

Status of forest genetic resources conservation and management in Vietnam

Nguyen Hoang Nghia

Deputy Director General, Forest Science Institute of Vietnam, Dong Ngac, Tu Liem, Hanoi, Vietnam

Introduction

Vietnam is a tropical country, located in Southeast Asia, between latitudes 8° – 23° N, with a total land area of about 330 000 km². The forest area as of December 1999 is presented in Table 1.

Table 1. Total forest areas of Vietnam as of 1999 (Central Board for Forest Statistics 2001)

Total forest area	10 915 592 ha (Forest cover 33.2%)
Natural forest	9 444 198 ha
Protection forest	4 812 671 ha
Special use forest	1 463 746 ha
Production forest	3 167 781 ha
Plantation forest	1 471 394 ha
Protection forest	537 997 ha
Special use forest	61 122 ha
Production forest	872 275 ha

Based on utilization objectives, the forest area is classified into three types as shown in Table 2.

Table 2. Total forest areas of Vietnam as of end December 1999 based on utilization objectives (Central Board for Forest Statistics 2001)

Special use forest	1 524 868 ha
Protection forest	5 350 668 ha
Production forest	4 040 056 ha

The objectives for forest development until 2010 are indicated in Table 3:

Table 3. Objectives for forest development in Vietnam

Targets	2001 – 2005	2006 – 2010
National forest cover	39%	43%
Special use forest	1.6 mill ha	2.0 mill ha
Protection forest	5.4 mill ha	6.0 mill ha
Production forest	6.2 mill ha	8.0 mill ha

The forestry sector plays an important role in agriculture as well as in the economy of Vietnam. In the early 1990s, the total volume of roundwood exploited from natural forest was about 2–4.5 million m³ per year. Most of the current requirement for wood is being met from plantations and imports, only 300 000 m³ is harvested from natural forests. Fuelwood and non-timber forest products (NTFPs) are also very important for the life of the Vietnamese people. Export value of processed wood has been approximately US\$ 250 million per year during the past 5 years and is expected to exceed one billion by the year 2005.

Vietnam has an abundant and diverse forest flora, which is not very well studied. According to Flore Generale L'Indo-Chine (Lecomte 1907–1951), there are more than 7000 plant species belonging to 1850 genera and 290 families. Of these, 64 genera (3%) and 2084

species (27.5%) are endemic to Vietnam. However, according to the Ecological and Biological Resources Institute (Tran Dinh Ly 1993), there are 11 000 species in more than 2500 genera within only Pteridophyta, Gymnospermae and Angiospermae. The National Action Plan of Biodiversity (MOSTE 1995), lists about 12 000 plants, 275 mammals, 800 birds, 180 reptiles, 80 amphibians, 2470 fish and 5500 insect species. The uniqueness of flora and fauna is high with 40% of all species being endemic. The flora of Vietnam also contains many species that originated from three surrounding floristic areas of:

- Indo-Malesian flora: Plant species from southern origin typically represented by species of Dipterocarpaceae
- Chinese flora: Species from northern origin represented by species of Gymnospermae, Betulaceae, Ericaceae, Fagaceae, Juglandaceae, Lauraceae, etc.
- Indian–Myanmar flora: Species of western origin represented by species of Bombacaceae, Combretaceae and Lythraceae

The Vietnamese have been using tree species for thousands of years for food, fodder, medicine, construction materials, ornaments and other purposes. In 1993, the Ecological and Plant Resources Institute named about 1900 useful tree species in Vietnam, which belong to about 1000 genera and 230 families (Tran Dinh Ly 1993). However, this figure may increase with more thorough studies and surveys in the future. For medicinal plants alone, recent surveys and studies have shown that there are about 3200 species used for disease treatment (Vo Van Chi 1997). The available plant species have been divided into 7 categories by their uses (Table 4).

