

STRATEGY FOR SUSTAINABLE FORESTRY MANAGEMENT

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Introduction

Environmental merits of forest products related directly with the forest from which forest products are harvested. In natural forests, where diversity are much higher than plantation forests, environmental merits of non-wood forest products are much higher. Non-wood forest products is part of forest ecosystem where every components of the forest relate with others, living and non-living as well. The role of non-wood forest products in forest ecosystem, among others, are nutrients supplier for other living organism in the forests, regeneration of the forest itself including non-wood forest product, and maintenance of forest habitat quality.

Forest products are harvested from the forest and from the forest grown on forestland. It may be part of the trees such as logs, bark, gum, leaves, fruits, oils, and flowers. It may be part of the forest but not of the tree such as wildlife, grass. Some are intangible such as recreation services.

Both plantation and natural forests can produce both wood and non-wood forest products. Some plantation forests are developed specifically to produce non-wood forest products, such as pine and rubber plantation forests to produce resin, cinnamon forest to produce barks, aleuritus forest to produce nutmeg, schleichera plantation as host of bugs producing lacquer, and palm forest to produce sugar. Another specific forest areas were designed for recreations and hunting. The non-wood forest products is no longer *minor forest products* but the major produce of forestry activities. It become difficult to distinguish between forestry and agriculture in such cases. Most plantation and natural forests are grown for wood production.

In many countries, timber can only be harvested from production forests, while non-wood forest products can be harvested from all forests, whether production, protection forest or naturereserves. This way NWFP has a broader base to produce than timber. Some non-wood forest products are prices higher than wood by weight, but some other has no price and become public goods such as recreational aspects of forests.

The increasing demand of forest products and the disappearance of forests ecosystem has become an important decision by many countries to protect the existing forest ecosystem, especially tropical forests which has high biological diversity.

Meanwhile, new products have been developing almost daily. Some of them are based on wood and non-wood forest products such as medicined and other chemicals, genetic materials, and new plants and animals to improve production of agricultural products. Availability of some of these new products depended on the existence of natural forest habitat and its exploitation poses another threat to the sustainability of the forest.

Sustainability of forest products will depend on the sustainability of forests. On the other hand, sustainability of forest will depend of the way forest products is harvested and stability of land allocated to forestry against conservation to other uses. The continuous depletion of world forests, especially in developing countries, will eventually reduce the forest products availability.

Although the term **sustainability** has different meanings to different people, it has been used in the context of human survival on earth. In relation to production of forestland resources it means the ability of each generation to maintain and pass on a stock of forest resources no less productive, protective and utilizable than the stock inherited; such forestlands resources will include, inter alia, natural forest and other sensitive ecosystem.

Sustainability of forest production, including non-wood forest products, require management. Since non-wood forest products in many countries has been considered as minor forest products or by products, most production of non-wood forest products has no management of the resources what so ever. It become an effort of hunter and gatherer type activities, and its sustainability become questionable. Ecolabelling of forest management is important tool in reaching the objective of sustainable forestry.

To improve sustainability of forest products more knowledge need to be improves, especially related to ecology of their habitat (the forest) and ecology of forest products that is the role of plant and animal matter in the intricate and interrelated ecological sistem. Understanding of the role of forest products in the forest ecosystem is essential to understand the impacts of exploitation of forest products on the environment. In many developing countries, indigenous community has a unique interaction with the forest and forest products. Their culture and social system have a certain linkage with the specific uses of forest products in their community.

Criteria and means of forest products management may be developed quickly, through an understanding of sustainable relation between forest and traditional community living in the forests.

Environmental Roles of Forest Products and Impacts of Its Exploitation on the Environment

In the forest ecosystems, biotic and abiotic factors linked together forming an intricate relationships, whether physical or chemical, supporting and enriching each other forming a stable and sustained system. Biotic component such as plants, insects, small and large mammals, bird, and so on are linked together in the energy, nutrients, waters, materials cycles. And many other cycles linked biotic factors one another, and biotic with abiotic factors such as water regimes and soils. Sustainability of forest will relate with sustainability of its biotic and abiotic component.

Energy cycles

Forest continue to be one of the most important efficient type of terrestrial vegetation for harvesting solar energy, especially in inhospitable environments. They contribute to world net primary production disproportionately to their area and make up the majority of the world living plant biomass. Forest productivity is closely related to leaf area, optimum productivity in humid environments being attained at intermediate leaf areas. Hence leaf and other biomass may be considered as non-wood forest products and as important component of energy cycles in the forest ecosystem.

By the beginning of 1980s, it become apparent that biomass is about to make a come back as significant contributor to national energy budgets in developed countries. While developing countries has never escape from this dependency, and with a real possibility of a world wood famine in the next few decades, wood appear to be about to regain some of its historic importance as major factor in human cultural evolution.

Biochemical cycles

Because of biochemical nature of ecological energetic, organic production can occur in ecosystem only if the appropriate chemical elements are available at appropriate concentrations, in the appropriate relative quantities, and in the appropriate total amounts. The dynamic of nutrients chemical in terrestrial ecosystems can be identifies with one or more of three cycles. The geochemical cycles, which involves inputs into and loses of nutrients out of particular ecosystem; the biogeochemical cycle, which involves the uptake by, storage in, and loss of nutrients from plants within an ecosystem, including movement of nutrients through grazing and detritus trophic webs; and the biochemical cycle, which involves an internal redistribution of nutrients within organisms that permits the organisms to satisfy some of its nutritional

requirements for new growth from within its own nutrient capital. For each cycle, there is a variety of pathways which vary in relative importance among different species and different environments. Dead leaves and litter may be also an important component of biogeochemical cycles in the forest ecosystem.

