INDONESIA:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

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Note by FAO

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CHAPTER 1
Introduction

Indonesia is an archipelagic country, lying between longitudes 95°E and 141°E, and latitudes 6°N and 11°S, stretching between two continents, Asia and Australia.

This is the largest archipelago in the world, consisting of at least 17,500 islands, situated between the Indian and the Pacific Ocean. It occupies 191 million hectares of area, 5,100 km in length, with 317 million ha of exclusive economic zone of its territorial waters. The country has the longest coastline in the world, a little less than 81,000 km long, which is approximately 14% of the total coastline of the world.

Being in between two continents and two oceans, the climate is largely influenced by this conditions. Rainy season is generally between October and April, while the other six months are the period of dry season. However, the Nusa Tenggara Islands have less period of rainy season, generally only 3-4 months, between November or December and March. Rainfalls varied according to the localities.

The highest is recorded from southern Central Java, in a place called Baturaden, on the slope of Mt. Slamet, with the rainfall of over 8,000 mm annually. Some of the lowest rainfall is shown by Timor Island with the record of 1,100 - 1,200 mm annually.

There are five major islands, namely Sumatera (47.5 million ha), Java (13.25 million ha), Kalimantan (as the southern part of Borneo, 53.5 million ha), Sulawesi (18.6 million ha) and Irian Jaya (western half of New Guinea, 41.5 million ha).

There are additional two major islands of smaller size, namely Nusa Tenggara (Lesser Sundas, 8 million ha) and Maluku (the Mollucas, 7.8 million ha). Each of the islands has its own characteristic, geographically as well as biologically.

- *Sumatera* has extensive swampy eastern coast and hilly inland on the western side. The eastern coast are mainly plain rich in mangrove forests, peat and freshwater swamps. The western coast is mainly steep, facing the Indian

Ocean. The hilly ridge of Sumatera is known as the Bukit Barisan, stretching from Aceh, the northernmost province, to Lampung, the southernmost one. On this chain of mountains, there are quite a number of living volcanoes. The most remarkable one is Sumateran Merapi, which erupts every now and then. There are 8 provinces on this island.

- *Java* has plain northern coast, lacking swampy areas, with the fringing remaining mangroves, and steep southern coast, facing the Indian Ocean. The smallest among the major islands, Java is very rich in active volcanoes. Not less than 7 volcanoes are showing high activities. Some of them, mainly the Javan Merapi, is erupting almost constantly. In some cases, causing casualties.

The island is divided into 5 provinces.

- In between Sumatera and Java, there is a famous island, called the *Krakatau*. It is in the complex of 4 small islands.
- *Kalimantan* has the most swampy areas, mainly on the southern and western coasts and most of the eastern coast. There is hardly any high mountain, and lack of volcano on this island. There are 4 provinces comprising this island.
- *Sulawesi* has the least swampy areas compared to the other two larger islands. There are several mountains, but the most remarkable one is the volcano in the northern tip of the island, called Mt. Kelabat. It is still active and showing activity. There are 4 provinces on this island.
- *Irian Jaya* is the richest in mangrove forest and swampy area, fringing the northern and the southern coast line. It has the highest mountain in the country, Puncak Jaya Wijaya, which is a little over 5,000 m high, with the snow on its caps. This is one of the very few snowed mountains in the tropics.

This is the largest province in area wise.

- The *Maluku Islands* has more than one thousand islands. This is part of the country where the sea is the deepest, reaching more than 8,000 m deep. These islands make up one province.
- The *Nusa Tenggara* consists of a chain of islands, running from east of Bali reaching southern part of Maluku islands. These islands are mostly rocky with dry season. Two provinces are located in these chain of islands.
- All together, with Bali and the Capital of Jakarta, there are 27 provinces.

Volcanism help the country in its soil fertility. In the whole country, there are not less than 100 active volcanoes, a total of more than the rest in the world. Other remarkable volcanic features are shown by the Dieng Plateu in Central Java, which has "kawah upas" or the death valley, due to the high concentration of CO2, the Bromo in East Java, with its naked peak surrounded by sand dunes, and the Kilimutu in Nusa Tenggara (Flores Island), with three lakes which change colors from time to time.

The deep seas in Indonesia have resulted in remarkable phenomena, especially in the distribution of its fauna. The deep sea that runs from between Bali and Lombok, and goes up north between Kalimantan and Sulawesi, has acted as a boundary between the western and the eastern faunistic region of the world. This is called the *Wallace's Line*, the easternmost limit of the distribution of the fauna of the Oriental Region.

The deep sea in the eastern part has acted as the western boundary of the fauna of the Australian Region (as it has been known, the fauna of the world is divided into 6 regions, namely the Oriental, the Australian, the Palaearctic, the Neartic, the Neotropic, and the Ethiopian Regions). The Oriental Region and the Australian Region are matched perfectly with the two shelves, known as the Sunda in the west and the Sahul in the east. However, since the distances among islands in Indonesia are not too long, there have been infiltration of the fauna of the two regions. The islands from Sulawesi to Maluku, are having two components, coming from the west and from the east. This area is a transitional one and called the *Wallacea*. Thus as far as is concerned, Indonesia is divided into three groups, the Oriental, the Australian and the transitional Wallacea.

The vegetation of Indonesian is included in the area called the *Malesia* (the area covers the Philippines, Malaysia and Papua New Guinea). This area is determined by the distribution of plant genera, indicated by three demarcation knots, on Kra in Malaysia, southern Taiwan, and Torres Strait in the east. These demarcation knots have been formed by geological processes in the past.

There are approximately 300 ethnic groups living in Indonesia, but these consider themselves as Indonesians. The total population at present is around 190 million, the fourth largest population living in one country. Almost each of these ethnic groups has its own language. However, the country manages to use a national language, the Bahasa Indonesia. The diversity of population aspects is not only on the language, but also the diets, customs and traditions, and the way of viewing the nature.

Sumatera and Java are very lush in vegetation, due to the very fertile condition of the soil. Agriculture is developing well in these two islands. In general, the country is in primary economic stage, depends largely on agriculture. Agricultural activities are mainly aimed at self sufficiency in rice. The government has developed programmes in mass guidance to the farmers, intensification and special intensification programmes, to maximise the rice production per unit area of rice paddies.

Through these programmes, Indonesia has been successful in the rice sufficiency by the end of its fourth Five-year Plan. Agriculture is mainly done by the individual farmers, most of them are small holders. However, there is a private enterprise, The Sang Hyang Seri, operating especially for producing rice. For the rice production, the seeds for the farmers are supplied by the government through the provincial and district seed agents.