Table 4. Groups of plant species as divided by Vu Van Chuyen *et al.* (1987)

Timber	1200 species
Paper, fibre	100 species
Essential oils	500 species
Vegetable oil	260 species
Tannin	600 species
Dye	200 species
Medicinal plants	1000 species

Many valuable plant species have been freely cut and collected and hence are in danger of becoming extinct. This is true for animals as well. The fact that large forest areas are becoming scarce is posing a major threat to the survival of animals dependent on such habitats. There is an urgent need to conserve biodiversity and forest genetic resources (FGR).

Conservation of forest genetic resources

Conservation is the proper management option for biological resources to obtain sustainable benefits for the present and future generations, without endangering the existence of the plant and animal species and their habitats. The objectives of conservation should include:

- Maintaining ecological processes and other support systems of the living biosphere, including water and soil resources
- Conserving genetic diversity within species and populations
- Using natural resources in a sustainable manner

It is clear that conservation of FGR plays an important and necessary role in environmental protection and sustainable forest management. Our objective should be to “conserve for development and to develop for conservation”. Conservation is not only preservation – it should integrate measures to protect and sustainably use FGR.

The forest area of Vietnam has declined remarkably as a result of the long war, shifting cultivation and inappropriate harvesting practices. According to a French researcher P. Maurand (1943), approximately 43% of the total land area was covered by forest in 1943.

Forest cover was reduced to 27.1% by 1980 and 26.2% by 1985 (Ministry of Forestry 1991). Thanks to the efforts of the nation in general and the forestry sector in particular, the rate of deforestation has now been reduced considerably. As a result of forest rehabilitation programmes, the total forest cover has increased to 33.2% in 1999.

Timber exploitation from natural forest has also been reduced while protection forests and special use forests have been included in a forest restoration programme. Native tree species have been and will be widely used to sustain and to conserve the FGR of indigenous tree species of Vietnam. The Government of Vietnam also requires the use of native tree species in production forests in order to diversify the species for plantation establishment.

However, there is an urgent demand for additional forest restoration and regeneration measures in order to fulfil the objective of the Five Million Hectare Reforestation Programme (5MHRP) by 2010. Uses of different exotic and indigenous tree species in plantation activities are very clear but there are many obstacles and challenges that require more attention and practical solutions from researchers and managers. After many years of forest development work using both exotic and indigenous tree species, the forest area of Vietnam has exceeded 1.5 million ha again in 1999. Table 5 provides a list of some important species used in forest plantations in Vietnam.

Table 5. Area of forest plantations of some important species in December 1999 (Central Board for Forest Statistics 2001)

No.	Species	Area (ha)	No.	Species	Area (ha)
1.	<i>Eucalyptus</i> spp.*	348 001	17.	<i>Chukrasia tabularis</i>	9044
2.	<i>Acacia</i> spp.*	228 073	18.	<i>Vernicia/Aleurites</i> spp.	9146
3.	<i>Casuarina equisetifolia</i> *	43 884	19.	<i>Melia azedarach</i>	8354
4.	<i>Tectona grandis</i> *	11 583	20.	Palms	7766
5.	<i>Khaya senegalensis</i> *	4777	21.	<i>Bruguiera</i>	5156
6.	Dipterocarpaceae species	26 924	22.	<i>Avicennia</i>	5107
7.	<i>Pinus</i> spp.	218 056	23.	<i>Sonneratia</i>	4700
8.	<i>Melaleuca cajuputi</i>	114 837	24.	<i>Canarium album</i>	2502
9.	<i>Rhizophora apiculata</i>	80 216	25.	<i>Azelia xylocarpa</i>	2467
10.	Bamboo	73 852	26.	<i>Tarrietia javanica</i>	972
11.	<i>Styrax tonkinensis</i>	64 734	27.	<i>Camellia oleosa</i>	645
12.	<i>Manglietia glauca</i>	50 023	28.	<i>Fokienia hodginsii</i>	335
13.	<i>Cinnamomum cassia</i>	27 270	29.	<i>Erythrophleum fordii</i>	309
14.	<i>Illicium verum</i>	18 085	30.	<i>Castanopsis</i>	307
15.	<i>Cunninghamia lanceolata</i> *	13 866	31.	<i>Liquidambar formosana</i>	92
16.	<i>Cassia siamea</i>	10 163			

