2003, n. 12**, "Safeguard of plant and animal genetic resources of the territory of the Marche"
Tuscany	**L.R. 16/11/2004, n. 64**, "Safeguard and utilization of the local patrimony of plants and animals of agrarian, zootecnical and forestal interest"
Emilia Romagna	**L.R. 29/01/2008, n. 1**, "Safeguard of the local patrimony of plants and animals of the territory of Emilia-Romagna of agricultural interest"

Tab. 21 below provides an overview on current reginal activities towards the conservation of regional autochthonous PGRFA.

5.4 Other national legislation

Further to the above-mentioned legislation, the conservation, access to and exchange of RGV is regulated by the following laws:

- **Law 25/11/1971 n. 1096**, which regulates the conditions for commercial production and the commercialization of seeds, except for forest and medicinal species. The law also foresees the establishment, through the MIPAAF, of lists of cultivated varieties for all species.
- **MIPAF Decree 5/3/2001**, which defines genebanks and other conserving institutions within Public bodies or funded by the State and whose main mission is to safeguard plant genetic resources destined to agriculture, alimentation and rural environments and which are held in the public domain; this material is under the control of the MIPAF (today MiPAAF), which regulates its adequate use and storage in the interest of the farmers and for the integrity of agricultural systems and rural environments, to make sure its free and permanent availability for a sustainable agricultural development and food security of Italy.
- **Legislative Decree 19/8/2005 n.214**, which, in full compliance with Directive 2002/89/CE, defines the conditions, procedures and formal requirements concerning phytosanitary aspects of exchanged material, as well as the required controls on PGR, both in case they arrive from an EU member State or from third countries.
  Particular attention is paid to
  - the establishment of Regional Official Producers' Registers, united in a National Register;
  - the issuing of internationally agreed "phytosanitary passports" of the plants, in order to ensure that the required sanitary criteria concerning plants and their products destined to circulation in the EU are met;

- the accurate documentation, by means of a "register of plants and plant products", of all purchases, productions and sales of plants and related products, to ensure their traceability;
- the definition of EU-wide "quarantine areas", which, thanks to the absence of harmful organisms, are eligible for targeted phytosanitary measures.

- **MiPAAF Decree 18/4/2008** which, in compliance with national law n. 46/02 and referring directly to national law n. 46/07, regulates the provisions to be applied to the commercialization of seeds of "varieties to be conserved"; the Decree ascertains that either the MiPAAF and the Regions and Autonomous Provinces favour and promote *in situ* and on-farm conservation of certain "varieties to conserve". These "varieties to conserve" have to be registered in a special chapter in the above-mentioned National Register (for further details see Chapter 7).

TABLE 21

Current examples of regional projects towards the recovery, safeguard and utilization of autochthonous PGRFA

Crop group	Objectives	Species	Regions involved
Cereals	Recovery and characterization of varieties of particular local interest; reintroduction in their traditional cultivation system	Those used for local types of bread	Abruzzi, Apulia, Emilia Romagna
		Maize	Piedmont, Tuscany
		All	Veneto
Vegetables	Recovery of local varieties at risk of extinction	All	Apulia, Campania, Marche, Piedmont, Tuscany, Umbria, Veneto
		Peppers, local bean and leek varieties	Piedmont
		Local bean and potato varieties	Tuscany
		Lathyrus	Marche
		"Lens of Santo Stefano di Sessani"	Abruzzi
Historical fruit varieties	Recovery and characterization of local varieties and reintroduction in their traditional cultivation systems	All	Campania
		Apple, Pear, *Prunus*	Emilia-Romagna, Marche, Lazio Piedmont, Tuscany, Umbria
		Pome fruits	Veneto
		Sweet cherry	Apulia
		Almond	Abruzzi, Apulia
		Fig	Apulia
Forage species	Recovery and utilization of local ecotypes	*Medicago*, *Onobrychis viciifolia*	Abruzzo
MAPs	Identification, recovery and conservation	All	Umbria
Flowers and ornamentals	Recovery and safeguard of local germplasm	*Rhododendron, Camellia, Azalea, Orchids, Ranunculus,* Tulips, Anemone, Mimosa	Piedmont, Tuscany, Liguria, Sicily
Citrus	Recovery and characterization of historical local varieties; clonal selection for ornamental purposes	All	Apulia, Calabria, Campania, Liguria, Sardinia, Sicily
Olive	Identification and molecular characterization of local varieties and conservation *ex situ*; utilization in high-quality olive oil	*Olea europea*	Apulia, Latium, Marche, Tuscany, Umbria,
Grapevine	Clonal and ampelographic selection, identification and molecular characterization of local and abandoned vineyards; evalutation of the potential to produce typical and original vines.	*Vitis* spp	Emilia-Romagna, Piedmont, Sicily, Tuscany, Veneto,
		"Primitivo di puglia"	Apulia

CHAPTER 6

THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

Italian experts are actively involved in numerous international collaborations which target at research, breeding and collection of PGRFA, including their documentation and capacity building in related fields of activities.

Several governmental collaboration agreements are in place, for example with Australia and Albania.

Concerning long-term initiatives, the European Cooperative Programme on Plant Genetic Resources (ECPGR) and the European Forest Genetic Resources Programme (EUFORGEN), both formally coordinated by Bioversity International (formerly IPGRI), are the main fora for the promotion of concerted research, conservation and utilization of Plant and Forest Genetic Resources in Europe. Experts from the CRA, Universities, the CNR, the Agronomic Institute for Overseas (IAO) of the Ministry of Foreign Affairs and of the National Forest Service are representing Italy in nearly all Working Groups and Networks.

The Task Force on *In situ* and On-farm conservation, recently divided in two separate Working Groups, is chaired by the Italian delegate, and within the Working Group on Industrial species, either the vice-chair and the manager of the European Central Crop Database on Flax and Hemp are Italian representatives. The ECCDBs on *Solanaceae* and Minor Fruit trees are managed by CNR-IGV and University of Florence, respectively.

The Task Force on International Cooperation, with active participation of a IAO delegate, is exploring possibilities to set up collaboration with other regional cooperative programmes and has established contacts with the Genetic Resources Network for West and Central Africa (GRENEWECA).

The implementation of the global benefit-sharing process is a central item outlined by the FAO International Treaty. The Secretariat of the Treaty is being significantly supported by Italy, in particular with specific contributions to the Benefit Sharing Trust Fund and to the Trust Fund for Agreed Purposes. Italy has furthermore substantially contributed to the activation of programmes regarding *ex situ* conservation coordinated by the Global Crop Diversity Trust.

At the institutional level, most institutions are collaborating with one or more international partners, both from Europe and from other continents. Bilateral long-term collaboration agreements at institutional level exist for example between CNR-IGV and Julius-Kuehn Institute (JKI, formerly IPK) in Gatersleben, Germany and between CRA-FRU and the Fruit Growing Institute in Plovdiv, Bulgaria.

Furthermore, most researchers are periodically involved in collaborative international research projects, such as, for example, the EU-financed AGRI GEN RES and COST programmes.

CHAPTER 7

IMPLEMENTATION OF THE FAO INTERNATIONAL TREATY ON PGRFA, ACCESS AND BENEFIT SHARING, FARMERS' RIGHTS

As outlined in Law no. 101/2004 of April 6 2004 which followed the Italian ratification of the Treaty, the Ministry of Agriculture, Alimentation and Forestal Policies (MiPAAF) is responsible for the monitoring and reporting on the international floor of the national measures taken and the progresses made towards the implementation of the signed obligations, mainly the ones expressed in Articles 5, 6, 9, 11 and 12 of the Treaty (see Chapter 5).

In addition to the measures taken by the Regions and Autonomous Provinces (see Chapter 5), the MiPAAF adopted a two-tier approach to ensure the proper implementation of the Treaty by the development of two national activities on PGRFA conservation and utilization. One programme, already in function, is targeted at the *ex situ* conservation of plant germplasm, including measures to facilitate access to PGRFA and sharing of benefits arising from their utilization. The other programme, still to be initiated, focuses on the *in situ* conservation of plant genetic material and on the strengthening of rural communities, farmers' rights and the sharing of benefits arising from the use of the PGR conserved under their responsibility.

Both programmes are briefly outlined below.

7.1 Programme "Implementation of the FAO Treaty on PGRFA" (*ex situ*)

The programme follows the Project "Plant Genetic Resources" (see Chapter 5) and was initiated in 2005. CRA-FRU in Rome is responsible for the scientific coordination of the programme, which is revised and adjusted to new arising developments and challenges on a three-year-basis. It currently comprises 27 Research Institutions of the CRA, CNR-IGV and, since the beginning of the second triennium in 2008, also the Rural Seeds Network.

