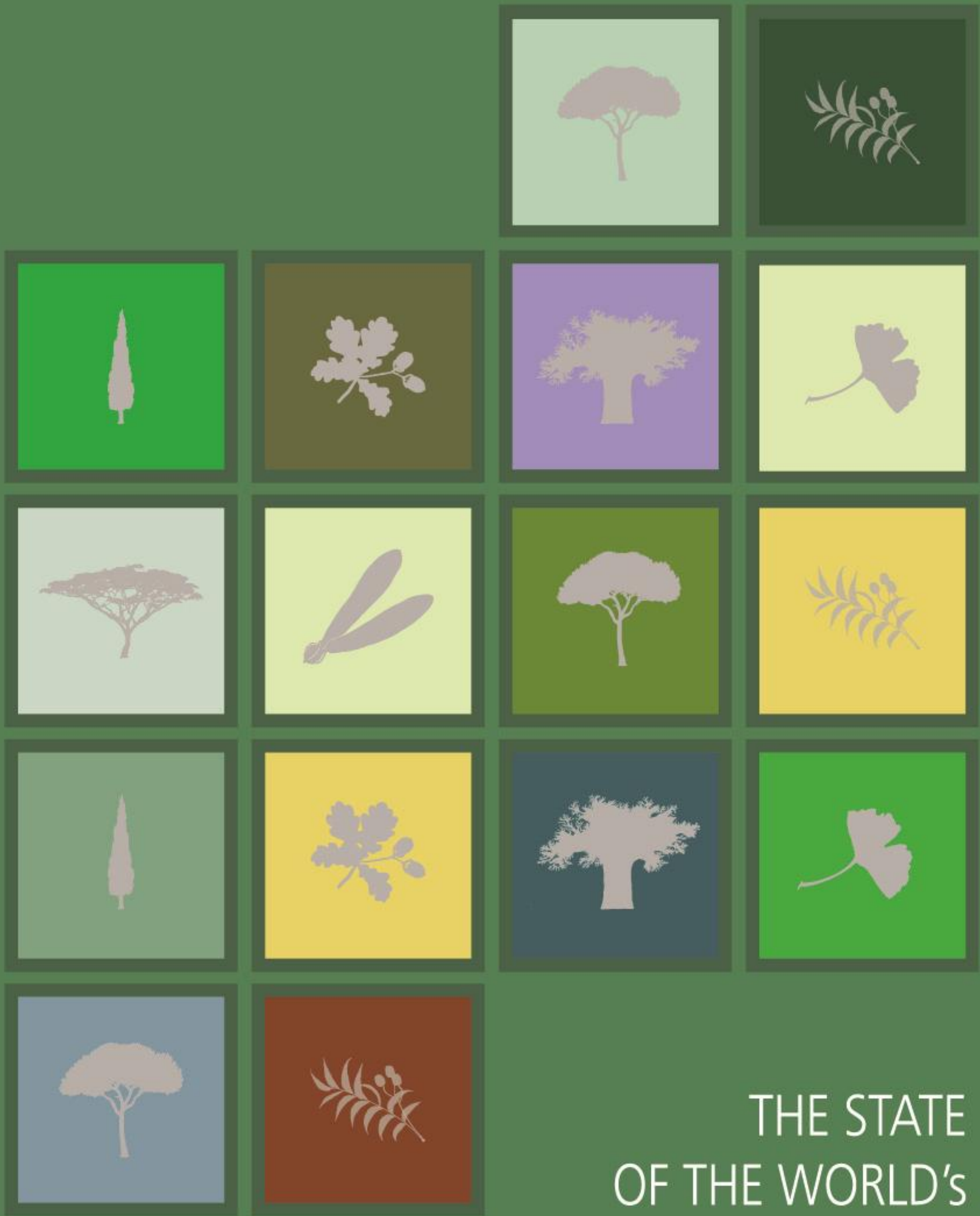

THE STATE
OF THE WORLD's
FOREST GENETIC RESOURCES

COUNTRY REPORT

JAPAN

This country report is prepared as a contribution to the FAO publication, The Report on the State of the World's Forest Genetic Resources. The content and the structure are in accordance with the recommendations and guidelines given by FAO in the document Guidelines for Preparation of Country Reports for the State of the World's Forest Genetic Resources (2010). These guidelines set out recommendations for the objective, scope and structure of the country reports. Countries were requested to consider the current state of knowledge of forest genetic diversity, including:

- Between and within species diversity
- List of priority species; their roles and values and importance
- List of threatened/endangered species
- Threats, opportunities and challenges for the conservation, use and development of forest genetic resources

These reports were submitted to FAO as official government documents. The report is presented on www. fao.org/documents as supportive and contextual information to be used in conjunction with other documentation on world forest genetic resources.

The State of Forest Genetic Resources in Japan

Forestry Agency Japan

2012

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SECTION I: EXECUTIVE SUMMARY

The Japanese archipelago, located in northwest of the Pacific and east offshore of the Eurasian Continent, comprises four main islands with many other smaller islands. Much of Japan falls into the temperate zone with four distinct seasons, but the parts include colder northern and highland area, and also sub-tropical southern area. Since the islands of Japan are stretching over 3,000 kilometers distance from north to south, Japan has various types of forest: boreal, temperate and sub-tropical ones.

Japan’s land area is about 37.8 million ha in extent with a population of 127.51 million (in 2009). Japan's forest area is 25.1 million ha (66 % of its land area). Natural forests account for 50 % while planted forests, which consist mostly of conifers, make up 40 % and the remaining 10% is categorized as area without trees. Japan's forest growing stock is 4.4 billion m^3, of which 2.7 billion m^3 (60%) are from planted forests.

Forests in Japan are registered under the Forest Planning System, which covers nearly 100% of total forests, regulated by the Forest Act as well as the Forest and Forestry Basic Act. About 30 % of forests belong to the national government; about 10 % are owned by the prefecture and municipality governments; and about 60 % are privately owned. Privately owned forest in Japan is characterized by small in size and scattered/fragmented in location. Almost 90% of such private owners have less than 10 ha of forests. The number of forestry workers was 47,000 in 2005. The gross forestry output was 4.3 billion USD in 2008. Domestic wood supply (log conversion) totaled 18.7 million m^3 and the self-sufficiency rate for timber was 24.0 % in 2008.

Owing to the geographic and climatic diversity and uniqueness in the past and now, Japan has exceptionally abundant in species diversity in the temperate zone area. Due to high precipitation, vegetation in Japan is more or less affected by temperature and snow fall availability. *Cryptomeria japonica*, *Chamaecyparis obtusa*, *Pinus* spp., *Larix kaempferi*, *Abies sachallinensis*, *Quercus* spp. are the main species in Japan in terms of growing stock level. All the above species are native and mostly commercially planted. The largest stocking is by *C. japonica*, which reaches 34% of total growing stock. In Japan, there are approximately 1,500 forest trees species. Among those, the “Red List” includes 304 tree species. Many of the endangered species are found only in the remote small islands.

In situ conservation of the genetic resources of forest trees is secured mainly by the “protection forest” system (in total 782,000 ha, launched in 1915) maintained by the National Forest. Constraints for the *in situ* conservation could be explained by the diversity of species composition in general. The abundance and associated diversity of species lead difficult in prioritizing target species for the conservation. And also there is the lack of the information of the distribution and genetic diversity within a species for most of the species. It should be immediate tasks for *in situ* conservation for forest trees that collecting detailed information of the distribution and associated genetic diversity of major species and that making decisions for the priorities of target species among them for the conservation.

Ex situ conservation of the genetic resources of forest trees is secured by the “Gene Bank” project executed by the National Forest and FTBC-FFPRI (Forest Tree Breeding Center, Forestry and Forest Products Research Institute) respectively. A “Forest tree superior gene conservation stand” scheme is operated by the National Forest to conserve genetically superior native/natural old stands by collecting seeds from such stands and establishing plural planted stands by those seedlings. There are 380 stands of 18 species in this category. Clone bank activity, which includes collecting scions from plus trees, then propagating and archiving them in a clone bank, has been conducted by FTBC-FFPRI. Approximately 20,000 collections for 310 species are archived in ten clone banks. As to germplasm collection, FTBC-FFPRI has collected and preserved pollen and seeds, but not in vitro preservation. There are approximately 8,000 collections from 450 species for seeds and 3,000 collections from 60 species for pollen respectively. Constraints for the *ex situ* conservation could be the lack of the appropriate conservation technology as well as associated information system. There is a little knowledge in long-term seed preservation techniques of many target species for *ex situ* conservation. Similar to the case of *in situ* conservation, the lack of the information of various species hamper the progress and development of the *ex situ* conservation.

The forest tree breeding of Japan was started in the late of 1950's, and advances to aim at increasing productivity and upgrading quality as sawn timber of the main reforestation species: *Cryptomeria japonica*, *Chamaecyparis obtusa*, *Larix kaempferi*, *Abies sachalinensis* and *Picea glehnii*. Several specialized programs have also been initiated such as breeding of frost resistance and snow resistance, selection of trees with less spiral grain, and resistance to pine wilt disease, etc. Breeding programs for the other conifer and hardwood species are also available but in limited scales. The national tree breeding program is composed of five breeding regions. These breeding regions are basically divided by administrative boundary in line with the climatic and vegetation zonings. The breeding program in each breeding region started from the selection and collection of plus trees: for example, in *Cryptomeria japonica* 500-1,000 individuals selected as plus trees. For the entire target species for breeding listed above, seed orchards and progeny trials with the first generation plus trees has been established in each breeding region. The seed orchards of *Cryptomeria japonica* and *Chamaecyparis obtusa* were rogued by culling plus tree clones whose progeny trial performances were proved poor. Selection of second generation plus trees from the progeny trials was partly performed in *Cryptomeria japonica* and *Chamaecyparis obtusa*. The progeny trials for the selection of the second generation consist of mainly control-pollinated families of superior first generation plus tree clones that have been tested. On the other hand, the nationwide provenance test has not been executed, because the intensive tree breeding program has already started within each breeding region and seed transfer for these main tree species beyond each breeding region has been restricted by the Forestry Seeds and Seedlings Law. The current share of the improved seed is 88 % in the seed market of conifers for planting. The forest tree breeding in Japan has been executed by FTBC-FFPRI in cooperation with the National Forest and local governments. The headquarters of FTBC-FFPRI and four the regional breeding offices collect the information on progeny trials and provide the information for upgrading the genetic worth of the seed orchard seed.

