HUMAN INVOLVEMENT AND BIODIVERSITY CONSERVATION IN INDONESIA

Keterlibatan Manusia dan Konservasi Sumberdaya Alam di Indonesia

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Abstrak

Sejarah kehidupan menunjukkan bahwa mikroba memprakarsai munculnya kehidupan, yang kemudian diikuti oleh tanaman berhijau daun, hewan dan manusia. Meskipun manusia sebenarnya muncul setelah bentuk-bentuk kehidupan lainnya, namun pada kenyataannya, manusia telah mengalami evolusi sebagai makluk yang paling sempurna. Karena evolusi seperti itu, manusia dapat mengembangkan peradaban sehingga mampu mengubah gaya hidupnya. Dalam hal ini, teori adaptasi dan integrasi menjadi penting dalam menjaga stabilitas hubungan antara organisme satu dengan lainnya dalam sebuah ekosistem. Dengan demikian, ekosistem dengan segala relung dan isinya adalah realitas yang dinamis dan terus menerus berubah. Dalam artikel ini akan diuraikan dan dijelaskan hubungan keterkaitan antara kebudayaan di Indonesia dalam konteks konservasi sumberdaya alam dalam studi ekologi manusia (*human ecology*).

Kata Kunci: Indonesia, konservasi, manusia, sumberdaya alam.

INTRODUCTION

The history of life shows that microbes initiated the emergence of life, which is then followed by green leaf plants, animals and humans. Although human actually appeared after the other life forms, but in reality, humans have evolved the most perfect organ and functions. Because of such evolution, human could develop his level of civilization that is capable of changing his lifestyle. In this regard, the theory of adaptation and integration has become important in maintaining the stability of the relationship between organisms with one another in a whole ecosystem. Thus, the ecosystem with all its niches and contents is a dynamic reality continuously occurring across time. This has caused the value of human life greatly influenced by his own perception toward: (1) life and his existence, (2) the meaning of work, attainments and his deeds, (3) time, (4) his relationship with the nature, and (5) his relationship with fellow human beings. These dynamic relationships with one another are interconnected by functions and processes are interdependent and mutual influence (Schutkowski, 2006).

Due to the immense variety of human behavior, which is mostly known as human culture, scientists are lately interested in investigating the immediate connection between subsistence and human culture has been an emphasis of research into human/ environment relations and ecological studies in anthropology from outset and not lost anything of relevance. This knowing emerging field of science is believed to be able to contribute to the advancement of science and technology. Long tradition in Western

intellectual thinking pioneered by Montesquieu or even since ancient Greek, has been trying to explain the variations of relationships between cultures with reference to the differences in environment, or more specifically, in their natural habitat characteristics. This basic understanding has inspired the view of anthropologists that gave birth to schools of "environmental determinism" and "environment possibilism". Both determine the cultural domain, *i.e.*, systematically examine the relationship between the natural environment and cultural variables in some areas by taking into account the "biogeographic" limitations.

In many ways, Walujo *et al.* (1993) emphasized that most human ecologists exaggerated the nature as a factor in shaping the patterns of human life. Naturally, it is only one of the many other factors such as economic, hereditary and psychological. Perhaps because of modernization and development strategy that gave priority to high economic growth rate have destroyed the local institutions and local culture as well as natural environment. Such interactions generate advancement that needs to be thoroughly in order to understand human, his environment and future. In line with understanding the human activities and his culture WRI, IUCN and UNEP (1992) asserted that the diversity of human culture and knowledge systems can also be considered as part of biodiversity. Cultural diversity is reflected by 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. It is acknowledged that Indonesia is the third highest cultural diversity in the world, after Papua New Guinea and India (Mittermeier *et al.*, 1997). So, the diverse of Indonesian local cultures are also associated with knowledge systems on biodiversity utilization and conservation, and often known as traditional wisdom. Finally, this paper outlines the importance of human involvement knowledge in maintaining the richness of biodiversity.