The involved institutions dedicate their studies to a large variety of crops; therefore, the programme does not limit its activities to the species included in Annex I of the FAO Treaty but is extended to 71 species which are of cultural, economic and strategic importance to Italy. (see Tab. 22 below)

TABLE 22

Species covered by the Programme, of which 27* are included in Annex I of the FAO Treaty

Cereals	Barley*, Oat*, Maize*, Rice*, Sorghum*, Wheat*
Vegetables	Artichoke, Asparagus*, Bean*, Brassica*, Chick pea*, Eggplant*, Faba bean*, *Lathyrus** spp., Lentil*, Nasturzio, Onion, Potato*, Pea*, Peppers*, Tomato, Radish*, Rucola*, Pumpkin
Fruits	Apricot, Apple*, Cherry, Citrus*, Fig, Small fruits, Kiwi, Nashi, Pear, Peach and Nectarine, Plum, Strawberry*;
Nuts	Almond, Chestnut, Hazelnut, Pecannut, Pistachio, Walnut
Forage species	*Hedysarum**, *Lolium**, Lupin*, *Medicago**, *Trifolium**
Industrial crops	Sugar beet, Flax, Hemp
Aromatic and medicinal Plants	*Achillea, Chamomilla, Gentiana, Hypericum, Salvia, Thymus*
Ornamental species	*Euphorbia, Hebe, Limonium, Nicotiana, Passiflora, Viburnum*
Forest species	Abies, *Eucalyptus*, Pine, Poplar, *Pseudotsuga*, *Salix*
Others	Grapevine, Mulberry, Olive

The work plan of the programme foresees the following activities:

- **Individuation, recovery and conservation** of germplasm of regional, national or foreign origin;
- Agronomic, morpho-physiologic, biochemical and molecular **characterization** of the material;
- **Utilization** of the recovered PGR for human and animal alimentation (including local traditional products and high quality animal-based products), their nutraceutic value, their technological characteristics, ornamental aspects as well as their utilization for environmental, ecological and landscape purposes;
- Agronomic **evaluation** for distinctiveness, uniformity and stability (DUS) of material obtained from breeding;
- The study and assessment of alternative methods of conservation and conservation (cryoconservation, micro and *in vitro* culture);
- guarantee **access** to the material by means of reproduction, phytosanitary measures and adequate conservation;
- Documentation of the stored material and related information; this task is being realized at three different, to some extent interrelated levels:
    1. Internal level: the single institutions manage electronic archives on the germplasm they conserve. These internal databases report on passport and species-specific descriptors defined and agreed at international level (FAO/IPGRI) and/or considered of further importance by the holding institutions. In this case descriptors are in line with the standards of UPOV and the National Register of New Varieties.
    2. National level: the institutions participating in the programme transfer the information on the respective accessions contained in their internal databases in the National Inventory, an interactive online database of the PGRFA conserved *ex situ* in Italy (www.rgv-politicheagricole-cra.it).
    3. International level: data included in the National Inventory are transferred periodically to the European search catalogue EURISCO, managed by Bioversity International. Institutions which participate in Crop Working Groups within the European Cooperative Programme on Plant Genetic Resources (ECPGR) provide for the inclusion of the crop-specific data in the respective European Central Crop databases (ECCDBs).

TABLE 23

Crops conserved *ex situ* in Italy which are included in Annex I of the FAO International Treaty

Crops	Number of species	Number of taxa	Number of accessions
FOOD			
Cereals	6	43	49 539
Vegetables	12	77	2 784
Fruits	3	80	3 336
Others	1	1	2
FODDER			
Legumes	8	25	6 323
Grasses	7	15	2 373
TOTAL	**37**	**241**	**64 357**

7.2 Institution of a National Register on varieties to be conserved (*in situ*)

Law no. 46/2007 of April 6, 2007 defines further measures to be taken, at national level, to ensure the conservation of PGRFA, access and benefit sharing as well as the promotion of farmers' rights.

Specifically, this law foresees the institution of a national register of "varieties to be conserved", which will be realized under the responsibility of the MiPAAF, in tight collaboration with the Regions and Autonomous Provinces.

"Varieties to be conserved" are defined as varieties, populations, ecotypes, clones and cultivars of agricultural interest which fall under the following categories:

- Autochthonous and non autochthonous material, not included in any other national register, and which has been an integral part of Italian agricultural systems for at least 50 years;
- Genotypes no more included in any national register and at risk of genetic erosion;
- genotypes no more cultivated on national territory and only conserved *ex situ* in botanical gardens, research institutions, public and private gene banks, and whose re-introduction in production systems is suggested by economic, scientific, cultural and environmental interests.

The MiPAAF and the Regions and Autonomous Provinces will, within their field of competences, safeguard the above-defined heritage in PGR, and will provide for a just and equal retribution of those local communities and farmers which ensure the conservation of this plant material.

Furthermore, farmers which recover, propagate and cultivate these materials in the places of their origin or traditional environment, will be given the right to directly sell the products and to commercialize on local markets moderate quantities of seeds or other reproductive material of the germplasm produced on their farm. This reduces the risk of loosing rare varieties which are not reproduced by big seed companies due to limited market request.

Several Regions have already set in place provisions which fall under these regulations.

CHAPTER 8

THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

Conservation and utilization of PGR are central aspects for the safeguard of human wellbeing, stable ecosystems and cultural heritage all over the world. Serious events, such as genetic erosion and genetic pollution within plant genetic materials, as well as ongoing change of climatic conditions in our traditional environments, are threatening the survival of the worlds' plant diversity. Potential dangers for human nutrition might become real if the narrow genetic pool of species which provides large percentages of our daily diet and wellbeing will be hit by these changes as well. Broadening the genetic base of our alimentation, through research and breeding, and strong commitment for the realization of sustainable agricultural systems and practices are crucial to ensure the quality of life not only for present, but also for future generations.

The safeguard of genepools is essential not only for breeding and the implied broadening of the genetic base within cultivated species, but benefits reveal themselves directly in private households which profit from a high diversification of products, which are essential for healthy and varied diets.

Socio-cultural benefits arising from the sustainable management of local varieties of PGRFA comprise the safeguard of local traditions and characteristics, the strengthening of local identity and the education of current and future generations on the value of biodiversity in general and the rich plant genetic heritage which surrounds us.

This last aspect is best reflected in diversified, typical landscapes which are made up of the species evolved in their traditional environments and which strongly influence our identification with the territory we live in. These species are best adapted to the predominant biotic and abiotic conditions and can therefore play an essential role in the re-qualification of devastated landscapes or in the re-naturalization of sites which are highly influenced by human activities.

The strengthening of local farmers and rural communities which are given the opportunity to directly participate in the markets is only one of the many economical benefits arising from the sustainable management of PGRFA.

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ANNEX 1

LIST OF CITED INSTITUTIONS AND REFERENCE NUMBERS

- **Council for Research in Agriculture (CRA)**

Ref. no.	Acronym and City	Name of Institution
1	CRA-SCA Bari	Unità di Ricerca per i Sistemi colturali degli ambienti caldo aridi (Research Unit for cultivation systems in hot and dry environments)
2	CRA-MPF Trento	Unità di Ricerca per il monitoraggio e la pianificazione forestale (Research Unit for forest monitoring and management)
3	CRA-CER Foggia	Centro di Ricerca per la Cerealicoltura (Research Centre for Cereals) - Foggia
4	CRA-GPG Fiorenzula d'Arda	Centro di Ricerca per la genomica e la postgenomica animale e vegetale (Research Centre for animal and plant genomics and postgenomics)
5	CRA-MAC Bergamo	Unità di Ricerca per la Maiscoltura (Research Unit for Maize)
6	CRA-RIS Vercelli	Unità di Ricerca per la Risicoltura (Research Unit for Rice)
7	CRA-SCV Sant'Angelo Lodigiano	Unità di Ricerca per la selezione dei cereali e la valorizzazione delle varietà vegetali (Research Unit for cereal breeding and valorization of plant varieties)
8	CRA-QCE Rome	Unità di Ricerca per la valorizzazione qualitativa dei cereali (Research Unit for qualitative valorization of cereals)
9 (a)	CRA-ACM Catania	Centro di Ricerca per l'Agrumicoltura e le colture mediterranee (Research Centre for Citrus and Mediterranean Crops)
9 (b)	CRA-ACM Acireale	Centro di Ricerca per l'Agrumicoltura e le colture mediterranee (Research Centre for Citrus and Mediterranean Crops)
10	CRA-FLC Lodi	Centro di Ricerca per le produzioni foraggere e lattiero-casearie (Research Centre for Forages, Milk and Cheese production)
11	CRA-CIN Bologna	Centro di Ricerca per le Colture Industriali (Research Centre for Industrial species)
12 (a)	CRA-OLI Rende	Centro di Ricerca per l'Olivicoltura e l'Industria olearia (Research Centre for Olive cultivation and Olive Oil technology)
12 (b)	CRA-OLI Pescara	Centro di Ricerca per l'Olivicoltura e l'Industria olearia (Research Centre for Olive cultivation and Olive Oil technology)
13	CRA-FSO Sanremo	Unità di Ricerca per la Floricoltura e le specie ornamentali – (Research Unit for Floriculture and ornamental species)
14	CRA-VIV Pescia	Unità di Ricerca per il vivaismo e la gestione del verde ambientale e ornamentale (Research Unit for Nursery Plants Production and Management of Landscape and Ornamental Plants)
15	CRA-SFM Palermo	Unità di Ricerca per il recupero e la valorizzazione delle specie floricole mediterranee (Research Unit for the recovery and valorization of mediterranean flower species)
16	CRA-FRU Rome	Centro di Ricerca per la Frutticoltura (Research Centre for Fruit Trees)
17	CRA-FRC Caserta	Unità di Ricerca per la Frutticoltura (Research Unit for Fruit Trees)
18	CRA-FRF Forlì	Unità di Ricerca per la Frutticoltura (Research Unit for Fruit Trees)
19	CRA-ORT Pontecagnano	Centro di Ricerca per l'Orticoltura (Research Centre for Vegetables)
20	CRA-ORL Montanaso Lombardo	Unità di Ricerca per l'Orticoltura (Research Unit for Vegetables)
21	CRA-ORA Monsampolo del Tronto	Unità di Ricerca per l'Orticoltura (Research Unit for Vegetables)
22	CRA-PLF Casale Monferrato	Unità di Ricerca per le Produzioni legnose fuori Foresta (Research Unit for Timber production)
23	CRA-SEL Arezzo	Centro di Ricerca per la Selvicoltura (Research Centre for Silviculture)
24	CRA-CAT Scafati	Unità di Ricerca per le Colture alternative al tabacco (Research Unit for species alternative to tobacco)
25	CRA-VIT Susegana	Centro di Ricerca per la Viticoltura (Research Centre for Viticulture)
26	CRA-VIC Arezzo	Unità di Ricerca per la Viticoltura (Research Unit for Viticulture)
27	CRA-ENO Asti	Centro di Ricerca per l'Enologia (Research Unit for Enology)