At the national level, Forestry Agency, National Forest and FTBC-FFPRI are engaged for the forest tree genetic resources conservation. These three parties work for policy making and management planning, monitoring and operating *in* and *ex situ* conservation forests, and collecting and preserving, respectively. Scientific researches for forest tree genetic resources were conducted by FFPRI, universities, and research institutions of local governments. In education, the conservation and preservation of forest tree genetic resources can be lectured in a part of biodiversity, silviculture or forest tree breeding in forestry. Japan has ratified to CBD (Convention on Biological Diversity) and other international agreements concerning genetic diversity of forest trees. With those international legislations, several domestic laws have been introduced for the genetic resource conservation. Therefore it is necessary to improve the understanding of the society to the importance of genetic diversity, namely the intra species genetic diversity. Fine geographic scale intra-species genetic variation has been already studied in some species such as *Cryptomeria japonica* and *Fagus crenata*, and that knowledge are used for future tree breeding and genetic conservation activities, and expected to enable them more strategic and efficient. In order to enhance the accessibility to the information about forest tree genetic resources, building some databases about research outcomes of the forest tree genetic resources would be required.

Japan has ratified international treaties and other agreements in relation with forest tree genetic resource conservation. On the other hand, the demand of introducing exotic tree species is limited, and then there are few activities to import foreign forest tree genetic resources. Therefore, Japan is not intended to have international collaborations for forest tree genetic resource exchange scheme seriously although there is possibility. For forest trees there is little demands from Japanese society but some interests from foreign countries. For food security, poverty reduction, and agroforestry, there are, and will be even in the near future, small contribution by forest tree genetic resource in Japan.

SECTION II: INTRODUCTION TO THE COUNTRY AND FOREST SECTOR

The Japanese archipelago, located in northwest of the Pacific and east offshore of the Eurasian Continent, comprises four main islands (Honshu, Hokkaido, Kyushu and Shikoku, in order of size) with many other smaller islands. The Sea of Japan lies between the Eurasian Continent and Japan. The warmer Kuroshio Current flows from southwest to northeast on east side of the country, while the colder Oyashio Current flows in the opposite direction, with these currents meeting near the country.

Much of Japan falls into the temperate zone with four distinct seasons, but Hokkaido and the highlands are cold, while the southern areas are sub-tropical. Seasonal winds blow from southeast in summer and from northwest in winter, with relatively high precipitation in summer on the Pacific side and in winter on the Sea of Japan side. There are many active volcanoes in Japan since the country is located in the Pacific Rim volcanic zone. Forests cover about two-third of the total land area of Japan, and many rivers are steep and fast flowing. Japan's land area is about 37.8 million ha in extent with a population of 127.51 million (in 2009).

Japan's forest area is 25.1 million ha (66 % of its entire surface area). Boreal, temperate and some sub-tropical forests are distributed since the islands of Japan are stretching over 3,000 kilometers from north to south (Table 1). Natural forests account for 50 % while planted forests, most of which are conifer, *Cryptomeria japonica*, *Chamaecyparis obtusa* and *Larix kaempferi* plantations, make up 40 % (Table 2). Meanwhile, Japan's forest growing stock is 4.4 billion m^3, of which 2.7 billion m^3 (60 %) are from planted forests.

Table 1. Major forest type categories and main species.

Major Forest Types	Area (covered by forest type) (1,000 ha)	Main species for each type	
		Trees	Other species
Boreal coniferous forest	1,721	*Abies veitchii, Abies mariesii, Picea jezoensis*	
Cool-temperate deciduous forest	8,619	*Fagus crenata, Quercus mongolica* var. *crispula, Acer mono*	
Warm-temperate evergreen forest	6,304	*Castanopsis sieboldii, Quercus acuta, Machilus thunbergii*	

Source: Vegetation suvey, Third Mesh Data, Ministry of the Environment
http://www.biodic.go.jp/dload/mesh_vg.html

Table 2. Forest characteristics and area. (FRA2010)

Main forest characteristics	Area (1,000 ha)
Primary forest	4,747
Naturally regenerated forests	9,906
Planted forest	10,326

Forests in Japan are registered under the Forest Planning System, which covers nearly 100% of total forests, regulated by the Forest Act as well as Forest and Forestry Basic Act. Considering a fact of long-term period required for forest growth, this planning system aims to balance supply of and demand for forest products and to secure demonstration of multiple functions of forests by promoting their environmental and biodiversity functions as well as the improvement of forest productivity in a sustainable manner.

In Japan, about 30 % of forests belong to the national government; about 10 % are owned by prefecture and municipality governments; and about 60 % are privately owned (Table 3). Privately owned forest in Japan is characterized by small in size and scattered/fragmented in location. Almost 90% of such private owners have less than 10 ha of forests.

Forestry contractors in Japan are roughly divided into the Forest Owners' Cooperatives in each region and independent private forestry contractors including harvesting companies.

The Forest Owners' Cooperatives are major forestry contractors in Japan, conducting more than 60% of forestry operations in Japan. As many small-scale forest owners move to urban areas for permanent stable work and become older, they are no longer able to manage their forests by themselves. Under such conditions, there are growing demands for the Forest Owners' Cooperatives to play an active role in forest management activities in each region.

Independent private forestry contractors conduct almost 70% of harvesting and logging activities. 83% of them are small-scale corporations with annual log production volume of less than 5,000m^3 and account for 25% of total log production, while 17% of them are relatively large-scale corporations with more than 5,000m^3 per year and account for 75% of the production.

Table 3. Forest ownership and area. (FRA2010)

Forest ownership	Area (1,000 ha)
Public	10,142
Private	14,739
Others	0

The number of forestry workers has been decreasing for the long time period, reaching 47,000 in 2005. Although the aging rate (the share of those who are aged 65 or older) is as high as 26%, the ratio of young workers is increasing.

In 2008, the gross forestry output was 4.3 billion USD, approximately 38% of 1980's figure which is a record high in history. Among the gross output, output derived from wood production was 2.0 billion USD, 5.4% decrease from the previous year, mainly due to the decline of production and lower prices in *Cryptomeria japonica* and *Chamaecyparis obtusa*.

Domestic wood supply (log conversion) totaled 18.7 million m^3 in 2008, which is approximately 36 % of the peak in 1967 (52.7 million m^3). In 2008, Japan's self-sufficiency rate for timber was 24.0 %. Currently, Japan depends mostly on imported timber for pulp, woodchip and plywood material.

The downsizing in domestic timber production activities has resulted in a decline in the number of workers engaged in forestry. In 2005, there were 47,000 workers engaged in forestry, a level which represented only 70 % of the number recorded five years ago. Also, one out of four workers was aged 65 and over, highlighting the aging of the labor force.

Public demands for forests, which range from conventional wood production to emerging carbon sequestration and biodiversity, are becoming diversified and sophisticated. The functions that forests play in soil and water conservation and the mitigation of global warming need to be exercised in a sustainable manner by smooth arrangement of the cycle of cutting, planting and tending planted forests.

Forests planted in 1950’s-1960’s have been reaching their maturing ages for use as industrial material resources. Given such resources condition, large-scale sawmills and plywood mills are shifting their raw material procurement from the imported logs to the domestic logs, in response to the uncertainty of international market, caused by the growing demand of wood in emerging economies such as China and India, as well as drastic increase of export tax on log in Russia. The domestic forestry sector is now strongly expected to supply raw materials from planted forests to wood mills sustainably, while contributing to the mitigation of global warming, and to create jobs in rural areas.

Under such circumstances, the “Forest and Forestry Revitalization Plan”, developed in 2009, was taken up and endorsed as a part of the “Japanese Government New Economic Development Strategy” in June 2010. The Ministry of Agriculture, Forestry and Fisheries (MAFF) began to study possible measures for the realization of the “Forest and Forestry Revitalization Plan” from January 2010. In November 2010, the final report on those measures was publicized. The final report proposed to reexamine the Japan’s forest and forestry policies, institutions and organizations as a whole, for the development of the new forest and forest policies in Japan.

The MAFF has conducted implement the reexamination of forest planning system, the introduction of a system to assure proper forest management (including the introduction of the “forest management and environmental conservation financially direct support system”), acceleration of the forest road network system, and training of cost effective forestry operation technical experts, for the realization of the “Forest and Forestry Revitalization Plan” from the FY 2011.

SECTION III: MAIN BODY OF THE COUNTRY REPORT

Chapter 1: The Current State of Forest Genetic Resources

1.1 Diversity within and between forest tree species

Japan is an archipelago locating in east offshore of the Eurasian continent, stretching 3,000 kilometers from north to south and 1,800km in east to west. The majority of the lands are covered with temperate oceanic forest, while central parts of the main islands are occupied with temperate mountain system. Sub-boreal forests exist in north island and sub-tropical humid forests exist in the southern islands. In addition, the snowfall of the west shore is heavier than that of the east shore because of the temperate zone monsoon climate in winter. Due to the geographic and climatic diversity and uniqueness in the past and now such as less impact of the glacier, Japan has exceptionally abundant in species diversities in the temperate zone area.

Due to high precipitation, vegetation in Japan is more or less affected by temperature and snow fall availability. This is because the archipelago extends from north to south with relatively high mountains in the central parts, while the rainfall is abundant and evenly distributed. Therefore, the change of the vegetation zone in Japan has been clearly explained by Warmth Index (WI): sum of monthly mean temperature minus 5 when monthly mean temperature is above 5 degree C (Kira 1949). The southwest islands of Okinawa in the south end of the country is 180-240 WI, and is covered with sub-tropical forest that comprises *Ficus superba*, *Ficus microcarpa*, *Schima liukiuensis*, and *Castanopsis cuspidata* var. *sieboldii*. The southwest Pacific Ocean shore in Kyushu, Shikoku, and Honshu is 85-180 WI, and is covered with warm temperate forest that comprises *Castanopsis cuspidata* var. *sieboldii*, *Machilus thunbergii*, *Distylium racemosum, Cyclobalanopsis salicina*, and *Camellia japonica*. The central part and northern Honshu is 45-85 WI, and is covered with cool temperate forest that comprises *Fagus crenata*, *Quercus crispula*, *Acer mono*, *Tilia japonica*, and *Magnolia obovata*. And, Hokkaido in the north end of the country is 15-45 WI, and is covered with boreal forest that comprises *Picea jezoensis*, *Abies sacahlinensis*, and *Picea glehnii*. The mountainous area of high elevation of Kyushu, Shikoku, and Honshu is also 15-45 WI, and is covered with sub-alpine forest that comprises *Picea jezoensis* var. *hondoensis*, *Abies veitchii*, *Abies mariesii*, and *Tsuga diversifolia*, etc.