Mechanisms have evolved to conserve and store nutrients within ecosystem. Plants establishing on uncolonized mineral substrate will gradually remove available nutrients from mineral layers and transfer them to living plants biomass and a surface accumulation of decomposing organic matter. Atmospheric inputs are also accumulated within the ecosystem. Trees are particularly well adapted to accumulate nutrients from the geochemical cycle into a tight biogeochemical cycle, and after a period of time a forest may be able to live in virtual nutritional independence of the underlying mineral layers. This important phenomenon permits reasonably productive forest growth on some exceedingly nutrient-poor mineral substrates and its major reason why forests are such a successful form of vegetation.

In managing ecosystems, the biogeochemical mechanisms responsible for production must be identified and conserved. Over the past 2 thousands years, and especially in the past 50 years, human has been dislocating nutrient cycles on an ever increasing scale. In many areas the accumulated nutrient reserves that have taken centuries, or even millennia, to build up have been dissipated. Natural processes are fully capable of rebuilding these reserves in time, but generally too slowly for human purposes. The energy required to rebuild these concentrations of nutrients rapidly once they are dissipated would be enormous. Continued life as we know it will require that we conserve available nutrients by maintaining biogeochemical cycles intact, and nutrient management will become as important in non-wood forest products forestry as it is in agriculture.

Shoots and roots system are very active nutrients absorbers for the plants. Shoots actively absorb CO_2 , O_2 , H_2O , NH_4^+ , SO_4^{2-} , and roots absorb P, Si, B, Na, K, Mg, Ca, Fe, Cu, Mn and Mo (Isermann, 1980). Many shoots and roots are important non-wood forest products harvested and used by mankind. In traditional communities these materials are used for foods, medicines, and animal feeds. Harvesting shoots, roots, and fruits are actually harvesting the nutrients of the trees and the forests.

Genetic and evolutionary aspects

Ecosystems are biogeochemical systems that have evolved to trap, concentrate, and accumulate energy. The biological components of this system all utilize the same basic mechanism for energy accumulation and transfer, but evolution has produced a remarkable number of variations on the basic theme of life. Thousands of millions of years of natural selection induced by unvarying

physical conditions, competition of energy and other resources, and exploitation by other organisms has diversified life into a myriad of different types of organisms. Each type has become specialized in competing, surviving, and reproducing itself in particular types of physical biotic environment, but is also capable of adaptation to changing conditions.

This ability arises from the natural variation in morphology, physiology and behavior that is present in all natural populations of organisms. As condition change, different genotypes within the population become the best adapted and are favored by natural selection. In this way species evolve. Harvesting wild species from the forests may have some impacts on evolutionary pathways of the forests.

Biodiversity

Biological diversity, or biodiversity, encompasses the variety and abundance of plants, animals, and microorganism as well as the ecosystems and ecological processes to which they belong. Biodiversity is usually considered at three levels, i.e. genetic, species, and ecosystem diversity. Genetic diversity is the total genetic information contained in the genes of individual organism. Species diversity refers to the variety of living organisms. Ecosystem diversity related to the enormous diversity of habitats and biotic communities, as well as to the variety of ecological processes within ecosystems (Macheely et al., 1990).

Remarkably little is known about species diversity in quantitative terms. Estimates of the total number of species on earth range from 2 million to 100 million, of which less than 1.5 million have been named. And only a small fraction of these have been considered for their economic value (Reid, 1992). Reid and Miller (1989) among others, have estimated that 5 to 10 percent of these species are presently being lost each decade, a rate not seen since dinosaurs died out 65 million years ago. Population growth and climatic changes could accelerate such extinctions even beyond these figures.

Some argue that biodiversity is valuable because it is the raw materials of further evolution, or alternatively, it is the evolution of biodiversity which gives a value to that what is essentially a random process. Biodiversity is seen as an important source of miracle drugs: one of the most frequently cited examples is that of rosy periwinkle, a tropical forest plant which yields an extract used for treating leukemia (Lee, 1993).

In Indonesia, for example, although covers only 1.3 percent of the Earth's surface yet it harbors 10 percent of all flowering plant, 12 percent of the world's mammal, 16 percent of the world's reptiles and amphibians, 17 percent of all birds and more than a quarter of all marine and freshwater fishes. This rich biodiversity can be attributed to the fact that Indonesia spans two major biogeographical realms, Indomalaya and Australasia. Its terrestrial areas

extending from sea level to snow capped mountain. Its marine ecosystem extends from deep trenches of Sulu Seas to coastal plain and mudflats. Biological diversity is linked closely to variability of physical environments. The more varied the physical environment the more diversity in biological resources. Biological diversity is more than just the sum of species numbers, it encompasses the variety, variability and uniqueness of genes, species and ecosystems where they occur. With its wide range of natural habitats, rich plant and animal resources and high number of island endemic, Indonesia has been recognized as a major world center for biological diversity.

Bioresources is very important in Indonesia economic development. It is very important to sustain community needs on food, medicines and other amenities. In the past 25 years many efforts have been executed to conserve bioresources in its natural habitats as well as in captivity. The objective of biodiversity in situ conservation of Indonesia is setting aside 10% of representative habitats as nature reserves. Currently, there are 125.5 thousands square kilometers (6.6% of terrestrial habitat) already under nature reserves. Including new planned nature reserved areas 189.9 thousands sq.km (9.8% of terrestrial habitats) will become nature reserves within the next 5 years.

There are many challenges faced in bioresources conservation and sustainable utilization. Population increases and improvement of community welfare require more lands to be cultivated, to be settled for housing, infrastructure has to be developed, and more forest has to be cleared.