Ref. no.	Acronym and City	Name of Institution
28	CRA-ENC Velletri	Unità di Ricerca per le produzioni enologiche dell'Italia centrale (Research Unit for Wine production in Central Italy)
29	CRA-UTV Turi	Unità di Ricerca per l'uva da tavola e la Vitivinicoltura in ambiente mediterraneo (Research Unit for table grape and Viticulture in Mediterranean climates
30	CRA-API Padova	Unità di Ricerca di Apicoltura e Bachicoltura (Research Unit for Bees and Silkworms)

- **Universities**

Ref. no.	Acronym and City	Name of Institution
31	UNI AN Ancona	Dipartimento di Biotecnologie Agrarie e Ambientali (Dept. for Biotechnology in Agriculture and Environment)
32	UNI BA Bari	Istituto per le Coltivazioni Arboree
33	UNI CT Catania	Dipartimento di Ortofloroarboricoltura e Tecnologie agroalimentari
34	UNI BO Bologna	Dipartimento per le Colture Arboree
35 (a)	UNI FI Florence	Dipartimento per l'Ortoflorofrutticoltura
35 (b)		Dipartimento di Scienze agronomiche e gestione del territorio agro-forestale
36	UNI MI Milan	Dipartimento per le Produzioni vegetali, Sezione Colture Arboree
37	UNI NA Naples	Dipartimento per l'Arboricoltura, Botanica e Patologia vegetale
38	UNI PA Palermo	Istituto per le Coltivazioni Arboree
39 (a)	UNI PC Piacenza	Istituto di Fruttiviticoltura
39 (b)		Istituto di Biologia e Genetica Vegetale
40	UNI PD Padua	Dipartimento per l'Agronomia Ambientale e le Produzioni Vegetali
41	UNI PG Perugia	Dipartimento di Biologia applicata
42	UNI PI Pisa	Dipartimento per la Coltivazione e la Difesa delle Specie Legnose
43	UNI SS Sassari	Dipartimento di Economia e Sistemi Arborei
44	UNI TO Turin	Dipartimento delle Colture Arboree
45	UNI UD Udine	Dipartimento per la Produzione vegetale e le Tecnologie Agrarie
46	UNI VT Viterbo	Dipartimento per la Produzione vegetale

- **National Research Council CNR**

Ref. no.	Acronym and City	Name of Institution
47	CNR-IGV Bari	Istituto di Genetica Vegetale
48	CNR-IVALSA Florence	Istituto per la Valorizzazione del legno e delle Specie arboree
49	CNR-ISPA Sassari	Istituto di Scienze delle Produzioni alimentari

- **Regions**

Ref. no.	Acronym and City	Name of Institution
50	ARSSA (Chieti)	Abruzzi (Agenzia Regionale per i Servizi di Sviluppo in Agricoltura)
51	ALSIA (Matera)	Basilicata (Agenzia Lucana di Sviluppo e di Sperimentazione in Agricoltura)
52	AARN (Aosta)	Aosta Valley (Assessorato dell'Agricoltura e Risorse Naturali)
53	ARSSA (Reggio Calabria)	Calabria (Agenzia Regionale per i Servizi di Sviluppo in Agricoltura)
54	SeSIRCA (Napoli)	Campania (Giunta Reginaòle Campania, Settore Sperimentazione Informazione e Consulenza in Agricoltura)
55	CRPV (Cesena)	Emilia Romagna (Centro di Ricerche per le Produzione Vegetali)
56	ERSA (Udine), Prov. Por. (Pordenone)	Friuli-Venezia Giulia (Agenzia Reegionale per lo Sviluppo Rurale): (Amministrazione Provinciale di Pordenone)
57	ARSIAL (Roma)	Latium (Agenzia Regionale per lo Sviluppo e l'Innovazione in Agricoltura)
58	ERSAF (Milan)	Lombardy (Ente Regionale per i Servizi all'Agricoltura e alle Foreste)
59	ASSAM (Ancona)	Marche Agenzia per i Servizi nel Settore Agroalimentare)
60	AssAg (Torino)	Piedmont (Assessorato all'Agricoltura della regione Piemonte)
61	Cons.Fru (Cagliari)	Sardinia (Consrzio per la Frutticoltura di Cagliari)

Ref. no.	Acronym and City	Name of Institution
62	LAIM Laimburg	Trentino-Alto Adige (Centro Sperimentazione Agraria Regionale)
63	ARSIA (Florence)	Agenzia Regionale per lo Sviluppo e l'Innovazione nel settore Agricolo-forestale
64	Dip. Agricoltura e Foreste (Perugia)	Umbria
65	Veneto Agricoltura (Padova)	Veneto

- **Others**

Ref. no.	Acronym and City	Name of Institution
66	CFS	Corpo Forestale dello Stato
67	RISI (Padua)	National Institution for Italian Rice varieties
68	RSR	Rete Semi Rurali (NGO) – Rural Seeds Network
69	BG	Botanic Gardens

ANNEX 2

SPECIES RELATED TO THE ONES CONSERVED *EX SITU* IN ITALY AND FOUND IN PROTECTED AREAS

Abies: alba, cephalonica, nebrodensis
Achillea: clavenae, collina, distans, erba-rotta, macrophylla, millefolium, moschata, nana, nobilis, oxyloba, roseo-alba, rupestris, setacea ssp. *setacea, tomentosa*
Acer: campestre, cappadocicum ssp. *lobelii, mospessulanum, negundo, obtusatum, opalus, opalus* ssp. *obtusatum, opulifolium, palmatum, platanoides, pseudoplatanus, saccharinum*
Aconitum: anthora, lycoctorum, lycoctorum ssp. *neapolitanum, napellus, napellus* ssp. *vulgare, variegatum, variegatum* ssp. *variegatum, vulparia, vulparia* ssp. *neapolitanum*
Acorus: calamus
Aegilops: geniculata, neglecta, triuncialis, podagraria
Agrimonia: eupatoria, eupatoria ssp. *eupatoria*
Agropyron: caninum, junceum, repens, junceum, pungens, repens
Agrostis: alpina, canina, capillaris, castellana, gigantea, rupestris, schraderiana, stolonifera, tenuis
Ailanthus: altissima
Alcea: biennis ssp. *biennis, rosea*
Allium: ampeloprasum, angulosum, carinatum, cepa, cirrhosum, ericetorum, insubrium, lusitanicum, moschatum, oleraceum, oleraceum ssp. *oleraceum, paniculatum* ssp. *paniculatum, parciflorum, pendulinum, rotundum, sativum, schoenoprasum, schoenoprasum* ssp. *sibiricum, sphaerocephalon, suaveolens, ursinum, ursinum* ssp. *ursinum, victorialis, vineale*
Alnus: cordata, glutinosa, incana, viridis
Amelanchier: ovalis, ovalis ssp. *ovalis*
Amorpha: fruticosa
Ampelodesma: mauritanicus
Anemone: appennina, baldense, campestris, coronaria, hepatica, hortensis, narcissiflora, nemorosa, ranunculoides, trifolia, trifolia ssp. *brevidentata*
Anthyllis: vulneraria
Apium: graveolens, nodiflorum
Aquilegia: alpina, atrata, einseleana, magellensis, ottonis, vulgaris
Arbutus: unedo
Arctium: lappa, minus, nemorosum, tomentosum
Arctostaphylos: alpinus
Argryolobium: zanonii
Armoracia: rusticana
Arnica: montana
Artemisia: absinthum, alba, annua, campescens, coerulescens, genipi, glacialis, mutellina, nitida, umbelliformis, verlotiorum, vulgaris
Ascelpia: syriaca
Asparagus: acutifolius, albus, officinalis, tenuifolius
Astragalus: alpinus, australis, carnicolus ssp. *albiflorus*
Atropa: belladonna
Avena: barbata, fatua, sativa, sterilis
Berberis: aetnensis, vulgaris, vulgaris ssp. *vulgaris*
Beta: vulgaris, vulgaris var. *cruenta*
Betula: pendula, verrucosa