* = introduced species (the rest being native to Vietnam)

Demand and supply of tree seed

Availability of good-quality germplasm is of importance in planting programmes including production forests, protection forests and special-use forests as well as scattered plantings. In order to effectively carry out the 5MHRP by 2010, national germplasm programmes have been developed. The aim of these programmes is to gradually supply high quality germplasm with diversity in type and to terminate the use of germplasm of unknown origin in increasing the productivity of commercial forests in the future.

According to the tasks and plans in the 5MHRP, during 1999 and 2000 on average 200 000 ha per annum were planted and another 300 000 ha per annum have been projected to be planted during the period 2005–2010. If an estimated one thousand seedlings are planted per hectare and in addition, many seedlings are used for scattered tree-planting efforts, there will be a need to produce millions of seedlings in nurseries. A suitable nursery system must be established on a national scale in order to supply high-quality seedlings for key planting areas and for farm forests while genetic variation should also be taken into consideration.

One of the preconditions for the 5MHRP to be successful is that supply of sufficient and high quality germplasm would be guaranteed. This is a demanding task including planning of germplasm production areas (seed stands, seed orchards), collecting, storage, pre-processing, transportation, supply, exchange, import and production of seedlings. Up to 1993, the Central Forest Seed Company (CFSC) established 73 ha of clonal seed orchards, 906 ha of seedling seed orchards and 1200 ha seed production areas. Since 1994, the areas for seed production for some important tree species include 1000 ha for *Pinus kesiya*, 400 ha for *P. merkusii* and 160 ha for *Tectona grandis*.

Information from the CFSC shows that seeds collected from seed production areas satisfy only 15–20% of the demand. The remaining is collected from natural forests or unplanned forests, from unknown and uncontrolled provenances or scattered trees. This practice has a negative impact on the productivity and quality of plantations, resulting in low rate of germination, low survival rate and/or low productivity of plantation forests.

In order to improve the quality of planting materials, the Minister for Forestry has issued in 1993 the Directive No. 08 on germplasm in order to establish seed production areas. Many germplasm projects have been approved and carried out and initial results are available. In addition, awareness on the importance of using good-quality germplasm has been increased. Supply of germplasm is not restricted to seed, seed production areas and seed orchards only, but expanded to new concepts. Newly established production units make use of cutting techniques and production of hybrids and plantation forests are commonly established using tissue culture technique. Besides deciding on the type of germplasm for forest planting purposes, provincial agencies also focus on planning of genetic resource conservation areas for rare and valuable species, i.e. species that have a high potential value but have not been planted on a large scale yet.

Endangered species

Deforestation and shifting cultivation are the main causes of forest fragmentation that may lead to a decline in natural populations of species and a loss of genetic diversity, and even extinction. Some examples of endangered tree species in Vietnam include (Nguyen Hoang Nghia 2000b):

- *Pinus dalatensis*. This species is found only in a few areas such as Mat Station (Da Lat City), Lac Duong (Lam Dong province) and Mang Giang (Gial Lai province). The population at Mat Station, which was where the first samples of *P. dalatensis* were collected, is now almost extinct. Only two trees remain along the riverbank at Uyen Uong Waterfalls.
- Many important populations of *Erythrophloeum fordii* in Bac Giang, Lang Son, Phu Tho and Son Tay have disappeared.
- *Aquilaria crassna*, which used to be distributed throughout Vietnam, is now found only in Ha Tinh, Tay Nguyen and Phu Quoc.
- *Glyptostrobus pensilis* is in danger of extinction. Only two populations remain: 32 trees at Trap Ksor and about 230 trees at Ea H'Leo (Dac Lac). Some of these trees are able to produce seeds but fail to germinate and hence there is no natural regeneration.
- Only some 50 individuals of *Taxus chinensis* and *Pinus kwangtungensis* remain in the country.
- Less than 250 individuals of *Taxus wallichiana* have been found in Lam Dong province.
- *Shorea falcata* is represented by only six trees at Song Cau (Phu Yen province) and seven trees at Cam Ranh (Khanh Hoa province), with twenty more coppices.
- *Hopea cordata* is represented by about 100 young saplings at Cam Ranh (Khanh Hoa) and cannot be found in any other areas.
- *Hopea reticulata* is found in only one area, namely Ca Na Mountain at 290–300 m asl and is represented by 192 individuals only.