Secondary and horticultural crops are also well developed in agricultural activities. They are main sources of carbohydrate, fat and protein as well as mineral and vitamins for the people. The vegetables are mainly of the introduced ones, of the highland as well as the lowland, such as cabbage, carrot, asparagus, amaranth, tomato, eggplant and chili peppers. There are also native species that have taken stable position in the people's diets, such as the aquatic cabbage (kangkung - *Ipomea aquatica)*, taro leaves and parkia beans. Some of these vegetables, mainly cabbage and carrot, are exported to the neighbouring countries, such as Singapore.

The other known sources of carbohydrate are the cassava, the maize and the potatoes. In the eastern part of the country, especially in Maluku islands, people main source of carbohydrate is sagu (*Metroxylon sago*), while those in Irian Jaya, depend mainly on yam, taro and sweet potato. The cassava is in part exported as tapioca (cassava flour). The source of plant protein is mainly the legumes, which are of vast variety, of introduced as well as native species. These vegetables are mainly for home consumption. The animal protein comes from cattle, pigs, goats, sheep, birds, and fishes. Most of these sources are introduced from other countries. However, during the course of time, these have become secondarily native to Indonesia, and developed their genetic diversity.

Other noticeable agricultural products are the fruits. Indonesia is rich in fruit species. Many of them are seasonal, such as durians (*Durio zibethinus*) and its relatives (krantongan, lae, etc), rambutans (*Nyphelium lappaceum*), duku (*Lansium domesticum*), mangos (*Mangostana indica*) and its relatives (bembem, wani, kemang), manggis (mangosteen, *Garcinia edulis*) etc. Many others are not seasonal, such as salak or snake fruits (*Salacca edulis*). There are also a number of introduced fruits, such as chico (*Achras sapota*), alpukat (avocado,

Parsea americana), ananas (pineapple), and apple. All of these are mostly for home consumption, but there is a strong tendency that fruits are exported to the neighboring countries, mainly Singapore and Malaysia. Industrial plants are also well established. Most of these are introduced ones, such as coffee, tea, rubber, oil palm, quinine, and cocoa. Products of these commodities are mostly exported. Minor in grouping but major in their products are the medicinal plants. Most of these plants are processed in the country to produce traditional medicines (*jamu*), and as ingredients of cosmetics. Both jamu and cosmetics and for home consumption and export.

The agricultural products, mainly the horticultural commodities, owes the improvement to some extent to oil crisis. The switch to non oil and gas export move has given opportunity to the export of the other commodities. This has encouraged the farmers to improve their quantity and quality of horticultural products. Self reliance on rice has also paved the way to the increasing products of other commodities. Successful system in the rice production is copied to be implemented in other main commodities.

The success in horticultural - mainly the already known fruit crops - give impacts to the population to grow more of the productive trees. As far as pests are concerned, Indonesia has adopted well the integrated pest management, especially for rice. The IPM has cut down a great number and volume of pesticides used for controlling pests of rice. Yet, the long term impacts on attitude of farmers and acceptance by all concerned are still being studied. In addition to pests, the loss of production is due to long draught. However, this loss can be recovered in the following planting seasons. The loss is mainly felt on rice production. Other, especially of long term horticultural commodities, do not suffer much of this draught.

The country has wide range of forest types. There are not less than 42 natural terrestrial ecosystems found in Indonesia. The lowland vegetation covers range from mangroves, through freshwater forest, swamp forest, sagu forest, peatswamp forest, and forests of other aquatic environment, to lowland dipterocarp forest, lowland non-dipterocarp forest, peat forest and forest on ultra basic rock. The higher altitudes accommodate lower and upper montane forest through lower and upper subalpine, grasslands to wet alpine tundra.

There are also monsoon vegetations that cover monsoon forest and savannah. In addition, there are succession ecosystems which cover primary and secondary succession ecosystems. Many of these formations are undergoing changes in size and types. The rate of decrease has not been determined concisely, but the rough estimates show that the vanishing forests, mangroves and wetland vegetation are in the alarming rates. The decreasing processes are still going on.

CHAPTER 2
Indigenous Plant Genetic Resources

The genetic diversity of the Indonesian forest plants have been explored on limited accounts, mainly on their existence and distribution in limited extent. Therefore, elaboration is quite difficult since the necessary data are not available. However, at species level, over 100 species of forest trees are harvested commercially for timber. Of these, the dipterocarp family is the most valuable and vastly exploited. Indonesia harbours 386 species of dipterocarp or 70% of the world's dipterocarp species in its rainforests, particularly in Kalimantan and Sumatera. In addition, there are other valuable timber species such as ebony (endemic to Sulawesi) and ramin (*Gonostylus bancanus*, mainly in Kalimantan), just to mention two of them.

Due to the value of these timber species, large scale exploitation has caused depletion in the sources. Unfortunately, genetic screening has not been done. Consequently, the level of genetic erosion in forest tree species is hardly known. The data are mainly on the rough estimate of the existence of certain species, whether or not these are still present.

At the non timber level, knowledge on genetic diversity is more forthcoming. As it is commonly known, Indonesia is the centre of distribution of some important groups of plants. pals, zingibers (ginger family), bananas, mangos, cloves, nutmegs, orchids are highly diversed in this country. Indonesia has the largest number of rattan species in the world. One can be impressed by the diversity of the genetic make up of many indigenous plant species, such as bamboos, pandanus, ahorea species, albizzia species, the beach vegetation species, such as *Barringtonia* and *Callophylum*.

Fruits and spices such as banana, durian, mangoes, rambutan, lansium, snake fruits, cloves, nutmegs are all native Indonesian. Many of these species, which have been cultivated, have high genetic variation. Ten out of 27 naturally occuring durian are found in Kalimantan, while matoa (*Pometia pinnata*) which is originated from Irian Jaya, is represented by at least 9 varieties. FAO data reveals that there are 86 durian cultivars and 70 rambutan cultivars collected in gene banks.

Rich as it is, there are dangers being faced due to the damage suffered by the forests from the over-exploitation. There are some species that need extra attention, for they are already endangered. There are at least 14 forest plant species whose populations have drastically been reduced during the past 10 years (Annex 2b). The list ranges from the ornamental species, such as *Rafflesia arnoldi* to the valuable timber species such as kayu besi *Eusideroxylon zwageri.*

2.1 PROGRAMME IN SUSTAINABLE DEVELOPMENT

Sustainable development in terms of commercial utilisation has only been realised recently. Large scale exploitation of biodiversity exists in the form of logging operations, jamu (traditional herb medicine) production and estate plantation crops. In the past, these activities were conducted by disregarding the sustainable principles. However, recently, sustained utilisation has been realised and efforts are being made toward the implementation of this principle. This is evident from the newly issued legislations and action plans enacted by the government. For instance, the national Development Planning Board/Agency (BAPPENAS) established the Indonesian Biodiversity Action Plan, while the Ministry of Environment has issued the National Strategy for the Management of Indonesian Biological Diversity. There are as well the Act No. 5, 1990 on the Conservation of Living Resources and Their Ecosystems, Act No. 5, 1994 on the Ratification of the UN Convention on Biodiversity. There are a great deal of other acts and regulations that are meant to ensure the sustainable management of biodiversity.