Need for Environmentally Sound Management of Forest Products

One of the most basic, and rarely questioned, assumptions underlying much of the current interest in extractive resources is that commercial and sustainable exploitation of wood and non wood forest products has little or no ecological impact on forest ecosystem. As non wood forest product is harvested from the tree in the forests, there are many opinions saying that non wood forest products harvest does not have any impact on the environment as long as the trees are not cut. This assumption seems to have originated from two simple observations: (1) local people have been harvesting fruits, nuts and latex from forests for thousand years, and (2) a forest exploited for non wood forest products, unlike a logged-over forest, maintains appearance of being undisturbed. Of course, both are incorrect and potentially very dangerous. Two qualifiers however, should be added to these observations. In the first place, the intensity of subsistence harvesting as traditionally practiced by forest peoples is usually quite a bit lower than that of commercial extraction. Secondly, the gradual extinction of a plant species over time is rarely a visible phenomenon. Collecting fruits and tapping latex are clearly less damaging than felling trees or building roads, but this certainly does not imply that the former activities are

entirely benign from an ecological perspective. Every non wood forest products resource has a site specific, maximum sustainability level of harvest. If this harvest level is exceeded, the plant populations being exploited, as well as the community of animals that depend on them, will all be adversely effected.

Uncontrolled hunting and grazing in the forests and rangelands may result in depletion of animal population and soil fertility. Even recreation activities may have detrimental effects on the forest ecosystems reducing the production of non wood forest products in the longrun. Forests in South America and Africa is disappearing quickly due to grazing activities (WRI-UNEP-UNDP, 1994).

The enormous variety of products produced by the forest have been grouped into two basic categories based on the origin of non wood forest products actually exploited: (1) type of plant tissue or compound actually harvested (reproductive propagules, plant exudates, vegetative structures), and (2) material or living things harvested from the forest ecosystem (woods, wildlife, recreations, and minerals). All taxa are primary forest species, but in some regions certain plants may also be cultivated. In South East Asia, Burkhill (1935) listed over 2,400 species plant resources grouped into 102 different categories. About 1,283 species, or one out of six species from a total estimated flora of over 8,000 species, are non timber resources found only in lowland primary forests (Jacobs, 1982, 1988).

Given the complex inter-relationships and ecological process in a forest ecosystem, it should be obvious that almost any type of resource extraction conducted in the forests will have an ecological impact. Unfortunately, the exact nature of this impact can be extremely difficult to predict. The delicate ecological balance maintained in the forest is easily disrupted by human intervention. For example, indiscriminate harvesting of insects of the forests will have negative impacts on the population of insect-eating birds and bats, and in turn it will have impacts on flowering and fruiting of trees.

Managing forests for wood and non wood forest product harvest require a good combination of scheme. Single output, whether woods or non woods, will produce less compared to balance output of both, in terms of financial and ecological benefit. Although financially may be appealing, mass production of a single commodity will always have negative impacts on biodiversity and ecological processes. It will direct the development toward plantation forests establishment which has more negative impacts on the environment. For example, high resin production from pine plantation using sulfuric acid will cause tigers and panthers to create hogs overpopulation destroying many seedlings of the trees.

Most of the world's biodiversity is located in the tropics, and some 40 to 90 percent of the world's species live in tropical forests (Raven, 1988; Myers, 1980; Reid and Miller, 1989).

Benefits of good management and costs of bad management of non wood forestry have been acknowledged by many countries in many terms such as species loss, loss of biodiversity, and damage to ecosystem. In Peruvian Amazon, for example, female trees of the dioecious aquaje palm (*Mauritia flexuosa*) are frequently felled by commercial fruit collectors. After very few of this harvest cuts, the forest is left with a preponderance of barren male palm trees; with time, the species disappears completely from the forest (Kahn, 1988; Vasquez and Gentry, 1989). Forests surrounding Iquitos, Peru, have no female palm trees left, and fruit collectors are now forced to travel upstream up to three days to find unharvested palm stands.

The effect of human activity on biodiversity depletion has been profound. Some estimates suggest the loss of as much as 90% of the genetic diversity of the biosphere that existed in human history (Vida, 1978).

There has been some accidental loss of diversity due to over exploitation by those possessing more sophisticated technology but less ethology than other hunter-gatherers. However the main loss of diversity has been due to deliberate forest ecosystem destruction (Ehrlich, 1985). There is growing concern over possible effects of pollution. Global warming could cause habitat destruction on a massive scale (Cohn, 1989). Experts suggest that following each previous extinction episode, it took 10 million years or more for the number of species to return to the level of diversity existing prior to the event in the question (WRI, 1994).

Fruits and seeds left in the forest after harvesting will almost certainly be subjected to unusually high levels of consumption by animals of the forest. Commercial collectors in effect, are competitors with fruit-eating ground animals, and their activities reduce the total supply of wood resources available to ground foraging animals. Decreased fruit densities could mean increased foraging and corresponding increase in the overall percentage of fruits and seeds destroyed. As a consequence of decreasing fruits and seeds supply on the ground, the animal will migrate trying to find new foraging ground (Leighton and Leighton, 1983). This response could have a serious impact on seedling establishment for those species whose seeds require scarification by animals to germinate (Ng, 1983). Without dispersal agents, a relatively high proportion of the fruits and seeds produced by these species will fall directly under the crown of parent tree where there are more easily harvested by collectors, more easily encountered by potential seed predators, and more susceptible to the effects of intraspecific competition (Augsburger, 1983; Clark and Clark, 1984; Howe et al. 1985; Schupp, 1988).