Past and present activities in the field of conservation, utilization and management of FGR

Conservation methods applied in Vietnam

The research project on conservation of FGR, managed by the Forest Science Institute of Vietnam (FSIV), has received continuous funding from the Ministry of Science and Technology (MOST, former MOSTE) since 1988. Strategic orientation and the selection of conservation methods and priority species have received special attention. Priority species have been divided into the following groups (Nguyen Hoang Nghia 1997):

1. Threatened species with high economic value
2. Threatened species with high scientific value
3. Precious native species for reforestation
4. Valuable exotic species for reforestation

In situ conservation is the primary method used by the project, applied in combination with establishment of *ex situ* conservation stands. The following steps are taken to conserve FGR:

- Inventories (botanical and genecological surveys)
- Collecting, evaluation and documentation of information
- *In situ* and/or *ex situ* conservation
- Utilization

Although conservation of genetic resources and nature conservation (conservation of natural habitats in national parks and nature reserves) have some similarities, there are also important differences between them. The purpose of nature conservation is to protect entire ecosystems found in certain environments; however, this approach does not pay special attention on the conservation of genetic diversity as such. The ecosystems to be selected for nature conservation are sometimes more easily identified while the genetic variation that needs to be conserved is very difficult to recognize and identify.

There are also differences between genetic conservation of agricultural crops and forest tree species. Agricultural crops are generally annual species with orthodox seed and storing seeds in genebanks is the main conservation method, while for forest tree species, conservation in the form of living individuals or populations (*in situ* and *ex situ* conservation stands) is more appropriate. The total number of important agricultural crops (such as rice, maize, wheat etc.) is limited, while the number of forest tree species that would need to be conserved may be very large. In addition, trees have a wide and scattered distribution range and, therefore, conservation efforts cannot focus on one provenance or population only. Most agricultural crops were domesticated over a long period of time while very few forest tree species can be considered domesticated. Therefore, efforts to establish *ex situ* conservation stands or plantations face many difficulties.

***In situ* conservation**

In 1943, the forest area of Vietnam was estimated to be about 14.3 million ha, or 43% of the total land area (Maurand 1943). Owing to war, shifting cultivation, land clearances, unsustainable logging and repeated burning, forest cover shrank at a rate of about 100 000 ha each year. Efforts to protect the natural habitats of Vietnam began in 1962 with the creation of Vietnam's first national park at Cuc Phuong. In 1972, a Decree on Forest Protection established a forest ranger system with about 10 000 rangers across the country.

On the basis of the Decision No. 194/CT of the Council of the Ministers in 1986, the government decided to establish a network of special-use forests covering 87 protected forest areas. The government issued laws for forest protection in 1991 and for environment protection in 1994, along with other decrees and decisions to create a legal framework for establishing and managing special-use forests. Vietnam's Tropical Forest Action Plan (TFAP), which was issued in 1991, has also contributed to integrated planning of forest management. The first volume of the Vietnam Red Data Book was published in 1992 and included 347 endangered animal species. The second volume, which was published in 1996, included 350 rare and endangered plant species.

According to the Strategy for Management of Nature Reserve System in Vietnam (Anon 2003) as of February 2003, Vietnam has a system of 121 nature reserves, which includes national parks, nature reserves and landscape protection areas. Tables 6 and 7 provide current statistics on the nature reserve system in Vietnam.