1.2 The main value of forest genetic resources

Table 4 shows 30 main tree species in Japan. They are all indigenous forest tree species in Japan, and most of them are important for timber production. Conifers such as *Cryptomeria japonica* and *Chamaecyparis obtusa* and hardwood such as *Fagus crenata* and *Zelkova serrata* are major species among them. *Abies firma*, *Tsuga sieboldii*, and *Betula* spp. are the main comprising species in the alpine region, and *Carpinus* spp. is widely distributed in the cool-temperate forest. Among these species, *Cryptomeria japonica*, *Chamaecyparis obtusa*, and *Zelkova serrata* have been used for the construction of Shinto shrines and Buddhism temples traditionally. *Prunus* spp. is a national flower of Japan, and it is planted widely for ornamental purposes such as parks and street side trees.

Table 4. Priority species.

Priority species (Scientific names)	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
Abies mariesii	T	N	Social importance
Abies sachalinensis	T	N	Economic importamce
Abies spp. *1	T	N	Social importance
Acer mono	T	N	Economic importamce
Alnus spp. *2	T	N	Economic importamce
Betula ermanii	T	N	Economic importamce
Betula maximowicziana	T	N	Economic importamce
Betula platyphylla var. *japonica*	T	N	Economic importamce
Carpinus spp. *3	T	N	Social importance
Castanea crenata	T	N	Economic importamce
Castanopsis spp. *4	T	N	Economic importamce
Chamaecyparis obtusa	T	N	Economic importamce, Cultural importance
Cryptomeria japonica	T	N	Economic importamce, Cultural importance
Fagus crenata	T	N	Social importance
Larix kaempferi	T	N	Economic importamce
Picea glehnii	T	N	Economic importamce
Picea jezoensis	T	N	Economic importamce
Pinus densiflora	T	N	Economic importamce
Pinus luchuensis	T	N	Social importance
Pinus thunbergii	T	N	Economic importamce
Five-needled *Pinus* spp. *5	T	N	Social importance
Prunus spp. *6	T	N	Economic importamce, Cultural importance
Quercus acutissima	T	N	Economic importamce (log cultivation of mushroom)
Quercus crispula	T	N	Economic importamce
Quercus serrata	T	N	Economic importamce
Evergreen *Quercus* spp. *7	T	N	Economic importamce
Thujopsis spp. *8	T	N	Economic importamce
Tilia japonica	T	N	Economic importamce
Tsuga diversifolia	T	N	Social importance
Zelkova serrata	T	N	Economic importamce, Cultural importance

Note:

*1 *Abies* spp. includes *A. firma* and *A. homolepis*.

*2 *Alnus* spp. includes *A. japonica, A. japonica* var. *arguta, A. hirsuta, A. hirsuta* var. *sibirica, A. firma,* and *A. firma* var. *hirtella*.

*3 *Carpinus* spp. includes *C. japonica*, *C. laxiflora*, *C. tschonoskii* and *C. cordata*.

*4 *Castanopsis* spp. includes *C. cuspidata*, *C. cuspidata* var. *sieboldii,* and *C. cuspidata* var. *lutchuensis*.

*5 Five-needled *Pinus* spp. includes *P. pentaphylla*, *P. pentaphylla* var. *himekomatsu*, and *P. armandii* var. *amamiana*.

*6 *Prunus* spp. includes *P. jamasakura, P. sargentii*, and *P. verecunda*.

*7 Evergreen *Quercus* spp. includes following four species of *Quercus* Subgenus *Cyclobalanopsis*: *Q. glauca*, *Q. acuta*, *Q. myrsinaefolia*, and *Q. gilva*.

*8 *Thujopsis* spp. includes *T. dolabrata* and *T. dolabrata* var. *hondae*.

Table 5 shows the tree species list with currently popular in Japan. The current growing stock wise order will be *Cryptomeria japonica*, *Chamaecyparis obtusa*, *Pinus* spp., *Larix kaempferi*, *Abies sachallinensis*, *Quercus serrata*, *Picea jezoensis* and *Quercus acutissima* (FAO Forestry Department 2010). All of these species are indigenous in Japan, and the main usage of the conifer is sawn timber. *Cryptomeria japonica,* which are in plantation, accounts for 34% of total growing stock volume, but the recent reforested area of *Cryptomeria japonica* is equal to *Chamaecyparis obtusa* (Table 6b). *Chamaecyparis obtusa*, which are in plantation, accounts for 11% in terms of growing stock volume. Annual planting of *Chamaecyparis obtusa* has been the top in the last 20 years in terms of area, whereas it is decreasing recently. *Pinus* spp. consists of *Pinus densiflora* (Japanese red pine) and *Pinus thunbergii* (Japanese black pine), and the timber is mainly supplied from the secondary forest of red pine. Annual planting area is sharply decreased due to the pine wilt disease outbreak. *Larix kaempferi* (Japanese larch) has been planted widely in the central and northern part of Honshu up to Hokkaido due to fast early growth character although its natural distribution is limited in the high-elevation area of the central Honshu. Recently, the planting area is increasing due to a high demand in processing industry. *Abies sachallinensis* (Saghalien fir) and the *Picea glehnii* are common in Hokkaido and majority of the timber supply is from their natural forest, although the supply from plantation has been initiated.

Table 5. Forest tree species currently used in Japan; for each species please indicate (N or E) whether native or exotic.

Species	Native (N) or exotic (E)	Current uses (code) *	Type of management system (e.g. natural forest, plantation, agroforestry)	Area management (plantation) (ha)
Abies sachalinensis	N	1	plantation, natural forest	784,863
Chamaecyparis obtusa	N	1	plantation	2,597,675
Cryptomeria japonica	N	1	plantation	4,504,945
Larix kaempferi	N	1	plantation	1,020,971
Picea glehnii	N	1	plantation, natural forest	In total of two species 81,391
Picea jezoensis	N	1	natural forest	
Pinus densiflora	N	1	plantation	In total of two species 885,704
Pinus thunbergii	N	1	plantation	
Quercus acutissima	N	1	plantation, natural forest	64,985
Quercus crispula	N	1	natural forest	In total of *Quercus* spp. 12,166
Quercus serrata	N	1	natural forest	

Data: Forest and Forestry Census in japan 2009

Note:

Current use (Code)*:

1 Solid wood products
2 Pulp and paper
3 Energy (fuel)
4 Non wood forest products (food, fodder, medicine, etc.)
5 Used in agroforestry systems
6 Other

Table 6a. Annual quantity of seed produced and current state of indentification of forest reproductive material of the main forest tree and other woody species in Japan.

Species	Native (N) or exotic (E)	Total quantity of seed produced (kg)	Quantity of seed from documented sources (provenances / seed zone delimited) (kg)	Quantity of seed from listed (provenances trial established and evaluated)	Quantity that is genetically improved (kg)
Abies sachalinensis	N	3,160	3,020		3,020
Chamaecyparis obtusa	N	1,650	1,390		1,390
Cryptomeria japonica	N	930	880		880
Larix kaempferi	N	290	40		40
Picea glehnii	N	1,030	930		930
Pinus densiflora	N	40	40		40
Pinus thunbergii	N	80	60		60
Quercus acutissima *Quercus serrata*	N	5,370	70		70

Source: Statistical book of forest tree breeding program 2010
Numbers in table represented as a mean of '04-'08

Table 6b. Annual number of seedlings (or vegetative propagules) planted and the state of indentification of the reproductive material used for the main forest tree and other woody species in Japan.

Species	Native (N) or exotic (E)	Total quantity of seedlings planted ($x10^3$)	Quantity of seedlings from documented sources (provenances / seed zone delimited) ($x10^3$)	Quantity of seedlings from listed (provenances trial established and evaluated)	Quantity of vegetative reproductive material used	Quantity of seedlings that are genetically improved ($x10^3$)
Abies sachalinensis	N	3,810	1,770			1,770
Chamaecyparis obtusa	N	18,910	14,930			14,930
Cryptomeria japonica	N	17,100	10,530			10,530
Larix kaempferi	N	8,340	2,910			2,910
Picea glehnii	N	5,790	1,340			1,340
Pinus densiflora	N	600	490			490
Pinus thunbergii	N	1,140	530			530
Quercus acutissima *Quercus serrata*	N	2,620	190			190

Source: Statistical book of forest tree breeding program 2010
Numbers in table represented as a mean of '04-'08

Growing stock of *Quercus ssp.* is the largest in the hardwood (FAO Forestry Department 2010). The three major species (*Quercus serrata*, *Q. dentata*, and *Q. crispula*) are deciduous trees and become the main compositing species of the cool-temperate forest. *Quercus serrata* had been common in the countryside forest to supply fuel wood and bed log for shiitake mushroom culture by coppice regeneration. As for *Quercus* *acutissima*, it has almost the same usage as the *Q. serrata*, and the plantation has been established mainly in the warm-temperate forest. Besides this, the wood of *Zelkova serrata* has been appreciated by its durability as well as its beautiful grain color and has been used for the large-scale construction such as shrines and temples from ancient times. Therefore many old plantations are available, and the present annual planting area follows *Quercus serrata* and *Q. acutissima* in the hardwood.

Table 7 shows the usage of the 30 main species in terms of the environment and the social aspect. Since several functions of forest, such as water conservation, soil conservation and biodiversity conservation are realized through the existence of the forest as a whole, all the species in Table 7 will fall in the category (1) and (3). Among those, *Fagus crenata* and *Quercus crispula*, the species widely distributed in the mountainous areas from Hokkaido to Honshu, Shikoku, and Kyushu, are regarded as superior in water and soil conservation and are indispensable for the landscape value as well. Evergreen *Quercus* spp. and *Castanopsis* spp., both of which are considered as latent vegetation in southwest Japan, are important in water and soil conservation as well as landscape value in the region. The conservation forest at sea coastal lines, used for wind break, protection of residential area and farm land from sand and salt, has been established and maintained in Japan. For this purpose, *Pinus thunbergii* is used in Honshu, Shikoku, and Kyushu, *Quercus dentata* is used in Hokkaido, and *Pinus luchuensis* etc. is used in the southwest islands. *Alnus japonica* is used for soil fertility increase in the degraded slope rehabilitation and erosion control of the road side.

