1 INTRODUCTION

BACKGROUND

Biodiversity is the variety of all life forms on Earth, along with the interactions among them and between them and their physical environment. As an archipelagic state[1] , with its thousands of islands scattered between two continents (Asia and Australia) and between the Pacific and Indian oceans, Indonesia endowed with a rich and unique biodiversity.

A large part of Indonesia's development activities have relied on the existence, potential and conservation of its natural resources, including biodiversity. Therefore, biodiversity is an asset for development and the prosperity of the nation. However, this "living" asset is not easy to manage. So far, biodiversity has been regarded as a resource that can be exploited easily with little regard for its sustainability. Indonesia has the potential to become one of the world's sources of food and medicinal plants, tourism destination and carbon sinks of the world. And, more importantly Indonesia has the potential to carry out sustainable development for the welfare of its people through, among others, sustainable management of its biodiversity.

In order to realize these potentials, a comprehensive, effective, and participatory strategy and action plan is required. In 1993 the Government of Indonesia, through the National Development Planning Agency (BAPPENAS), produced the Biodiversity Action Plan for Indonesia (BAPI), which will be further described in the following section.

Almost ten years have passed since BAPI was published as a guide for sustainable management of Indonesia's biodiversity. However, based on the available data, the rate of biodiversity degradation in the past decade is of a serious concern. This is not to say that BAPI 1993 has been ineffective, but many factors affect biodiversity management.

Indonesia is currently at a crossroads. The country has been facing multiple crises since 1998. But at the same time, there is a positive change toward democracy, regional autonomy and decentralization. The opportunity to involve the community in biodiversity management is also growing. Along with these changes, there is a need to shift biodiversity management paradigm and systems. Therefore, a new strategy and action plan that is more contextual with the current situation needs to be developed, in order to make sustainable management and use biodiversity for the prosperity of the Indonesian people may become a reality.

The Indonesian Biodiversity Strategy and Action Plan (IBSAP) is formulated to answer the above challenge. This activity supported by grants from the Global Environment Facility (GEF–TF 023957) and facilitated by BAPPENAS. The formulation of IBSAP documents does not begin from scratch, but is based on the evaluation of the implementation of BAPI 1993 and other activities related to biodiversity.

This chapter describes the essence and evaluation of BAPI 1993, as the basis for IBSAP formulation, followed by a description of the objectives, process and approach of IBSAP, and the organization of the document.

BAPI 1993 AND ITS IMPLEMENTATION

The publication of BAPI 1993 was a strategic step of the Indonesian government, prior to the ratification of the UN Convention on Biodiversity (CBD). It was hoped that BAPI 1993 would be used as a reference to set priorities and investment in biodiversity conservation during the Fifth and Sixth Five Year Development Plan (up to 1999) and beyond. Its main target is to conserve as much as biodiversity as possible, which provides liveli-

[1] In international discourse Indonesia is known as the largest archipelagic country in the world, but there are others who say it is a maritime country scattered with islands.

hood support and prosperity of the Indonesian people.

BAPI's objectives were:
1. To reduce the rate degradation in primary forest, wetlands, coral reefs and other terrestrial and marine habitats.
2. To develop the availability of data and information on the richness of national biodiversity to be used by decision makers and the public to make informed decisions.
3. To encourage a more sustainable and environmentally friendly use of natural resources.

BAPI 1993 prioritized in-situ conservation measures, both inside and outside protected areas, and ex-situ conservation, with four main activities as follows.
1. In-situ conservation in national parks and terrestrial areas.
2. In-situ conservation outside protected areas, including forest, wetland and cultivated areas.
3. Conservation of coastal and marine resources.
4. Ex-situ conservation through gene and seed banks, protection of plant varieties and breeding programs.

This action plan also emphasized that the above measures can be effectively implemented if supported by:
1. Improvement of community participation on biodiversity conservation.
2. Accurate identification of research and training needs.
3. Management and use of information base.
4. Improvement in education, training and community awareness programmes.
5. Reforms in and enhancement of institutional capacity to implement the action plan.

Reform and enhancement of institutional capacity includes:
1. Enhancement of the capacity of institutions managing biodiversity.
2. Development of coordination mechanism.
3. Appropriate resource allocation and authority for resource management.
4. Improvement in the capacity of local institutions.
5. Application of accurate resource valuation.

Although BAPI 1993 was formulated before the reform era, one of its main messages was in fact the need for institutional reform. This means that the structural constraints related to biodiversity management was acknowledged. In addition, BAPI 1993 was formulated together by the Indonesian government (BAPPENAS, the Ministry of Environment, Ministry of Agriculture, Ministry of Forestry, Ministry of Internal Affairs), research institutions (Herbarium Bogoriense and the Indonesian Institute of Sciences) and non-governmental stakeholders (WALHI, SKEPHI) with the support of international development institutions (the World Bank, IUCN and WWF). This is an indication that although the formulation of BAPI 1993 was not fully consultative, there was a process of dialog between the government and other stakeholders.

In its implementation, the role of BAPI 1993 as a reference for decision making has not been optimal. A study conducted by the IBSAP Stocktaking Team in 2001 indicated some factors why BAPI 1993 did not function optimally, as briefly described below.