Table 6. The nature reserve system in Vietnam in 2003

Category	Name	Number	Area (ha)
I	National Parks	25	883 391 ha
II	Nature Reserves	59	1 388 010 ha
II a	Nature Reserves	46	1 262 147 ha
II b	Species / Habitat Reserves	13	125 863 ha
III	Landscape Protection Areas	37	206 892 ha

Table 7. A newly developed system for nature reserves in Vietnam

Category	Name	Number
I	National Parks	32
II	Nature Reserves	53
III	Species/Habitat Reserves	29
IV	Landscape Protection Areas	19

Ex situ conservation

Since the French rule, arboreta have been established in Vietnam, for example, in the 1940s arboreta were established in Eakmat (Daklak) and Trang Bom (Dong Nai) for some species such as *Azelia xylocarpa*, *Pterocarpus macrocarpus*, *Dipterocarpus alatus*, *Hopea* spp., *Tectona grandis* etc. During the past 10 years, some more arboreta have been established. These include many species for each representative area. Cau Hai arboretum (Phu Tho) of the FSIV has more than 250 tree species and 35 bamboo species. Some of the most important arboreta are presented in Table 8.

Table 8. Some arboreta established in Vietnam in the 1990s

Location	Number of species	Area
Cau Hai, Phu Tho	250 tree species and 35 bamboo species	20 ha
Trang Bom, Dong Nai	120 tree species and 10 bamboo species	8 ha
Lang Hanh, Lam Dong	20 rare and valuable tree species	10 ha
Mang Linh, Lam Dong	40 rare and valuable tree species	10 ha
Cuc Phuong, Ninh Binh	100 tree species	100 ha

Ex situ conservation stands have also been established during the past ten years in some forest stations of the FSIV for certain important tree species (Table 9).

Table 9. *Ex situ* conservation stands established by the FSIV since 1990

Species	Number of seed sources	No. of trees or area planted
<i>Erythrophleum fordii</i>	8	2.5 ha
<i>Dipterocarpus retusus</i>	4	2.0 ha
<i>Madhuca pasquieri</i>	2	6 ha
<i>Calocedrus macrolepis</i>	2	2000 trees
<i>Fokienia hodginsii</i>	1	2000 trees
<i>Taxus wallichiana</i>	4	1000 cuttings + 100 seedlings
<i>Dalbergia annamensis</i>	1	1000 trees
<i>Azelia xylocarpa</i>	5	1400 trees
<i>Dalbergia cochinchinensis</i>	2	2600 trees
<i>Pterocarpus macrocarpus</i>	2	2000 trees
<i>Dalbergia mammosa</i>	1	2000 trees
<i>Shorea falcata</i>	1	3000 trees

Introduction of species, tree breeding and propagation

The Vietnamese people have been successfully planting some native and exotic tree species, including *Pinus massoniana*, *Cunninghamia lanceolata*, *Castanea mollissima*, *Cinnamomum cassia*, *Illicium verum* etc. The French people initiated importing exotic species and planted species such as *Eucalyptus*, *Tectona grandis*, *Khaya senegalensis*, *Grevillea robusta* and *Casuarina equisetifolia* all over Vietnam. They also started to plant some species outside their natural distribution. Such species include *Erythrophleum fordii* in Trang Bom (Dong Nai), Lang Hanh (Lam Dong) and Dan Chu (Hoa Binh); *Cinnamomum camphora* was planted in both lowland and highland, and *Hopea odorata* was planted in North Vietnam.

During the 1920s and 1930s, a French forester named Paul Maurand brought *Dipterocarpus alatus* and *Hopea odorata* seedlings from natural forest to be planted in Trang Bom Forest Station (Dong Nai). Three different methods were applied:

- Pure plantation; density up to 20 000 trees/ha
- Band planting (1931). (This resulted in low growing trees due to competition with natural forest.)
- Mixed planting with supporting trees such as *Indigofera teysmannii* and *Cassia siamea*

The first method was not very successful due to high density, which required additional silvicultural measures. Trees planted with the second method were successful only when climber cutting was applied. The third method was successful. At present, other leguminous species such as *A. auriculiformis* can also be used as support tree species.