Table 7. Main tree and other woody forest species providing environmental services or social values.

Species	Native (N) or exotic (E)	Environmental services or social values (code) *
Abies mariesii	N	1,3,5
Abies sachalinensis	N	1,3
Abies spp. *1	N	1,3,5
Acer mono	N	1,3,5
Alnus spp. *2	N	1,2,3
Betula ermanii	N	1,3,5
Betula maximowicziana	N	1,3,5
Betula platyphylla var. *japonica*	N	1,3,5
Carpinus spp. *3	N	1,3,5
Castanea crenata	N	1,3,5
Castanopsis spp. *4	N	1,3,5
Chamaecyparis obtusa	N	1,3,4,5
Cryptomeria japonica	N	1,3,4,5
Evergreen *Quercus* spp. *5	N	1,3,5
Fagus crenata	N	1,3,5
Five-needled *Pinus* spp. *6	N	1,3,5
Larix kaempferi	N	1,3
Picea glehnii	N	1,3
Picea jezoensis	N	1,3
Pinus densiflora	N	1,3,5
Pinus luchuensis	N	1,3,5
Pinus thunbergii	N	1,3,5
Prunus spp. *7	N	1,3,4,5
Quercus acutissima	N	1,3,5
Quercus crispula	N	1,3,5
Quercus serrata	N	1,3,5
Thujopsis spp. *8	N	1,3
Tilia japonica	N	1,3,5
Tsuga diversifolia	N	1,3,5
Zelkova serrata	N	1,3,4,5

Note:

Surivces and values include (Code)*:

1	Soil and water conservation including watermanagement	4	Cultural values
		5	Aesthetic values
2	Soil fertility	6	Religious values
3	Biodiversity conservation	7	Other

*1-8 see Table 4.

1.3 Factors influencing the state of forest genetic diversity in Japan

In Japan, 66% of the total land is covered with forest and this ratio has been stable for the last several decades, however, most of the forests are more or less intervened due to the high population pressure. Therefore the National Forest has designated the valuable forests where the unique ecosystem exist and/or the habitat of valuable species of animals and plants as "protection forest". Total area of "protection forest" is 782,000ha as of April 1, 2010. This protection forest system had been launched in 1915 and it was reorganized in 1983. Since 2008, periodical monitoring with 5 year interval had been started in all protection forests.

The reduction in intra-species genetic diversity due to the extinction of local populations caused by pest, disease or animal damage is the major concern for the main forest tree species. As for the pine species, which have been severely damaged by pine wilt disease in the low land of south to central region, the infected areas is gradually spreading toward north as well as higher elevation in line with global warming effect. The rapid expansion of the mass mortality of oak caused by *Raffaelea quercivora* in recent years is also a serious concern and attention should be paid for the trend in the future. In addition, the browsing damage of plantations by wild deer (*Cervus nippon*) is increasing as the population of wild deer increases rapidly, and it has become a serious factor that disturbs the natural regeneration as well as increases maintenance cost of plantation. It is expected that the future adaptation plan against climatic change for *Fagus crenata* will be necessary for the isolated populations especially distributed in the southern Honshu because it is forecasted that the suitable land of *Fagus crenata* reduces in line with the global warming effect.

Regarding to the endangered species, 304 of woody plant species are registered in the Red List (Ministry of the Environment, 2007). Among them, 84 species classified as CR (Critically Endangered) were shown in Table 8. Many of the endangered species are found only in the remote small islands. The Red Lists are also compiled by the local governments independently. The approach of *ex situ* conservation in addition to *in situ* conservation has been conducted for *Pinus armandii* var. *amamiana*, *Picea koyamae*, and *Morus boninensis* of which had been severely exploited due to their rareness and high value. The conservation activities in various sectors such as the Forestry Agency, local governments, universities, and NGOs have been extended with awareness of the ecosystem integrity concept in recent years. These activities would be more important and urgent in the future because of the increase in the number of endangered species due to the climate change induced by the global warming.

Table 8. List of tree and other woody forest species considered to be threatened in all or part of their range from genetic conservation point of view.

Species	Proportion of species' natural distribution in Japan (%)	Distribution in the country: widespread (W), rare (R), or local (L)	Type of threat (Code)*	Threat category **		
				High	Medium	Low
Abelia chinensis var. *ionandra*		R	17	✓		
Abelia serrata var. *tomentosa*	100	R	3	✓		
Acer amamiense	100	RL	3, 16	✓		
Barringtonia asiatica		R	16	✓		
Betula apoiensis	100	RL	15, 16	✓		
Buxus microphylla var. *sinica*		RL	16	✓		
Callicarpa formosana		RL	16	✓		
Callicarpa glabra	100	RL	3, 16	✓		
Callicarpa longissima		R	16	✓		
Callicarpa nishimurae	100	RL	8, 16	✓		
Celtis biondii var. *insularis*		RL	3	✓		
Citrus nippokoreana		RL	15, 16	✓		
Claoxylon centenarium	100	RL	3, 16	✓		
Cornus hongkongensis		RL	3, 16	✓		
Cryptocarya chinensis		RL	3	✓		
Deutzia naseana var. *amanoi*	100	RL	3	✓		
Diplomorpha phymatolossa	100	RL	3, 16	✓		
Discocleidion ilmifolium		R	17	✓		
Ecdysanthera utilis		R	3	✓		
Ehretia dichotoma		R	3	✓		
Elaeagnus arakiana	100	R		✓		
Entada phaseoloides		R	3	✓		
Euchresta formosana		R	3, 16	✓		
Euodia ailanthifolia		R		✓		
Euonymus oblongifolius		RL	3, 16	✓		
Euonymus oligospermus		RL	16	✓		
Eurya zigzag	100	RL	3	✓		
Gardneria liukiuensis	100	R	17	✓		
Gardneria shimadae		RL	16	✓		
Gfewia rhombifolia		RL	16, 17, 18	✓		
Hydrangea involuculata var.*takaraensis*	100	RL	3	✓		
Ilex dimorphophylla	100	RL	3, 16, 18	✓		
Ilex macrocarpa		RL	3, 16	✓		
Illigera luzonensis		RL	3	✓		
Indigofera kirilowii		R	3, 15	✓		
Intsia bijuga		R	3	✓		
Ligustrum tamakii	100	RL	16	✓		
Lonicera demissa var. *borealis*	100	R	3	✓		
Lonicera japonica var. *miyagusukiana*	100	RL	17	✓		
Lumnitzera racemosa		R	17	✓		
Margaritaria indica		RL	16, 17	✓		
Melastoma tetramerum	100	RL	3, 16	✓		
Myrsine okabeana	100	RL	16	✓		
Nothapodytes amamianus	100	RL	3, 16	✓		
Nypa fruticans		R	16	✓		
Ochrosia oppositifolia	100	RL	3	✓		
Photinia serrulata		R	18	✓		
Phyllanthus oligospermus subsp. *donanensis*		RL	3, 16	✓		

Table 8. - (continued)

Species	Proportion of species' natural distribution in Japan (%)	Distribution in the country: widespread (W), rare (R), or local (L)	Type of threat (Code)*	Threat category **		
				High	Medium	Low
Pieris japonica var. *koidzumiana*	100	RL	16, 18	✓		
Pittosporum chichijimense	100	RL	3, 16	✓		
Pittosporum parvifolium	100	RL	3, 16, 18	✓		
Polyalthia liukiuensis		RL	16	✓		
Prunus incisa var. *bukosanensis*	100	R	3, 17	✓		
Prunus tamaclivorum	100	RL	3, 16, 17	✓		
Pterocarpus indicus		RL	3, 16	✓		
Pyrus ussuriensis	100	R	3	✓		
Raphidophora liukiuensis		R	3	✓		
Rhamnus kanagusuki	100	RL	16	✓		
Rhododendron amamiense	100	RL	3, 16	✓		
Rhododendron boninense	100	RL	3, 16, 18	✓		
Rhododendron dilatatum var. *satsumense*	100	RL	16	✓		
Rhododendron eriocarpum var. *tawadae*	100	RL	8, 16	✓		
Rhododendron keiskei var. *hypoglaucum*	100	R	18	✓		
Ribes horridum		R	3	✓		
Rubus amamiana var. *minor*	100	RL	3, 16	✓		
Rubus arcticus		RL	16	✓		
Ryssopterys timoriensis		R	17	✓		
Salix nummularia ssp. *pauciflora*	100	RL	16	✓		
Sophora franchetiana		RL	3, 16, 18	✓		
Stachyurus macrocarpus	100	RL	3, 16	✓		
Stachyurus macrocarpus var. *purnifolius*	100	RL	3, 16	✓		
Symplocos boninensis	100	RL	16	✓		
Symplocos kawakamii	100	RL	16	✓		
Terminalia nitens		RL	16	✓		
Tilia chugokuensis		RL	16	✓		
Tilia mandschurica		RL	15, 16	✓		
Uraria picta		RL	16	✓		
Vaccinium amamianum	100	RL	3, 16	✓		
Vaccinium sieboldii	100	R	17	✓		
Viburnum koreanum	100	R	16	✓		
Vitex quinata		RL	16	✓		
Vitex trifolia var. *bicolor*		R	16	✓		
Vitis quinqueangularis		R	3	✓		
Weigela florida		R	15, 16	✓		

Note:

Type of threat (Code)*:

1	Forest cover reduction and degradatioin	10	Pollutant emissions
2	Forest ecosystem diversity reduction and degradation	11	Pests and diseases
3	Unsustainable logging	12	Forest fires
4	Management intensification	13	Drought and desertification
5	Competition for land use	14	Rising sea level
6	Urbanization	15	Vegitational succession
7	Habitat fragmentation	16	Marginal distribution
8	Uncontrolled introduction of alien species	17	Habitat destruction by development
9	Acidification of soil and water	18	Exploitation by plant collecters

** Threat categories: High - threatened throughout species range within the country; Medium - threatened in at least 50 % of range within country; Low - threatened in less than 50 % of range within country.