Bidens: bipinnata, cernua, frondosa, radiata, tripartita
Borago: officinalis
Brachypodium: caespitosum, distachyum, genuense, pinnatum, rupestre, rupestre ssp. *caespitosum, sylvaticum*
Brassica: insularis, napus, napus ssp. *napus, nigra, rapa* ssp. *campestris, rapa* ssp. *sylvestris*
Bromus: arvensis, arvensis ssp. *arvensis, benekenii, commutatus, diandrus, erectus, erectus* ssp. *erectus, gussonei, hordeaceus, hordeaceus* ssp. *hordeaceus, inermis, intermedius, japonicus, madritensis, racemosus, rubens, scoparius, secalinus, squarrosus, sterilis, tectorum, willdenowii*
Buxus: sempervirens
Calamintha: nepeta, nepeta ssp. *glandulosa, nepeta* ssp. *nepata, nepeta* ssp. *sylvatica, sylvatica, sylvatica* ssp. *sylvatica*
Calendula: arvensis, officinalis
Carlina: acanthifolia ssp. *acanthifolia, acaulis, corymbosa, macrocephala, utzka, vulgaris, vulgaris* ssp. *vulgaris*
Carpinus: betulus, orientalis
Castanea: sativa
Cedrus: atlantica, deodara
Celtis: australis, australis ssp. *australis, occidentalis*
Centaurea: aetaliae, alba, ambigua, ambigua ssp. *ambigua, ambigua* ssp. *nigra, aplolepa, aplolepa* ssp. *aetaliae, aplolepa* ssp. *aplolepa, aplolepa* ssp. *carueliana, arrigonii, bracteata, calcitrapa, centauroides, cineraria, cyanus, dichroantha, diomedea, dissecta* ssp. *ilvensis, dissecta* ssp. *intermedia, eritreae, gymnocarpa, hainaldii* ssp. *julica, horrida, jacea, jacea* ssp. *gaudini, maculosa, montana, montis-borlaeche, nemoralis, nervosa, nigra, nigrescens* ssp. *nigrescens, paniculata, pratensis, pulchellum, rhaetica, scabiosa, scabiosa* ssp. *alpestris, scabiosa* ssp. *scabiosa, solstitialis, stoebe* ssp. *stoebe, subtilis, tenoreana, tommasinii, triumfetti, triumfetti* ssp. *triumfetti, veneris*
Centaurium: erytraea ssp. *erytraea, puchellum, pulchellum* ssp. *pulchellum*
Centranthus: ruber, ruber ssp. *ruber*
Ceratonia: siliqua
Cercis: siliquastrum, siliquastrum ssp. *siliquastrum*
Chamaecyparis: lawsoniana
Chamomila: recutita
Chenopodium: album, album ssp. *album, ambrosioides, bonus-henricus, botrys, glaucum, hybridum, murale, opulifolium, polyspermum, rubrum, suecicum, urbum, vulvaria*
Chrysanthemum: leucanthemum
Cichorium: intybus
Cistus: albidus, clusii, creticus ssp. *eriocephalus, incanus, ladaniferus, monspeliensis, salviifolius*
Citrullus: lanatus
Colutea: arborescens
Cornus: mas, sanguinea
Coriaria: myrtifolia
Coronilla: emerus, minima, scorpioides, varia
Corylus: avellana, maxima
Cotinus: cogyggria
Cotoneaster: horizontalis, integerrimus, mathonnetii, nebrodensis, tomentosus
Crataegus: azarolus, crus-galli, laevigata, mollis, monogyna, oxyacantha
Crocus: albiflorus, biflorus, corsicus, etruscus, ligusticus, minimus, napolitanus, sativus, tomasii, vernus, vernus ssp. *albiflorus, vernus* ssp. *vernus*
Cucumis: melo
Cynodon: dactylon
Cynosurus: cristatus, echinatus
Cytisus: emeriflorus, hirsutus, nigricans, pseudoprocumbens, scoparius, scoparius ssp. *scoparius, sesselifolius, villosus*
Dactylis: glomerata, hispanica
Dasypyrum: villosum
Daucus: carota, carota ssp. *carota*
Digitalis: ferruginea, grandiflora, lutea, lutea ssp. *australis, micrantha*
Dipsacus: fullonum, laciniatus
Dorycnium: herbaceum, hirsutum, pentaphyllum
Echinops: ritro, ritro ssp. *ritro, siculus, sphaerocephalus* ssp. *sphaerocephalus*

Elaegnus: angustifolia
Eleusine: indica
Elymus: caninus, hispidus, pycnanthus, repens, repens ssp. *repens*
Eragrostis: cilianensis, megastachya, minor, pectinacea, pelosa
Erica: arborea, baccifera, carnea, cinerea, multiflora, scoparia, scoparia ssp. *scoparia*
Eruca: sativa, vesicaria
Eryngium: alpinum, amethystinum, campestre, maritimum
Eucalyptus: camaldulensis
Euphorbia: amygdaloides, amygdaloides ssp. *amygdaloides, bitorzoluta, brittingeri, carnolica, chamaesice, characias, cyparissias, dendroides, dulcis, dulcis* ssp. *purpurata, esula, exigua, exigua* ssp. *exigua, falcata* ssp. *falcata, flavicoma, flavicoma* ssp. *verrucosa, gasparrini* ssp. *samnitica, helioscopia, helioscopia* ssp. *helioscopia, hyberna* ssp. *insularis, kerneri, lathyris, maculata, myrsinites, nicaeensis* ssp. *prostrata, nutans, palustris, paralis, peplus, pithyusa, platiphyllos, platiphyllos* ssp. *platiphyllos, prostrata, seguierana, spinosa, spinosa* ssp. *ligustica, triflora* ssp. *kerneri, variabilis*
Fagus: sylvatica, sylvatica ssp. *sylvatica, sylvatica* ssp. *asplenifolia,*
Festuca: alpina, altissima, arundinacea, arundinacea ssp. *arundinacea, austrodolomitica, nigrescens, brevipila, calva, centroappenninica, cinerea, circummediterranea, curvula, dimorpha, filiformis, flavescens, gracilior, guestfalica, heterophylla, inops, laxa, negrescens, nigrescens* ssp. *nigrescens, ovina, paniculata, pratensis, pratensis* ssp. *pratensis, robustifolia, rubra, rubricula, scabriculmis, talleri, tenuifolia, ticinese, trachyphylla, valesiaca, varia, violacea*
Ficus: carica
Filipendula: ulmaria, vulgaris
Foeniculum: officinalis, vulgaris
Fragaria: moschata, vesca, viridis
Frangula: alnus
Fraxinus: angustifolia, excelsior, ornus, ornus ssp. *ornus*
Galega: officinalis
Genista: aetnensis, cilentina, corsica, desoleana, januensis, pilosa, radiata, sardoa, sericea, tinctoria, tinctoria ssp. *ovata, tinctoria* ssp. *tinctoria*
Gentiana: acaulis, asclepiadea, brachyphylla, ciliata, cruciata, cruciata ssp. *cruciata, dinarica, froelichi, kochiana, lutea, lutea* ssp. *luteanivalis, pneumonanthe, pumila, punctata, purpurea, rostanii, vera, verna, verna* ssp. *verna, villarsii*
Gingko: biloba
Gleditsia: triacanthos
Glycine: max
Gypsophyla: muralis, repens
Hedysarum: coronarium
Helianthus: annuus, pauciflorus ssp. *pauciflorus, tuberosus, x laetiflorus*
Helichrysum: italicum, italicum ssp. *italicum, litoreum, microphyllum* ssp. *tyrrhenicum, stoechas*
Hibiscus: palustris, syriacus, trionum
Hieracium: alpinum, amplexicaule, bifidum, crinitum, cymosum, dentatum, florentinum, glanduliferum, intybaceum, lachenalii, lactucella, murorum, pallidum, pilosella, pilosella ssp pilosella, piloselloides, piloselloides ssp. *piloselloides, praealtum* ssp. *praealtum, prenanthoides, pulmonarioides, racemosum, sabaudum, sabinum, schmistii, staticiifolium, sylvaticum, tenuiflorum, tomentosum, umbellatum, villosum, virgaurea, wiesbauerianum*
Hippocrepis: comosa, emerus
Hippophae: fluviatilis, rhamnoides
Holcus: lanatus, mollis
Hordeum: bulbosum, leporinum, murinum, murinum ssp. *leporinum, murinum* ssp. *murinum, secalinum, vulgare*
Hypericum: androsaemum, calycinum, coris, hirsutum, humifusum, montanum, mutilum, perfoliatum, perfoliatum ssp. *perforatum, perforatum* ssp. *veronense, quadrangulum, richeri, richeri* ssp. *richeri, tetrapterum*
Ilex: aquifolium
Inula: bifrons, britannica, chrithmoides, conyza, graveolens, helenium, hirta, montana, salicina, salicina ssp. *salicina, spiraeifolia, viscosa*
Iris: cengialti, ensata, foetidissima, germanica, graminea, lutescens, marsica, pallida, pseudoacorus, pseudopumila
Isatis: tinctoria
Juglans: nigra, regia
Juniperus: communis, communis ssp. *nana, nana, oxycedrus, oxycedrus* ssp. *oxycedrus, phoenicea, sabina*

Koeleria: cristata, lobata, macrantha, pyramidata, splendens
Laburnum: alpinum, anagyroides, anagyroides ssp. *anagyroides*
Lactuca: muralis, perennis, saligna, serriola, vimenea ssp. *vimenea, virosa*
Larix: decidua, kaempferi
Lathyrus: annuus, aphaca, aphaca ssp. *aphaca, cicera, clymeneum, hirsutus, incospicuus, latifolius, linifolius, montanus, niger, niger* ssp. *niger, nissolia, ochraceus* ssp. *occidentalis, palustris, pratensis, pratensis* ssp. *pratensis, sphaericus, sylvestris, syvestris sylvestris, tuberosus, venetus, vernus, vernus* ssp. *vernus*
Laurus: nobilis
Lavandula: angustifolia, angustifolia ssp. *angustifolia, stoechas*
Limonium: acutifolium, angustifolium, aquilanum, avei, bellidifolium, contortirameum, cordatum, dianium, doriae, dubium, glomeratum, gorgonae, ilvae, laetum, multiforme ssp. *sommieriana, nymphaeus, planesiae, remotispiculum, retirameum* ssp. *caralitanum, serotinum, virgatum*
Leonurus: cardiaca ssp. *cardiaca, marrubiastrum*
Ligustrum: lucidum, ovalifolium, vulgare
Linum: alpinum, bienne, campanulatum, carthaticum, carthaticum ssp. *carthaticum, carthaticum* ssp. *suecium, strictum, strictum* ssp. *strictum, suffruticosum* ssp. *salsoloides, tenuifolium, tommasini, trigynum, usitatissimum, viscosum*
Lolium: multiflorum multiflorum ssp. *multiflorum, perenne, remotum, rigidum, temulentum, temulentum* ssp. *temulentum*
Lonicera: alpigena, caprifolium, caeruela, etrusca, implexa, japonica, nigra, xylosteum
Lotus: alpinus, angustissimus, corniculatus, cytisoides, maritimus, tenuis, uliginosus
Lunaria: annua, annua ssp. *annua, rediviva*
Lupinus: angustifolius, graecus
Lythrum: hyssopifolia, salicarium
Malus: domestica, florentina, sylvestris
Malva: alcaea, moschata, neglecta, nicaensis, pusilla, sylvestris, sylvestris ssp. *sylvestris*
Marrubium: incanum, vulgare
Medicago: arabica, falcata ssp. *falcata, glutinosa, hispida, lupulina, marina, minima, orbicularis, polymorpha, rigidula, sativa, sativa* ssp. *sativa, scutellata*
Melica: ciliata, ciliata ciliata, nutans, transsylvanica, uniflora
Melilotus: alba, altissima, napolitana, officinalis
Melissa: officinalis, officinalis ssp. *officinalis*
Mentha: aquatica, aquatica ssp. *aquatica, arvensis, arvensis* ssp. *parietariifolia, longifolia, nemorosa, nepetoides, pulegium, pulegium* ssp. *pulegium, requienii, spicata, spicata* ssp. *spicata, suaveolens, suaveolens* ssp. *suaveolens*
Mespilus: germanica
Milium: effusum, vernale
Morus: alba, nigra
Myrtus: communis
Nerium: oleander
Nepeta: cataria, nepetella, nepetella ssp. *nepetella*
Olea: europea, oleaster
Onobrychis: caput-galli, montana, viciifolia
Ononis: cristata, masquillierii, miutissima, natrix, pusilla, repens, spinosa, spinosa ssp. *antiquorum, spinosa* ssp. *foetens, spinosa* ssp. *spinosa*
Origanum: hercaleoticum, majorana, vulgare, vulgare ssp. *vulgare*
Ornithopus: perpusillus
Oryza: sativa
Oryzopsis: virescens
Ostrya: carpinifolia
Paliurus: spina-christi
Panicum: capillare, debile, dichotomiflorum, miliaceum
Paspalum: dilatatum, paspaloides
Pastinaca: sativa, sativa ssp. *sativa, sativa* ssp. *urens*
Paulownia: tomentosa
Petroselinum: crispum
Peucedanum: austriacum, cervaria, officinale, oreoselinum, ostruthium, palustris, schottii, venetum, verticillare