Before 1975, about 20 *Acacia* and 50 *Eucalyptus* species were imported into Vietnam and planted in e.g. Lang Hanh and Mang Linh (Lam Dong). However, these plantations were not allocated and designed to be species trials.

Since 1970s, complete sets of seedlots have been imported, and numerous organizations have established species and provenance trials for many species such as *Eucalyptus* (120 provenances of 15 most important *Eucalyptus* spp.), *Acacia* spp. (70 provenances of 5 lowland species; 15 provenances of ten dry-zone species and 20 provenances of 20 temperate species), *Casuarina* (international provenance trial), *Pinus caribaea* (10 provenances of 3 varieties: var. *hondurensis*, *bahamensis* and *caribaea*), *Azadirachta indica* (international provenance trial) and the species of Meliaceae (international provenance trial for *Chukrasia tabularis* and *C. velutica*).

Not many provenance trials have been carried out for indigenous tree species thus far. However, some work has been initiated with *Pinus merkusii*, *P. massoniana*, *P. kesiya*, *Manglietia glauca*, *Styrax tonkinensis* and *Chukrasia tabularis*. Breeding activities for indigenous species are still restricted to *Pinus merkusii* (for high resin yield), *P. massoniana*, *P. kesiya* and *Manglietia glauca* (for growth). Many highly important local species have not yet been included into tree improvement programmes and trials.

Until recently, germplasm supply had to rely on natural forests, newly established seed production areas and seed orchards. At present, very effective techniques, such as propagation through cuttings and tissue culture are also applied. The latter highly advanced technique has been applied for *Eucalyptus* (for high productivity clones), *Acacia* (including *Acacia* hybrids), *Casuarina* (mainly for cutting and partly for tissue culture). In addition, many species have been successfully propagated using cutting technique. These include *Dipterocarpus alatus*, *Hopea odorata*, *Camellia oleosa*, *Calocedrus macrolepis*, *Fokienia hodginsii*, *Dacrydium elatum*, *Cinnamomum balansae*, *Rhodoleia championii*, etc.

Identification of national priorities

Priority species for FGR conservation and management

Priority species for Vietnam are presented in Appendix 1. Regional and national workshops have been organized by the FSIV or projects in Vietnam to discuss the list of species to be used in forest rehabilitation. Recently, a list provided by Danida Tree Seed Project contains almost 200 tree species for both conservation and production forest (Schmidt and Nguyen Xuan Lieu 2000).

Criteria for selecting priority species

Criteria for selecting priority species for commercial planting (Nguyen Xuan Lieu 2000) are as follows:

- Fit into the objectives of the planting programme
- Bring high benefits
- Have large and stable market
- Availability of seed sources and propagation methods
- Availability of planting and tending technique

Priority conservation areas and species are selected according to the following criteria (Nguyen Hoang Nghia 2000b):

- Level of diversity
- Representativeness
- Endemism
- Degree of endangerment
- Scientific and economic value

Economic importance or value of the priority species

Most of the priority species (Nguyen Xuan Lieu 2000) are of very high economic importance. They provide high quality timber that is used for furniture, handicrafts and construction and there is a high demand in the domestic market. Table 10 provides a list of important products and value of some priority species.