With the rise of a social concern on the diversity of forest as well as the technical progress in molecular genetics in recent years, public research institutions and universities including Forestry and Forest Products Research Institute (FFPRI), which is an incorporated administrative agency of the Japanese government, are conducting research on many forestry species to access their genetic differentiation and genetic diversity with using DNA markers. The results of research on the intra-species genetic diversity for the 30 species listed in Table 9 were already published. It has been reported that the current geographic variation of genes of many species in Japan could be regarded as a consequence of the repeated expansion of the habitat during inter-glacial period and the shrinkage during the glacial period. The studies on intra-species variation on morphological traits and adaptive characters are also conducted for the species with a high use frequency in Table 5.

Table 9. Forest species for which genetic variability has been evaluated.

Species (Scientific name)	Native (N) or Exotic (E)	Morphological traits	Adaptive and production characters assessed	Molecular characterization
Abies firma	N			✓
Abies homolepis	N		✓	✓
Abies mariesii	N			✓
Abies sachalinensis	N	✓	✓	✓
Acer mono	N			
Alnus firma	N			
Alnus firma var. *hirtella*	N			
Alnus hirsuta	N			✓
Alnus hirsuta var. *sibirica*	N			
Alnus japonica	N			✓
Alnus japonica var. *arguta*	N			
Alnus sieboldiana	N			
Betula ermanii	N			✓
Betula maximowicziana	N			✓
Betula platyphylla var. *japonica*	N		✓	✓
Carpinus cordata	N			
Carpinus japonica	N			
Carpinus laxiflora	N			
Carpinus tschonoskii	N			
Castanea crenata	N			✓
Castanopsis cuspidata	N	✓		✓
Castanopsis cuspidata var. *sieboldii*	N	✓		✓
Castanopsis cuspidata var.*lutchuensis*	N			✓
Chamaecyparis obtusa	N	✓	✓	✓
Cryptomeria japonica	N	✓	✓	✓
Fagus crenata	N	✓	✓	✓
Larix kaempferi	N	✓	✓	✓
Picea glehnii	N		✓	✓
Picea jezoensis	N	✓	✓	✓
Pinus armandii var. *amamiana*	N			✓
Pinus densiflora	N	✓	✓	✓
Pinus luchuensis	N			
Pinus parviflora var. *pentaphylla*	N			✓
Pinus pentaphylla	N			
Pinus thunbergii	N	✓	✓	✓
Prunus jamasakura	N			✓
Prunus sargentii	N			
Prunus verecunda	N			
Quercus acuta	N			
Quercus acutissima	N			✓
Quercus crispula	N	✓	✓	✓
Quercus gilva	N			
Quercus glauca	N			
Quercus myrsinaefolia	N			
Quercus serrata	N		✓	✓
Thujopsis dolabrata	N			✓
Thujopsis dolabrata var. *hondae*	N			✓
Tilia japonica	N			
Tsuga diversifolia	N			
Zelkova serrata	N		✓	✓

1.4 Future needs and priorities

In 2008, Forestry Agency, Ministry of Agriculture, Forestry and Fisheries (MAFF), had set up a “Forest Biodiversity Working Group”, and a report "Promotion strategy of a conservation of the biological diversity and sustainable use in woodland" was adopted in July, 2009. In this strategy report, it proposes the concrete political measures needed to achieve the conservation of biological diversity in the forest, including the conservation of the forest genetics resources in Japan. The outline of the proposal is as follows:

- Forest area plays a role as the fundamental basis of the ecosystem network in the country, and maintains a rich biological diversity.
- Under the certain domain, existence of various types of vegetations that are adapted to the local environment and well balanced arrangement of forests at various succession stages that help to ensure the biota are important.
- An idea of adaptable management that changes measures according to the result of periodic monitoring is emphasized based on the recognition that there are a lot of factors in the biodiversity that have not been fully accessed in a scientific manner.
- Maintaining various forest ecosystems that consist of various stand/tree ages by encouraging measures to promote sustainable forestry activity within a range of productivity of forest ecosystem contributes to securing the biological diversity.

Based on this proposal, Forestry Agency has been conducting the survey at the permanent monitoring points concerning the diversity of the nationwide forest ecosystem, development of appropriate technology to seize forest vegetation by analyzing the digital aerial photograph and also the publicity of various activities related to the conservation of forest biodiversity in Japan.

It is necessary to conserve the forest genetic resources mainly by the current system of the protection forest, while the research to strengthen the system is also required to make it more effectively. The research to evaluate the intra-species genetic variation for several hardwood species should be continued because of their ratio increase in plantation. Results of the research would be utilized to reallocate the current protection forests as well as to reorganize/update the *in situ* genetic conservation programs as a whole.

Forest Tree Breeding Center of FFPRI (FTBC-FFPRI) is constructing a database linked with species distribution, meteorology information of a mesh level that covers the entire country in Japan, positional information of preserved genetic resources by using GIS to grasp intra-species genetic variation of the major forest species efficiently. It is preferable to develop it into a system that can connect and link with a prediction of global warming in the future by adding the data of the *in situ* genetic resources conservation in the above-mentioned database.

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Chapter 2: The State of *in situ* Genetic Conservation

2.1 Overview

Japan has several systems for the conservation of *in situ* biodiversity including forest trees. Firstly, a "protection forest system", including "forest ecosystem protection area", "forest-related genetic resources protection forest" and "forest tree genetic resources protection forest", are maintained by the National Forest. Secondly, the national and/or prefectural governments designate "wilderness areas" and "nature conservation areas" under the Nature Conservation Law. Additionally, based upon the Natural Park Act, there are "national parks" and "quasi-national parks" by the national government as well as "prefectural natural parks" by the prefectural governments. In addition to the above *in situ* conservation schemes, Japanese forests themselves also contribute *in situ* genetic conservation of forest trees, which consist of approximately 1,500 native tree species. This is because that the forest area is occupying two thirds of the Japanese land area, and that there is little pressure for development and conversion of forests into other land use due to its steepness in nature and associated various regulations against conversion.

A status of the genetic resources in the forest-related genetic resources protection forests in the National Forest are monitored for major tree species, but not for the other forest conservation schemes. There has not been any systematic survey to understand the state of forest tree genetic resources in the entire forest in Japan.

2.2 Protection forests in the National Forest

Forestry Agency set up a program of "protection forest" in its national forest for *in situ* conservation of forest genetic resources since 1915 based upon an official notice (Director-General of Forestry Agency 2010). This protection forest is operated by National Forest in collaboration with FTBC-FFPRI.

The protection forests can be divided into seven categories. The three of them were directly designed for conservation of forest genetic resources, namely, "forest ecosystem protection area", which consists of a large area of primeval forest with rich natural environment and ecosystem (29 sites: 495,000ha in total); "forest-related genetic resources protection forest", which consists of a relatively large area of natural forest targeting all living organism within the forest (12 sites: 35,000ha in total); "forest tree genetic resources protection forest", which consists of a smaller area of natural forest targeting major forest trees for plantation (325 sites: 9,000ha in total). In addition, another category can be recognized potentially conserving forest genetic resources, i.e., "specific plant community protection forest", which consists of forest where scientifically/historically valuable plant community exists (370 sites: 182,000 ha in total).

Both in case of "forest ecosystem protection area" and "forest-related genetic resources protection forest", the target species are virtually "all" species in the protection forest including animals. On the other hand, in case of “forest tree genetic resources protection forest”, the target tree species are clearly designated respectively. Therefore, Table 10 was provided based upon forest tree genetic resources protection forest above only. Since some of forest tree genetic resources protection forest will cover plural targeted species, the total number and area of stands in Table 10 are not equal to the above description. The total number of target species in forest tree genetic resources protection forest is 105, however, this number accounts for only 7% of the total number of Japanese native tree species (approx. 1,500). On the other hand, Japanese forests are registered and managed sustainably under the Forest Planning System, almost all tree species are somehow protected and/or conserved in association with various direct and indirect protection forest scheme.

Table 10. Target forest species included within *in situ* conservation programmes / units.

Species	Number of stands conserved	Total area (ha)
Abies firma	18	782.2
Abies homolepis	5	329.8
Abies mariesii	3	71.1
Abies sachalinensis	15	293.2
Abies sachalinensis f. *nemorensis*	1	4.6
Abies veitchii	5	183.6
Abies veitchii	1	4.2
Acer japonicum	4	145.6
Acer matsumurae	1	9.4
Acer mono var. *marmoratum*	10	336.6
Acer mono var. *mayrii*	3	40.5
Acer palmatum	2	44.0
Aesculus turbinata	9	407.5
Alnus hirsuta	3	19.6
Alnus hirsuta var. *sibirica* (yachi-han'noki)	1	5.0
Alnus hirsuta var. *sibirica* (yama-han'noki)	1	8.4
Alnus japonica	1	8.7
Betula davurica	1	8.1
Betula ermanii	13	595.2
Betula grossa	13	451.8
Betula maximowicziana	13	147.6
Betula platyphylla var. *japonica*	8	106.0
Carpinus japonica	2	156.8
Carpinus laxiflora	9	762.0
Carpinus spp.	1	9.4
Carpinus turczaninovii	3	157.1
Castanea crenata	10	118.0
Castanopsis cuspidata	6	184.1
Castanopsis cuspidata var. *sieboldii*	7	574.6
Castanopsis spp.	1	11.0
Cercidiphyllum japonicum	7	193.9
Chamaecyparis obtusa	13	579.6
Chamaecyparis pisifera	3	111.0
Chosenia arbutifolia	1	8.4
Cinnamomum camphora	2	62.3
Cornus controversa	1	34.2
Cryptomeria japonica	27	1939.6
Distylium racemosum	9	637.2
Fagus crenata	35	1918.2
Fagus japonica	5	159.5
Fraxinus lanuginosa var. *serrata*	3	47.8
Fraxinus mandshurica	7	96.5
Fraxinus spaethiana	3	101.2
Juglans sieboldiana	2	19.8
Kalopanax pictus	10	206.6
Larix gmelinii	3	32.2
Larix kaempferi	6	440.2
Larix olgensis var. *koreana*	2	12.3
Maackia amurensis var. *buergeri*	3	31.1
Machilus thunbergii	8	378.9
Magnolia obovata	7	188.6
Ostrya japonica	4	41.3
Pasania edulis	1	69.1

Table 10. - (continued)