The formulation process

Though some non-governmental organization (NGO) representatives were involved, the formulation of BAPI was regarded as highly exclusive in nature, and involved only little public participation. Its approach was centralistic and top-down, and as a result there was limited sense of ownership and commitment towards BAPI 1993 among the stakeholders.

The dissemination process

The formulation of BAPI 1993 was neither supported by a well-planned dissemination strategy, publication through mass media nor intensive and continued public campaign. The document was written in English, which became a constraint for the stakeholders in trying to grasp its message, even among government officials. Therefore, ten years after its publication, many stakeholders involved in biodiversity conservation are not aware of the existence of neither such document nor the information it contains.

The implementation process

This document also did not define clearly the institution that is charged with the responsibility to ensure its implementation and to achieve its targets and objectives set in it. In addition, BAPI 1993 did not have formal legal basis in the national legislation, so it was not legally binding. As a result relevant stakeholders were not legally bound to comply with its contents. This is true as well as for sectoral ministries or other government institutions that felt they had no obligation to adopt BAPI 1993 in their planning and management programs.

Despite the above weaknesses, it does not mean that the contents of BAPI 1993 were irrelevant. Some biodiversity management activities were carried out as result of it. Among others, the biodiversity collection and inventory activities conducted by LIPI with funding from GEF grant (see details in Chapter 4). Integrated conservation and development programs or ICDP also intensified (see Chapter 4 for more details on ICDP). However, the prevailing structural problems remain unsolved even after the publication of BAPI 1993. Thus, this action plan was considered not yet effective.

In addition, many changes have occurred in the last ten years, and therefore it is time to have a more contextual biodiversity strategy and action plan for Indonesia.

OBJECTIVES

The main objective of formulating a national biodiversity strategy and action plan is to facilitate activities on the conservation and sustainable of biodiversity as indicated in the CBD. The following are the specific objectives of IBSAP:

- To conduct a review of the needs and priority actions as stated in BAPI 1993, to identify what had been achieved, what could not be implemented and to find out why the required funds and/or motivation had not been forthcoming.
- To identify new needs and priority actions and to revise the action plans according to potential changes in current and future environmental policies.
- To identify existing opportunities and constraints for effective biodiversity conservation and sustainable use, including the gaps in existing knowledge, and, set realistic targets as well as actions to address these gaps.
- To prepare new and clear strategies, with detailed action plan.

APPROACH AND PROCESS

Learning from the experience of BAPI 1993 and given the ongoing decentralization process, a greater attempt was made to apply, as far as possible, a participatory, bottom-up and transparent approach in the formulation of IBSAP. Such an approach was also aimed at building a greater sense of ownership towards the documents produced, and developing a national consensus, so that the resulting IBSAP documents will be legally as well as morally binding.

However, in its implementation, such an approach faced several technical and non-technical constraints. Nevertheless the participatory spirit of IBSAP formulation was upheld, as far as possible, during the 18 months period, from July 2001 to March 2003. One example of the participatory element is the membership of the Steering and the Technical Committees, which consists of representatives from various government agencies and non-governmental elements. The IBSAP process is described below.

The First National Workshop

This workshop was held in 6-7 November 2001 in Bogor, West Java, attended by 126 participants from various stakeholders at the national and regional levels. The purpose of this workshop was to 1) introduce IBSAP activities to the relevant stakeholders and to encourage their participation; 2) identify issues and prepare the outline of the IBSAP documents. This workshop produced a proceeding, which was then used as a reference for the writing of IBSAP documents.

Outreach activities

This is consisted of many activities, one of which was distribution of questionnaires to identify public aspiration and opinion. Basically, the questionnaires posed questions about respondents' knowledge of biodiversity, BAPI 1993 and IBSAP, and their opinion on how IBSAP should be formulated, what should be the contents, whether it would need a legal status, and whether they would subsequently use

the IBSAP documents as a reference for their planning and decision making activities. About 200 questionnaires were distributed through electronic mail and also through various meetings. But only about 26 respondents actually filled and returned them, much too small to be representative[2].

Input was also sought and given through an electronic mailing list, IBSAP@yahoogroups.com, which has about 100 members. The moderator of the mailing list also sent IBSAP draft document to another 50 mailing lists. This mailing list is still active at the time of this writing of IBSAP documents and can be used as a communication media for the follow up actions of IBSAP.

Another outreach activity was workshop for journalists held in several regions. In the Java-Bali and Sumatra regions it was held prior to their respective regional workshops. In Sulawesi region, the workshop was held after the regional workshop. Due to technical constraints, this workshop was not held in the other three regions. These workshops were expected to encourage participants to be more active in writing about the IBSAP processes and biodiversity in general.

Regional workshops

These workshops were carried out in all six regions, Sumatra, Java-Bali, Nusa Tenggara, Kalimantan, Sulawesi, and Papua. For each region BAPPENAS recruited a regional coordinator, whose main tasks were to identify and gather regional aspirations, hold regional workshop and write a regional report. The regional workshops were held in turn at each region during May-July 2003. The regional consultation process is summarized in Appendix 9.