In addition to its impact on seedling establishment, population structure and the foraging behavior of local animals population, harvesting commercial quantities of fruits, nuts, and oilseeds can also effect the genetic composition of tree population being exploited (Peters, 1990). In this case, the important

question is not so much how many fruits or seeds are harvested, but rather which ones. Tropical tree populations usually exhibit a high degree of genetic variability (Hamrick and Loveless, 1986; Bawa and Krugman, 1991). For example, a single population of forest fruit trees will invariably contain several individuals that produce fruits of intermediate size and quality, and a few individuals that produce fruits that, from a commercial standpoint, are far inferior. If a population is subjected to intensive fruit collection, the inferior trees will undoubtedly be the ones whose fruits and seeds are left in the forest to regenerate. Overtime, the selective removal of only the best fruit genotypes will result in a population dominated by trees of marginal economic value. Indiscriminant commercial exploitation of other non wood forest products such as leaf, fiber, exudates could impair the functioning of forest ecosystem in supporting life of animals, plants and local human community.

Economic and Environmental Implications and Linkages

The world economy is an integral part of the earth's ecosystem, which created the conditions that make life possible. Before the year of 1750, the ecosystem of the world was generally in a good shape. The industrial revolution which was getting underway around 1750 brought the first real change in the interaction between human activities and ecosystem. Control over nature has paradoxically resulted in the actual destabilization of the ecosystem in many areas. Worldwide, the ecosystem function to support life is threatened by mankind to improve life. Biological diversity is threatened by human activity. In the past erosion of biological diversity are caused by expansion of agriculture in developed world. Many still believe that biological diversity in the ecosystem is threatened mainly by deforestation in many poor developing countries. But in reality, it is threatened mostly by pollution in the modern world causing global climatic changes and irreversible damage to the ecosystem.

The biodiversity degradation was acknowledged in the RIO Summit Meeting, but the action to mitigate the cause is not forthcoming as expected. The economic recession in many developed countries has been blamed for the inaction on ecosystem and biological diversity conservation measures. Actually, from an economic point of view the ecosystem performed three functions: production factor in production processes, supplier of consumer services and source of technological progress. Ecosystem as production factor can be seen in the important role played by air, water, land and forest within many production processes especially in agriculture and fisheries. Another role of ecosystem as production factor is the fact that it can absorb pollution, which is also referred to as waste assimilation. The ecosystem provides consumer services in relation to health-related situations, recreation possibilities, and the ecosystem as a source of aesthetic as well as religious emotions. The role played by the ecosystem in

technological progress is perhaps the least well known. However, biological diversity, in particular provides both agricultural and pharmaceutical research with a vast gene bank of untapped wealth in the form of potential fruits, crops and medicines.

In performing these economic functions the ecosystem contributes toward the human quest for prosperity, unbounded by countries. Brazilian nuts (*Bertholletia excelsa*) has been exported mostly to European and Northern American countries. And sustainable harvest of the nut depends not only on Brazilian but also on world market behavior, underpricing of the products and consumer behavior in developed economy. While local indigenous community suffer due to fore degeneration.

Foresters, especially public land foresters, now actively manage forestlands for the production and consumption of many products beside timber. Some of these are sold and others are not. Some, such as forage or recreation, are consumed on the forest and others, such as water or berries, are transported off the forest for consumption. Today, the production of non timber goods and services is an issue because the demands for these goods and services have increased to compete strongly with timber for the use of lands and management of the resources. But timbers sell for dollars, while most of these other goods bring goodwill and often ample, but unquantified satisfaction.

Forest output can be classified by how they are priced and where they are consumed (Davis and Johnson, 1987). Timber, minerals and some recreation are market priced, while water, wildlife, and much dispersed recreation including hunting and fishing are provided free. Priced below market value and often lower than their supply cost are fuelwood, forage and much developed recreation. The exact placement of an output within this category obviously depends on the particular forest and owner in question.

The outputs associated with endangered species and elusive ideas such as visual quality and camera hunting are particularly difficult valuation problems. Opportunity costs can be estimated and informative, but this still begs the question of what the spotted owl or view is worth. USFS in 1981 - 1982 have revealed a total timber opportunity cost for spotted owls to be somewhere in the neighborhood of 3.6 billion dollars or about US\$ 500,000 per breeding pair, depending on the national forest.

The most politically appealing and economically attractive argument in favor of maintaining biodiversity is that it provides enormous direct economic benefits in the form of food, medicines, and industrial raw materials, and has the potential for generating many more (Ehrlich and Wilson, 1991; McNeely, 1988). Thus, forests produce timber, as well as an extraordinary range of plant and animals products that do not, for the most part, pass through formal economic markets (de Beer and McDermot, 1989). The genetic richness of wild plants is indispensable for developing new agricultural and medicinal varieties. In

addition, many countries earn substantial foreign exchanges from natural ecosystems with touristic values. These direct economic values of biodiversity though relevant scientific and economic data are lacking in all but a handful of examples (Braatz, 1992).

There are two possible response to the ecological impact caused by harvesting forest resources. One is to completely ignore that it is occurring, the other is to implement management activities that will minimize the intensity of this impact. The former course of action, or lack thereof, inevitably leads to forest degradation and resources depletion; the later may ultimately produce a sustainable form of landuses and thus improving economic values of the resources.

Given proper management and controlled harvesting of wood and non wood forest products, the tropical forest can be manipulated by resource manager to actually improve production forest products.