Species	Number of stands conserved	Total area (ha)
Phellodendron amurense	8	178.5
Picea bicolor	2	263.9
Picea bicolor var. *acicularis*	1	5.9
Picea glehnii	10	540.9
Picea jezoensis	12	417.8
Picea jezoensis var. *hondoensis*	5	205.2
Picea jezoensis var. *takadae*	3	10.0
Picea koyamae	1	5.9
Picea polita	1	28.2
Pinus densiflora	15	816.7
Pinus koraiensis	2	67.6
Pinus luchuensis	2	30.5
Pinus pentaphylla	2	73.7
Pinus pentaphylla var. *himekomatsu*	6	585.8
Pinus thunbergii	3	22.7
Podocarpus macrophyllus	2	156.6
Populus davidiana	2	12.1
Populus maximowiczii	3	25.9
Prunus jamasakura	1	11.2
Prunus ssiori	3	60.6
Pseudotsuga japonica	3	28.2
Pterocarya rhoifolia	8	188.6
Quercus acuta	9	446.7
Quercus acutissima	3	96.1
Quercus crispula	35	760.7
Quercus dentata	5	146.5
Quercus gilva	7	227.0
Quercus glauca	3	175.6
Quercus miyagii	1	98.8
Quercus mongolica	4	95.4
Quercus myrsinaefolia	2	92.4
Quercus phylliraeoides	2	47.7
Quercus salicina	9	312.6
Quercus serrata	10	219.9
Quercus spp.	1	3.2
Quercus variabilis	1	5.4
Schima liukiuensis	1	161.0
Sciadopitys verticillata	7	301.6
Sorbus alnifolia	2	53.5
Stewartia pseudocamellia	1	114.7
Taxus cuspidata	4	53.3
Thuja standishii	5	91.4
Thujopsis dolabrata	1	81.1
Thujopsis dolabrata var. *hondae*	4	71.3
Tilia japonica	6	146.8
Tilia maximowicziana	5	47.8
Torreya nucifera	8	324.4
Tsuga diversifolia	7	320.1
Tsuga sieboldii	12	683.9
Ulmus davidiana var. *japonica*	6	124.7
Ulmus laciniata	2	69.3
Zelkova serrata	14	409.5

Source: FTBC-FFPRI internal data. 2010

The protection forests in the National Forest are managed on a forest compartment unit basis. All forest operation/intervention in protection forest are done under the long-term authorized management plan of the forest. Protected forests in the National Forest are periodically surveyed with "protection forest monitoring system" to observe whether the forest is maintaining its expected roles and functions.
The area other than protection forests in the National Forests are also managed sustainably with the long-term regional forest management plans. Thus, such forests are also contributing to enhance its biodiversity including genetic resources conservation.

2.3 Constraints for improving in situ conservation action and improvement toward better conservation

In Japan, there are approximately 1,500 tree species excluding exotic/introduced species. Such a relatively high diversity at species level makes difficult to prioritize the target species for genetic resource conservation, particularly *in situ* conservation. The information on intra-species genetic variation is insufficient in many species and the research funding and efforts tend to be dispersed among such many diversified species. Small scale and scattered/fragmented ownership in private forests is also another obstacle for *in situ* conservation measures.

Although some problems/obstacles can be found as above, there seems to be a little concern on *in situ* conservation of forest tree genetic resources at this stage in Japan. On the other hands, the state of the *in situ* conservation cannot be evaluated quantitatively, like comparing between the information of species-wise natural distribution and the current conservation state associated. It is required that calculation of the cover ratio, i.e. genetic variation covered by the current *in situ* conservation over total range of genetic variation in natural distribution through the survey of the information of species-wise natural distribution and the associated species genetic variation. The output should be used for further refinement of the strategy associated.

Therefore, the collection of the information on many species should be an immediate task. The fact that almost all on-going studies on forest tree genetic resources are focusing on those on genetic diversity of various species in nation-wide and/or in regionally as well as *in situ* in Japan tells us its importance and urgency. Any permanent organization/committee is not available to examine on *in situ* conservation of forest tree species. However, there are some committees consist of academics for the establishment and management of the protection forests in the National Forest.

Chapter 3: The State of ex-situ Genetic Conservation

3.1 Over view

Ex situ conservation activities of forest tree genetic resources has been solely executed by FTBC-FFPRI, based on the official notice by Director-General of Forestry Agency "Forest and forest tree gene bank project implemented by Forestry Agency" issued in 2000. Prior to the D-G's official notice, the forest tree gene bank project itself was launched in 1985 as a part of the MAFF integrated gene bank project. Upon the delivery of the D-G's official notice, the activity of the forest and forest tree gene bank project has been expanded and covered both *in situ* and *ex situ* conservation. FTBC-FFPRI, which has responsibility for *ex situ* conservation, has been entitled to implement *in situ* conservation as well in collaboration with National Forest which manages protection forests. In a broader definition, progeny tests, of which the details are described in the next chapter, also can be regarded as one of *ex situ* conservation activities.

3.2 Field collection

There are two types of field collection, both of them are planted forests, Forest Tree Superior Gene Conservation Stand (SGCS) that the National Forest of Forestry Agency manages and clone bank activity which FTBC-FFPRI manages. The aim of SGCS is to conserve genetically superior natural/native old stand by collecting seeds from such stands and establishing plural planted stands by those seeds in 1970s. At present, there are 380 SGCSs for 18 species (Table 11). 139 SGCSs for *Cryptomeria japonica* is the largest, and around 50 SGCSs for each of *Pinus densiflora* and *Chamaecyparis obtusa*, around 30 SGCSs for each of *Larix kaempferi*, *Abies sahalinensis* and *Picea glehnii*, around 20 SGCSs for each of *Pinus thunbergii* and *Picea yezoensis*. Some SGCSs are for hardwood species such as *Betula* species. In principle, when setting up a SGCS, seed source trees for seedlings to be planted are selected from more than 30 trees in the targeted superior natural/native old stand in order to maintain genetic diversity of superior gene pool.

Table 11. *Ex situ* conservation

Species		Field collection				Germplasm banks					
(Scientific names)	Native (N) or exotic (E)	Collections, provenance or progeny test, arboreta or conservation stands		Clone banks		In vitro (incruding cryo conservation)		Seed banks		Pollen banks	
		No. stands	No. acc.	No. banks	No. acc.	No. banks	No. acc.	No. banks	No. acc.	No. banks	No. acc.
Abies mariesii	N										
Abies sachalinensis	N	24	21	2	334			2	318	2	122
Abies spp. *1	N			5	80			2	63	1	8
Acer mono	N										
Alnus spp. *2	N			2	81			1	73	1	36
Betula ermanii	N			2	32					1	22
Betula maximowicziana	N			3	41						
Betula platyphylla var. *japonica*	N			2	165			1	37	1	62
Carpinus spp. *3	N							1	39		
Castanea crenata	N			5	115						
Castanopsis spp. *4	N										
Chamaecyparis obtusa	N	48	35	7	2,452			1	1,515	1	315
Cryptomeria japonica	N	139	91	9	7,812			1	2,298	1	1,483
Fagus crenata	N			3	90						
Larix kaempferi	N	27	13	5	2,450			2	508	2	142
Picea glehnii	N	34	16	3	1,172			2	112	1	46
Picea jezoensis	N	11	9	2	168			2	59	1	33
Pinus densiflora	N	55	28	9	1,609			1	466	1	472
Pinus luchuensis	N			3	17			1	14	1	3
Pinus thunbergii	N	9	7	7	883			1	269	1	291
Five-needled *Pinus* spp. *5	N			7	337			1	43	1	31
Prunus spp. *6	N										
Quercus acutissima	N			5	246						
Quercus crispula	N			4	133					1	2
Quercus serrata	N										
Evergreen *Quercus* spp. *7	N										
Thujopsis spp. *8	N			8	420						
Tilia japonica	N										
Tsuga diversifolia	N										
Zelkova serrata	N			6	1,277			1	58		

Note:

There are overlapping clones/strains among banks.

*1-8 see Table 4.

Clone bank activity, which includes collecting scions from plus trees, then propagating and archiving them in a clone bank, has been conducted by FTBC-FFPRI and its four regional breeding offices. In principle, five ramets per clonal collection, i.e. plus trees in most cases, are archived in a clone bank. About 20,000 collections for 310 species are archived in ten clone banks in Japan. The number of collections for major forest tree species is listed in Table 11. 7,071 collections for *Cryptomeria japonica* are followed by around 2,000 collections for each of *Chamaecyparis obtusa* and *Larix kaempferi*, around 1,000 collections for each of *Pinus densiflora* and *Abies sahalinensis*. These are all major planting species in Japan, and plus trees selected for breeding purpose occupy more than half of the collections. As to other important forestry species such as *Thujopsis* species, deciduous *Quercus* species (*Q. serrata* and *Q. acutissima*), *Betula* species (*B. ermanii*, *B. platyphylla* var. *japonica*, and *B. maximowicziana*) and *Zelkova serrata*, more than 300 collections have been archived respectively.

Genetic resources are divided into three following categories based on the current and future needs: 1) the first category includes species that are important genetic resource as breeding materials, e.g. coniferous species for breeding programs, fast growing species for mitigation of global warming, and economically important hardwood species. 2) The second category includes rare species and fairly old-growth big trees such as species listed in the Red List and trees designated as natural monuments. The collection of the Red List species is aiming at the conservation of biodiversity. The fairly old-growth big trees are often culturally/religiously important, and those trees may possess useful genetic variation that is suitable for breeding purposes. 3) The third category is composed of various species and trees that are not included in the first and second categories. This category includes species that is important for pharmaceutical and/or ornamental use.

3.3 Germplasm collection

As to germplasm, FTBC-FFPRI has collected and preserved pollen and seeds, but not in vitro preservation. FTBC-FFPRI and its four regional breeding offices engaged with collecting germplasms from their own responsible area, but all the collections are preserved and managed in facilities at the FTBC-FFPRI. The number of preserved germplasm is about 8,000 collections from around 450 species for seeds and about 3,000 collections from around 60 species for pollen, respectively (Table 11). *Cryptomeria japonica* and *Chamaecyparis obtusa* occupy the majority for both pollen and seeds collections. Collections are available for coniferous species and hardwood species that have fine grain seeds, but those for species that have large seeds such as *Fagus* species, of which seed preservation is generally difficult, are limited. Most of pollen collection is of anemophilous species.

As to seeds of coniferous species, after germination test and desiccation, seeds are packed into 100 mL plastic bottle, and cryopreserved at -20 ºC. As to seeds of hardwood species, after germination test and desiccation on necessity, packed into plastic bottle or polyethylene bag, and preserved at +2 to 4 ºC. As to pollen, after germination test and desiccation, stored into 2 to 15 mL tube, and cryopreserved at -80 ºC.