The objectives of these workshops were to identify problems in each region, formulate strategic framework, to convey a message or mandate for the IBSAP process at the national level and to try to build regional commitment to implement the follow up actions. Each workshop was designed differently based on the needs of each region. However, as far as possible, workshops involved stakeholders from government, NGOs, Parliament, entrepreneurs, *adat*/traditional community and the media. It was also designed to be as participatory as possible, in order to record the aspiration of participants. The complete report of each workshop is published in one volume as the Regional IBSAP Document accompanying this National Document, while part of the recommendations arising from the workshops are integrated in this National IBSAP document.

Preparation of thematic reports

BAPPENAS also recruited four technical consultants to prepare thematic reports on the current condition of forest, wetland, marine and coastal ecosystems, and agro-ecosystem. These reports were written based on discussions with relevant government departments and institutions, and individual experts. A summary of these reports is presented mostly in Chapter 3 of this national document.

Focus group discussions (FGDs)

The FGDs were held to harness the commitment and aspirations of those who had not been involved in the regional workshops. They were held on 15 and 22 October 2002. Participants of the first meeting were entrepreneurs and government officials, while national NGOs and scientists from various backgrounds attended the second. The objectives were to distribute initial IBSAP draft document to be reviewed by the participants, and to build commitment for the finalization of IBSAP documents and the follow up process.

The preparation of National IBSAP Document

The initial outline of IBSAP was formulated before the regional workshops were held. Similarly, some parts of the strategy (vision, mission, and objectives) were written to be discussed during the regional workshops. The first draft was written after the regional workshops and the initial draft was reviewed during the FGDs. Subsequently, the revised draft was presented at the second National Workshop. Inputs, suggestions and recommendations from this workshop were then incorporated into the Final draft.

[2] The majority who returned the questioners was from NGO (14 questionnaires); the rest was from donor institutions, universities, local governments and individuals. Although it was hardly representative of public opinion, respondents' aspiration must be acknowledged. The important finding was that 12 respondents said they would use IBSAP as a reference if it has a legal status. They thought that IBSAP is much needed because the rate of biodiversity degradation in Indonesia is very high, while there is no comprehensive and integrated policy in place. Sixteen respondents knew nothing about BAPI 1993 and 15 were not aware of IBSAP. Therefore, the dissemination and communication about IBSAP is very important.

The Second National Workshop

The aims of this national workshop were to get input to the national IBSAP draft document and build commitment for follow up activities. This workshop was conducted in Jakarta on 14 to 15 November 2002, attended by 125 participants, representing government, NGOs, universities and academics from national and regional levels and regional coordinators of the IBSAP team. The input from this workshop were summarized as a final mandate for further revision of the IBSAP national document. Four most important results were identified:

1. The needs and conditions of regions must be reflected in the national document.
2. Communication and socialization programmes are required after the IBSAP documents are published.
3. IBSAP must have a legal status, and should be pursued at least in the form of a government regulation.
4. An *Ad hoc* team needs to be established to coordinate IBSAP follow up activities, i.e. the communication and socialization programs and the efforts to obtain a legal status.

A chart describing the process applied in the preparation of IBSAP documents is presented in Appendix 8.

Thus IBSAP formulation involved many relevant stakeholders. Their names and addresses are listed in the Directory of Stakeholders of Biodiversity in Indonesia, which also contains some websites. This Directory will hopefully be useful for those who want to conduct follow up activities on biodiversity management.

IBSAP OUTPUT

The output of IBSAP is a set of three documents: This IBSAP National Document, the IBSAP Regional Document, which presents the result of the process in the six bioregions and the Directory of Stakeholders of Biodiversity in Indonesia. Only the national document is translated into English.

The IBSAP national document consists of seven chapters. Chapter 2 describes important general concepts of biodiversity and cultural diversity. Chapter 3 portrays the state of Indonesia's biodiversity in terms of forest, wetlands, coastal and marine ecosystems, and agricultural ecosystems. It also discussed the state of species biodiversity and traditional wisdom. A review of the efforts to manage biodiversity and an analysis of the factors causing biodiversity crisis in Indonesia are presented in Chapter 4. This chapter also reviews the current and future context of sustainable management of biodiversity in the context of sustainable development.

Chapter 5 presents strategies for biodiversity management, which contains the vision, mission, objectives and goals. The strategies are for the national level but to be used as a reference for biodiversity management at regional level. Chapter 6 provides the action plan, together with policy direction and performance indicator. Finally, Chapter 7 discusses the ideal and minimum preconditions for the effective implementation of IBSAP.

Background materials that are considered important and relevant are presented in boxes or in appendices as an integral part of the document. A glossary of terms and abbreviations is also provided to facilitate readers.

The IBSAP documents are meant for all stakeholders, both from government and non-governmental sectors, as a reference in policy making and planning on biodiversity management. Hopefully this document can become the basis of future actions in sustainable biodiversity management.

The writing team acknowledges that there may be flaws and inadequacy in this document. Therefore constructive suggestions and critiques from readers are welcome to improve the content and presentation of information in this document. We hope that the objective of this publication can be achieved, that is to serve as a reference for sustainable management of biodiversity for the prosperity of the Indonesian nation and its people.

Aerides inflexum is a fragrant orchid, used as ornamental plants. It grows in South and Southeast Sulawesi. This epiphyte is usually found in forests near a lake or attached to the *Artocarpus elastica* tree.