Table 10. Important products and economic value of some priority species

Scientific name of species	Important products	Economic value
<i>Pinus merkusii</i>	Resin, timber	Average
<i>Hevea brasiliensis</i>	Resin, timber	High
<i>Dipterocarpus alatus</i>	Timber, resin	High
<i>Hopea odorata</i>	Timber, resin	High
<i>Chukrasia tabularis</i>	Timber	High
<i>Erythrophleum fordii</i>	Timber	High
<i>Canarium</i> spp.	Timber, fruit	High
<i>Melaleuca cajuputi</i>	Wood, essential oil	High
<i>Rhizophora apiculata</i>	Wood	High
<i>Styrax tonkinensis</i>	Timber	Average – high
<i>Manglietia glauca</i>	Timber	High
<i>Michelia mediocris</i>	Timber	High
<i>Cunninghamia lanceolata</i>	Timber	Average
<i>Pinus kesiya</i>	Timber	Average
<i>P. massoniana</i>	Timber	Average
<i>Cinnamomum cassia</i>	Bark, essential oil	High
<i>Illicium verum</i>	Fruit	High
<i>Aquilaria crassna</i>	Agarwood	Very high
<i>Dendrocalamus membranaceus</i> (bamboo)	Stem	Very high
<i>Phyllostachys pubescens</i> (bamboo)	Stem	Very high
<i>Calamus platyacanthus</i> (rattan)	Stem	Very high

Institutional framework and capacity-building activities

Institutions involved in FGR conservation and management

The Forest Science Institute of Vietnam (FSIV) is the leading institution for FGR conservation research in Vietnam. The FSIV is also a focal point for research on FGR conservation and management and is carrying out a research project titled "Conservation of Forest Plant Genetic Resources in Vietnam" supported by the MOST. The FSIV and its research centres are also involved in the establishment of arboreta, living tree collections, *ex situ* conservation stands as well in guiding both *in situ* and *ex situ* conservation. Species-provenance trials and breeding programmes are also carried out by the FSIV.

The Central Forest Seed Company (CFSC) is working on the establishment of some seed production areas. Recently, with support from a Danida-project, the CFSV established genetic conservation stands for certain species. The Forest Inventory and Planning Institute (FIPI) is working on baseline inventory work, such as species lists and planning for nature reserves in Vietnam. Other research institutes and universities may also be involved, but they do mostly inventory work and basic research.

National legislation, policy and strategy on FGR

The main documents and important stages in the history of forest conservation in Vietnam are given in the Table 11. Legislation regarding access, property rights and benefit sharing of FGR has not been formulated. The National Assembly is planning to discuss a new Biodiversity Law during the period 2002–2007.

Table 11. Development of the legislative system for FGR conservation and management in Vietnam

1962	Decision to establish the Cuc Phuong National Park
1972	Decree for forest protection to establish the forest ranger system
1986	Decision No. 194/CT to approve 87 protected forests. Ministry of Forestry Decision No. 1171/QD for management regulations of special-use forests
1987	Formulation of a national program on conservation of genetic resources started by MOSTE
1988	Research project on conservation of forest plant genetic resources started by the Forest Science Institute of Vietnam (FSIV). Land Laws, modified in 1993
1989	Ministry of Forestry (MOF) Decision No. 276 to ban exploitation of 38 wild plant and animal species Member of RAMSAR Convention
1991	Laws for forest protection and development. National Plan for Environment and Sustainable Development. Tropical Forestry Action Plan (TFAP)
1992	Decree No. 18/HDBT to ban exploitation of 13 plant species and 36 animal species and to limit exploitation of 19 plant and 10 animal species. Vietnam Red Data Book, Volume 1 (Animals) published
1993	Convention on Biological Diversity (CBD) signed
1994	CBD ratified. Laws for environmental protection approved and issued. CITES signed
1995	Biodiversity Action Plan (BAP) of Vietnam issued
1996	Vietnam Red Data Book, Volume 2 (Plants) published
2001	Decision No. 08/2001/QD/Ttg to issue the regulation for management of special-use forests, protection forests and production forests as natural forest

Training and capacity building

Many national and international projects have organized training courses on biodiversity issues, but not on FGR. With funding from the Government as well as international sources, the FSIV organized some training courses on biodiversity, which contained some FGR elements. These are as follows:

- Conservation of biodiversity and FGR; APAFRI-TREELINK, Hanoi
- Vegetative propagation for clonal forestry and gene conservation; APAFRI-TREELINK, Hanoi