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The value of forests includes direct contributions in terms of goods and services and indirect contributions in the form of soil conservation, carbon sink capacity, recreation and amenities, watershed stability and protection of biodiversity including habitat, species and genetic diversity. Increasing complementarity in the direct and indirect uses supports optimization of forest values on a sustained basis. Non-wood forest products in general have higher attributes of complementarity. The use of non-wood forest products is as old as human existence. In subsistence and rural economies, the role and contributions of non-wood forest products were crucial, because of their richness of variety, as sources of food, fodder, fibre, fertilizers, herbal potions, organic construction

materials, and cosmetic and cultural products. They supported village level artisanal and craft activity (FAO, 1994).

In the High Andes of Peru, most shrubs are used as firewood (19 species) and medicines (15 species). Other uses are as indicators (8 species), making tools (6 species), fodder (4 species) and flavoring, protections, detergent, lyujta, phytosanitary and explosives (Torres, et al. 1993). In Botswana, 80% of meat consumed by bushman and farmers are wild meat. The diet of the rural people of Guatemala include armadillo, iguana, capybara and many other wildlife. Similar situation are present in many African Countries such as Ghana and other Sub-Saharan Africas, and in South Americas (Butyinski and von Richter, 1974; Asibey, 1974, 1977; Bressani, 1976).

A new generation of modern industries are experimenting in producing bio-plastic and bio-polyester, which is environmentally friendly, from oilseeds. This new product will revolutionalize the production and uses of plastics and polyester in the world. Another non-wood forest product with high potential economic value is recreation and other ecotourism. Nature tourism or ecotourism and ecoventure have long been recognized as a potentially significant source of revenues for conservation. Such tourism can generate support for conservation in several ways: (a) by providing financial return, it can justify setting aside large areas of forestlands for conservation; (b) park entry fees can generate substantial funds to support park and reserves management and more; (c) tourist expenditures in and around the parks (on logging, transportation, goods, guides, and souvenirs) can be important source of income for communities near protected areas and forests, compensating them for the loss of access to traditional resources and giving them incentive to conserve the protected areas. All of the benefit accrue from ecotourism has proven to be very significant sources of income for many countries such as Kenya, Nepal, Thailand, and Costa Rica (Braatz, 1992).

Economic benefits of ecotourism in some of Thailand's protected areas is far exceeded government's direct management expenditures. Tourism spending at Khao Yai National Park amounted to between US\$ 3.8 to US\$ 7.7 million per year during 1982-1988. But this apparent economic benefits from non wood forest products have not yet persuaded the government to established adequate management to ensure protection and sustainability (Dixon and Sherman, 1990).

Another ecoventure are harvesting recreational values of forestlands. Recreation in the forest is generally free to general public. Some kind of fee may be imposed on game hunting, fishing and camping.

Many local communities in developing countries harvesting non-wood forest product from their surrounding forest as traditional activities. Increasing population, and subsequently demand, of the community has resulted in over exploitation destroying the forest as habitat of non-wood forest product. To

mitigate this problem, Forest Agency develops bufferzone around forest area to protect the forests and provided non-wood forest product needed by the local community, such as grass and leaf for domestic animal, medicinal herbs, foods, cosmetics and fuelwood.

In such condition, the objective of bufferzone management is protecting the forests and maintaining subsistency of local community on non-wood forest products. Local community's increasing demand of non-wood forest products cannot be solved by such management, and in the end the bufferzone areas will be destroyed followed by the main forest. If properly managed, non-wood forest product can be harvested sustainably from the main forestlands for local community and save the forest from destruction.

In general, traditional forest product is harvested in small size operations and using appropriate technology, best suited for local community activities. Harvesting and primary processing of non-wood forest products could generate income and employment for local populations, hence the sustainability of the forest carrying the products could be guaranteed by local community participation. Local community knowledge, roles and benefits are important assets in developing forest management for sustainable non-wood forest resource production. Many indigenous community has substantial knowledge on the sites and season where and when a certain non-wood forest product can be harvested.

Many kinds of mushrooms that are important in trade can only grow in very particular kinds of natural habitat under a narrow range of ecological conditions and micro climate. That often means they cannot be systematically cultivated despite abundant demand in distant and local market places. For example, black mushrooms or morels which are widely gathered in wooded areas of north central Pakistan and traded internationally to large quantity.

Trade in lac and lacquerworks depends on an insect products, the gummy secretion exuded by the lac beetle (*Technadria lacca*) onto certain forest tree species in many part of Asia. The lac is collected, purified, colored and sold in stick-form to handicraft where it is used to give glamorous finish to wooden toys or other small items of carpentry. The lac production and trade are usually a small scale operations with involvement of many woman artisans. In the town of Channapata in Karmata State, India, where lacquerwork is predominant local industry employing more than 35 percent of the total workforce, annual production in 1991 was worth some US\$ 300,000,- and 70 percent of total production was exported (FAO, 1993).

Development, including development of wood and non wood forest products, has been considered important to improve welfare of the people. Development is believed to produce all amenity for many people, and never linked with disutility of many resources. In fact, development produce both useful products and waste or disutility. Benefit to the communities of useful

products are emphasized, while cost and risk to the communities of wastes or disutilities are deemphasized.

Brundtland's Commission defined sustainable development as a process in which the exploitation of resources, the direction of investments, the orientation of technological development, and the institutional changes are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs and does not imply in any way encroachment upon national sovereignty. Achievement of sustainable development involves cooperation within and across national boundaries. It implies incorporation of environmental concerns and considerations into development planning and policies and does not represent a new form of conditionality in financing the development (WCED, 1987).