2 BIODIVERSITY FOR THE PRESENT AND FUTURE GENERATIONS

There is a global awareness on the significance of and threats to biodiversity. This is reflected, among others, by the enactment of the UN Convention on Biological Diversity (CBD) in 1992 during the UN Conference on Environment and Development (UNCED, or Earth Summit). As of December 2001, 182 countries have ratified it. Indonesia ratified CBD through Law No. 5 of 1994 on the Ratification of the *United Nations Convention on Biological Diversity*. CBD has three main objectives: conservation of biodiversity, sustainable use, and equitable sharing of benefits arising from the utilization of genetic resources. Further discussion on the CBD is provided in Box 4.1 of Chapter 4.

One of the obligations of countries that ratify CBD is to prepare a national strategy and action plan on biodiversity management. The first step of this is the creation of common understanding on biodiversity, as discussed in this chapter. This chapter presents the diversity of cultures and their associated knowledge system, as well as the value and significance of biodiversity for communities and national development.

UNDERSTANDING BIOLOGICAL DIVERSITY

Biodiversity is a term used to describe the diversity of life forms on earth, the interaction between various life forms and between them and the environment. The diversity in knowledge system and the culture of a community is also closely associated with biodiversity. Thus biodiversity includes all life forms on earth, from simple organisms such as fungi and bacteria to thinking beings such as humans; from one tree stand in a home garden to thousands of tree stands that form an interconnected and complex life system in a forest.

In biological terms, biodiversity are grouped in **ecosystem, species, and genetic** levels.

a. *Ecosystem diversity* refers to the diversity of forms and composition of landscapes, terrestrial as well as aquatic, in which living organisms (plants, animals and microorganisms) interact and form inter-connections with their physical environment. The terrestrial ecosystem diversity includes, for instance, ice fields and moss at the peak of Papuan Mountains, tropical rainforests in Sumatra and Kalimantan, to savannah and shrubs in Nusa Tenggara. In coastal and marine ecosystems, there are beautiful coral reefs such as in Bunaken to sea grass in the Sunda Straits. Lakes, rivers and freshwater swamps are components of the wetland ecosystem. Agro-ecosystems are agricultural systems constructed by human with diverse agricultural crops, plantations and livestock.

b. *Species diversity* is the diversity of species in one ecosystem, whether terrestrial or aquatic. Thus each organism has different characteristics. For example, Indonesia has six different species of turtle, green turtle (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), olive ridley (*Lepidochelys olivacea*), flatback turtle (*Natator depressus*), leatherback (*Dermochelys cariacea*) and loggerhead (*Caretta caretta*), and each has different physical characteristics (Conservation International 1999). Species diversity is determined not only through the number of

(Doc. Ministry of Forestry)

Figure 2.1. Tropical rainforests harbor rich natural resources and diversity but their existence are increasingly threatened.

(Doc. BirdLife-Indonesia)

Figure 2.2. Savannah grassland as a dominant landscape in Nusa Tenggara.

(Doc. BirdLife-Indonesia)

Figure 2.3. Coral reefs is one of the marine and coastal ecosystems that are vulnerable to human disturbance.

species in a given area, but also by taxonomic diversity (class, family or order). For instance, an island inhabited by two bird species and one lizard species has a higher taxonomic diversity compared to one which has three bird species but no lizard (WRI, IUCN and UNEP 1992). Indonesia is considered as a country having one of the highest level of biodiversity and endemism (organisms that occur only in a certain area) in the world (UNEP 2002). The biological richness of Indonesia is discussed in Chapter 3.

c. *Genetic diversity* refers to individual diversity within a single species. This diversity is caused by genetic differences among individuals. The gene is the factor that determines individual traits and can be inherited from one generation to the next. Thus one individual within one species has a different genetic makeup from another individual of the same species. This difference explains the different appearance of, for instance, human beings. One may have straight hair and yellow skin, while others have curly hair and dark skin. Another example is the many varieties of rice (such as Rojo lele, Menthik, Cianjur) or mango (Golek, Harum manis, Manalagi).

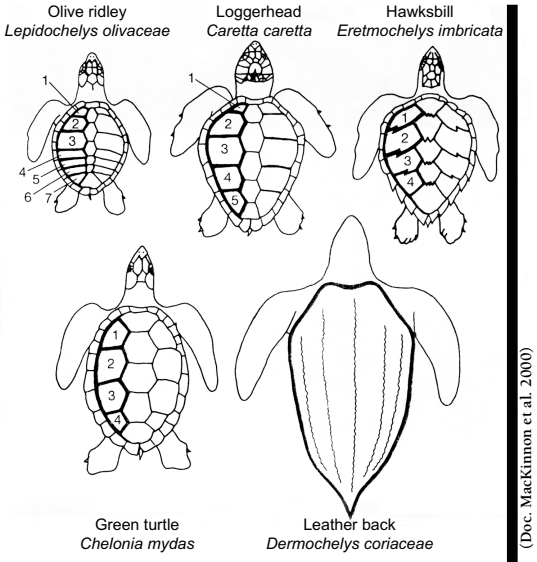
The three levels of biodiversity are interconnected. So an area with high ecosystem diversity, usually would also have high diversity of species, and vast genetic variations.