Long term sustainable management has been attempted through establishment of *in situ* and *ex situ* conservation areas. Currently, there are 303 terrestrial conservation areas, covering 16.022 million hectares, based on habitat types.

Although most of these areas have been gazetted to conserve specific species of fauna and/or ecosystems, certain areas do protect specific plant species. The Kerinci Seblat National Park, for instance, was established to protect the giant rafflesia, *Rafflesia arnoldi*. Hatta and Djuanda Grand Forest Parks were established to conserve specific forest tree species. In addition, the Condet Cultural Reserve in the Jakarta area, functions as well to preserve the special variety of salak (snake fruits).

In situ conservation efforts have been shown by the establishment of many botanical gardens, be it run by the government or by private enterprises. Many of these gardens have been established on the ground of the type of tree and

other plant species they collected. The garden may be specialising in tropical tree species of the world, mountainous species, or of the arid regions. However, the unique plant collection is established based on the genetic resources consideration. This is what is found in Serpong area, near Jakarta, which collects at least 50 plant individuals to represent their species. These are indigenous Indonesian plant species.

On farm conservation efforts are in the form of traditional agroforestry, such as those commonly found in West Java. The establishment has been known as the home garden. In Timor island, there is a special place, called *mamar* which is also functions as *ex situ* conservation area. In Krui Sumatera, there is *damar* gardens. Government managed conservation areas cover also fruit collection such as established in Paseh, West Java, mangoes in Grati, East Java, coffee in Ijen, East Java, coconut in Bone-Bone, Sulawesi, medicinal plants in Cimanggu-Bogor, West Java, sugar cane in Purwodadi, and other commodities in various sites.

Inventory and assessment on genetic resources has been done by FAO and produced a list of germplasms conserved in genebanks of Indonesia. Many of these species are not indigenous and the collection cover fruits, cereals, vegetables, and industrial species. The FAO data show the collections of some species of *Arthocarpus spp* (the bread fruit and jack fruit genus), species of mango family. The land races listed include many of the ordinary daily-used vegetables, like amaranth, beans, *Solanum spp* (chili peppers, eggplant and tomato) and rice.

Other plant species that are listed include fruit species (durian, duku, rambutan, mangosteen, etc), industrial crops and spices (nutmegs, cloves, aleurites, etc), tubers and starch sources (yam, sweet potatoes, taro, etc), medicinal, oil and sap (damar, cajuput, etc), and timber. Many of these traditional fruits are now facing threats of being extinct. Many forest and medicinal species are yet to be collected. Wild species have also been listed by CITES covering protected plant species that have to be given extra care.

The landraces and old cultivars are conserved by traditional community, such as found in the Dayak community in Kalimantan. These people here still cultivate old rice varieties. Such traditional is still followed by the people in Kasepuhan area, West Java. Probing deeper into the motivation of these people, why they still practise the old tradition is mainly due to the familiarity with the crops, familiarity with the time of sowing, weeding, harvesting, and other cultural techniques.

However, due to the government plan on self sufficiency in rice such traditional rice cultivation is discouraged, sine the traditional varieties produce only poor yield. Consequently there is a practise of monoculture that leads to the danger of diminishing the diversity of germplasms, especially in rice.

There is also similar tendency of the shift of interest of the high yielding varieties of fruits. Many of the old varieties, which produce less - although may have superior characters, such as resistance to certain condition and diseases - have been neglected. The time consuming varieties are pushed aside, leaving narrow diversity of the commodities concerned. The people would prefer high yielding, short-time varieties rather than the old traditional varieties that produce less economic value.

The threats on the traditional varieties come also from the transformation of the designation of land use. Many of the fruit gardens or the suitable lands for fruits crops have been transformed into different designations. Real estates, settlement areas, golf courses and the likes have occupied the formerly productive fruit gardens/orchards and other fertile lands.

Westlands that so far had been the areas for water supply have been altered into industrial areas and resorts. In this case, there has been a confusion on the policies concerning the protection of the fertile lands that are suitable for the conservation of plant genetic resources.

Other threats are exerted by the introduction of exotic species. Without prior research and investigation on what will be the impacts of introducing certain exotic germplasms, people-permitted by the government-has introduced the exotic commodities, such as fruits, cereals, vegetables and medicinal plants. These germplasms have of course pushed the indigenous germplasms to the background. Many of the indigenous germplasms have gone or at least very difficult to find.

Maintaining the indigenous species or germplasms have to be done by methods such as exploration, inventory, collection, characterisation and so on. However, these activities are not done properly. Therefore, it is hard to develop genebanks as needed and useful for the development in breeding of the species or germplasms in question. The loss of germplasms, however, does not have meaningful impacts, since these have not been used for further efforts such as breeding.

CHAPTER 3
National Conservation Activities

Indonesia has a strong vested interest in conserving its natural resources and protecting the living ecosystems upon which so much of its economic activity depends. The direct and measurable benefit from agriculture, timber and non timber forest resources including food, medicines, and building material, fish, shrimp and other marine products, and related revenues from tourism are enormous. The indirect benefits are equally important, albeit more difficult to quantity. terrestrial and marine ecosystems: protect watersheds and coastal areas from erosion; provide essential habitats for the growth of plants, animals and other valuable organisms; assimilate human, industrial and agricultural waste; and help to regulate microclimates. They also play a role in maintaining global ecosystems, and are a repository of Indonesia's intrinsic value may be ascribed, Indonesian biodiversity represents a storehouse of considerable potential value to future generations including, for example, improvements in food crop genetic and the benefits of as yet undiscovered drugs.

Indonesia possesses what is probably the richest diversity of plant and animal species, ecosystems and genetic resources in the world. Although Indonesia covers only 1.3% of the earth's surface, it contains 10% of the world's flowering plant species, 12% of the mammal species, 16% of the reptile and amphibian species, 17% of the bird species and 25% or more of the world fish species. Indonesia's rainforests are of special interest because of their extreme diversity or living organisms, with often very specialized habitat requirements. Indonesia's coastal and marine ecosystems also shelter a rich variety of corals, fish and other reef organisms.