BIODIVERSITY AS THE CAPITAL FOR HUMAN DEVELOPMENT

Biological diversity or biodiversity, is the variability of life on earth from genes to species to the entire biosphere. Biodiversity provides immeasurable benefit to human societies through medicine, food, fiber, ecosystem services, and cultural values. Indonesia is well known as the place of various types of ecosystem and abundant biological species which are derived from the region's various climate and geographic elements and characteristics. Also the inhabitants of Indonesia (rich in ethnics and cultures) have inquired the wisdom of life to coexist harmoniously with nature, and this philosophy has been shared among them while developing many different kinds of culture since the ancient times. In relation to the wide range of natural habitats, richness of plant and animal species and high number of island endemism, Indonesia is recognized as major world center for biodiversity. Data from Ministry of Environment (1999) shown that communities in Indonesia consume no less than 100 food plant species (from tubers and grains). No been less than 100 bean species and nut species, 450 fruit species and 250 vegetables and mushroom species are used in their daily diet. One clear example on agro-ecosystem is imperative for agriculture, to increase production but particularly for food security. Therefore agrobiodiversity is the main building blocks to fulfill basic human needs. Various types of agroecosystem has developed in Indonesia, ranging from traditional ones such as shifting cultivation, to the monoculture systems such as cultivation of high yielding rice variety. In general traditional agro-ecosystems harbor many cultivated species, which are planted simultaneously at the same time or rotation (Qualset *et al.*, 1995).

Although, since the ancient time, Indonesian people have lived in the midst of its natural resource wealth, but the history also noted that most food crops and cash crops have come from other countries. Along with the development of civilization and tolerance of the community against invasion of foreign culture has slowly caused a lot of alien plant species that have been fused in the daily life of

various tribes of our nation. The entry of Hindu and Buddhist cultures made ancestral Indonesian people began to realize the aesthetic values of plants. They introduced the significant and meaning of lotus (*Nelumbium nuciferae*) and bodi (*Ficus religiosa*) as the sacred species. Later, the Islamic culture introduced pomegranate (*Punica granatum*), date palm (*Phoenix dactylifera*), salam koja (*Clausena* sp.) and then the Chinese brought shio (*Michelia figo*), radish (*Raphanus sativus*) and tea (*Camellia sinensis*). While the arrival of Europeans carried not less than 2000 species of plants and crops.

In terms of the world's center for plantation culture, Indonesia was categorized as one of the centers in South-east Asia (Vavilov, 1926), or the center for Indochina (Zeven and Zhukovsky, 1967), or the rings of southern islands (Li, 1970). Vavilov stated that it was the center for gingers, bananas, rice, sugar cane, nuts (*e.g., Canavalia gladiata, Mucuna pruriens, Psophocarpus tetragonolobus, Parkia speciosa* and *Pithecellobium jiringa*), bamboos, coconut and others. Li (1970) also agreed with Vavilov that the rings of southern islands are the center for fruits such as mangosteen (*Garcinia mangostana*), rambutan (*Nephelium lappaceum*), durian (*Durio zibethinus*) and lime (*Citrus aurantica*). Also Li (1970) added that, because of the islands are always green throughout the year and make the resources available for harvest from the wild, there has been no pressure for the local communities to culture vegetables and fruits. In relation with the local livelihood in the villages, the use and preservation of biological resources can be found in a variety of land use systems. Researches on the economics of botany in gardens, home yards, and fallow lands found that a number of primitive cultivars are widely utilized in the interior of Sumatra and Kalimantan. These are, for example durian (*Durio zibethinus*), rambutan (*Nephelium lappaceum*), duku (*Lansium domesticum*), mundu (*Garcinia dulcis*), sentul (*Sandoricum koetjapi*), rukam (*Flacourtia rukam*), pisang (*Musa x paradisiaca*), buni (*Antidesma bunius*), wild lianas (*Dioscorea alata, D. penthaphylla* and *D. hispida*), kecipir (*Psopocarpus tetragonolobus*), kacang panjang (*Vigna sinensis*) and paria (*Momordica charantia*), jahe (*Zingiber officinale*), kunyit (*Curcuma domestica*) and serai (*Cymbopogon nardus*).

Some economic plant species with global importance, but an important aspect of the agroecosystem is medicinal plant, both cultivated and wild status. Data on the number of Indonesia medicinal plants is varied. Zuhud *et al.* (2001) reported there are 1845 plant species which potentially contain medicinal properties in Indonesia. It should be noted that the value of Indonesia's traditional medicine trade was only Rp 124 billion in 1992 and it is increased to Rp 1 trillion in 1999/2000 (Sumaryono, 2002). Wild species from the forest, known with the aphrodisiac properties such as *Eurycoma longifolia*, *Ficus deltoidea* and yellow root *Arcangelisia flava* are also used in traditional medicine by local communities.