Phalaris: canariensis, rotgesii
Phleum: alpinum, ambiguum, bertholonii, hirsutum ssp. *ambiguum, hirsutum* ssp. *hirsutum, paniculatum, phleoides, pratense, pratense* ssp. *pratense, subulatum*
Phillyrea: angustifolia, latifolia
Physalis: alkekengi
Phytolacca: americana, decantra
Picea: abies, excelsa
Pinus: cembra, excelsa, halepensis, leucodermis, mugo, mugo ssp. *mugo, nigra, nigra* ssp. *nigra, pinaster, pinea, radiata, rigida, strobus, sylvestris, uncinata, wallichiana*
Pistacia: lentiscus, terebinthus
Pisum: sativum
Plantago: afra, alpina, altissima, arenaria, argentea, atrata, atrata ssp. *atrata, cornuti, coronopus, cynops, holosteum, indica, major, lanceolata, lanceolata* ssp. *sphaerostachya, major, major* ssp. *major, maritima, maritima* ssp. *serpentina, media, media* ssp. *media, sempervirens, serpentina*
Platanus: hybrida, orientalis
Poa: alpina, alpina ssp. *alpina, annua, bulbosa, carniolica, cenisia, chaixi, compressa, molineri, nemoralis, nemoralis* ssp. *nemoralis, palustris, pratensis, supina, sylvicola, trivalis, violacea*
Polypogon: viridis
Populus: alba, canadensis, canescens, nigra, nigra ssp. *italica, nigra* ssp. *nigra, tremula, x euroamericana*
Prunus: armeniaca, avium, cerasifera, cerasus, domestica, dulcis, laurocerasus, mahaleb, padus, persica, serotina, spinosa
Pseudotsuga: menziesii
Pyrus: amygdaliformis, communis, pyraster
Quercus: cerris, coccifera, congesta, crenata, frainetto, gussonei, ilex, ilex ssp. *ilex, pedunculata, petraea, pseudosuber, pubescens, pubescens* ssp. *pubescens, robur, robur* ssp. *robur, rubra, suber, troiana, virginiana*
Ranunculus: aconitifolius, acris, acris ssp. *freasianus, alpestris, appenninus, aquatilis, arvensis, auricomus, bulbosus, bulbosus* ssp. *aleae, bulbosus* ssp. *bulbosus, ficaria, ficaria* ssp. *ficaria, flammula, fluitans, glacialis, illyricus, languinosus, lingua, magellanensis, millefoliatus, montanus, muricatus, neapolitanus, nemorosus, oreophylus, parviflorus, platanifollius, pollinensis, polyanthemophyllus, pyreneus, repens, reptans, sarduos, scleratus, seguieri, serpens, serpens* ssp. *nemorosus, traunfellneri, trichophyllos, velutinus*
Reynoutria: japonica
Rhamnus: alaternus, alpinus, alpinus ssp. *alpinus, cathartica, pumila, pumila* ssp. *pumila, saxatilis*
Ribes: alpinum, multiflorum, petraeum, rubrum, uva crispa, vitis-idaeus
Robinia: pseudoacacia
Rosmarinus: officinalis
Ruscus: aculeatus, hypoglossum
Ruta: angustifolia, graveolens, halepensis
Salix: alba, alba ssp. *alba, appennina, appendiculata, aurita, babylonica, caprea, cinerea, daphnoides, elaegnos, elaegnos* ssp. *angustifolia, elaegnos* ssp. *elaegnos, foetida, fragilis, glabra, hastata, helvetica, herbacea, myrsinifolia, pentandra, purpurea, purpurea* ssp. *lambertiana, purpurea* ssp. *purpurea, reticulata, retusa, riparia, rosmarinifolius, serpyllifolia, triandra, triandra* ssp. *amygdalina, triandra* ssp. *triandra, viminalis, waldsteiniana*
Salsola: soda
Salvia: argentea, glutinosa, officinalis, pratensis, pratensis ssp. *haematodes, pratensis* ssp. *pratensis, sclarea, verbenaca, verticillata, vischiosa*
Sambucus: ebulus, nigra, racemosa
Sanguisorba: dodecandra, minor, minor ssp. *balearica, minor* ssp. *minor, minor* ssp. *muricata, officinalis*
Satureja: acinos, calamintha, hortensis, montana ssp. *monana, nepeta, variegata, vulgaris*
Scorpiurus: muricatus
Secale: cereale
Securigera: varia
Setaria: ambigua, glauca, italica, pumila, verticillata, viridis, viridis ssp. *viridis*
Securigera: varia
Sideritis: romana ssp. *romana, syriaca*
Silybum: marianum
Sisymbrium: austriacum, irio, officinale, polyceratium

Solanum: dulcamara, luteum, nigrum, nigrum ssp. *nigrum, nigrum* ssp. *schultesii*
Solidago: canadensis, gigantea, serotina, virgaurea, virgaurea ssp. *alpestris, virgaurea* ssp. *virgaurea*
Sorbus: aria, aucuparia, aucuparia ssp. *aucuparia, chamaemespilus, domestica, torminalis*
Spartium: junceum
Staphylea: pinnata
Stipa: austroitalica, bromoides, capensis, etrusca, fontanesi, pennata, pennata ssp. *eriocaulis, tirsa, tortilis*
Symphytum: bulbosum, officinale, tuberosum, tuberosum ssp. *nodosum, tuberosum* ssp. *angustifolium*
Tanacetum: corymbosum, corymbosum ssp. *corymbosum, corymbosum* ssp. *tenuifolium, parthenium, vulgare*
Taxus: baccata
Teucrium: botrys, capitatum ssp. *capitatum, chamaedrys, chamaedrys* ssp. *chamaedrys, flavum* ssp. *flavum, fruticans, lucidum, montanum, polium, scordium, scorodonia*
Thymus: acicularis ssp. *ophiolithicus, alpestris, capitatus, glabrescens* ssp. *decipiens, longicaulis, longicaulis* ssp. *longicaulis, praecox* ssp. *polytrichus, praecox* ssp. *praecox, pulegioides, pulegioides* ssp. *pulegioides, serpyllum, spinulosus, striatus, striatus* ssp. *ophiolithicus, vulgaris*
Tilia: cordata, platiphyllos, platiphyllos ssp. *platiphyllos, tomentosa, vulgaris*
Trigonella: monspeliaca
Trifolium: alpestre, alpinum, angustifolium, angustifolium ssp. *angustifolium, arvense, arvense* ssp. *arvense, aureum, aureum* ssp. *aureum, badium, campestre, dubium, echinatum, fragiferum fragiferum* ssp. *fragiferum, glomeratum, hybridum, hybridum* ssp. *elegans, hybridum* ssp. *hybridum, incarnatum* ssp. *incarnatum, incarnatum* ssp. *molinerii, medium, medium* ssp. *medium, micranthum, montanum, nigrescens, nigrescens* ssp. *nigrescens, noricum, ochloreucon, pallescens, phleoides, pratense, pratense* ssp. *pratense, repens, repens* ssp. *repens, resupinatum, rubens, scabrum, scabrum* ssp. *lucanicum, scabrum* ssp. *scabrum, stellatum, striatum, striatum* ssp. *striatum, subterraneum, subterraneum* ssp. *subterraneum, thalii*
Trigonella: monspeliaca
Triticum: aestivum, neglectum, ovatum
Ulmus: campestris, glabra, laevis, minor, minor ssp. *minor*
Urtica: atrovirens, dioica, dioica ssp. *dioica, membranacea, urens*
Vaccinium: gaultherioides, microcarpum, myrtillus, vitis-idaea
Valeriana: celtica ssp. *celtica, collina, dioica, montana, officinalis, officinalis* ssp. *collina, saxatilis, supina, tripteris, tuberosa, wallrothii*
Verbascum: blattaria, chaixii ssp. *chaixii, densiflorum, longifolium, lychnitis, nigrum, phlomoides, pulverulentum, sinuatum, thapsus, thapsus* ssp. *crassifolium, thapsus* ssp. *thapsus*
Verbena: officinalis
Viburnum: lanatum, opulus, tinus, tinus ssp. *tinus*
Vicia: bithynica, cassubica, cracca, cracca ssp. *incana, disperma, dumetorum, hirsuta, hybrida, incana, lathyroides, lutea, melanopos, narbonensis, onobrychoides, pannonica* ssp. *striata, parviflora, peregrina, pisiformis, pubescens, sativa, sativa* ssp. *angustifolia, sativa* ssp. *cordata, sativa* ssp. *nigra, sativa* ssp. *sativa, sativa* ssp. *segetalis, sativa* ssp. *macrocarpa, sepium, sylvatica, tenuifolia, tenuissima, tetrasperma, villosa, villosa* ssp. *varia, villosa* ssp. *villosa*
Vitis: berlandieri x riparia, riparia, vinifera, vinifera ssp. *sylvestris, vinifera* ssp. *vinifera*
Vulpia: ciliata, membranacea, myuros