Inherent in the concept of sustainability is continuity perpetuating the flow of benefits from the resource stock and maintaining its productive potential. However, a definition based on maintaining or increasing the flow over time is difficult to justify because the rate of removal/utilization of the resources is influenced by the size of resource stock. Some example in relation with natural forest : natural forest with plentiful of overmature trees will provide large first harvest, followed by a lower, sustainable harvest.

Sustainability requires certain conditions. Some of those are : (1) only sustainable yield is extracted from renewable resources and their longterm productivity is maintained, (2) profit (rents) from depletion of non renewable resources are invested in human and man-made capitals and technology, and (3) capacity of the environment to receive and assimilate waste is not exceeded or damaged. Sustainability is impossible without management. Hence, management is another requirement to implement sustainability.

Ecologically, sustainability is continuous functioning of ecological life support system. Since ecosystem has a certain tolerance limit, then measure of sustainability will vary from ecotype to ecotype according to certain range of measure. In nature conservation, for example, 10% or more of undamaged ecotype is sufficient to protect biodiversity survival. And 30% of well forested areas in a watershed is sufficient to maintain ecological functioning of watershed ecological system. If this criteria is used, many areas in the world are already unsustainable. Western Europe and Northern America should be our first concern. Economically, sustainability is continuous functioning of resources in economic growth. Depletion of a resource resulted in increasing of other resources productivity. How much economic growth is needed by any community is depended on economic and social value system of the community. Economic measures will have to work within this value system. In the 30's a complete depletion of natural forest in Western Europe or North-Eastern USA

have been instrumental in developing high productivity of other resources (human resources, technology, man-made resources) and was acceptable. Now, we heard that a degradation of tropical forest is not acceptable, even though those degradation of the forest has improve productivity of other resources (cattle ranches, estate crops, industries, real estate, human resources and technology, etc.). Depletion of resources in third world that enable development of other resources in developed countries have not guarantee continuous functioning of the ecosystem supporting worldwide development.

Sustainability of forest products will certainly depend on the sustainability of the forest, the issue of the interaction among natural system, man-made production system (technology) and social system. Hence, it is become a more complex issues than just optimal harvest or biodiversity conservation.

At the field level, however, we need to define the issue of sustainability in more practical terms. In the context of extractive reserves, the following issues are important : understanding optimal harvest rate and resource stock, effects of property rights on resources, and effects of increasing demand.

Optimal level of harvest and the corresponding stock of resources depend on environmental and economic objectives of the extractors. Many trees can produce a steady flow of exudates daily, and optimal production will depend on the health of tree and the forest ecosystem. In dry season production of exudates is lower than in rainy season. Some methods to increase the production of exudates ahve been tried, for example by applying a certin acid on open wound of the stem in pine to obtain more resin.

Unlike wood forest products, non-wood forest products may be harvested from production forest, protection forest and nature reserve as well. From production forests, all materials non-wood forest products may be harvested. From protection forests, some form of materials non-wood forest products such as flower, fruits and animals may be harvested with cautions. While in nature reserves some other non-wood forest products, such as recreational values and some medicinal herbs may be harvested as cultivars. Calculation of total production of non-wood forest product will have to include all type of forestland uses.

Natural forests can produce all kind of forest products, usually in small quantity each. Especially non wood forest product, it seldom make the economic size and hence has never been able to be valued appropriately in market.

In most countries, objective of forest management are related to uses catagory. In general, production forests are supposed to produce timber, protection forests and nature reserves are producing environmental services such as protection of hydrological system and preserving genetic resources and biodiversity.

So far, production of environmental services are the responsibility of national government. But to maintain the service requires investments, and

somebody have to pay for the service. And the pricing of the service become crucial.

Many plants and animals contained valuable genes. These genetic resources differ from biological resources because their value lies in the information contained in their genes, not in their physical form. The considerable uncertainty over the potential value of genetic resources has been confounded by the emergence of new biotechnologies, and controversy surrounds genetic resource ownership and access. At the root of the current debates is the knowledge that genetic resources found in many developing countries are assets that, if managed properly, could make significant contributions to local and national economies. Example of potential values of genetic resources for developing countries has been shown by Costa Rica, where INBIO has signed a contract with pharmaceutical industries in the United States to collect plant species and carry out primary screening for potential pharmaceutical uses. As part of this contract, Costa Rica will receive a 5 percent share of the revenues (a potentially enormous sum) of any commercial product that might eventually result.

Increasing awareness of the world's environmental problems in the consuming countries has created a lot of pressure in most industries to seek for more acceptable production and distribution processes. The main focus was originally given to the major polluting industries but all the natural resource-based activities particularly forestry and forest industries, are subject to increasing attention. In the consuming countries, timber and non-wood forest product certification or ecolabelling is considered necessary to achieve sustainability of forest management and to assure consumers that they are not contributing to deforestation when buying tropical forest produce. A survey by MORI and WWF on public attitudes toward tropical forest rain forest revealed that: 33% would accept higher prices if it would guarantee that raw materials come from countries protecting the forests, 50% find that labelling of wood products very or fairly important, 15% would avoid buying/buy less tropical hardwoods for health, environment, moral and other reasons, 35% would be prepared to pay on the average 13% extra for sustainably produced timber, but main factors in buying wood products are quality (66%), price (50%) and style of product (48%). (MORI and WWF, 1991; Simula, 1993).

Increasing demands on wood and non-wood forest products is potentially dangerous to sustainability of natural forests. As mentioned earlier, indiscriminate and increasing extraction of non-wood forest products have endangered the existing forests. And to avoid bad practices and enhance good sustainable management of non-wood and wood forest resources a certain trade regulation is necessary. Possibility of ecolabelling of traded forest products has been studied with the main objective to protect the forests from extinction or degeneration caused by extraction of the products from the forest.