In line with the use of plants, the direct utilization of wild fauna from their wild population has become troublesome to their conservation. In turn, this has threatened the population of valuable species that are now categorized as critical. Trade in wild animals is a serious threat to many species in Indonesia. Data from PROFAUNA give as the overview of trading of wild animal in Indonesia that over 95% of animals sold in markets are taken directly from the wild and not from captive breeding stocks. More than 20% of animals sold at market die in transportation. Despite this, many endangered and protected species are traded freely, with the rarer species commanding higher prices. The other fact that approximately 115,000 parrots are trapped each year in the wild in Papua and Maluku, including the highly endangered palm Cockatoo (*Probosciger atterimus*), Black headed Lory (*Lorius lory*) and Yellow Crested Cockatoo (*Cacatua galerita*), and at least 2500 Javanese ebony langurs (*Trachypithecus auratus*) each year are hunted for illegal trade and for meat.

CONSERVATION AND MANAGEMENT OF BIODIVERSITY IN INDONESIA

In term of conservation, biodiversity is a statement for the occurrences of a variety of forms,

performances, numbers and characteristics that can be seen on a number of creature association levels, namely ecosystem level, species level, and genetic level. Species diversity, the most observable level has become the center of attention. However, the diversity of ecosystem that is formed by the variety of species, which in turn are formed by the diversity of genes, has an invaluable value for the very existence of human being (Sastrapradja *et al.*, 1989). When this sense is viewed in the management perspective, it will have to take account of measures to plan and implement various approaches to:

1. Protect and utilize sustainably the biological resources that can secure equitable benefit sharing.
2. Improve man power capacity, financial capability, infrastructure availability and institutional stability in pursuing the goals described above.
3. Enforce the necessary institutional procedures that encourage cooperation and actions from the private sector and communities.

Therefore, the term "biodiversity management" is used to maintain the biological diversity and its related materials, socio-cultural condition, spiritual realm and ecosystem values. This covers the whole activities from species and genetic preservation, habitat and landscape management through ecosystem rehabilitation and biological resource sustainable harvesting system to gaining and sharing equitable benefits. Thus, the success of integrating biodiversity management purposes is: the protection, sustainable use and benefit sharing, and the overall depends on two aspects. First, policy makers and managers need an adequate understanding on social context, politics, economics and culture where the desired objectives of biodiversity management take place. Second, they need to select tools and methods that are able to integrate the two interests above.

The awareness that a harmonious environment is a desire of all human being on earth, environmental problems have become the political agenda that is very important in any development pace. The slogan of "Only One Earth" proclaimed 30 years ago, precisely June 5, 1972 in Stockholm, Sweden, proved that the world community has begun to think about sustainable development (Dahl, 2001). It is impossible to separate economic development from environmental issues. Later on, poverty is found to be one of the causes of environmental damage, and it lead the world environmental experts on the "Earth Summit 1992" to prioritize the poverty as the main problem to tackle. This strategic meeting was aimed to save the earth (environment) for human's interest, but political struggles seem to keep touching on such a noble goal. Developed countries are worried about the damage of the lungs of the world (the magical term for tropical forests). For decades they supported the campaigns for a boycott of tropical timber products, or prohibit people of the world to buy the tropical timber products. On the other hand, developed countries are suspected as the major contributor to global destruction though the development of industries encouraging the global warming. In order to bridge such conflicts, Japanese initiated a meeting that produced a global consensus, known as the Kyoto agreement.

As we may be aware of, there have been increasing concerns on the biodiversity conservation among us, not only the scientific communities but also the government and even common peoples since the 1992 summit meeting in Rio. Biodiversity conservation is closely linked with the human lives on the earth. The human beings have been keeping their lives so far on the-well-balanced nature since their appearance to this planet. In other words, the failure in the maintenance of the balanced system in the environment might eventually bring the extermination of the human being. But the truth is the current situation the diversity of life is under siege: species are being lost at a rate far beyond the natural extinction rate. The responsibility of Indonesian people is manifested in a number of policies for saving the environment in the forms of national acts, governmental regulations and other related regulations. It is also acknowledged that the Indonesian development should aim to achieve: (1) poverty risk reduction, (2) civil society development, (3) clean water service, (4) improvement of

agriculture and fishery productivity, and (5) increase of education service through 12 year compulsory education (BAPPENAS, 2003). Many efforts have been undertaken to deal with damage to biodiversity. For instance, the government support in the areas of policy and institution, conservation, development of information system, and socio-economy. One clear example on depletion in production forest area, particularly in Kalimantan, Sumatra and Sulawesi together with changes in land cover indicates a significant reduction in forest cover. Recalculation of production forest by Ministry of Forestry based on Landsat Images in 1997 to 1999 showed that out of the 46.7 million hectares production forest, actual primary forest was only 41%; logged over areas is good to moderate condition was about 2%; and the remaining 30% was degraded forest areas (BAPPENAS, 2003).