Three other important aspects to be understood about biodiversity:

- **Center of origin:** is a geographical area where a taxon originates or is developed for the first time. Taxon is a unit of taxonomy, the science that classifies all living organisms in the world.
- **Center of diversity:** a geographical area with high species or genetic diversity. A center of origin is not necessarily a center of diversity. Indonesia, for instance, is considered as the center of origin of banana and sugar cane, but is also a center of diversity for plants, which did not originate here, such as rice, mango and the ginger family.
- **Center of endemism:** a geographical area with a high number of endemic species at the local level[3].

Biodiversity is not distributed evenly on earth. The tropics have a higher degree of diversity compared to other parts of the world. Indonesia and Brazil, for example, are known as *megadiversity* countries, i.e. geographical areas with the highest level of biodiversity. The tropical region is important for biodiversity conservation because many areas are centers of origin, centers of diversity or centers of endemism.

[3] Definitions of center of origin, center of diversity and center of endemism are taken from www.flmnh.ufl.edu/fish/tropical/JSA/terms1.htm



(Doc. MacKinnon et al. 2000)

Figure 2.4. Carapace patterns of five species of marine turtles which feed and nest in Indonesian waters.

An important feature in the tropics is high diversity of species, but the number of individuals in one population is usually low. Therefore their sustainable management needs a different approach from the one applied in temperate areas. Archipelagic areas, such as Indonesia, also have different and unique characteristics compared to large tracts of land. Small islands usually have lower level of biodiversity, but higher number of endemism. Indonesia has both big islands as well as groups of small islands, so a different pattern of biodiversity management is needed, one which conforms to the biological and physical characteristics of each island.

Human activities and consumption pattern also influence biodiversity. Human actions such as clearing forest for agriculture, or excessive logging of forest, hunting beyond the carrying capacity of the species to survive, or over utilizing species without rehabilitation will reduce the biodiversity in a certain area. Monoculture utilization or cultivation, of one or two species or varieties (for example, teak plantation or fields planted with only one variety of rice) also threatens biodiversity. Similarly development patterns influence biodiversity. For instance, industrialized or developed countries, which are mostly located in temperate areas, have undertaken less sustainable development in the past and followed a consumptive life style which have negative impacts on biodiversity. Unfortunately, the same pattern of development and excessive exploitation also occurs in developing countries in the tropical areas of Asia, South America and Africa, which still harbor relatively high level of biodiversity today. If there is no shift in such development pattern, degradation and even extinction of the remaining biodiversity will inevitably happen.

CULTURE AND KNOWLEDGE SYSTEM ASSOCIATED WITH BIODIVERSITY

The diversity of human culture and knowledge systems can also be considered as part of biodiversity. Cultural diversity is reflected by the diversity of language, belief, land and natural resources management system, knowledge system, art, music, social structure, crop selection and food habits, all of which support communities to adapt towards changes (WRI, IUCN and UNEP 1992). Indonesia has the third highest cultural diversity in the world, after Papua New Guinea and India (Mittermeier et al. 1997). As presented in Table 2.1, Indonesia has about 336 cultural groups with their diverse cultures.

Diverse local cultures are also associated with knowledge systems on biodiversity utilization and conservation, often known as **traditional wisdom**. Local and traditional knowledge systems as well as cultural practices can maintain the biodiversity of agricultural crops,

(Doc. BirdLife-Indonesia)

Figure 2.5. Land clearing activities of other non-forest uses are not only change the landscape but often become the causes of animal and plant species extinction.

(Doc. Ministry of Forestry)

Figure 2.6. Land degradation resulting from economic activities that put strong emphasis on short-term growth.

Table 2.1. Countries with the highest cultural diversity.

Country	Cultural Group
Papua New Guinea	875
India	613
Indonesia	336
United States	300
Democratic Rep. of Congo	250-300
Mexico	240
Brazil	206
Australia	200-250
Philippines	111
Peru	96
Colombia	81
China	56

Source: Mittermeier et al. 1997.

livestock and habitat because indigenous culture tends to maintain diverse plants and animals (KONPHALINDO 1993).

One important aspect of cultural diversity is language. A language developed by certain cultural groups contains biological and ecological knowledge on the use and management of plants, animals, and ecological relationship between the various components of biodiversity. Songs, rituals and myths sometimes contain information in the form of symbols on the benefits of biodiversity that can be developed to be used by modern agriculture and health sectors (KONPHALINDO 1993).

One of the practices of traditional wisdom that has been proven very useful is the traditional healing system. Some 20,000 species of living organisms have been used in traditional medicine (WEHAB Working Group 2002). Out of 121 modern drugs derived from plants, three fourths are obtained by tracing the traditional knowledge of indigenous cultural groups (ethnopharmacology). The knowledge of an indigenous community in Madagascar on the benefit of *Vinca rosea* as a treatment for leukemia has made it possible for three fourth of children suffering from this ailment to survive. The plant provides basic medicinal material to treat leukemia, i.e. vincristine and vinblastine. RAFI *in* Khor (2002) reported that at least 80% of the world's population rely on traditional knowledge about plants, animals, insects, microbes and agricultural systems to fulfil their needs for food and medicine.