To protect its most valuable natural ecosystem, Indonesia has designated 341 terrestrial conservation areas accounting for 10% of total land area or about 19 million hectares. Twenty four marine conservation areas have also been designated and another 200 are proposed which will bring the total areas of marine reserves to approximately 30 million hectares. The Directorate General of Forest Protection and Nature Conservation (PHPA) in the Department of Forestry is responsible for the management of conservation areas and for preparing and implementing regulations in accordance with new legislation which came into effect in 1990.

Substantial progress has been made in establishing the scientific basis for setting up the conservation area system, largely through the efforts of the PHPA and international environmental NGO's such as the World Wildlife Fund (WWF) and the International Union for Indonesia issued by BAPPENAS in 1993, the system may still be inadequate to conserve all of Indonesia's rich biodiversity. Some habitats such as montane forests are well represented, while others like lowland forests and wetlands are poorly represented. Many of the designated conservation areas have small or nonexistent budgets and little effective management.

3.1 *EX SITU* CONSERVATION

As a complement to protection of specific conservation areas and the managed development of surrounding buffer zone and other areas, the strategy for natural ecosystem protection, as formulated in the *Biodiversity Action Plan* also includes the expansion of the data and information available on Indonesia's biodiversity and its dissemination to policy makers and the public, and the promotion of the utilisation of biological resources in ways which are sustainable and less harmful than current practices.

The *ex situ* component of the conservation strategy includes:

a) national facilities to collect, store, maintain and document a reasonable proportion of existing plant genetic resources;

b) field gene banks and tissue cultures;

c) on-farm conservation;

d) research;

e) training and education.

Activities of national conservation among others consists mainly of:

A. Faunal and floral inventories

1. Survey inventory and identification of diverse and threatened ecosystems.

2. Collection, identification and documentation, of new species of flora and fauna.

3. Taxonomical studies.

4. Ethnobotanical and ethnozoological studies.

B. *In situ* conservation

1. Identification and characterisation of priority ecosystem/habitats within and outside of the protected areas.
2. Management techniques for *in situ* gene banks.
3. Restoration of degraded ecosystems.
4. Genetic research.

C. *Ex situ* conservation

1. Establishment of gene banks, seedbanks, botanic gardens, zoos, aquaria, safari parks.
2. Captive breeding of endangered wildlife.
3. Tissue culture and other micropropagation techniques.
4. Studies on reintroduction of flora and fauna in ecosystems.

For non-timber forest product for which there is strong commercial demand, cultivation or rearing of the wild species provides the only sure way of relieving pressure on natural forest stocks. Moreover, it provides an opportunity to generate domestic product and/or foreign exchange earnings by capitalising on existing market demand. At the same time it provide income and employment in rural areas, thereby improving rural welfare and discouraging migration to urban centres. The use of indigenous rather than exotic species as cash crops brings with it the advantages of genetic conservation and ecological stability as well as cultural familiarity and value.

The development of methods and selection of varieties for the cultivation of wild species require a great deal of basic scientific research (into indigenous models as well as biological aspects), extensive field trials and organised extension efforts to put research results into practise. Considerable progress has been made on the first two steps for rattan and bamboo.

Support should be provided for comparable efforts for other non-timber forest species, such as wild fruit, edible nut and oleoresin-bearing tree species.
The manner and scale on which cultivation of non-timber forest products is undertaken will have important bearing on its impact on the rural populations which collect them. It can take several forms, among them, the following have been suggested and practised:

A. Commercial plantations

While large-scale commercial plantations can have beneficial effort by providing employment both directly and through processing and manufacturing off-shoots, there is also the possibility that they will simply capture or flood the market upon which forest collectors have depended. Furthermore, plantation establishment should not become an impetus for clearance of forest other than the most degraded sort. Prospects for intercropping with other plantation species should be investigated (as they are currently for rattan and rubber, for example).

B. Smallholder cultivation

Alternatively, smallholder cultivation of forest product holds out the most promises for the benefit of rural people, particularly forest-dweller for whom cultivation of traditionally collected (and valued) product would provide a form of cultural continuity. Moreover, precedents for forest product cultivation which exists in traditional farming systems should be studied and built upon. In these systems, forest species are generally "farmed" in swidden fallows, homegardens or other forms of agroforestry.

1. Integration with shifting cultivation; fallow farming retention and management of useful wild species is occuring in swidden plots or 'invading' fallows is common to many shifting cultivation systems. One instructive example of the further intensification of slash and burn agriculture is offered by the practise of the Luangan Dayaks of Central and East Kalimantan : they plant rattan in swidden by immediately following the cultivation period, returning to harvest it and replant food crops after 7-15 years, an appropriate length for the fallow recovery period and rattan maturation alike. Other models for the increasing the productivity of swidden systems through management for non-timber forest products are found in parts of Amazonian Peru where some shifting cultivators make charcoal from cleared trees and selectively manage fallows for cash crop fruit trees and game foods; this allows them reap market and subsistence returns for up fifty years after forest clearance. The promotion and extension of these models and others like should be pursued as means of integrating food and cash crop production, supplementing wild sources of non-timber forest products, stabilising shifting cultivation and thereby opposing deforestation and over-exploitation pressures.

2. Incorporation into homegarden of useful forest species, such as wild fruit trees and sago palm, is achieved either by sparing them from the initial forest clearance, by transplanting wild seedlings or by planting seeds of wild, or more commonly, semi domesticated stock. These practices, also applied to greater range of species, should be developed and promoted.

3. Other forms of agroforestry. A complex form of agroforestry is practiced in southern Sumatera based on cultivation of an oleoresin-yielding depterocarp, *Shorea Javanica*, seedlings of this locally occuring tree are planted in intimate mixtures with a variety of wild and planted species in communally owned plots dispersed throughout the forest. Not only are these agroforests ecologically stable, mimicking the natural forest in structure and diversity, they are also commercially successful, rewarding villagers in some area US$ 1.000 per hectare each year from damar tapping alone. For such reason, rural development and extension programmes are promoting agroforestry systems; they should exploit the potential in traditional systems and also in the selection of as yet uncultivated non-timber forest products, particularly multi-purpose tree species, for incorporation into their models.

C. Enrichment planting

The adoption of yet another form of cultivation of non-timber forest product species, enrichment planting of existing forest, is also to be recommended. For this too, there is traditional precedent in the interplanting of rattan in secondary forest practiced for the last century in parts of Central Kalimantan. What is apparently not traditional practice, but which should be investigated is the propagation of non-timber forest products *in situ* after harvesting (e.g. of large-diameter, single-stemmed rattans which do not resprout after cutting). In addition, the planting of non-timber forest product species in degraded forests as part of forest rehabilitation efforts should be implemented.