ANNEX 3

LIST OF TAXA OF SINGLE SPECIES CONSERVED *EX SITU* IN ITALY

1. Cereals

Crop	N° taxa	Species
Barley	4	*Hordeum vulgare, H. vulgare* ssp. *disticum; Hordeum vulgare* ssp. *vulgare, H. vulgare* ssp. *spontaneum*
Maize	2	*Zea mays, Z. mays* var. *indurata*
Oat	12	*Avena barbata, A. byzantina, A. canariensis, A. clauda, A. insularis, A. magna, A. murphyi, A. nuda, A. sativa, A. sativa* var. *nuda, A. sterilis, A. strigosa*
Rice	1	*Oryza sativa* ssp. *japonica*
Rye	2	*Secale. cereale, S. cereale* var. *technicum*
Wheat	22+	*Triticale, Triticum arartricum, T. aestivum, T. boeoticum, T. dicoccum, T. durum, T. monococcum, T. monococcum* ssp. *aegilopoides, T. monococcum* ssp. *boeoticum, T. monococcum* ssp. *monococcum, T. polonicum, T. timopheevii, T. spelta, T. turgidum, T. turgidum* ssp. *carthlicum, T. turgidum* var. *durum, T. turgidum* ssp. *dicoccoides, T. turgidum* ssp. *dicoccum, T. turgidum* ssp. *palaeocolchium, T. turgidum* ssp. *polonicum, T. turgidum* ssp. *turanicum, T. uratru. and a number of interspcific hybrids*

2. Vegetables

Crop	N° taxa	Species
Artichoke	2	*Cynara cardunculus* ssp. *altilis, C. scolymus*
Asparagus	4	*Asparagus acutifolius, A. albus, A. officinalis, A. scaber, A. stipularis*
Bean	4	*Phaseolus coccineus, P. lunatus, P. ritensis, P. vulgaris*
Beet	2	*Beta vulgaris, B. vulgaris* var. *cruenta*
Brassica spp.	28	*Brassica alba, B. bivoniana, B. campestris, B. chinensis, B. fruticulosa, B. incana, B. insularis, B. japonica, B. juncea, B. macrocarpa, B. montana, B. napus, B. napus* var. *oleifera, B. nigra, B. oleracea, B. oleracea* var. *ocephala, B. oleracea* var. *botrytis, B. oleracera* var. *gongylodes, B. oleracea* var. *italica, B. pekinensis, B. pourretti, B. rapa, B. rapa* var. *gongyloides, B. rupestris, B. souliei, B. tinei, B. villosa, B. villosa* ssp. *drepanensis*
Carrot	1	*Daucus carota*
Celery	1	*Apium graveolens*
Chick pea	1	*Cicer arietinum*
Cichory	2	*Cichorium intybus, C. endivia*
Cowpea	5	*Vigna unguiculata, V. unguiculata unguiculata, V. unguiculata sesquipedalis, V. unguiculata dekindtiana dekindtiana, V. unguiculata unguiculata unguiculata*
Cucurbits, Pumpkins and related species	7	*Citrullus vulgaris, Cucumis melo, C. sativus, Cucurbita foetidissima, C. maxima, C. pepo, Lagenaria sativa,* L. *vulgaris*
Dipsacus	1	*D. fullonum* var. *sativus fullonicum var sylvestris*
Eggplant (*Solanum*)	1	*S. melongena*
Faba bean	2	*Vicia ervilia, V. fava*
Fennel	1	*Foeniculum vulgaris* var. *azoricum*
Grass pea	1	*Lathyrus sativus*
Lettuce	2	*Lactuca sativa,* L. *sativa* var. *longifolius*
Onion	1	*Allium cepa*
Pea	2	*Pisum* arvense, P. sativum
Peppers	9	*Capsicum annuum, C. baccatum, C. baccatum* var. *baccatum, C. baccatum* var. *pendulum, C. chinense, C. frutescens, C. esculentum, C. luteum, C. pendulum*

Crop	N° taxa	Species
Potato	30	*Solanum acaule, S. berthaultii, S. brachystotrichum, S. brevidens, S. bulbocastanum, S. canasense, S. cardiophyllum, S. chacoense, S. commersonii, S. demissum, S. etuberosum, S. fendleri, S. infundibuliforme, S. juzepczukii, S. guerreroense, , S. microdontum, S. multidissectum, S. neocadenasii, S. papita, S. phureja, S. pinnatisectum, S. raphanifolium, S. sparsipilum, S. spegazzinii, S. stenotomum, S. stoloniferum, S. tarijense, S. vernei, S. verrucosum*
Soia	1	*Glycine max*
Spinach	1	*Spinacia oleracea*
Tomato	10	*Lycopersicum cheesmannii,* L. *chinense,* L. *chmielewskii,* L. *esculentum,* L. *glandulosum,* L. *hirsutum,* L. *parviflorum,* L. *pennellii,* L. *peruvianum,* L. *pimpinellifolium*
Tumbleweed	1	*Salsola soda*

3. Fruits and nuts

Crop	N° taxa	Species
Fruits		
Apple	20+	*Malus adstringens, M. aldenamensis, M. baccata, M. contorta, M. domestica, M. eleyi, M. floribunda, M. hilleri, M. hupehensis, M. kirgishiorum, M. lemonei, M. pallasiana, M. paradisiaca, M. platicarpa, M. prunifolia, M. profusion, M. pumila, M. robusta, M. spectabilis, M. sylvestris,* and interspecific hybrids
Apricot	5	*Prunus armeniaca, P. arizonicum, P. brigantiaca, P. dasycarpa, P. mume*
Avocado	1	*Persea americana*
Cactus pear	4	*Opuntia ficus-indica, O. amyclacea, O. amyclacea* var. *leucosarca; Nopalea* spp.
Cherry	2	*Prunus avium, P. cerasus*
Citrus and related species	58+	*Citropsis gilletiana, Citrus amblycarpa, C. aurantifolia, C. aurantium, C. benikoji, C. bergamia, C. celebiaca, C. clementina, C. excelsa, C. grandis, C. hystix, C. ichangensis, C. indica, C. jambhiri, C. junos, C. karna, C. keraji, C. kinokuni, C. latifolia, C. latipes, C. limetta, C. limettoides, C. limonia, C. macrophylla, C. medica, C. meyerii, C. micrantha, C. mitis, C. moi, C. nobilis, C. myrtifolia, C. obovoidea, C. paradisi, C. pectinifera, C. reshni, C. reticulata, C. rokugatsu, C. sinensis, C. tachiwana, C. taiwanica, C. tangerina, C. tengu, C. vulgaris, C. webberi, Clausena excavata, Eremocitrus glauca, Fortunella crassifolia, F. hindsii, F. margarita, F. obovata, F. germanica, Microcitrus australasica, M. australis, M. virgata, Murraya koenigii, M. paniculata, Poncirus trifoliata, Severinia distica* and a large number of different intra-specific hybrids
Cornelian Cherry	1	*Cornus mas*
Feijoa	1	*Feijoa sellowiana*
Fig	1	*Ficus carica*
Vitis	23+	*V. aestivalis, V. amurensis, V. amazonica, V. berlandieri, V. betulifolia, V. bourrisqcou, V. candicans, V. champini, V. cinerea, V. coignetiae, V. colombeau, V. cordifolia, V. doaniana, V. labrusca, V. longii, V. monticola, V. mourvedre, V. novae angliae, V. riparia, V. rubra, V. rupestris, V. solonis, V. vinifera* and numerous interspecific hybrids
Hawthorn	1	*Crataegus azarolus*
Kaki	1	*Diospyros kaki*
Kiwi	11	*Actinidia arguta, A. arguta* var. *purpurea, A. chinensis, A. deliciosa, A. glaucophylla, A. indochinensis, A. kolomikta, A. latifolia, A. macrosperma, A. melanandra, A. polygama*
Medlar and Loquat	2	*Mespilus germanica, Eryobotrya japonica*
Nashi pear	1	*Pyrus serotina*
Olea	2	*O. europea, O. sylvestris*
Paw Paw	1	*Asimina triloba*
Pear	24+	*Pyrus communis, P. amygdaliformis, P. betulaefolia, P. boisseriana, P. calleryana, P. caucasicus, P. complexa, P. cordata, P. cossonii, P. decaisne, P. fauriei, P. glabra, P. koehnei, P. mamorensis, P. nedvedevii, P. ovoidea, P. pashia, P. pyraster, P. pyrifolia, P. regelii, P. salicifolia, P. syriaca, P. torminalis, P. ussuriensis,* and interspecific hybrids
Pomegranate	1	*Punica granatum*
Plum	7+	*Prunus cerasifera, P. dasycarpa, P. domestica, P. insistitia, P. syriaca, P. salicina, P. simonii,* and interspecific hybrids
Quince	1	*Cydonia oblonga*
Service tree	2	*Sorbus domestica; S. torminalis*
Small fruits		
Blackberry	1	*Rubus ulmifolius*
Blueberry	3	*Vaccinium ashei, V. corymbosum, V. vitis-idae*
Currant	2	*Ribes nigrum, R. rubrum*
Gooseberry	1+	*Ribes uva-crispa, intraspecific hybrids*