Traditional wisdom is facing erosion or transformation because cultural diversity is threatened with extinction. Mittermeier et al. (1997) said that 80 cultural groups in Brazil have become extinct during the 20th century. One of the indicators of cultural diversity erosion is the disappearance of language because the indigenous language experts and speakers are increasingly limited. Experts estimate that only five percent of the languages in the world, or only about 300 languages, are currently secure (KONPHALINDO 1993). This erosion is partly caused by the degradation of forests, the home of most of these cultural groups. The extinction of cultural groups and their languages as well as traditions is a threat to biodiversity, because important knowledge and technology on the ecological relationship between biodiversity, together with the benefits and use patterns, lost as these groups disappear.

Modern knowledge systems and technology development have also contributed to the understanding about biodiversity and its benefits. One important aspect is the domestication of wild plants and animals into livestock and agricultural crops, based on the knowledge about the biology of certain species. This will be further discussed in Chapter 4.

(Doc. BirdLife-Indonesia)

Figure 2.7. Human and nature relationship is often expressed in the form of artwork that display uniqueness of each local culture or region.

THE SIGNIFICANCE AND VALUE OF BIODIVERSITY

This section discusses some of the significance and value of biodiversity that have been partly adapted from economic assessment of biological resources by the Natural Resources Management Program (NRM/EPIQ)[4]. Economic valuation deals more with the economic aspect of biological resources, while the values presented here represent the entire value of biodiversity. There is thus a need to distinguish biological resources and biodiversity.

Biological resources are often interpreted as assets to produce products and services only, while biodiversity refers to all aspects of life support system, which includes the social, economic and environment dimensions, knowledge system, ethics and the relationship between these various aspects. These values have been acknowledged and known, but they are often ignored because not all these values can always be assigned a monetary value. For example, the meranti timber cut from the forest and then sold to a sawmill has a clear value in dollar. But the meranti tree, which is allowed to grow in watershed areas to prevent erosion and protect soil, clearly has a great significance, but assigning a monetary value to this would be difficult.

Therefore economic valuation of biological resources is needed to assign economic value to all their benefits. Yet not all benefits can be valued economically. Even so, economic valuation is still important as one of the tools to make decisions on biodiversity management options. Biodiversity valuation methods are presented in Box 2.1. The entire significance of biodiversity is described below, while the value of conservation areas is provided in Box 2.2.

Box 2.1
BIODIVERSITY ECONOMIC VALUATION METHODS

Natural resources valuation will enhance the understanding about the value and services provided by natural resources and biodiversity. Valuation can help decision-makers to make alternative development policy choices that will most benefit their region. Valuation would also be useful in identifying and comparing the investment made, opportunity costs, and the benefits produced. A better understanding of who bears the cost and who enjoys the benefit is important in formulating and implementing effective policies for protecting and utilizing natural resources efficiently (NRM/EPIQ).

There are five valuation approaches (IIED 2001 *in* Vermeulen and Koziell 2002):

a. *Market price approaches*, including estimation of profits from consumption and subsistent production;
b. *Surrogate market approaches*, including travel cost model, the price of enjoyment and substitution approach;
c. *Production function approaches*, that emphasize on the biophysical relationship between the functions of forests and market activities;
d. *Stated preference approaches,* particularly contingency valuation methods together with their variations;
e. *Cost based approaches*, including compensation cost and cost for maintaining it.

The above methods can provide a relative value estimation, which can compare resources in different locations. This method also assigns monetary value to those values, which cannot be accommodated by the market by making direct comparisons between various products and services.

[4] The valuation undertaken by some experts in general classify biodiversity value into three categories: direct use value (productive and consumptive benefits), non-direct use value (environmental services, option value), non-use value (heritage and existence values) (Vermeulen and Koziell 2002). This document tries to present a holistic understanding of the value of biodiversity and so does not use the above classification. All values are considered to have equal significance.

Existence value

In this case, biodiversity is valued due to it existence in a given area (Ehrenfeld 1991). This value is not associated with the potential of a certain organism, but is linked to its right to live as a part of nature. Existence value is sometimes known as intrinsic value, which is associated with ethics, that is a value based on ethics or religion. All religions of the world teach humans to protect God's creations. By adhering to the existence value, some people feel they get a benefit, in the form of an opportunity to practice their religion.

Existence value is also linked to aesthetic value for humans. For example, many people, whether nature lovers or tourists, are willing to spend money to visit national parks in order to see animals in their natural habitat, although they get no economic benefit from such an activity. A more concrete example is the fact that tourists are willing to pay a lot of money to enjoy coral reefs in their natural form at the Bunaken National Park (NP), whose recreation value indeed amounts to Rp. 9,8 billion per year (NRM/EPIQ nd). Similarly, cave lovers or speleologists are willing to pay a lot of money and to take risks just to enjoy the beauty of the caves in Indonesia.

Although the existence value of biodiversity is hard to quantify in monetary terms, the benefit in increasing the psychological wellbeing of humans is quite clear. This is the reason why some people, particularly in developed countries, are willing to mobilize funds for nature and biodiversity conservation mainly to be able to enjoy their existence value.