The best policy is always to conserve biodiversity *in situ*, i.e. in the place where is occurs naturally. *In situ* conservation allows large numbers of individuals be conserved, something that is more difficult to do *ex situ*. However, *ex situ* methods should also be used, especially for plants, as a complement to *in situ* techniques. In some case *ex situ* conservation is the only possible option.

Much important work has been carried out recently in conserving crop plant genetic diversity in gene banks (collections of seeds or tissue stored under special conditions and from which new plants can be grown). Genetic resources, however, need to be conserved in natural ecosystems too. This is not only cheaper in the long term, but also allows natural selection to continue with the possible evolution of new taxa, and co-evolution with pests and diseases. Another advantage is that it ensures the participation of a wider community of people in genetic diversity conservation.

CHAPTER 4
In Country Uses of Plant Genetic Resources

4.1 USE OF PLANT GENETIC RESOURCES

The most frequently used plant genetic resources in Indonesia belong to several commodities, but mainly the food plants. Of these, rice is the most frequently used. This is due to the fact that rice is the most important staple food for the greatest part of the country. Other food commodities are the corns and the sweet potatoes. However, some horticultural and plantation plant species are important as well. For the horticultural commodities, fruits are the ones on the top, while in plantation, the rubber and the oil palm are the most frequently used.

The number of scientists using the genetic resources depend on the commodities. The most is on the rice and other staple food commodities, followed by rubber, while for the horticultural species, the number is very low, with one scientist working with several commodities. In the private endeavour, those working on flowers and ornamental plants are a little better in number. Practically all plant genetic resources samples used in commercially related activities come from our own collections. almost none comes from the major external sources.

The number of unused species in the gene bank is quite high. This is due to the lack of capable scientists for the species development. Many of the fruit plant genetic resources collection lay idle. Our expectation is using these collection for the future use, since many of the resources outside the collection has become rare and even extinct. However, there are difficulties, which mainly come from financial aspect.

The farmers obtain their genetic resources from all kinds of sources. Some are doing their own propagation, some others buy from other sources, such as the government run nurseries. There is no community seed bank.

4.2 CROP IMPROVEMENT PROGRAMMES AND SEED DISTRIBUTION

The main function of the national plant breeding programmes is to improve local varieties. To a certain extent it is to introduce specific characteristics, mainly the pest resistance. This is true for rice and other staple food species. For other commodities, such as those of fruit trees and ornamental plants, the consumers preference is the aim of the breeding programmes, such as on taste and beauty. However, the ultimate objectives are mainly the increase of production, mainly to meet the national needs.

The breeding programmes are still below the expectation, except for the rice. The constraints are mainly lying on the adequate number and quality of breeders working on the breeding programmes. This is especially true for the commodities that take such a long time as the fruit species as durian, mango, mangosteen, and rambutan. The government is at present planning the improvement of the situation by developing educational programmes for the breeders. The breeding programmes are mainly of the government run activities.

In the country's agricultural system, farmers are involved and made aware of the government programmes on the improvement of agricultural commodities. There are groups called "kontak tani" (forum of farmers communication/contact), "karang taruna" (groups of rural youths), "kelompen capir" (group of learners - to listen, to read, to watch), and the likes, that are always kept informed on the development of the government agricultural programmes.

4.3 USE OF FOREST GENETIC RESOURCES

The better forest seed production has been developed by the companies having forest concessions. The species involved are mainly those being in demand, such as the fast growing tree species needed for plywood, pulp and other demanded/marketed products. There is a national association of the forest concessionaires.

4.4 BENEFITS DERIVED FROM THE USE OF PLANT GENETIC RESOURCES

There is no species in the collection that is mainly supplied for foreign users. All of the efforts are mainly exerted for the home use. The benefit of using indigenous plant genetic resources are mainly on the easy availability, continuous supply, less constraints in adaptation of the newly developed commodities, and the high diversity of the resources. However, for rice, International cooperation/use of plant genetic resources through IRRI is the main mechanism applied. The benefits are obvious, that is to obtain of wider chance of success and broad spectrum of varieties to be developed.

4.5 IMPROVING PGR UTILISATION

The main achievement of the plant genetic activities in the country is mainly in the improvement of traditional plant production. In rice production, this is clearly shown. By using the programme on the improvement of rice production through, inter alia, using better varieties, the country has achieved self sufficiency in rice. However, for other commodities-except to a certain extent, rubber and oil palm the success has not been clearly enjoyed.

As implicitly indicated in the previous descriptions, the relationship between our genetic resources conservation and breeding systems is not on the happy side. The barriers come from many aspects. The awareness of the importance of breeding is still low. If it is realised, the constraints come from the time frame of the programmes. These two aspects cause the lack of interests of those who are supposed to develop the programmes. As also indicated previously, the government is starting to, little by little, step by step, overcome this difficulty.

The greatest value of plant genetic resources in our country is the vastness of the resources, giving us the opportunity to have better options in the utilisation. With the improvement of the mechanisms of the utilisation, such as the better quality and quantity of breeders, better identification of the commodities to be developed, and other requirements, it is expected that the resources will be more valuable, especially in the development of better quality, be it for higher productivity, preference of the consumers, export and other purpose. For the short term, more planting (expansion), more seed supplies, and certainty of plant quality, will be more profitable.

The assistance needed is on the capacity building, especially the development of human resources involved in the breeding programmes. This is mainly to improve the performance and capability of the breeding programmes. The formal education for the production of capable breeders will be the right form of assistance. Funds for this programme will be the most needed assistance.

CHAPTER 5
National Goals, Policies, Programmes and Legislations

5.1 NATIONAL PROGRAMMES

In the country programming structure, all plant genetic programmes are under the coordination by the Department of Agriculture, while those concerning wild species are by the Department of Forestry. The programmes are developed in two way systems, namely "bottoms up" and "top down" approach. The government, through Agency for Agricultural Research and Development (AARD), Department of Agriculture, sets up guidelines that have to be followed by the research institutes mandated to conduct relevant researches. Then, the institutes will develop proposals of research failing into the scope of the guidance set up by AARD. Final approval will be in the hand of AARD. All of the approved proposals will be funded by the government.

Fields of researches in plant genetic resources are reflected by the structure of the organisation within the AARD. In general, they are food crops, horticulture and industrial plants, as far as plant genetic resources are concerned. Each of the institutes is in charge of certain commodities, while the aspects of researches are determined by the institute, within the scope of their mandates and guidelines. In conducting research activities, each institute will be responsible for as well as in need of plant genetic materials, therefore, the programmes will also cover conservation and utilisation of plant genetic resources for breeding and selection.

Directly, there is no commercial firms involved in the research programmes. However, to certain extents, private enterprises are taking advantage of the results of researches. Development of new varieties that are commercially beneficial will be adopted by the business sector to be marketed. There have been channels to the farmers that deliver such results. For the past few years, there has been reorganisation within the AARD that will ensure the effectiveness of the delivery. So far, there is no direct involvement of the non-government organisations.