The implementation of policies for natural resource management, especially those that have been declared in danger of extinction, is still inadequate. The responsibility for monitoring the population, distribution, genetic markers of flora and fauna threatened with extinction is still lacking. The conversion of forests and swamps has lead to the scarcity of clean water. Meanwhile, the lack of public awareness and knowledge about the ecosystems and their benefits at the regional and national levels has also accelerated the environmental degradation. Therefore, if not careful, the implementation of Regional Autonomy Law where the region has greater power in exploiting its natural resources will exacerbate this situation (Widianarko, 2009).

Despite the wealth of biodiversity, Indonesia seems to be very much dependent on the imported commodities and goods, from cereals and fresh fruits, seeds and germs to agricultural inputs and all of which dominate the Indonesian economics. Yet, indigenous materials and goods are not utilized, and they are even marginalized by the imported products. This is reflected in the development of agribusiness sectors, rehabilitation and environmental monitoring systems. In the agribusiness sector, the weakness is that the government has been unable to promote the native natural resources that should have high competitive values. Rehabilitation system often takes shortcuts through the introduction of plant species that may be ecologically not feasible, while many types of fast growing plant species are left untapped. In terms of environmental monitoring, it is still general in nature and not specific.

In term of applied technology is suggested to improvement the added values of biodiversity should be environmentally friendly, in order to avoid severe impacts on both the biodiversity itself and human well being, which mostly pose yet other new environmental problems. The utilization of micro-organisms should be promoted in advancing agribusiness sector, such as in production improvement, quality enhancement, added-value improvement, as well as biocatalyst products as alternative to synthetic chemical products. The advancement of endophytic microorganisms (or those living in vascular plants) will prove significant for bioprospecting measures and those for soil fertility improvement in areas needing for rehabilitation.

CLOSING REMARKS

Indonesia is an archipelago country that has a wide range of size, from narrow to wide, and shape, from the flat, hilly and mountainous high, where the diversity of flora, fauna and microbes reside. Not less than 47 ecosystem types are found in Indonesia, whether natural or man-made. Each ecosystem has its own characteristics with different species richness. BAPPENAS (1991) and UNEP (1991) state that Indonesia has 10% of the world's flowering plants, 12% of the world's mammals, 16% of the world's herpetofauna, 17% the worlds of bird diversity, 25% of the world's fish, and 15% of the world's insects. In terms of fauna, Mc.Neely *et al.* (1990) noted that Indonesia ranks at a special position in the world. Of 515 large mammals, 36% species are endemic; of 33 primates, 18% are endemic; of 78 parrots, 40% are endemic; and of 121 butterfly species, 44% are endemic.

Uncontrolled population growth, severe poverty, low education levels and lack of knowledge

and appreciation of the importance of flora and fauna for their survival, will make Indonesia experiencing great difficulty to secure the implementation of sustainable development. The consequences are the decline of environmental quality, including various types of ecosystem degradation, the depletion of natural resources, and even the extinction of various species of flora, fauna and other living creatures. The recent official data from Ministry of Forestry shows that degraded forest area in Indonesia amount to 43 million hectares, with an average deforestation rate of 1.6-2.4 million hectares per year. Deforestation is 0.20% per year in Sumatra, 0.42% in Java, 0.94% in Kalimantan, 1% in Sulawesi and 0.70% in Papua. This forest depletion and degradation threatens the integrity of forest ecosystem and the wildlife living in it.

Indonesia is not alone in facing the problems associated with biodiversity conservation. Exploitation of natural resources, including forest resources for development increased in line with the development of technology. Conversion of land functions always invites a lot of concerns.

The tradition of scholarly thoughts or scientific exploration should continue to be driven to influence policy makers at every level. That is why the preservation and utilization of biodiversity should be based on the support and the role science and technology.

It should be recognized by all levels of society that science and technology shall be developed on the basis of human cultural development of the present and future. Without basing on science and technology, the measures of biodiversity conservation and utilization tend to be determined by a short consideration to meet urgent needs. With science and technology, the added values of biodiversity will be enhanced and effective and efficient conservation could be developed.

Sustainable use of biodiversity is the use of biological diversity that maintains future availability, when the needs of future generations can be secured (Sastrapradja, 2006). All parties, whether the governmental or non-government institutions and whether directly or indirectly manage the biodiversity must fulfill their duties and functions maximally and seek to optimize its use in each activity.