Ecological value

Biodiversity provides ecological or environmental services for humans. For instance, forests maintain the hydrological balance thus preventing floods and droughts. Forests also maintain soil fertility by supplying nutrients through the leaf litter, prevent erosion and regulate the micro climate. Coral reef and seagrass provide nursery grounds for various fish and shrimp species. Karst and cave ecosystems provide a place for water storage that is used by the organisms in the surrounding areas and protection for seed dispersing and pollinating bats that are useful for plant reproduction.

The ecological value can be harnessed if biodiversity is considered as one entity, where the components are inter-dependent. For example, the diverse ecosystems provide a place for the food chain to function and a space for species to survive and breed. A well functioning ecosystem can supply and produce environmental services beneficial for the species living in it; these services are, among others, protection of water and soil quality, regulation of local climate. Environmental services are undervalued because it is difficult to quantify. Yet, this value is substantially high, as presented in Box 2.2.

Species diversity makes it possible to create food chain among plants and animals; this guarantees continuity of food supply for each species. Various species also develop mutually beneficial relationship within the food chain. For instance, insects that take nectar from flowers help in the pollination process of plants, or bats that eat durian actually help the dispersal of durian seed.

Genetic diversity is needed by each species to maintain their breeding capability, develop resistance to diseases and adapt to environmental changes. Species need a supply of diverse genes in order to survive in the ever changing environment.

Heritage value

This value is associated with the wish to conserve biodiversity for future generations. For instance, the Kasepuhan community in Halimun Mountain, West Java, stores seeds from each rice variety to be planted in the next season, and to conserve their rice varieties. Their purpose is to reserve this valuable resource for the next generations. Among communities in Mentawai (an island off the West Coast of Sumatra) only certain people are allowed to hunt monkeys and turtles to get protein. The number of animals killed is also limited and the meat is equally shared among community members. The intention is to prevent wasteful use of and depletion of resources, to make them available for the next generation.

This value is often linked to the sociocultural and option values. Certain species or area is deliberately conserved and bequeathed from generation to generation in order to maintain the cultural and spiritual identity of certain ethnic groups or so that the next generations maybe able to fulfil their needs.

Option value

This is the value of biodiversity in providing benefits for communities in the future (Primack et al. 1998). Biodiversity has uses and

(Doc. Ministry of Forestry)

Figure 2.8. Medicinal plants cultivation is one of the potentials for sustainable development that need further exploration and development.

values, which may not yet be known or cannot be utilized by humans at present. With the change in demands and consumption pattern as well as technological advances, this value will be important in the future. The potential of wild plants as medicinal sources is an example of the option value. Many pharmaceutical companies and government health agencies are intensively trying to discover new medicinal materials from biodiversity in its natural habitat in order to treat diseases such as AIDS and cancer. It should be noted that the 20 most often prescribed drugs in the USA, with an average annual value of US$ 6 billion contain chemicals found in nature (Primack et al. 1998).

Similarly, germplasm collections in the various research centers may not seem to have direct value at present, while the cost of maintenance is quite high. But, in the future, cultivated and wild plant germplasm collections will become very valuable for agricultural plant breeding.

The economic value of most of the world's species may be unknown yet at present, or knowledge on their utilization is limited. If one species with a high option value becomes extinct, even before it can be identified, the loss for human welfare can perhaps be high. If biodiversity were to be considered as a manual for improving the welfare of human beings, then the loss of one species would be like tearing a page of that manual (Primack et al. 1998). When we need information to solve one of our problems, which may be contained in that torn page, only then can we become aware that we have lost that information forever.

Box 2.2
CONSERVATION AREAS: ASSET OR LIABILITY?

Conservation areas are often treated as liabilities because their environmental services cannot be assessed fully, or are underestimated. Such a notion can be eliminated by several techniques and approaches that can provide a comprehensive value for all the significance and functions of biodiversity.

Valuation has been conducted in some conservation areas and areas with high biodiversity in Indonesia, such as Gunung Leuser National Park, Togean Islands, Taka Bonerate NP, Gede-Pangrango NP and Bunaken NP. Results of studies show that the total economic value of these areas is higher than the productive value and other forms of utilization. For example, the monetary value of tourism activities and environmental services (water regulation for agriculture and household use and sedimentation control) derived from the protection of the Gede-Pangrango NP amounts to Rp. 40,80 billion per year (for net present value - NPV or a 10% discount rate) and very much higher than the management costs and the monetary value from timber felling in the area which amounts to only Rp. 27,96 billion. The annual value derived from protecting Bunaken NP is estimated to be 9,6 billion, and Bukit Baka Raya NP is Rp.10 billion. The economic benefits of protecting water in Ruteng is US$ 35 per household per year and the economic benefit of improving the quality of the water in Ciliwung river is estimated to be Rp. 30 million per year (NRM/EPIQ). Likewise, protecting forest in Gede, Halimun, Pangrango and Salak mountains in West Java will guarantee drinking water supply for the communities and for various economic activities such as agriculture and processing industries in the Jakarta-Bogor-Tangerang-Bekasi area, Sukabumi and Banten.

Source: extracted from training on economic valuation of natural resources by NRM/EPIQ.

The option value is similar to savings that will enable humans to develop choices in order to adapt when faced with physical environmental and social changes.