The FTBC-FFPRI delivers the genetic resource collection such as seeds, pollen, scions, and seedlings to domestic research users on request. There are about 30 requests per year, and about 200 to 500 collections are delivered per year. There is no international delivery in the last five years, but some collections have been exchanged with other countries' collections, only after making a necessary MOU (memorandum of understanding).

3.4 The main constraints to improving ex situ conservation

Due to expansion of the targeted species of conservation from breeding targeted species to ecologically important dominant species as well as rare/endangered species, technical difficulty in vegetative propagation and seed preservation is increasing. When preserving in clone banks, collections are propagated by cutting and/or grafting, but such vegetative propagation for those species such as *Fagus* and *Carpinus* are almost impossible and hence propagation of clones for clone bank planting are very difficult. Therefore, some technical improvement for enhancing survival rate of grafting or rooting rate of cutting is essential for those species propagation. Preservation condition that enables to maintain seed germination capability is also one of research topic and should be developed for many hardwood species.

Prioritizing targeted species for collection and securing ample land for preservation are matters that should be taken for further activity. As mentioned in section 3.1, collection of breeding targeted species and rare/endangered species have been conducted so far, many of rare/endangered species are endemic to Nansei Islands and Bonin Islands. More enhanced logistical support system should be taken for such remote area collection and preservation. *In situ* conservation should be the principle strategy for dominant species, which are important ecologically. However, the detailed information is not sufficient, even in the distribution of each species in each region. In order to facilitate effective *ex situ* conservation measures that complements insufficiency of *in situ* conservation, a database of forest tree species genetic resources should be built and enhanced.

Chapter 4: The State of Use and Sustainable Management of Forest Genetic Resources

4.1 Over view of forest genetic resource

The forest genetic resources currently managed by forest tree gene bank in Japan is mainly comprised of the target species for tree breeding, whereas it also includes major forest tree species for timber production as well as rare/endangered forest tree species. Among those, plants and germplasm other than the breeding materials are distributed for research purposes domestically as described in Chapter 3. Thus, this chapter describes the current state of the breeding program and the dissemination system of the improved seed and seedlings.

4.2 Genetic improvement programs and their implementation:

The systematic forest tree breeding program of Japan was started in the late of 1950's, and continues to aim at increasing productivity and upgrading quality as sawn timber for the main planting species: *Cryptomeria japonica*, *Chamaecyparis obtusa*, *Larix kaempheri*, *Abies sachalinensis* and *Picea glehnii* (Table 12). In addition to general breeding programs above, the frost resistance breeding had been conducted for 20 years since 1960's for *Cryptomeria japonica*, *Chamaecyparis obtusa*, and *Abies sachalinensis* and the snow resistance breeding is still underway for *Cryptomeria japonica*. The less spiral grain selection was done for *Larix kaempheri* in the 1980's. As to *Pinus densiflora* and *Pinus thunbergii*, both selection and breeding for timber and pulp wood production had been initiated in 1950’s, however, selection criteria for breeding has been changed into the resistance to pine wilt disease in the late of 1970’s due to the outbreak of the disease. The selection suitable for bed log for shiitake mushroom culture was done for *Quercus acutissima* and *Q. serrata* in the late of the 1970's.

Table 12. Forest improvement programs.

Species		Improvement programme objective					
(Scientific name)	Native (N) or exotic (E)	Timber	Pulpwood	Energy	MP *	NWFP **	Other
Abies sachalinensis	N	✓					
Chamaecyparis obtusa	N	✓					
Cryptomeria japonica	N	✓					
Larix kaempferi	N	✓					
Picea glehnii	N	✓					
Pinus densiflora	N	✓					✓
Pinus thunbergii	N	✓					✓

Note:
MP*: Multipurpose tree improvement Program
NWFP**: Non-wood forest product

The national tree breeding program is composed of five breeding regions, the five regions are namely from north, Hokkaido, Tohoku, Kanto, Kansai and Kyushu. These regions are basically divided by administrative boundary in line with the climatic and vegetative zonings. The breeding for *Cryptomeria japonica* is conducted in the four regions: Tohoku, Kanto, Kansai, and Kyushu, with the plus tree of 500-1,000 individuals selected in each of the region. Likewise, the breeding for *Chamaecyparis obtusa* is conducted in the three regions: Kanto, Kansai, and Kyushu, with 200 to 400 plus trees. In Hokkaido, the breeding for *Abies sachalinensis* and *Picea glehnii* are conducted with 700 plus trees and 300 plus trees respectively. Breeding for *Larix kaempheri* is conducted in the three regions: Kanto, Tohoku and Hokkaido with 100-300 plus trees. Up to now, the nationwide provenance test, which covers the area beyond breeding regions, has not been executed in full scale, because the intensive tree breeding program has already started within each breeding region and seed transfer for these main tree species beyond each breeding region has been restricted by the Forestry Seeds and Seedlings Law.

The plus trees were propagated by grafting or cutting and are preserved in the clone bank of FTBC-FFPRI (Table 13). The national forest and local government have established their clonal seed orchards with the supply of plus tree clones from FTBC (Table 14). Top ranked 30-50 plus tree clones selected in each of the breeding region were used in such seed orchard. In the case of *Cryptomeria japonica* and *Chamaecyparis obtusa*, average size of the seed orchard is around 2.0 ha, and more than 100 seed orchards of each species have been established in Japan and are producing seed for seedlings. The numbers of seed orchard of *Larix kaempferi*, *Abies sachalinensis* and *Picea glehnii* are limited, while the average size of these orchards is slightly larger than the ones in *Cryptomeria japonica* and *Chamaecyparis obtusa* (4-10ha). Although annual seed production in these orchards is not constant, the seeds are also used for seedlings. The seed orchards of pine species, once established with plus tree clones for timber and pulp wood production, were now replaced with the new seed orchard consisted of resistant pine clones and operational seed production has already started.

Table 13. Tree improvement trials.

Species (Scientific name)	Native (N) or exotic (E)	Plus trees Number	Progenies trials No of trials
Abies sachalinensis	N	782	48
Chamaecyparis obtusa	N	1,058	436
Cryptomeria japonica	N	3,670	1,107
Larix kaempferi	N	538	107
Picea glehnii	N	338	24
Pinus densiflora	N	1,012	117
Pinus thunbergii	N	528	16

Source: Statistical book of forest tree breeding program 2010

Table 14. Seed orchards.

Species	Seed orchards		
	Number	Generation	Area (ha)
Abies sachalinensis	12	1st	132.15
Chamaecyparis obtusa	149	1st	264.84
Cryptomeria japonica	71	1st	312.79
Larix kaempferi	22	1st	114.44
Picea glehnii	7	1st	29.61
Pinus densiflora	35	1st	71.44
Pinus thunbergii	15	1st	18.59

Source: Statistical book of forest tree breeding program 2010

The progeny tests, the majority were consisted of the open pollinated families of plus trees from clonal seed orchards, were established at more than 2,000 sites in national forest as well as in private forest (Table 13). Almost 50% of the tests were occupied by *Cryptomeria japonica* and it includes not only the test with the open pollinated families, but also the clonal tests aiming to evaluate clonal performance of the first generation plus trees as well as range wide tests to assess the magnitude of genotype-environment (G*E) interaction within the respective breeding region. Most of the progeny tests of other species were established with the open pollinated families of plus trees from clonal seed orchards. Measurements of the tests are conducted each five years until twenty years old, then every ten years after twenty years old to evaluate first generation plus trees.

The controlled pollination technique has been developed for all the species listed in Table 12. In the case of *Cryptomeria japonica* and *Chamaecyparis obtusa*, around 80 genetic tests comprising of several tens of crosses from the control pollination with ten to twenty plus trees that were selected based on their progeny performance has been established so far. Thus the second generation plus trees will be selected from these tests. On the other hand, because of the lack of an effective flowering stimulation technique for *Larix kaempferi*, *Abies sachalinensis*, and *Picea jezoensis*, the number of genetic tests that contain sufficient number of crosses is limited. Therefore the second generation plus tree will be selected from these tests as well as from the open pollinated progeny tests for those species. At present, the second generation plus trees of *Cryptomeria japonica* have been placed progeny test with rooted cutting at a few sites.

The current seed orchard of all species consists of the first generation plus tree, whereas the seed orchards of *Cryptomeria japonica* and *Chamaecyparis obtusa* were rogued by culling plus tree clones whose progeny performances were proved poor (Table 14). Moreover, the miniature-sized seed orchards of *Cryptomeria japonica* of around 0.2ha in size are recently established all over Japan for a specific purpose such as the pollen allergy countermeasures etc.

4.3 Delivery/deployment systems; availability of reforestation materials

The current share of improved seed is 88% in the seed market of conifer for seedling production (Table 6a). However the share of the improved seedlings to the total conifer seedlings/saplings remains around 58% because of the use of the local cutting variety of *Cryptomeria japonica* and *Chamaecyparis obtusa* (Table 6b). This comparatively high share of improved seed is attributed to the several reasons: the Forestry Seeds and Seedlings Law regulates the seed for commercial seedling production should be collected from the registered seed sources, and the seed production in the seed orchard of the local governments having become full-scale, and it is able to cover most of the demand of seedling for planting due to the decreasing trend of demand in total recently. Seed storage facilities are available in several local governments where the demand is relatively high and the surplus seeds in the good crop year are usually stored to supply in the poor crop year.

The information system of tree breeding, which consists of the data of plus trees and those collected from the progeny tests, is managed by FTBC and its four regional breeding offices. The measurement in the progeny tests is conducted by the National Forest and local governments according to the standardized procedures, and then the data is accumulated with the uniformed format at FTBC and the regional breeding offices. The plus trees are evaluated by analyzing the data of progeny tests in each of the five breeding regions. The results of evaluation are utilized for the roguing of seed orchards by linking with the database of seed orchards of the National Forest and local governments available in each breeding region.

The forest tree breeding program in Japan has been executed by FTBC-FFPRI in cooperation with the National Forest and local governments who are the users of the improved materials. FTBC-FFPRI is responsible for preserving plus tree clones and providing information for upgrading the genetic worth of the seed orchard seed; the report on which clone should be culled and/or added in the orchards. On the other hand, local governments and a part of the National Forest play the role that manage the seed orchards, produce improved seeds, and supply them to the private seedling producers/suppliers. At present, FTBC-FFPRI is distributing the plus tree clones for the establishment and improvement of the seed orchard with a fee for propagation cost according to the request from the local governments. There is a distribution request of the scion and planting stock of about 500 clones of 10,000 individuals from about 30 local governments annually, and are distributed accordingly. These improved materials are not delivered to the foreign countries according to the internal rules and regulations at FTBC-FFPRI.