REFERENCES

BAPPENAS. 2003. *Strategi dan Rencana Aksi Keanekaragamn Hayati Indonesia 2003-2020.* Dokumen Nasional Pemerintah Republk Indonesia, Jakarta.

Dahl, A.L. 2001. From Stockholm via Rio to Johannesburg: Thirty Years of International Action on Environment and Sustainable Development. Papers presented at the 5th Annual Conference of the International Environment Forum. 19-21 October 2001, Hluboka nad Vltavou, Czech Republic. Downloaded from *http://www.bcca.org /ief/ ddahl01c.htm*

Historical development of the notion of sustainability: *http://www.global-ethic-now.de/gen-eng/0d_ weltethos-und-wirtschaft/0d-04-verantwortung/0d-04-102-nachhaltigkeit-2.php*

Kantor Menteri Negara Lingkungan Hidup. 1999. *Kawasan Karst di Indonesia: Potensi dan Pengelolaan Lingkungannya.* Kementerian Negara Lingkungan Hidup, Jakarta.

Li, H.L. 1970. The Origin of cultivated plants in Southeast Asia. *Economic Botany* (24): 3-19.

McNeely, J.A., K.R. Miller, W.V. Reid, R.A. Mittermeier and T.B. Werner. 1990. *Conserving the Worlds Biological Diversity*. IUCN, World Resources Institute, Conservation International, WWF-US and the World Bank, Washington DC.

Mittermeier, R., P. Gill and C. Goettsch-Mittermeier. 1997. *Megadiversity: Earth's Biologically Wealthiest Nations*. Cemex, Prado Norte.

PROFAUNA: *http://www.profauna.org/content/en/ indonesian_animal_facts.html*

Qualset, C.O., P.E. McGuire and M.L. Warbuton. 1995. Agrobiodiversity: key to agricultural productivity. *California Agriculture* 49(6): 45-49.

Sastrapradja, D.S., S. Adisoemarto, K. Kartawinata, S. Sastrapradja, dan M.A. Rifai. 1989. *Keanekaragaman Hayati untuk Kelangsungan*

Hidup Bangsa. Pusat Penelitian Bioteknologi-LIPI, Bogor.

Sastrapradja, S. 2006. Mengelola Sumber Daya Tumbuhan di Indonesia: Mampukah Kita? *dalam* S. Soemodihardjo dan S. Sastrapradja (Penyunting). *Enam Dasawarsa Ilmu dan Ilmuwan di Indonesia*. Naturindo, Jakarta.

Schutkowski, H. 2006. *Human Ecology: Biocultural Adaptations in Human Communities. Ecological Study 182*. Springer, Berlin Heidelberg New York.

Sumaryono, W. 2002. Penelitian obat tradisional Indonesia dan strategi peningkatannya. *Proceeding of National Seminar on Medicinal Plants XXI*. Surabaya, 27-28 Maret 2002.

Vavilov, N.I. 1926. Studies on the Origin of Cultivated Plants. *Bulletin of Applied Botany* 16(2): 139–248.

Walujo, E.B., S.A. Adhikerana, R. Abdulhadi dan A. Budiman. 1993. *Konservasi Siberut: Pendekatan Status Ekosistem*. Lokakarya Pengelolaan Ekosistem Pulau: Kasus Pulau Siberut. Fakultas Kehutanan UGM, LKPKL, PERSAKI Cabang Yogyakarta. Yogyakarta 14 Desember 1993.

Widianarko, B. 2009. *Democratization, Decentralization and Environmental Conservation in Indonesia*. Plenary Presentation at the 9th Asia-Pacific NGO Environmental Conference (APNEC9) and the 30th Anniversary of Japan Environmental Conference (JEC), Kyoto, November 20-21, 2009.

WRI, IUCN and UNEP. 1992. *Global Biodiversity Strategy*. WRI, Washington.

Zeven, A.C. and P.M. Zhukovsky. 1967. *Dictionary of the Cultivated Plants and Their Center of Diversity*. Center for Agricultural Publishing and Documentation, Wageningen.

Zuhud, E.M., Aziz, M. Gbulamahdi, N. Andarwulan dan I.K. Darusman. 2001. *Dukungan Teknologi Pengembangan Obat Asli Indonesia dari Segi Budidaya, Pelestarian dan Pasca Panen*. Makalah dipresentasikan pada Workshop "Pengembangan Agribisnis Berbasis Biofarmaka" Departemen Pertanian. Jakarta, 13-15 November 2001. Unpublished.