Consumptive value

This value is derived from direct benefits from biodiversity, such as for food, housing or clothing. Communities in Indonesia consume no less than 100 food plant species (those producing grains and tubers). No less than 100 bean or nut species, 450 fruit species and 250 vegetable and mushroom species are used in their daily diet. Some 940 plant species are used in traditional medicine (KMNLH 1997).

Wild plant species from the forest, known with its aphrodisiac properties such as *Euriycoma longifolia*, *Ficus deltoidea* and the yellow root *Arcangelisia flava*, and cultivated species such as ginger (*Zingiber officinale*), turmeric (*Curcuma domestica*), galangal (*Kaempferia galanga*), java tea (*Orthosiphon aristatus*) and cardamom (*Amomum cardamomum*) are also used in traditional medicine by local communities. Some species, such as rosy periwinkle, have in fact been used in modern medicine products. More than 100 timber species, 56 bamboo species and 150 rattan species have also been used to build houses and make household utensils by communities (KMNLH 1997).

Productive value

This is the market value derived from trade in biodiversity at the local, national and international markets. For instance, the global market value of drugs derived from genetic resources is estimated to be US$ 75,000-150,000 million per year. The annual total value of sectors associated with the seeds market all over the world is US$ 45 billion, while the total output from the world's agro- ecosystem is equivalent to US$ 1.3 trillion per year (WEHAB Working Group 2002). In fact, about 40% of the world's economy depend on biological processes and products, in other words biodiversity (Crucible Group 2000; UNEP 2002).

Indonesia's economy has also largely been dependent on the productive value of biodiversity. During the 1970s and 1980s, forest products were important source of non-oil exports and revenue (Resosudarmo 2000). In 1998 seaweed export generated US$ 45 million (Suhartono 2000) and fish product exports generated US$ 2 billion in 2000 (Dirjen P3K-

(Doc. BirdLife-Indonesia)

Figure 2.9. Mangroves have high economic value for people and also as feeding and nursing ground for many species of fish and bird.

DKP 2001). Biodiversity-based industries are also important for domestic economy. For example the value of domestic sale of processed *jamu* (herbal medicine) was Rp. 200-400 billion in 1999, with an annual increase of 10% (Putterman 1999). Domestic sales of non-timber forest products such as terpentine, cayuput oil, copal and silk contributed to about Rp. 41 billion to the national economy (Departemen Kehutanan 2000).

The productive value of genetic resources (including human genes) will be increasingly important in the future, particularly in terms of creating new crop varieties, micro-organisms for industrial processes and gene therapy on livestock and humans. With advances in modern biotechnology and bioinformatics, the 21st century is often called the biotech century. The profitable business during this century is the life sciences industry, that is pharmaceutical, health, food, agriculture and cosmetics. All these industries rely on biodiversity as raw materials and biotechnology and bioknowledge, which will continue to develop in the future.

Life sciences industry will lead to increased commercialization of biodiversity. Thus the emphasis would be on the productive value of biodiversity, by sidelining all its other values. There are concerns that this imbalance will lead to degradation of biodiversity, particularly those considered devoid of economic/productive value.

The above description shows that biodiversity has local and global values. The perception and knowledge on the two values differ. Generally local biodiversity value is not well documented, and therefore is not well represented in the biodiversity policy debate and formulation at the global level (Vermeulen and Koziell 2002). The difference between local and global biodiversity value is given in Table 2.2.

HERITAGE FOR FUTURE GENERATIONS

The significance and value of biodiversity for human life and national development, as described above, is not just for this generation, but also for future generations. But from the range of benefits, very often only the productive value is emphasized, ignoring other values. The monolithic ways of production (only one mode or one type of utilization, for example timber), and monoculture cultivation system have reduced the entire set of values of biodiversity.

Such a monolithic way in considering the values of biodiversity has led to degradation of natural habitat, species extinction, erosion

Table 2.2. Differences between global and local value of biodiversity.

Global	Local
Non-direct and non-use values are the priorities	Direct use value is as important, if not more important, than non-use and indirect use values
Emphasis on conservation, with or without sustainable use	Emphasis on sustainable use
Usually no specific user groups	Specific user groups
Endemic and rare species given high value	Endemic species has same value as other species
Focus on genotype (genetic information)	Focus on phenotype (visible traits)
Wild and cultivated biodiversity are treated differently	Same treatment for wild and cultivated biodiversity

Source: Vermuelen and Koziell 2002.

of cultural diversity, and weakening of knowledge system at the local, national and global levels. In this process, only a few people benefit, but a large part of the community, whose livelihoods depend on biological resources, experience impoverishment.

Biodiversity as a development asset is in a critical condition, as will be discussed in Chapters 3 and 4. Unless there is a shift in the paradigm, production and utilization pattern, as well as mechanisms for sharing of benefits, it is difficult to predict if this asset will still available for future generations.

Depletion of assets will hamper the sustainability of development activities. Future generation will not have sufficient biological resources, for which they have right of, to meet their needs. Therefore, sustainable biodiversity management is required, not only in Indonesia, but also at the global level, to ensure the welfare of the present and future generations. The first step towards this is to identify the biological richness and detect the rate of degradation as well as factors causing its degradation. These will be discussed in Chapter 3.

(Doc. Bogor Botanic Garden)

Figure 2.10. National parks contain rich biodiversity that is crucial to support community welfare and ecological integrity.