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Sharing the Benefits and Costs of Forest Conservation*

Mingsarn Kaosa-ard**

Economic development is often cited as a major cause of environmental degradation. Growth typically generates a high demand for the extraction of natural resources, thus placing heavy pressure on the environment. Consequently, higher and accelerated production leads to both greater, and faster and faster, natural resources depletion and also to the greatly increased discharge of industrial pollutants into streams, rivers, canals, the sea, and into the very air we breathe.[1]

Economists are quick to answer the above allegation by pointing out that economic development per se does not necessarily lead to environmental degradation, provided of course that appropriate resource protection policies are in place and enforced. Resource policies which allow, de facto if not de jure, open access to natural resources, for example, will inevitably bring about what Garrett Hardin describes as "the tragedy of the commons." When the ownership of resources is unclear, their extraction is likely to be above safe levels.

In developing countries, forests too often become open access resources. Even where legislation protecting forest resources does exist, the enormous size of the forests makes it impossible to enforce protection effectively. Thus, forests in the Asia-Pacific region are declining at runaway rates. In Thailand, in the three decades since the 1960s, forest cover has been depleted by about one-half, from 53.3 percent in 1961 to 26.6 percent in 1991. The country's average annual rate of forest loss from 1976-1982—at 3.85 percent—was one of the highest among tropical countries worldwide.

Throughout this study, the term "forest resources" is defined in the broadest sense and refers to plant and animal ecosystems, and soil and water. The conservation of forest resources entails different benefits and costs to different stakeholders. This paper aims to demonstrate the need for sharing the benefits and costs of forest conservation equitably throughout the country, as well as among the various interest groups. It outlines possible conflicts, and cooperation, between national and international interest groups and lists the conditions that must be met before densely-populated countries in the Asia-Pacific region can make international forest conservation measures effective.

BENEFITS FROM FOREST RESOURCES

The benefits that come from forests are both obvious and numerous. Traditionally, forests provide food, medicines, fibers, etc., and hence are sources of income and employment. Even in countries where logging is prohibited, income from non-timber forest products is substantial and could be made moreso. The landscape, greenery, plants and animals found therein often render each forest both a tourist attraction and a source of national pride.

Forests are also an important fount of biodiversity. Forests' value as a habitat for a vast number of plant and animal species is important not only for direct use in agriculture, or as raw materials in pharmaceutical production, but for vital genetic information embodied in these resources. Such information is the base for devising products to increase immunity, to develop synthetic chemicals and compounds, and much more. These types of benefits have indeed become the very foundation of biotechnological progress.

The world's knowledge of the genetic information contained in forests is currently extremely low as the potential benefits from most plants and animals have not been fully explored. Less than 10 percent of the world's estimated 250,000 species of flowering plants have been scientifically investigated. At the current

rate of deforestation of 17 million hectares—nearly the size of Cambodia—per year (Reid, 1993-1994), the world is rapidly losing its options for a better future.

Another important value of forests springs from their ecological functions—preventing floods and soil erosion and storing carbon dioxide. Only recently have economists begun to calculate the value of these ecological functions. Most of them turn out to be quite significant. The control of flooding, watershed protection to conserve downstream fisheries, and the prevention of soil erosion, for instance, were estimated to provide benefits worth US$ 81 per hectare in Cameroon alone (Ruitenbeek, 1989, cited by Panayotou, 1995). The global estimate would, of course, be much, much higher, astronomically so.

Finally, apart from the benefits mentioned above, forests provide an additional range of non-consumptive or non-use values. Viewing photographs, paintings and film of beautiful forest landscapes and wild animals etc., provides great satisfaction to the many who may never visit such wondrous places. Some people enjoy simply knowing that some species—pandas, elephants and so on—continue to roam in the wild. A growing number of people worldwide now insist that plants and animals have as much right to exist as do humans. These values, called 'existence values,' can now be evaluated by a technique called "contingent valuation."[2]

Among the values of forest resources outlined above, two—the value of forests as reservoirs of biodiversity and carbon dioxide—have important policy implications for the international community and deserve detailed discussion.[3]

The Value of Biodiversity

Both directly and indirectly, wild plants, animals and other forest resources are important sources of scientific information. Although many medicines are made from wild plants and animals, the active ingredients need not be directly extracted. Information about the ingredients, or natural chemicals, can be used to develop synthetic substitutes that are equally good. Aspirin, for example, is a modified synthetic material emulating the salicylic acid found in willow trees. The natural chemical itself is too strong to be consumed directly (Sedjo, 1992). Tropical forests are more abundant sources of biodiversity by far than those of more temperate zones.