Crop	N° taxa	Species
Raspberry	2	*Rubus idaeus, R. occidentalis*
Strawberry	3	*Fragaria x ananassa, F. moschata, F. vesca*
Nuts		
Almond	1	*Prunus amygdalus*
Breadfruit	1	*Ceratonia siliqua*
Chestnut	4	*Castanea sativa, C. mollissima, C. sativa, C. seguini*
Hazelnut	3	*Corylus avellana, C. colurna, C. maxima*
Pecannut	1	*Carya illinoensis*
Pistachio	1	*Pistacia vera*
Walnut	1	*Juglans regia*

4. Forage crops

Crop	N° taxa	Species
Forage legumes		
Anthyllis	1	*A. vulneraria*
Argyrolobium	1	*A. zanonii*
Astragalus	4	*A. boeticus, A. glycophyllus, A. hamosus, A. pilosus*
Coronilla	3	*C. minima, C. scorpioides, C. varia*
Dorycnium	2	*D. pentaphyllum, D. rectum*
Galega	1	*G. officinalis*
Hedysarum	1	*H. coronarium*
Lathyrus	2	L. *cicera,* L. *silvester*
Lotus	14	L. *alpinus,* L. *angustissimus,* L. *conimbricensis,* L. *corniculatus,* L. *cytisoides,* L. *edulis,* L. *japonicus,* L. *ornithopodioides,* L. *pedunculatus,* L. *preslii,* L. *subbiflorus,* L. *tenuifolius,* L. *tenuis,* L. *uliginosus;* and interspecific hybrids
Lupinus	3	L. *albus,* L. *angustifolius,* L. *luteus*
Medicago	39	*M. aculeata, M. arabica, M. arborea, M. blancheana, M. coeruela, M. constricta, M. coronata, M. disciformis, M. doliata, M. falcata, M. granadensis, M. hispida, M. intertexta, M. laciniata, M. littoralis, M. lupulina, M. minima, M. murex, M. muriculeptis, M. noëana, M. orbicularis, M. polymorpha, M. praecox, M. prostrata, M. radiata, M. rigidula, M. rotata, M. rugosa, M. sativa, M. sauvagei, M. scutellata, M. soleirolii, M. sphaerocarpos, M. tenoreana, M. tornata, M. tribunoides, M. truncatula, M. truncatula x littoralis, M. turbinata*
Melilotus	3	*M. indica, M. messanensis, M. sulcata*
Onobrychis	5	*O. alba, O. arenaria, O. caput-galli, O. montana, O. viciifolia*
Ononis	2	*O. ornithopodioides, O. pulsilla*
Ornithopus	2	*O. compressus, O. perpusillus*
Pisum	1	*Pisum sativum*
Scorpiurus	2	*S. muricata, S. vermiculata*
Securigera	1	*S. securidaca*
Trifolium	43	*T. alexandrinum, T. angustifolium, T. ambiguum, T. argutum, T. arvense, T. aureum, T. bullatum, T. campestre, T. cherleri, T. echinatum, T. erubescens, T. fragiferum, T. globosum, T. glomeratum, T. haussknechtii, T. hirtum, T. hybridum, T. incarnatum, T. lappaceum, T. leucanthum, T. ligusticum, T. montanum, T. nigrescens, T. ochroleucum, T. pauciflorum, T. pilulare, T. plebeium, T. pratensis, T. pratensis* ssp. *nivale, T. purpureum, T. repens, T. resupinatum, T. scabrum, T. scutatum, T. spumosum, T. squarrosum, T. stellatum, T. strictum, T. subterraneum, T. subterraneum* ssp. *brachycalycinum, T. subterraneum* ssp. *subterraneum, T. subterraneum* ssp. *yanninicum, T. tomentosum, T. vesiculosum*
Trigonella	2	*T. arabica; T. monantha*
Vicia	74	*V. affimegalotropis, A. amoena, V. amphicarpa, V. amurensis, V. angustifolia, V. argentea, V. articulata, V. atropurpurea, V. barbazitae, V. bengalensis, V. biennis, V. bithycnica, V. calcarata, V. cassubica, V. communis, V. cordata, V. cracca, V. cuspidata, V. dalmatica, V. dasycarpa, V. dosperma, V. dumetorum, V. eristaloides, V. ervilia, V. faba, V. galilaea, V. giennis, V. gigantea, V. graminea, V. grandiflora, V. hayastana, V. hirsuta, V. hyaeniscyamus, V. hybrida, V. hycranica, V. incana, V. incisa, V. johannis, V. lathyroides, V. laxiflora, V. lutea, V. macrocarpa, V. megalotropis, V. melanops, V. meyeri, V. michauxii, V. microphylla, V. monantha, V. narbonensis, V. neglecta, V. ochroleuca, V. onobrychoides, V. oroboides, V. orobus, V. pannonica, V. peregrina, V. pilosa, V. pisiformis, V. pseudorubus, V. pubescens, V. pyrenaica, V. sativa, V. semiglabra, V. sepium, V. sernica, V. serratifolia, V. sicula, V. sylvatica, V. tenuifolia, V. tenuissima, V. tetrasperma, V. unijuga, V. vicioides, V. villosa*
Forage Grasses		
Aegilops	1	*A. ovata*

Crop	N° taxa	Species
Agrostis	3	*A. palustris, A. stolonifera, A. tenuis*
Avena	1	*A. sativa*
Brachypodium	1	*B. pinnatum*
Bromus	4	*B. inermis, B. matus, B. sitchensis, B. willdenowii*
Cenchrus	1	*C. ciliaris*
Cynodon	1	*C. dactylon*
Dactylis	1	*D. glomerata*
Dorycnium	1	*D. hirsutum*
Festuca	5	*F. arundinacea, F. ovina, F. pratensis, F. rubra, F. rubra* var. *commutata*
Lolium	4	L. *hybridum,* L. *multiflorum italicum,* L. *perenne,* L. *rigidum*
Paspalum	1	*P. dilatatum*
Phalaris	2	*P. aquatica, P. canariensis*
Phleum	2	*P. pratensis, P. rhaeticum*
Poa	2	*P. alpina, P. pratensis*
Triticum	1	*T durum*
x Festulolium	1	
Other Forage crops		
Amaranthus		
Atriplex	1	*halymus*

5. Industrial species

Crop	N° taxa	Species
Cannabis	1	*C. sativa*
Coringia	1	*C. orientalis*
Euphorbia	1	*E. lathyris*
Helianthus	1	*H. annuus*
Lesquerella	11	L. *alba,* L. *angustifolia,* L. *auriculata,* L. *bakeri,* L. *douglasii,* L. *fendleri,* L. *floccosa,* L. *gordoni,* L. *gracilis,* L. *montana,* L. *perforata*
Linum	1	L. *usitatissimum*
Lunaria	1	L. *annua*
Morus	6	*M. alba, M. bombycis, M. kagayamae, M. ihou, M. latifolia, M. nigra*
Nicotiana	1	*N. tabacum*
Stokesia	1	*S. laevis*
Vernonia	4	*V. anthelminthica, V. galamensis, V. hymenolepis, V. stenolepis*
Ysatis	1	*Isatis tinctoria*

6. Ornamentals

Crop	N° taxa	Species
Alstroemeria	13	*A. aurantiaca, A. aurea, A. diluta, A. excerens, A. garaventae, A. haemantha, A. hookeri, A. ligtu, A. pallida, A. pellegrina, A. psittacina, A. revoluta, A. versicolor*
Anemone		*A. coronaria*
Calla		*C. aethiopica*
Cammellia		*C. japonica*
Euphorbia	1	*E. x lomi*
Hebe		nn
Helichrysum	9	*H. bracteatum, H. hybleam, H. italicum, H. nebrodense, H. rupestre, H. saxatile, H. scandus, H. stoechas, H. tianshanicum*
Iris		*I. germanica, I. germanica* var. *florentina*

Crop	N° taxa	Species
Limonium	52	L. *aegusae*, L. *algusae*, L. *artunsi*, L. *aureum*, L. *avei*, L. *bellidifolium*, L. *binervosum*, L. *bocconei*, L. *bonduelli*, L. *calcarae*, L. *caspia*, L. *catanzaroi*, L. *cosirense*, L. *densiflorum*, L. *deracifolium*, L. *dubium*, L. *dumosum*, L. *flagellare*, L. *ferulaceum*, L. *fortunei*, L. *furnarii*, L. *gmelinii*, L. *gougetianum*, L. *halophilum*, L. *latifolium*, L. *lojaconi*, L. *lylibaeum*, L. *mazarae*, L. *melancholicum*, L. *minutiflorum*, L. *narbonense*, L. *optimae*, L. *opulentum*, L. *otolepis*, L. *pavonianum*, L. *peregrinum*, L. *perezii*, L. *ponzoni*, L. *puberulum*, L. *purpuratum*, L. *selinuntinum*, L. *serotinum*, L. *sinensis*, L. *simuatum*, L. *sinuatum*, L. *speciosus*, L. *syracusanum*, L. *tataricum*, L. *tetragonum*, L. *todaroanum*, L. *vulgare*, L. *virgatum*
Nicotiana	8	*N. glutinosa*, *N. megalosiphon*, *N. rustica*, *N. thirsiflora*, *N. umbratica*, *N. velutina*, *N. wigandiodes*, *N. wuttkei*
Nerium	1	*N. oleander*
Passiflora		nn
Ranunculus	1	*R. asiaticus*
Rosa	1	*R. chinensis*
Viburnum	20	*V. carlesii*, *V. dentatum*, *V. farreri*, *V. harryanum*, *V. hillieri*, *V. lantana*, *V. lucidum*, *V. macrocephalum*, *V. opulus*, *V. plicatum*, *V. propinquum*, *V. rhytidophyllum*, *V. sargenti*, *V. suspensum*, *V. tinus*, *V. x bodnantense*, *V. x burkwoodii*, *V. x carlcephalum*, *V. x juddii*, *V. x pragense*