In the forestry sector, research and development concerning genetic resources are under the guidance of the Agency for Research and Development in Forestry (ARDFor), Department of Forestry. As structured in the ARD. For, the development of programmes and research proposals are done through two way approaches. ARDFor is mainly responsible for research activities, basic as well as applied, leading to the utilisation of the commodities for fulfilling the needs. Conservation aspects of the forestry species are under the organisation of General of Forest Protection and Nature Conservation.

The main goals and objectives of the maintenance of plant genetic resource programmes are maximising the use of plant genetic resources in sustainable way, diversification of resources and basing the utilisation on science and technology. These programmes are in accordance with the national strategy on the management of biological diversity, in which plant genetic resources are one of the components. The strategy is a national implementation of Convention on Biological Diversity, therefore, all programmes on plant genetic resources are in the manifestation of the convention.

Long before Convention on Biological Diversity was put forward, a national committee on plant genetic resources had been established in Indonesia. This committee has now expanded to cover not only plant, but also animal and microorganism resources as well. In the scope of responsibility and mandate, the National Committee on Genetic Resources will advise the Minister of Agriculture, through the Director General of Agency for Agricultural Research and Development. In addition to this committee, which is membered by personnel from agricultural and forestry sectors, scientific community, higher education, and non-government organisations, there is a national board on biological diversity. This board is responsible to the Minister of Environment. The board is also advisory in its responsibility and mandate.

In each of the research institutes conducting programmes on plant genetic resources, there is a coordinated research project, led by a project leader. The leader is coordinating and integrating all technical and administrative activities, and see to it that the projects are run according to the scope and purpose of the projects, following the schedule planned in the proposals. The project leader in plant genetic resources is directed and advised by the National Committee on Genetic Resources, and responsible/reported the progress to his superior, who is appointed by the Director General of AARD. The project leader has a five year period of duty. After this period he will be succeeded by a different appointee. Decision of the personnel is made by the Director General, based on the advise of the superior of the project leader.

For the sustainability and safety of the collections, the government through the Department of Agriculture, has issued ministerial decree, protecting all living collections, so that the sites that have been declared as the collection sites.

5.2 TRAINING

Those who are involved in the national plant genetic resources programmes have come from various level and background of education. Bachelor to doctoral degrees have been joining the programmes, yet there are still undergraduates that are being sent by the institutes where they are working abroad as well as in the country to get higher education level. However, there are constraints in improving human resources in this way. Lack of potential candidates is the main constraints in this endeavour. This situation has been realised by the government, therefore, in recruiting the new staff members, some criteria have been set up to further planning on the development of highly educated staff members that can be projected for programmes in the utilisation of plant genetic resources. It is realised that the immediate need in this matter is the capable breeders.

Although the standards are not met yet, the staff members that are involved in the activities of plant genetic resources are distributed to almost all aspect of plant genetic resources utilisation. This practically complete skills have been obtained through the through curriculum in agriculture, which covers the skills needed in the management of plant genetic resources. The question is that the quality in some cases (fields or disciplines) does not meet the standards required.

Training in plant genetic resources has been conducted formally and non formally. Universities and colleges are those which accommodate the formal degree programmes. In some occasions, the Department of Agriculture conducts special training courses related to the management of plant genetic resources. This kind of training programmes are either funded by the Indonesian Government or sponsored by international agencies, such as FAO and IPGRI. Since this kind of training programmes are important and having reasonable impacts, all kinds of helps and supports will be welcomed. The assistance expected will not be only in financial support, but also in kinds as well, such as teachers/lectures, reading materials, equipment and so on.

The country (department concerned, Dept. of Agriculture) has experienced in organising such training activities. Therefore, if it is needed, the organisation

will be willing and able to conduct such training in regional scope. These activities have been carried on several times, involving countries of the Southeast Asian region. Undergraduate level will be the right level of the training. In so doing, as it has been carried on before, the international assistance that is needed is mainly in financial support for travel of the participants and their accommodation during their stay in the country. Additional lectures of international fame will be appreciated as well.

Every time such training is conducted, there is always much demand so that the organiser is having difficulties in selecting the participants (due to the limited resources not only in financial aspect, but also accommodation, class rooms, lectures and hands out).

The country's national training programmes in plant genetic resources have not met the full range of national needs. This is mainly due to the lack of in-depth probes and approaches to the problems in the management of plant genetic resources. This problem is expected to be overcome by the training in special programmes by looking at the current problems and issues concerning plant genetic resources. There is of course shortcomings from both sides, the participants and the organisers. This is felt mainly on the capability or willingness progress in the business of plant genetic resources. There is no gender and ethnic issues concerning the training programme on plant genetic resources. All men and women from all ethnic groups will receive equal treatment as far as training is concerned.

Another shortcoming is the lack of meaningful forum of communication between the users and the scientific community. This constraints is now being overcome by reorganising the structure of the institutions involved in the management and information dissemination, so that there will be improved way of communicating for this purpose. This reorganization is one of the consequences of the awareness of the policy-makers on the matter, that is the lack of direct communication from the scientific community to the users.

Staff turnover is considerably low. This is due the government carrier system. All of the research institutes are run by the government. Technical staff, including scientists, technicians, field workers, etc, are government employees. There is tendency that being government employee is preferred, since here the future of employee's welfare is more secured (no laying off, with retirement pay, etc).

5.3 NATIONAL LEGISLATION

As it was mentioned in the preceding subchapter, quarantine is playing important role in the plant genetic resources programmes. In fact there is an act that controls the incoming and outcoming plant materials (Act No. 12, 1992). So far the transfer is limited to seeds, however, to a limited extend, in vitro exchange may be permitted. This will be the case of banana, orchids and pineapple and some other commodities. Within the acceptable limits, so far there is no serious complaints on the delay in the passage of plant genetic resources that cause loss of materials.

The present existing laws and regulations on plant quarantine have been sufficient in controlling the international exchange of plant genetic resources materials. For certain horticultural commodities, such as fruits and vegetables, planting imported genetic materials are made possible. The limits are set by the legal instrument issued in 1992.

Formally, the government does not provide incentives to the farmers for conserving traditional varieties. This issue is becoming popular at the moment, in relation to the strong demand on the development of intellectual property rights. The farmer's rights is being put to the foreground by the Department of Agriculture, in the effort of protecting traditional varieties and developing benefits to the farmers for conserving such varieties. The absence of intellectual property rights in Indonesia does not affect programmes on plant genetic resources. This is due to the fact that all breeding programmes of important commodities, such as rice, corn and sweet potato are run by the government.