The value of the genetic resources found in tropical forests has been common knowledge for centuries, as evidenced by the transport of plants across whole continents. Drugs from the East were introduced into Western Europe as far back as the time of the Crusades (*The Lancet,* l994). The World Health Organization (WHO) presently estimates that about 80 percent of the population in the developing countries, some 4 billion people, still rely on traditional nature-based medicines. Estimates of their monetary worth are readily available in advanced market economies. Some 25 percent of the prescriptive drugs in the United States require plant extracts for their active ingredients. Sales of these drugs were estimated at US$ 15.5 billion in l990 (Principe, unpublished manuscript cited in Reid et al., 1993).

In agriculture, sales of biotechnology products can fetch from US$ 10 billion to 100 billion annually. These proceeds substantially outweigh the current related research and development expenditures of multinational corporations of around US$ 1 billion per year, and make biodiversity prospecting a worthy investment enterprise for both the public and private sectors. It is not only U.S. companies that are active in identifying potential commercial benefits from biodiversity in the world's remote regions. Japan's Ministry of Trade and Industry, in cooperation with 24 Japanese corporations, has also set up a major biodiversity prospecting program at the Marine Biotechnology Institute in Micronesia to investigate anti-biofouling agents, oil eating bacteria, and carbon fixing phyto-plankton (Reid, 1993-1994).

The value of plants and animals in the tropics has been known to plant hunters for centuries. But what explains the current heightened interests in both the developed and the developing world? Here are a few answers. First, the Western world's interest in tapping pharmaceutical leads and novel nature-based forest products greatly increased with the discovery of the efficacy of plant-based anti-cancer drugs. Nature products have also offered therapeutic relief for some chronic ailments where conventional medicine failed. Moreover, as the tropical forests are rapidly disappearing, scientists and companies are racing against time

to save as much as they can from the forests, before it is too late.

Second, the rising demand among the high income groups for natural health products and cosmetics has also contributed to the growing market potential of nature-based products. As the NICs (newly-industrialized countries) and China become increasingly prosperous, such nature products as ginseng are likely to have constantly expanding markets. Last, but certainly not least, important technological breakthroughs—such as the automated receptor-based screening process, which has increased the speed of testing by more than one hundred-fold—has greatly reduced the costs of screening large numbers of chemicals. Technological progress in genetics engineering has also enhanced the potential commercial value of biodiversity prospecting.

As the natural endowments of biodiversity are more abundant in the tropical forests of the developing countries, these countries stand to gain the most from the increased value of their forests and forest resources. But would the gain to developing countries be neutralized by synthesized chemicals? Existing evidence suggests that fewer than a dozen of the active ingredients in 119 drugs from plants have been synthesized (Farnsworth, 1990 cited in Reid et al., 1993). Yet the developing countries' gains from supplying raw materials to developed countries are likely to be less than the returns on the final products. Barton estimates that developing countries could probably extract no more than US$ 100 million annually (cited in Reid et al., 1993) for such materials, not much when compared to profits on the final products.

Why is this so? First, there is no international copyright or patent protection for the 'discovery' of plants. Thus, unlike the discovery of drugs, there is no artificial rent in this branch of activities. Second, developing countries may compete among themselves to offer their forest resources to foreigners, thereby driving down their own returns from discovery, especially when their genetic sources are not unique. Third, the chance of discovery of a novel chemical from plants is low. From 10,000 to 35,000 tests must be run before a significant lead is identified. The new screening techniques reduce the costs but do not increase the probability of discovering a marketable product. Finally, most developing countries do not have systematic knowledge of their own biodiversity, despite the often impressive traditional knowledge of indigenous groups. Nor do these nations have adequate numbers of trained people to carry out the necessary prospecting and classifying. In Thailand, for example, there are probably fewer than half a dozen plant taxonomists.

Forest as a Carbon Source and Sink

In recent decades, scientists have repeatedly warned that human-induced emissions of greenhouse gases (GHGs)—carbon dioxide, methane, nitrous oxide, chloro-fluorocarbons (CFC) etc.—will gradually adversely affect the Earth's climate. Industrial and household emissions of GHGs account for about 85 percent of the total output. The remaining emissions are a result of land use changes, chiefly from deforestation. Global warming is expected to produce many disastrous consequences—a rise in sea levels and changing patterns of precipitation, evaporation, and crop yields, among others. In 1992, a Framework Convention on Climate Change was signed by 154 countries to set up international supervision for the world's global common—the climate.

Forests are both sources and sinks of carbon, the most significant of the GHGs. As plants grow, the net carbon assimilation, or absorption, is positive. As the plants decay or are burned, they release carbon. To minimize the greenhouse effects through forest management, deforestation should be discouraged while afforestation and reforestation programs should be vigorously encouraged.