- Conservation of biodiversity and FGR; FSIV, Hanoi
- Vegetative propagation for clonal forestry and gene conservation; FSIV, Da Lat
- Conservation of biodiversity and FGR; FSIV, Da Lat

Conclusions

Conservation and development of FGR is recognized as an important issue in Vietnam. However, tree species are widely distributed; therefore collaboration between countries in the region is important. Besides exchange of documents, information and methods, germplasm can also be exchanged to broaden the genetic resources of each country. International cooperation is required for both research and development work. APFORGEN programme, within the framework of APAFRI and IFGRI should become a good coordinating body for regional collaboration in sharing experiences and fostering joint research projects which can bring benefits to the countries involved.

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Appendix 1

Information on priority species for the APFORGEN Inception Workshop

Priority species	Areas managed for conservation (ha)		Areas managed in natural forest for production of ... (ha)		Areas managed in plantations for production of ... (ha)		Recommend actions for genetic conservation	References and reports
	In situ	Ex situ	Timber	Non-timber	Timber	Non-timber		
1. <i>Alzella xylocarpa</i>	X	3						
2. <i>Anisoptera costata</i>	X	2						
3. <i>Aquilaria crassna</i>	0	1						
4. <i>Cassia siamea</i>	0					X		
5. <i>Casuarina equisetifolia</i>	0					X		
6. <i>Chukrasia tabularis</i>	X	2						
7. <i>Dalbergia bariensis</i>	X	3						
8. <i>D. cochinchinensis</i>	X	1						
9. <i>Dipterocarpus alatus</i>	X					200		
10. <i>Fagraea fragrans</i>	X	0				0		
11. <i>Gonystylus bancanus</i>								
12. <i>Hopea odorata</i>	X					350		
13. <i>Litchi chinensis</i>	X							
14. <i>Melaleuca cajuputi</i>	X					100		
15. <i>Pinus kesiya</i>	X					1000		
16. <i>P. merkusii</i>	0					160		
17. <i>Pterocarpus macrocarpus</i>	X					30		
18. <i>Shorea cochinchinensis</i>	X	0				100		
19. <i>S. roxburghii</i>	X	0				100		
20. <i>S. stenoptera</i>								
21. <i>Sindora cochinchinensis</i>	X							
22. <i>Tarrietia javanica</i>	X							
23. <i>Tectona grandis</i>	0	0				160		
24. <i>Toona sureni</i>	X							
25. <i>Xylia xylocarpa</i>	X	2				100		

Priority species	Areas managed for conservation (ha)			Areas managed in natural forest for production of ... (ha)		Areas managed in plantations for production of ... (ha)		Recommend actions for genetic conservation	References and reports
	In situ	Ex situ	Seed production	Timber	Non-timber	Timber	Non-timber		
List of priority bamboo & rattan species (Rao et al. 1998)									
1. Bamboo		X	X						
2. <i>Phyllostachys pubescens</i>	0	0	X						
3. <i>Dendrocalamus membranaceus</i>	X	X							
4. Rattan		X	X						
Additional priority species									
1. <i>Acacia</i> spp.			X						
2. <i>A. mangium</i>			X						
3. <i>Calocedrus macrolepis</i>		X							
4. <i>Cinnamomum cassia</i>		X							
5. <i>Cunninghamia lanceolata</i>		X							
6. <i>D. mun</i>		X							
7. <i>Eucalyptus</i> spp.			X						
8. <i>E. camaldulensis</i>			X						
9. <i>E. urophylla</i>			X						
10. <i>E. grandis</i>			X						
11. <i>Erythrophleum fordii</i>		X							
12. <i>Fokienia hodginsii</i>		X							
13. <i>Gmelina arborea</i>		X							
14. <i>Keteleeria fortunei</i>		X							
15. <i>P. caribaea</i>			X						
16. <i>P. massoniana</i>			X						
17. <i>Swietenia macrophylla</i>			X						
18. <i>Taxus wallichiana</i>		X							