The breeders who are doing these activities are government officials that do not need to be protected. Each departments in the country has their own legal matter officers. Therefore, there is no external assistance required by the department concerned.

Research on farm conservation is going on to lay foundation for the development of farmer's rights. As far as the farmers are concerned, they will willingly conserve traditional varieties as far as these will bring benefits to them. A number of rice varieties are still planted by the farmers, since the products are in much demands and giving them good income. However, laws on sale and distribution of seeds have not been properly developed. However, control is done by a National Seed Agency (Badan Benih Nasional).

Exchanges of plant genetic resources are under the control of the Department of Agriculture. The decision concerning this matter is made by the Minister of

Agriculture. For the implementation, the level of decision is in the hand of Director General for Food Crops of Department of Agriculture. Material collection by foreign party is regulated by a consortium consisting of the Department of Agriculture (for agricultural materials), Department of Forestry (for wild species), Department of Health (for medicinal plant materials), the Indonesian Institute of Sciences and State Ministry of Environment. The government through this consortium set the conditions for the foreign collecting missions, such as in sharing the materials collected, deposition of materials, documentation, etc.

5.4 OTHER POLICIES

Concerning production and marketing of improved varieties as certified seeds, the policies are made by the National Seed Agency. On the trade, commercial, and other international agreements, the accounts on this matter are covered in the rules, regulations, and agreements set by bilateral and multilateral cooperations in trade and commercial aspects.

CHAPTER 6
International Collaboration

6.1 UNCED

Indonesia has adopted Agenda 21 ever since it was issued during the Rio UNCED in 1992. In conjunction to Chapter 14, the Department of Agriculture, in cooperation with other organisations, has discussed and introduced the Agenda 21 to those concerned, through various fora, such as symposia, workshops, seminars, and institutional official meetings. For Chapter 15, the Department of Forestry is keeping their activities in accordance with this chapter.

Indonesia is one of the first country that signed up the Convention on Biological Diversity, followed by ratifying this convention in 1994, through Act, No. 5, 1995. For preparing the Rio Conference, the Government of Indonesia already published a country study on the Indonesian biological diversity. Indonesia had already issued *National Strategy on the Management of Biological Diversity*, to be accompanied by *Biodiversity Action Plan*, which then both officially issued in 1993. These have provided guidance for those who are interested in pursuing conservation efforts in Indonesia.

6.2 FAO GLOBAL SYSTEM ON PGR CONSERVATION

Indonesia has been active in the management of plant genetic resources since early 1970's, and formally established a committee in 1976, the National Committee on Genetic Resources. Realising the need, this committee then, was reorganised by extending it into one that covers the animal genetic resources as well. Indonesia has joined the FAO Commission since the establishment of this commission on the consideration that the country is one of 12 Vavilov Centres. Being the member of this Commission, Indonesia expects to be able to express its wishes as far as genetic resources are concerned.

Indonesia is also one of the mega-diversity as far as biological diversity is concerned. In conjunction to this fact, and referring to the Convention on Biological Diversity objectives which are "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding", Indonesia expects more from the existence of the FAO Commission.

Through FAO Commission it is expected that the country will have better chance in sharing the benefits arising out of the utilisation of plant genetic resources. In this forum, Indonesia will have the formal channel to speak on the establishment of some rights concerning biological and genetic resources, such as farmer's rights, one of many subjects that the commission is dealing with, intellectual property right, etc. In addition, cooperation concerning agricultural activities and programmes can be developed, with the help of FAO. However, Indonesia has not decided to join to be a member of the Undertaking. The reason is that the government has the opinion that the free exchange in genetic resources might have the implication on certain commercial commodities, such as coffee, tea, rubber, and cocoa, which under the decree of the Minister of Agriculture is strictly prohibited for exchange.

6.3 INTERNATIONAL AGRICULTURAL RESEARCH CENTRES

Like many developing countries in the world, Indonesia receives the benefits from the International Agricultural Research Centres (IARCs). The high yielding varieties of rice distributed by the International Rice Research Institute (IRRI) in early 1970's has made Indonesia being able to become self sufficient in rice production since 1983. Indonesia has also benefitted from other IARCs in the development of corn (CYMMYT), cassava (CIAT, IITA), and legumes (CRISAT). In term of crop genetic resources, Indonesia is not only a recipient, but also a contributor to the collection of the IARCs. Meanwhile, in 1974, the International Board for Plant Genetic Resources was established. Through various training activities organised by this institute, Indonesia developed its capabilities in making inventory of its crop genetic resources. The development of RECSEA (1976) has enabled Indonesia together with the colleagues in Southeast Asia to scheme what need to be done in crop genetic resources conservation regionally. Indonesia joined the INIBAB initiative in the developing collection, conservation and utilisation of banana.

In vegetable genetic resources, Indonesia is benefitting from the AVRDC regional centre in Taiwan. Although Indonesia has not formal diplomatic relationship to Taiwan, the research workers from AVRDC and the Research Institute in Horticulture of Indonesia has worked together in tomato, chili pepper and egg plant.

6.4 NON GOVERNMENT ORGANISATIONS

Though activities on genetic resources in Indonesia have been initiated in more than 25 years, the involvement of the non-government organisations, be it of the international or of the grass root level, is not well documented. There are several local NGOs which are interested in conserving traditional cultivars of rice, corn or cassava. However, their basic knowledge in genetic resources is minimum to enable them to contribute to the conservation significantly.

6.5 REGIONAL INTERGOVERNMENTAL INITIATIVES

ASEAN is one of the regional intergovernmental initiatives. Under the ASEAN umbrella, a committee on agriculture (COFAF) developed programme on genetic resources. Within this programme, one on medicinal genetic resources was initiated. A centre for biodiversity has recently been established with assistance of the European Community for the ASEAN countries. It was agreed that a small secretariat be set up in the Philippines while each country in ASEAN develops programmes which are relevant to national needs. No doubt that the genetic resources, being one of the level in biological diversity, will be covered in this endeavour.

SEARCA is another regional intergovernmental initiative which is an institution of high learning in Southeast Asian cooperate. One of the centres under this cooperation is BIOTROP (Centre for Research in Tropical Biology) which deals with researches in tropical biology. Within this programmes, genetic resources are part of the exercise and exchange between the participating countries in included.

A rather different arrangement in regional cooperation is performed with the government of Australia and IDRC of Canada. With Australia, a regional cooperation in biotechnology enables the ASEAN countries to work together

in evaluating potential microorganism for biotechnology. At the same time, conservation of these organisms are initiated. Indonesia also participates in IDRC's bamboo project for South East Asia. As a result, bamboo genetic resources from Indonesia are now in their collection.