An understanding of the value of forest resources is essential for identifying just who are the beneficiaries of forest resources conservation. Benefits from forest conservation need not necessarily accrue to forest residents and those living near the forests. The benefits from biodiversity conservation and from carbon sequestration are, in fact, global. Forest protection also preserves a wider range of options for future generations.

THE COST OF FOREST RESOURCE CONSERVATION

Unlike the benefits from global and intertemporal forests, the cost of forest conservation is immediate and borne by local communities and the nation owning the forests. Preliminary expenses include the cost of planning and implementing any conservation program. Costs are generally covered by the national budget, a major burden for developing countries. In Thailand, the budget for forest conservation in l995 totaled 8,670 million baht (around US$ 347 million), or just 1.2 percent of the total national budget of 715,000 million baht (US$ 28,600 million). This proportion is not an accurate indicator of the true burden, as government investments in infrastructure and other development projects often take precedence over nature conservation.

The desire to set forested areas aside for protection is not always supported by the people living in villages surrounding the areas to be protected. In general, willingness to urge the government to invest in nature conservation is greater among the more educated and urban citizens. They themselves are not adversely affected and can appreciate the broader range of direct and indirect benefits the forests will eventually provide the nation as a whole. People living in villages usually see it otherwise. They use the forests as a daily source of food and income. When "protection" comes in, they often suffer a decrease in welfare. Similarly and for the same reasons, the establishment of national parks also costs them money. In many cases, the cost to local communities far exceeds the budgetary costs of protection. According to a TDRI study, the cost of protecting Khao Yai National Park, an area of 160,000 hectares, amounts to US$ 32 million per year, while the net present value of income lost by families in 200 villages around the Park was estimated at US$ 66-132 million (Kaosa-ard et al., 1995). At the same time, extra income from ecotourism came to only one-tenth of what villagers could have earned from exploiting natural resources in the forest.

Depriving local communities of their forests and forest resources through legislation, without effective enforcement, generally produces even more disastrous results. Illegal cutting and poaching become rampant. Seedlings planted by the forest service are often uprooted and become free fodder for local cattle. Forest services in many developing countries have begun to realize, rather belatedly, that they are fighting a losing battle.

In developing countries, forest conservation based on conventional measures, such as the establishment of protected areas, tends to negatively affect income distribution, unless the expansion of the non-agricultural sector is rapid enough to provide the agricultural work force with alternative employment and income. In Thailand, enforcement of the National Park Law, under which the taking of even a pebble or a piece of dry leaf is illegal, often encounters fierce resistance from local villagers. The eviction of villagers from land earmarked as a protected area generally creates serious political upheavals. In the case of Khao Yai, the establishment of the national park has not created serious political conflicts because the villagers were given reasonable exit options. A land boom allowed villagers to sell part of their land, while finding new occupations. Because the area is close to booming urban and industrial centers, village youth were able to find work in the cities. In other national parks, conflicts between park managers and villagers have often been violent and politically dangerous.

Attempts are being made to devise a second-best solution for forest resources conservation where local communities are allowed to harvest forest products in a sustainable manner. In return, they have to look after the community forests. At the same time, the provision of property rights could encourage farmers to invest in their land and settle permanently.

CAUSES OF DEFORESTATION

The description of the benefits and costs associated with forest conservation suggests that the cause of deforestation is not simply a result of population pressure and poverty. A study in three villages near forests in Northern Thailand suggests that the wealthy in fact extract forest resources at a higher rate than do the poor (Kanchanaphan and Kaosa-ard, 1995). Policies and institutions that fail to give the right incentives to the right interest groups are central to the many problems of deforestation in developing countries. Policies that neglect the provision of land rights or discourage permanent settlements, or which subsidize agricultural production and encourage the over-expansion of agricultural land, or which under price concessions or subsidize energy and water consumption—all inevitably lead to over-exploitation and hence degradation of forests. Given these highly damaging and inappropriate resource policies, increased demand for forest

resources, coupled with the lack of effective enforcement of forest laws, tends to encourage communities surrounding the forests to convert public assets to private assets, in other words to appropriate the land for themselves.

To make matters worse, by neglecting the proper valuation of benefits from nature, conventional economic thinking tends to rank forest conservation projects well behind development projects, whose benefits are tangible and relatively easily calculated. Not surprisingly, investments in forest conservation are usually below optimal levels. In addition, even the public sector opportunity costs of protecting the forests from other economic uses are also quite high as land becomes increasingly scarce. In Thailand, degraded forests are often converted to landfill for garbage disposal or for other public uses, such as the establishment of new cities.