Chapter 5: The State of National Programs, Research, Education, Training and Legislation

5.1 National programs

The organizations engaging in the national-level forest tree genetic resource conservation program are Forestry Agency, National Forest and FTBC-FFPRI. Forestry Agency makes plans and formulates policies in order to conserve efficiently forest tree genetic resources. National Forest has charge of delineation and management of protection forests, and monitoring of those forests, and FTBC-FFPRI handles the Forest Tree Gene Bank Project (FTGBP). As to the details of *in situ* conservation including the forest tree genetic resources protection forest, please refer to Chapter 2. As to the details of FTGBP, please refer to Chapter 3. FTBC-FFPRI is conducting the FTGBP in cooperation with the National Forest under the supervision of the Forestry Agency.

5.2 Research, education and training

FFPRI including FTBC-FFPRI, prefectural research organizations, and universities are conducting researches relevant to forest genetic resource conservation. In universities, graduate students often research relevant subject with forest genetic resource conservation as their thesis/dissertation study. Importance and intellectual background of forest genetic resource conservation are dealt in lectures on biodiversity, silviculture and forest tree breeding.

Contemporary forest tree genetic resource researches can be divided into the following three themes: 1) intra-species genetic variation including phylogeography, 2) demographic genetics studies including gene flow by seeds and pollen at stand- and landscape-level, and 3) genome research. As to the intra-species genetic variation, many dominant species such as *Cryptomeria japonica*, *Fagus crenata*, and *Betula maximowicziana*, have been conducted. As to the demographic genetics studies, gene flow of major dominant species such as *Quercus salicina* and *Fagus crenata* and species that have ecologically characteristic feature like long distance dispersed seeds such as *Pinus densiflora*, *Magnolia obovata*, and *Cercidiphyllum japonicum*, and species composed of Japanese characteristic ecosystems such as mangroves and *Abies sachalinensis* have been studied from the view point of demographic genetics using genetic markers. As to the genome study, the most important forestry species, *Cryptomeria japonica*, is well studied, and high density linkage maps have been constructed, EST (Expressed Sequence Tag) information is catalogued, a BAC (Bacterial Artificial Chromosome) library is constructed as an infrastructure for future research development. The research situation of the most important 30 species is listed in Table 9.

Vegetative propagation (cutting, grafting) and controlled pollination techniques for *Cryptomeria japonica*, *Chamaecyparis obtusa*, and *Pinus* species are already well established, and these basic techniques have been transferred to developing countries such as Indonesia, Uruguay, and China through JICA technical cooperation projects funded by the ODA of Japanese government.

5.3 National legislation

Japanese government has ratified the ”Convention on Biological Diversity (CBD)“ in May 1993, and has developed the ”The National Biodiversity Strategy” that deals with overall matters relevant to biodiversity conservation and sustainable use including forest tree genetic resources conservation in October 1995. Moreover, ”National Biodiversity Strategy 2010”, the first national biodiversity strategy based on the Basic Act on Biodiversity (came into force in 2008), has been made available in March 2010. On the other hand, Forestry Agency has publicized ”Promotion Strategy of Conservation and Sustainable Use of the Forest Biological Diversity“ in July 2009.

Act on the Promotion of Activities for Biodiversity Conservation through the Cooperation among Regional Diversified Actors was come into force in December 2010. The act provides the government support for various regional actors to promote collaborative activities for conservation of biological diversity.

Forestry Agency, that has its mandate in the national-level forest tree genetic resources program, sets rules and regulations related. In one of these documents, ”Forest Tree Breeding Strategy“ deals with the issue related to the forest tree genetic conservation. The Plant Protection Act was promulgated in order to set rules for importing and exporting plants in 1914. While there are no quarantine rules for native plants, this act is applied to the epidemic prevention of invasive alien species brought from other countries. As to the domestic transfer of seeds and seedlings, the Forestry Seeds and Seedlings Act delineated seed transfer zones, which is consistent to five breeding regions mentioned in Chapter 4.2, for major forestry species. The Plant Variety Protection and Seed Act is also applied for the registration of new cultivars in forest tree species.

5.4 Public awareness

The year 2010 was the international year of biodiversity of the UN, and the CBD-COP 10 was held in Nagoya, Aichi Prefecture, Japan. These opportunities/events, concept relevant to the importance of ecosystem diversity and conservation of species diversity was deemed to be disseminated into Japanese society in general, thus it is further necessary to improve the understanding of the society to the importance of genetic diversity, namely the intra-species genetic diversity. Some further efforts to disseminate the importance of forest genetic resources and benefits obtained from such resources are needed hereafter. Knowledge on detailed geographic scale intra-species genetic variation would be useful for such dissemination efforts. Since detailed geographic scale intra-species genetic variation has been already made available in some species such as *Cryptomeria japonica* and *Fagus crenata*, those knowledge are used for future tree breeding and genetic conservation activities, and expected to enable dissemination efforts more strategic and efficient. While intra-species genetic variation have been studied on some major forest tree species so far, intra-species genetic variation study will be maintained and enhanced further to cover additional major species particularly hardwood species. Research outcomes relevant to the forest tree genetic resources are released to the public through academic meetings and publications on scientific journals. In order to enhance the accessibility to the information about forest tree genetic resources, building some databases about research outcomes of the forest tree genetic resources would be desired.

Chapter 6: The State of Regional and International Agreement and Collaboration

6.1 International agreements

Japan has ratified two treaties related to forest genetic resources, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Convention of Biological Diversity (CBD).

Japan has a relatively high ratio of forests to the land area with diversified forest tree genetic resources. The demand of introducing exotic tree species is at negligible level due to the past poor performance in introduction trial of such species. It is therefore there is few activities to import foreign forest tree genetic resources. In this connection, the effects/impacts of international conventions related to the rules and regulations on genetic resources are limited in terms of utilization of the Japanese native forest tree genetic resources within Japan.

6.2 International networks

Japan virtually does not collaborate internationally on the forest tree genetic resources because of the abundance of native forest tree genetic resources in the nation and of little demands for introducing forest tree species. However, FTBC-FFPRI is conducting international collaborative research activities in forest tree genetic resources with signing Memorandum of Understanding (MOU) with several counterpart organizations abroad. Moreover, as many closely related species of Japanese native species distribute in adjacent countries, there is a possibility of enhancing international collaboration in line with conservation of forest genetic resources in Japan.

6.3 International programs

Although it is not expected that the demand for exotic species may rise up soon, Japanese institutions can and would cooperate in exchanging forest tree genetic resources between Japan and other countries.

Japan will follow CITES as the ratified country. Japan does not export or import species, in principle, corresponding to the rules and regulation stipulated in CITES.

Japan has not received any international funding on conservation and sustainable use of forest tree genetic resources for more than ten years.

The priority of the future international collaboration on forest tree genetic resources would be research enhancing. There are only moderate priorities for the other objectives, understanding the state of diversity, *in situ* and *ex situ* management and conservation, use of forest genetic resources, education and training, legislation, information managing, public awareness, etc.

Chapter 7: Access to Forest Genetic Resources and Sharing Benefits Arising from Their Use

7.1 Domestic situation on ABS

Japanese government guides users who want to access genetic resources based on Bonn Guidelines, which was adopted by CBD-COP6 held in April 2002, in terms of the access, transfer and sharing the benefit of genetic resources including forest tree.

Within the country, FTBC-FFPRI distributes forest tree genetic resources to domestic users. FTBC-FFPRI charges the users for the distribution and limits their use to research purpose only. Prior to distribution, the users are required to agree with FTBC-FFPRI for not to transfer the genetic resources to the third parties and not to apply to take patents or other rights coming from the genetic resources use without written permission.

It remains rare that there have been few problems so far on the access and benefit sharing derived from forest tree genetic resources use within Japan, due to its domestic rich forest in biodiversity and relatively low current economic value of forest tree genetic resources in general.

7.2 ABS from foreign countries

Users in foreign countries sometimes request to access Japanese forest tree genetic resources, while there are little demand of domestic users to introduce exotic species for forestry in Japan. FTBC-FFPRI has not faced difficulties on the access to the foreign genetic resources because introducing exotic species has been inactive. Japanese government is now working towards the ratification of Nagoya protocol adopted at CBD-COP10 in 2010.

Japanese government prospects for the future ABS to genetic resources including forest tree as follows:

1) For users in Japan who want to access foreign forest tree genetic resources
   The government will take appropriate measures based on CBD and Nagoya Protocol to guide the users. All users will be required: to follow the legislation and regulations of the providing country that is to obtain prior informed consent of the government of the providing country unless otherwise determined by the providing country; and to establish mutually agreed terms with providers on the sharing benefit from the genetic resources
2) For the genetic resources in Japan
   The government is now considering the necessity of the prior informed consent from the government for users to access genetic resources available in Japan. When the owners of the genetic resources demand to share the benefit from the use of the genetic resources, the government will instruct users to make necessary contracts with the owners.

Chapter 8: Contribution of Forest Genetic Resources to Food Security and Poverty Reduction

Traditionally, Japanese people used to utilize forest trees for various purposes. Virtually, all forest species, including shrub, can be used variously: timber for construction, tools, furniture, fuel wood, etc. Similar to wood, acorns, nuts, fruits and seed of some forest trees are for edible use. For example: acorns of *Castanea crenata*, *Aesculus turbinata* and *Castanopsis cuspidata* var. *sieboldii*; seed of *Pinus koraiensis*; nuts of *Juglans sieboldiana*; are regionally familiar to use. *Castanea crenata*, *Diospyros kaki* and some *Citrus* spp. are native in Japan and have been used for horticulture and improved genetically.

However, economic and social value of such edible use of forest tree species is low and limited. Issue of food security should be dealt in the field of agriculture, and issue of poverty reduction is linked with social and political issues in Japan. There seems to be limited contribution to both issues from forest and forestry sector in Japan. For some trees in horticulture use originated from forest, like *C. crenata*, there are plenty of genetic resources being achieved in the field of horticulture sector. For agroforestry, only few practices in rural area have been recorded in Japan.