6.6 BILATERAL INTERGOVERNMENTAL INITIATIVES

In term of bilateral intergovernmental initiatives, in which genetic resources are one of the components, Indonesia receives aids from other countries in the field of agriculture, forestry, biology, and environment. Inventory, conservation and utilisation of genetic resources are dealt with in this type of agreement. Through the AARD, Indonesia develops a programme on lowland tropical vegetables with some institutes of the Netherlands. Mango genetic resources were mapped up through a project Indonesia has signed with Canada through IBPGR (now IPGRI). Japan provided aid for collection of Indonesian fruit genetic resources.

The best impact of the bilateral intergovernmental initiatives is felt in the field of human resources development. With ODA (United Kingdom), Indonesia in late 1970's was able to educate a number of staff members in the field of plant genetic resources in Birmingham University. Not all of the graduates stay in this field, but those who remain active have contributed to the sustainable effort in trying to conserve genetic resources in Indonesia.

CHAPTER 7
National Needs and Opportunity

Concluding from the previous chapter, there are needs for the future activities in the utilisation and conservation of the plant genetic resources of the country.

Awareness

1. The needs in increasing the number of population in awareness has been realised for a long time. Many efforts have exerted to make more people aware of the importance of genetic resources for their livelihood. Campaigns in this field have been carried on in all level of communities, from the community at large to the policy makers, through scientific community and the university. However, it is felt the progress is very slow therefore, there should be more mechanism of the awareness campaigns to be developed.

2. It is felt that unless utilisation is involved in the conservation, the efforts will be of no avail. Sustainable utilisation through breeding and development of new improved varieties will be the nearest approach of the efforts.

Involvement of concerned sectors

3. For the campaigns in awareness, cooperation has been developed among the government sectors (through the relevant committees, the institutes, etc), the non-government organisations, active in the management of genetic resources, the universities, which have programmes on genetic resources, scientific communities, students clubs, private sectors, youth movements, and even religious societies, that have access to the grass root level.

4. It is realised that the full use of plant genetic resources collection in Indonesia is still far from optimal. Even the collections are not adequate, basing the consideration on the vastness of the country, which has been catagorised as the Mega Centre or Vavilovian Centre. Therefore, optimal use of the collections is also a need for the future management of the genetic resources of Indonesia.

Human Resources and Institution Strengthening Need

5. For planning the future use that is efficient, there are some needs that have to be fulfilled. These will involved human resources, institutions and the networking.

- Human resources development in relation to enhancing the use of genetic resources collections are in the form of strengthening the quantity and quality of breeders. However, strategy must be developed so that the efficiency is involved in the planning. The strategy must be based on the long term and short term projections, since there are commodities that fall into short as well as term endeavour for their development. This is the strategy that needs to be developed. The strategy has also to be based on the fact that funds are not always available. The need of convincing policy makers that human resources development in using genetic resources has to be taken care of if the richness of the country is expected to be materialised, will have to be put on the higher part of priorities.
- Institution building is also a must for the development of plant genetic resources collections, be it for maintenance or for utilisation. Ability to communicate, clearing house mechanism and other efforts in making the collection useful are the needs that are felt and to be immediately fulfilled.

Network Establishment

6. Network system among the institutions needs to be developed, be it among the institutions that have similar functions and mission within the country, or at the regional or international level.

Supporting Policies

7. The stimulating and enhancing policies of plant breeding should be developed. The policies should be able to attract students or future scientists to be interested to being plant breeders. This will involve the improvement of incentives for the breeders and job security for those taking the course in plant and animal breeding.

8. Such policies should be able to allocate sufficient funds for the researches and development leading to the advancement of breeding activities and using plant genetic resources collections.

CHAPTER 8
Proposals for a Global Plan of Actions

Indonesia encourages the inclusion of five elements in the General Plan of Actions. They fall under the following broad categories : *encouraging and promoting awareness* towards biodiversity, *global policies*, *research agenda*, *international relations*, and *sustainable use* of biodiversity.

8.1 AWARENESS

Indonesia believes that in order to achieve the objective of conservation of biodiversity, its basic importance must be made part of the national consciousness. This could be accomplished by targeting education efforts, both formal and non-formal, to three critical levels of communities:

- policy makers and implementors in the government sectors;
- mentors and students in the entire educational system;
- those at the grass root level, i.e. the users and custodians of biodiversity.

8.2 GLOBAL POLICY

Indonesia considers the safe transfer of biotechnology of paramount importance in assuring that biodiversity is not diminished, harmed or destroyed. The country subscribes to the belief that biotechnology offers inherent advantages in the utilisation of biodiversity. However, it also believes that the dangers that it might pose must be minimised. Other disadvantages of this high level technology, such as requirements on highly educated human resources, sophisticated equipment and high operational costs, are also under consideration.

The country further propose a global code of ethics on the trans-national utilisation of biodiversity. Sharing of benefits which might be derived from the

utilisation of biodiversity must be adhered to. Bioprospecting must be conducted in such a way that the source country benefits, and that part of the benefits derived must be used for the continued conservation of biodiversity.

8.3 RESEARCH AGENDA

Indonesia proposes the conduct of research to the determine the extent and degree of biodiversity in each country at three levels: ecosystem diversity, species diversity, and genetic diversity. The base line information that will emerge from the research will, in great part, determine the direction and extent of further courses of action for the conservation and sustainable use of biodiversity in each country.

In additional, it also recognise the importance of activities that probe deeper into the other kind of diversity, namely functional diversity. Therefore, Indonesia further suggests that research into this novel area of biodiversity, must be looked into. As it is noticed, the functioning of ecosystems depend on the species that constitute them. In one ecosystem, the constituting species could be of a large number but of small number of function, while another ecosystem may have smaller number of species but of a more number of functions compared to the former ecosystem. This phenomenon of diminishing functions of species constituting ecosystem is becoming a trend in the biodiversity development in many of the developing countries.

Transformation of natural forests into man made forest plantation is one of the examples of this phenomenon.

8.4 INTERNATIONAL RELATIONS

The strengthening of the national, regional and global networks on the conservation and sustainable use of biodiversity is also a proposal forwarded by Indonesia. In this manner, the use of limited resources would be maximised, and common goals would be achieved through cooperative and concerted efforts.

8.5 SUSTAINABLE USE AND CONSERVATION

Indonesia believes that utilisation of biodiversity cannot be abstracted from conservation, considering economic realities in the developing world. It subscribes to the principle of sustainable use hand in hand with conservation of biological diversity. It further proposes the adoption of the strategy of mobilisation of traditional communities who are the custodians, users and developers of biodiversity toward the sustainable use and conservation of biological diversity.

Acknowledgements

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