SHARING THE GAINS WITH TRANSNATIONAL CORPORATIONS

There is an obvious and immense need for developing countries to conserve their forests. The benefits therefrom, however, are neither strictly local nor national. This suggests that a portion of forest conservation could, and should at least partially, be financed internationally. The increase in the value of biodiversity for pharmaceuticals, cosmetics and other nature-based products, with support from transnational corporations, could provide new avenues for developing countries to extract income from bioprospecting. Although this return is not expected to be very large, the non-monetary gains from actively participating in biodiversity prospecting, especially in human resource development, could be quite significant.

With varying degrees of success, developing countries are now experiencing benefit-sharing with transnational corporations. The best known case is the INBio/Merck arrangement (Box 1), in which the transnational corporation shares gains with government agencies. A second example is an agreement between a transnational and local communities (Box 2).

Not all transnational and transcultural deals are successful. The Riche Monde initiative to finance bioprospecting in Thailand, for example, failed before it could even take off. A joint effort of the Foundation of Ethnobiology—registered in England in 1988—and the Biology Department of the Faculty of Science, Chiang Mai University, the project aimed to study traditional medicines from plants and herbs used by the Saka Karen tribes in five remote villages in northern Thailand. The project planned to operate in two phases. The first phase was to involve library research and interviews with Karen informants who would be paid 100 baht (US$ 4) per day. Young Karens would then be trained to note the herbal and traditional medicines used by their elders. The second phase would begin only if the first phase yielded significant results. Riche Monde (Thailand), a well known distributor of imported beverages, mainly whiskies and brandies, agreed to finance up to 4.2 million baht (US$ 168,000) per year for three years. Riche Monde had earlier provided 13.5 million baht (US$ 540,000) for several projects on nature conservation, for example, the supply of communications equipment for park authorities in one national park, and a forest restoration project in another.

Upon completion of the project, the university was to receive all equipment, including a computer, but excluding the vehicle used (*Matichon Weekly*, July 18-24, l995). A set of all samples of plants, together with a computerized data set, was to be given to the university herbarium. A set of dry samples was to be sent to both the Royal Forest Department in Bangkok and the Pharmacology Department at Chiang Mai University.

Doubts about the project began when several newspapers reported the lack of an explicit agreement about the sharing of the benefits that might accrue as a result of the study. According to one newspaper (*Manager*, June 30, 1995), which published a facsimile memo from the project, Riche Monde had drawn up a contract for the Karen communities which included the following clause: "The signature on this contract indicates that you will allow us to work with your people, in your village, and on your land, and to receive the right to study your understanding of the environment, including both general knowledge and the knowledge of the specialists in your culture."

Local non-governmental agencies (NGOs) protested the contract, citing previous local and international examples of indigenous herbal medicines being patented by foreign firms and then sold commercially as medicine. Local communities, they say, are now paying for pharmaceuticals which were made based on their

own knowledge of herbs and medicinal plants. Such projects, the NGOs claim, convert traditional knowledge into private property for commercial benefits without returning a fair share of the profits to the communities involved.

Manager newspaper also made a number of controversial observations about the Riche Monde project. First, the project had not received the National Research Council's approval. Second, most of the eminent local advisers listed by Riche Monde as its consultants disclaimed any official association with the project. Third, the newspaper reported that the Foundation of Ethnobiology, whose representatives had conducted the preliminary feasibility study and design of the project, had received a grant from the Hutton Molecular Development Co. Ltd., a broker of intellectual property rights. Although not explicitly stated, *Manager* also implied that the project had a high expatriate content.

In an interview published in *Executive* newspaper (September 1, 1995), Riche Monde responded to these allegations as follows:

- The project was not a research study but aimed to record traditional uses of herbal medicine. National Research Council approval was, therefore, not necessary.
- The company's internal memo had been translated incorrectly so that the words "those consulted" became "consultants." The local advisers cited in *Manager*, though consulted during the project's preliminary feasibility study, and later listed as such in project publications, were not in fact project consultants.
- Hutton Molecular Development had hired the Foundation of Ethnobiology as a consultant for a project that had nothing whatsoever to do with the Thai project.
- No contract had been offered to the Karen community. In fact, the contract with Chiang Mai University had yet to be signed as the company had only just begun preparing the project feasibility study.
- The project, as described by the company, was entirely a philanthropical activity to help preserve Thailand's tribal heritage. There would be no commercial benefits. Sharing of the gains with the local communities had, therefore, not even been discussed.
- The hiring of expatriates was necessary because of the lack of local taxonomists.