In early stage of development, ecolabelling is implemented to traded goods that will environmentally save. So, biodegradable bottle, electric bulb, and the like are ecolabelled. To ecolabel a certain forest product, which is biodegradable, to protect the forests is considered as an irrelevant issues and only a trade gimmick to protect the interest of forest industries in developed countries. Issue of ecolabelling has become a political football (Kay, 1993; MORI and WWF, 1991; Barbier, 1993; ITTO, 1992).

Currently, ecolabelling is directed to management practice of the forest. Forest products from well managed forests is automatically ecolabelled. Several criteria of forest ecolabelling is developed by many institution such as ITTO and Forest Stewardship Council (ITTO, 1992, FSC, no date). Considering the potential negative impacts of non-wood forest product harvesting on the forest ecosystem and environment, a regulatory measure through market by ecolabelling is probably needed.

Strategy in Sustainable Forest Management

Basically, unsustainability is caused by unlimited human needs on limited resources productivities. Population of the world is increasing, especially in developing countries, while resource base is limited and degenerated rapidly.

Recognition of the issue of resources depletion and degradation has been widespread among policy makers, in developed countries as well as in developing countries. However, improvement of available instruments to mitigate the problems is still in a very early stages. Practical instruments for policy implementation, such as government regulation, market mechanism, and social value system has not developed to mitigate resources degradation or resource depletion. That is the only reason why those instrumen has not solved the problem.

Policy and market failures as causes of unsustainability is an interesting discussion topics. But we already acknowledge the weakness of each of the instrument. Deeper than the issues of policy and market instruments is institutions. After all, policy and market instrument are the product of an institution and will work within. It is then very clear that basic cause of unsustainability is institutional. But in many developing countries, proverty is also another concentrate its efforts on short term solution of basic needs, and has very little consideration of future environment.

In many developing countries, chief resources have been used as instrument to increase investment especially in remote areas. Subsidy is a very common tools to increase investment. It creates the impression of abundance and reduced the need in managing the resources for sustainable development. Basic reason in this case is improving competitive advantage at the cost of the environment.

To implement sustainable development principles into development practices require knowledge on the ecosystem, economic and social behavior. Knowledge on ecosystem behavior and ecosystem categorization are important to understand the potential use and damage to the function of the ecosystem which is the basic ingredient in sustainable development. Interaction among ecology, economic and social knowledge led to harmonious development is a process of development.

In its practical implementation, sustainable development has been interpreted as a dynamic interaction among production system, natural system and social system. Emphasizing production system is an easy and practical ways of planning the economic development in its initial stage. Natural and social system is assumed to be able to adjust to changing production system. Most development of production system is usually linked to improvement of social welfare, while its link to natural system is natural resources supply to production system.

Management of sustainable development is increasingly in demand all over the world. Basic strategies in improving regional sustainable development should consisted of (1) development of public awareness and community organization in environmental issues, (2) improving capability in spatial planning with environmental objectives, (3) improving human resources development in environmental planning and management, (4) improving knowledge and information on the regional ecosystems, (5) institutional development to integrate production system, natural system and social system into development practices, and (6) development of certain procedure in national and regional account system taking into account environmental costs.

There are many researches have to be done to improve knowledge and understanding on ecosystem and social system behavior, material balance in production systems, and behavior of production-nature-social systems dynamic interaction. Sustainable development in a global sense is implemented at local and regional level, and research should be conducted to measure impacts and roles of regional actions in sustainable development on global economic sum environment.

Forest products are part of forest ecosystem and each of them have specific role to support the functioning of the ecosystem. Hence, every consideration relates to improve sustainable management of the forest is applicable to non-wood forest resources management. Productivity and biodiversity conservation are the presupposition of sustainable management techniques of the tropical rain forest, while ecological and economical aspects related to the parameters are suggested to be obtained as tools for management purposes (Fantini, et al. 1992).

It is understood that the viability of managemet system under sustained yield regime should foresee the multiple use of forests for woods and non-woods

forest production. Hence the sustainable management of forest should be based upon two fundamentals aspects i.e. the cyclic character of the exploitation and the exploitation of each species individually. These conditions may be operated at the same time, or the success of the enterprise will not be reached.

As always, the available stock evaluation of non-wood forest resources through inventory is the starting point to elaborate a proposal to adequate the exploitation of the forest. Forestlands are categorized in ecological types, natural and man-made, site quality or fertility, and its spatial distribution related to accessibility.

Projection of growth of non-wood forest products may be developed by a certain correlation with biomass production through time. Certainly the correlation will differ from ecotype to ecotype, natural and man-made forest, etc. Understanding of ecological cycles is also important to balance non-wood forest product harvests to maintained sustainability and harmony in forest compositions and growth.

In many occasion, increaisng and sustainable supply of non-wood forest resources have to be met by more intensive management of the resources through domestication. It is understood that domestication of species would weakened the species. To improve the domesticated resources a nature reserve carrying the wild varieties of the species should be established as genetic resource for genetic improvement and maintenance of the domesticated species.

Traditional knowledge on non-wood forest product in production, uses and maintenance should be understood, used and improved and incorporated to the management scheme of the forests. Local community participation in forest management is necessary to maintain the forests intact. Small-scale activities with appropriate technologies uses in the operation is highly suitable to enhance community participation in non-wood forests resources management.