7. Medicinal and Aromatic Plants (MAPs):

Achillea filipendulina
Aconitum napellus
Agastache rugosa
Ailanthus glandulosa
Allium schoenoprasum
Amsonia tabenaemontana
Aquilegia vulgaris
Armoracia rusticana
Artemisia abrotanum
Artemisia dracunculus var. *odorata*
Aruncus dioicus
Atropa belladonna
Betonica officinalis
Borago officinalis
Calendula officinalis
Centaurea cyanus
Centhrantus ruber
Chenopodium bonus henricus
Chrysanthemum parthenium
Cichorium intybus
Coriandrum sativum
Crocus sativus
Digitalis grandiflora
Echinacea angustifolia
Echinacea purpurea
Elsholtzia fruticosa
Euphorbia lathyris
Foeniculum vulgare
Galega officinalis
Glycyrrhiza glabra
Gypsophila paniculata
Hibiscus syriacus
Hypericum perforatum
Inula helenium
Iris pallida
Lavandula angustifolia
Lavandula hybrida
Achillea millefolium Eruca sativa
Acorus calamus Eryngium alpinum
Agrimonia eupatoria
Alcea rosea
Amorpha fruticosa
Anetum graveolens
Arctium lappa
Arnica longifolia
Artemisia absinthium
Artemisia roxburghiana
Asclepia syriaca
Berberis vulgaris
Bidens pilosa
Calamintha nepeta
Carlina acaulis
Centaurium erytraea
Chamomilla recutita
Chrysanthemum cinerariifolium
Chrysanthemum roseum
Cnicus benedictus
Crataegus monogyna
Cucurbita pepo var. *styriaca*
Digitalis lutea
Echinacea pallida
Echinops sphaerocephalus
Eschscholzia californica
Filipendula ulmaria
Fragraria vesca
Gentiana lutea
Grindelia robusta
Hieracium pilosella
Hypericum androsaemum
Hyssopus officinalis
Iris germanica
Laurus nobilis
Lavandula angustifolia var. *'nana alba'*
Leonorus cardiaca

Leopoldia comosa
Linum usitatissimum
Macleaya cordata
Marrubium vulgare
Melissa officinalis
Monarda didyma
Nepeta cataria ssp. *citriodora*
Origanum vulgare
Pastinaca sativa
Peucedanum ostruthium
Physalis alchechengi
Plantago lanceolata
Reynoutria sachalinensis
Rhodiola rosea
Ruta graveolens
Salvia rutilans
Sambucus nigra
Satureja montana
Sideritis syriaca
Sisymbrium officinale
Solidago virgaurea
Tanacetum balsamita
Taxus baccata
Thymus vulgaris
Trigonella foenum graecum
Valeriana officinalis
Verbena officinalis

Levisticum officinale
Lythrum salicaria
Malva sylcestris
Melia azedarach
Mentha x piperita
Monarda fistulosa
Ocymum basilicum
Origanum vulgare ssp. *hirtum*
Petrosellinum hortense
Phlomis fruticosa
Phytolacca americana
Psidium guajava
Rheum x cultorum
Rosmarinus officinalis
Salvia officinalis
Salvia sclarea
Sanguisorba minor
Securigera suffruticosa
Silybum marianum
Solanum dulcamara
Symphytum officinale
Tanacetum vulgare
Teucrium chamaedris
Trigonella coerulea
Urtica dioica
Verbascum phlomoides
Vitex agnus castus

8. Forest species

Crop	N° taxa	Species
Abies	7	*A. alba, A. bornmulleriana, A. cephalonica, A. equi-troiani, A. nebrodensis, A. nordmanniana, A. pinsapo*
Acer	5	*A. campestre, A. monspessulanum, A. opalus, A. platanoides, A. pseudoplatanus*
Adenocarpus	1	*A. complicatus*
Alnus	4	*A. cordata, A. glutinosa, A. incana, A. viridis*
Amelanchier	1	*A. ovalis*
Amorpha	1	*A. fruticosa*
Arbutus	1	*A. unedo*
Arctostaphylos	1	*A. uva-ursi*
Berberis	1	*B. vulgaris*
Betula	1	*B. pendula*
Buxus	1	*B. sempervirens*
Carpinus	1	*C. orientalis*
Calicotome	1	*C. spinosa*
Carpinus	2	*C. betulus, C. orientalis*
Castanea	1	*C. sativa*
Cedrus	3	*C. atlantica, C. deodara, C. libani*
Celtis	1	*C. australis*
Ceratonia	1	*C. siliqua*
Cercis	1	*C. siliquastrum*
Chamaecyparis	1	*C. lawsonii*
Cistus	5	*C. creticus, C. incanus, C. incarnatus, C. laurifolius, C. salvifolius,*
Colutea	1	*C. arborescens*
Cornus	2	*C. mas, C. sanguinea*
Coriaria	1	*C. myrtifolia*
Coronilla	1	*C. emerus*
Corylus	1	*C. avellana*
Cotinus	1	*C. coggygria*
Cotoneaster	2	*C. integerrimus, C. nebrodensis*
Crataegus	4	*C. azarolus, C. monogyna, C. oxyacantha, C. pyracantha*
Cytisus	4	*C. nigricans, C. scoparius, C. sessilifolius, C. villosus*
Elaegnus	2	*E. angustifolius, E. umbellata*
Erica	1	*E. arborea*
Eucalyptus	7	*E. bicostata, E. camaldulensis, E. globulus, E. gomphocephala, E. occidentalis, E. viminalis, E. x trabutii,*
Euonymus	2	*E. europeus, E. latifolius*
Fagus	1	*F. sylvatica*
Frangula	2	*F. alnus, F. rupestris*
Fraxinus	3	*F. excelsior, F. ornus, F. oxycarpa*
Genista	5	*G. germanica, G. pilosa, G. radiata, G. salzmannii, G. tinctoria*
Gingko	1	*G. biloba*
Gleditsia	1	*G. triacantha*
Hippophae	1	*H. rhamnoides*
Ilex	1	*I. aquifolius*
Juglans	8	*J. cinerea, J. hindsii, J. nigra, J. regia, J. mandshurica, J. microcarpa, J. sieboldiana, J. sieboldiana cordiformis,*
Juniperus	4	*J. communis, J. nana, J. macrocarpa, J. oxycedrus*
Laburnum	2	L. *alpinum*, L. *anagyroides*
Larix	1	L. *decidua*
Ligustrum	1	L. *vulgare*

Crop	N° taxa	Species
Lonicera	4	L. *alpigena*, L. *etrusca*. L. *nigra*, L. *xylosteum*
Malus	2	*M. florentina, M. sylvestris*
Mespilus	1	*M. germanica*
Morus	2	*M. alba, M. nigra*
Myrtus	1	*M. communis*
Ostrya	1	*O. carpinifolia*
Osyris	1	*O. alba*
Paliurus	1	*P. spina-christi*
Paulownia	1	*P. tomentosa*
Phillyrea	2	*P. angustifolia, P. latifolia*
Picea	1	*P. abies*
Pinus	15	*P. brutia; P. cembra, P. excelsa, P. halepensis, P. mugo, P. mugo* var. *mughus, P. mugo* var. *pumilo, P. mugo* var. *uncinatus, P. nigra, P. nigra* var. *austriacus, P. nigra* ssp. *laricius, P. pinea, P. pinaster, P. strobus, P. sylvestris*
Pistacia	2	*P. lentiscus, P. terebinthus*
Platanus	2	*P. acerifolia, P. orientalis*
Populus	8+	*P. alba, P. deltoides, P. nigra, P. maximowiczii, P. simonii, P. trichocarpa, P. x canadensis, P. x generosa* and a large number of different interspecific hybrids
Prunus	9	*P. amygdalus, P. avium, P. brigantiaca, P. cerasifera, P. cerasus, P. laurocerasus, P. mahaleb, P. padus, P. spinosa*
Pseudotsuga	2	*P. flahaulti; P. menziesii*
Pyrus	2	*P. amygdaliformis, P. pyraster*
Quercus	7	*Q. borealis, Q. cerris, Q. ilex, Q. robur, Q. petraea, Q. pubescens, Q. suber*
Rhamnus	3	*Rh. alaternus, Rh. alpinus, Rh. carthaticus,*
Ribes	2	*R. multiflorum, R. petraeum*
Robinia	1	*R. pseudoacacia*
Rosa	8	*R. arvensis, R. canina, R. gallica, R. glutinosa, R. pendulina, R. pimpinellifolia, R. rubrifolia, R. villosa*
Ruscus	1	*R. aculeatus*
Salix	20+	*S. alba, S. appenina, S. babylonica, S. caprea, S. cinerea, S. daphnoides, S. dolichostyla, S. eleagnos, S. fragilis, S. jessoiensis, S. koreensis, S. matsudana, S. mongolica, S. nigra, S. pentandra, S. rosmarinifolia, S. sachalinensis, S. smithiana, S. tetrasperma, S. viminalis* and a large number of different interspecific hybrids
Sambucus	3	*S. ebulus, S. nigra, S. racemosa*
Sequoiadendron	1	*S. gigante*
Sorbus	5	*S. aria, S. aucuparia, S. chamaermespilus, S. domestica, S. torminalis*
Spartium	1	*S. junceum*
Staphylea	1	*S. pinnata*
Taxus	1	*T. baccata*
Teline	1	*T. monspessulana*
Tilia	3	*T. cordata, T. platiphyllos, T. x vulgaris*
Ulmus	4	*U. glabra, U. laevis, U. minor, U. pumila*
Viburnum	3	*V. lantana, V. opulus, V. tinus*