Finally, Riche Monde stated that the company had begun the project with only good intentions. Considering the damage the misleading publicity had caused, however, the company had decided to cancel the entire project.

Mistrust, lack of appropriate communication, and other cross-cultural problems plagued this project from the start. Thailand thus lost a good opportunity to increase its stock of knowledge. Significantly, however, the Riche Monde case demonstrates that, even if the firm involved derives no commercial benefits from a deal, issues of community intellectual property rights cannot be ignored. The Biodiversity Convention, although not ratified by Thailand, has raised increased awareness and expectations about the direct benefits of bioprospecting to local communities.

The differences in the arrangements of the above three cases may indicate some of the reasons for success or failure. First, the novelty of the INBio/Merck arrangement is in its explicit sharing of both the costs of biodiversity conservation and of the benefits therefrom. Such sharing of future commercial activities would be equitably spread among all the agencies involved. Second, the INBio/Merck case did not involve the traditional knowledge of local communities. There is a growing acknowledgment that traditional knowledge has been commercially exploited without adequately recognizing the intellectual property rights of local communities. Third, the Biodiversity Convention and the INBio/Merck case have heightened the developing countries' awareness that the rules of the game have changed. FAO's International Undertaking on Plant Genetic Resources, whereby developing countries obtain indirect benefits in the form of potential improvements in health, has now been superseded by the Biodiversity Convention where benefits can be targeted and shared with local communities (Reid, 1995). Commercial links are often acceptable. But, as in the INBio/Merck example, they must always be made clear from the very beginning.

INTERNATIONAL SUPERVISION OF FOREST RESOURCES

To protect the global commons and also to conserve species of common concern, international conventions have been registered with varying degrees of effectiveness. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) attempts to use trade sanctions as a means of enforcement. Another effort, the Framework Convention on Global Climate Change, is one of the weaker international conventions. Established as a *framework,* the convention provides general guidelines only and sets no definite goals for emission reduction.

The Convention on Biodiversity adopted in l992 at the UNCED meeting in Rio de Janeiro, in contrast, is an attempt to recognize the sovereignty of the owners of genetic resources. Previously, according to FAO's International Undertaking on Plant Genetic Resources, established in 1983 and since signed by 110 countries, wild species and genetic sources were considered a global heritage, all states having free access to these resources. It is generally felt among the developing countries that the FAO treaty did not fully recognize the burdens on the source countries, resulting in an unequal sharing of both the costs and benefits. Prior to the FAO Convention, a contract, such as the one between Merck and INBio, provided a way to equitably split costs and share benefits. Under the Convention, however, it is now entirely up to the developing countries alone to formulate policies and set up the infrastructure if they are to benefit from biodiversity prospecting and conservation.

A number of innovative economic and financial instruments now exist to facilitate cost sharing in nature conservation. Debt-for-nature swaps (DNS) allow international communities to help tropical developing countries repay their debts in return for improved conservation measures.

Under the DNS arrangement, the donor—which could be either a third country, an international conservation organization or a charity organization—may legally purchase a developing country's debt in a secondary market. The market price is generally below the value of the total debt. The donor then partially redeems the debt, in local currency, and uses this redemption as a conservation fund to support conservation projects.

Table 1 summarizes recent DNS arrangements. Although the debts were not large, as compared to the less developed countries' total debts, the redemption fund, in comparison to a developing country's budget for nature conservation, is usually substantial. A forest's carbon sequestration in a developing country, for example, can be used to offset carbon emissions in another part of the world. In other words, growing forests can be converted into their carbon equivalents and used to trade with other carbon dioxide emissions. The proceeds from carbon sequestration can thus be used for forest conservation.

CONCLUSION

This paper outlines the complex issues involved in conserving forest resources. The global and intertemporal nature of the benefits, along with the immediate and localized nature of the costs, render international supervision difficult, unless the problem of benefits and costs sharing can be successfully resolved. In developing countries, the problem is compounded by the pressing demand for land for agriculture and aggravated by inappropriate resource policies. The difference between social benefits, including non-cash welfare, and private costs, especially cash costs, tends to be large in developing countries. This means that a way must be found to extract more cash returns for developing countries and thus increase their incentives to conserve their forests. This paper stresses that not only the costs to the nation, but also to local communities, must be taken into account if forest conservation programs are to be effective. National governments may need to redesign their legislation, as it apparently discourages, and often even prevents, local communities from being effective custodians of forest resources.

Equally important, developing countries' governments need to build up their own ethnobiological and scientific capabilities so as to make bioprospecting a rewarding enterprise, able to capture a better share of the gains accrued from joint ventures with transnational corporations.

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