The World Conservation Strategy outlines the ways in which conservation objectives should be integrated into broader land-use plans in order to obtain more benefit and sustained yields from the world's natural renewable resources (IUCN, 1980; MacKinnon, 1986). Since non wood forest product is a renewable natural resource, then both Conservation Strategy and Sustained Yield of NWFP are linked by environmental consideration related to sustainable forest resources. Healty forest with high biodiversity is the objective of Conservation Strategy, similarly the objective of non wood forest resources management to obtain sustainable high production depended on the management of healthy forests.

At the regional and local level, implementation of sustainable development principles is developed following a sequential procedure of development, which are : step 1. allocation of space considering the capability of the ecosystem to function sustainably in producing some development products such as non-wood forest products; step 2. improving efficiency of production

system, including increase used of recycling technology in production system; step 3. employing waste treatment and disutility management of the forest resources, i.e. rehabilitation of degraded ecosystem through application of appropriate technology friendly to the environment. In another words, site selection is the first step in sustainable management and environmental consideration is become the guiding priciples in this site selection. The second step is selection of technology that increase efficiency and reduce uses of resources inputs. Consideration of environment as well as social suitability become the most important considerance of this step. And, the last step is related to disutility management to improve the resouces based capacity to withstand damaged cause by development activities such as harvest.

High diversity of natural system linked directly with the high diversity in social system in Indonesia. It is an important resources providing immense rich number of options in development. And sustainable development is defined as development of production system with high suitability with natural and social system.

It is very clear, that the first step in sustainable development is preserving the existence of natural system. Many countries set aside some of their forestlands for protection and nature reserves. Indonesia has already setting aside 10% (19.5 million hectares) of its terrestrial areas for nature conservation areas. At present, there are 16.2 million hectares of conservation areas has been gazetted. (Anon., 1991b).

Broader than forested areas protection there is another areas under the protection zone such as conservation areas (nature reserves, wildlife sanctuary, protection forests) and protected areas (such as aquifer recharge areas, corral reefs, mangroves, deep-peat forests, swamps, natural forests, coastal zones, natural rivers and lakes, and archeological sites). Conservation areas are closed to any development activities except for activities to support the management of the conservation areas. While protected areas are open to specific development activities that will not cause damage to the function of the ecosystem.

Second step of spatial planning is subdivision of development zone into several categories such as permanent agricultural lands, urban settlements and industrial zone. Irrigated agricultural and fertile agricultural lands are not to be converted to settlement or industrial uses.

One way to reduce negative impacts on the environment in minimized consumption through improving production technology. Efficiency in production system technology is usually linked with minimizing costs. In many instances to reduce costs many environmental cost is externalized. The result is degradation of the natural ecosystem and large burden to social system. It improves profit to the firm but increases lost to the community and the ecosystem. One way to eliminate such situation is to minimized wasteful uses of natural resources such as materials, energy, space and biodiversity.

Introduction of natural resources rent on forest, lands and waters is a good means to reduce wasteful uses of the natural resources. Rent on natural resources, such as non-wood forest resources, should be imposed consistently. At present, non-wood forest resources are undervalued. Rent on land water is still very low and not yet representing the value of the resources in term of environmental services. Poverty alleviation issues is one consideration on the issue of natural resources rent of water and lands.

Uses of recycling technology on the production system linked with minimum wastes discharged to the environment and with minimum use of natural resources taken directly from natural system. Instrument to enhance the use of recycling technology in production system is pollution control regulation and measures.

The first three steps, if rigorously applied, will reduce waste and disutility substantially. Waste treatment plants and waste management is still needed to process the waste before it can be discharged to the environments. Good environment will nurse healthy forests and in return will produce better and more NWFPs.

Almost all of governments put production system as its first priority in development to produce amenities (materials and services) and improving government income. In most developing countries, compared to central government regional government is ill equipped to manage sustainable development. It has very little knowledge on the environmental impacts of development. Added to all the inability to understand sustainable development, there is no method available procedure to account for environmental and natural resources degradation into GNP and GDP.

Basic strategies in improving regional sustainable development should consisted of (1) development of public awareness and community organization in environmental issues, (2) improving capability in spatial planning with environmental objectives, (3) improving human resources development in environmental planning and management, (4) improving knowledge and information on the regional ecosystem, (5) institutional development to integrate production system, natural system and social system into development practicesm and (6) development of a certain pcedure in national and regional account system taking into account environmental costs.

There ara many researches have to be done to improve knowledge and understanding on ecosystem and social system behavior, material balance in production systems, and behavior of production-nature-social systems dynamic interaction. Sustainable development in a global sense is implemented at local and regional level, and research should be conducted to measure impacts and roles of regional actions in sustainable development on global economic cum environment.

Conclusion

In conclusion, I would like to proposed to define sustainable forestry management, including non-wood forest products management, in relation to dynamic and progress of development and holistic ecosystem approach. Institutional system should be mentioned as boundary of the policy and market instruments to be developed to mitigate unsustainability. Consideration should also be given to non-market economy, in traditional rural community.

There should be a common procedure of measuring local, regional, national and world accounts to develop an acceptable principles and practices in distributing benefit and cost of environmentally sound forestry and forest products development. Some of the basic problems of forest products sustainable development is that every region and countries considered environmental costs as externalities, hence a system of internalization of environmental in national and global economy is important step toward sustainable forestry management and development. This include proper pricing of forest products in the market.

It should be understood that sustainable management of forest resources to improve the quality of the forest in terms of ecological, economical and social aspects, will eventually improve potential production of forest resources. Commercial exploitation of forest resources has potential negative impacts on the sustainability of the forest, social and economic disturbance to local community used to live within the forest ecosystem.

It seems, that small-scale operation and appropriate technology area well suited in managing wood as well as non-wood forest resources (harvesting, processing, and trade) through local community participation. Although the marketing of forest products may be global.

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