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Return to Sinharaja: Protecting the Forest of the Lion King

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By Cynthia M. Caron

Sinharaja is the largest undisturbed area (112 sq. km) of evergreen rain forest remaining in the lowland wet zone of Sri Lanka (See Figure 1). Seventy percent of the trees and lianas (creepers) are endemic as are 95 percent of the bird species. Without Sinharaja there would be a serious water shortage in southern Ratnapura and surroundings districts, countless number of these endemic species would face extinction and no one knows how many undiscovered, biologically-active medicinal compounds would be lost to deforestation. If there were no Sinharaja, I might not even be an ICWA fellow. To a significant extent I owe the idea for my 1993 ICWA fellowship proposal to a five-month stay at the Sinharaja Man and the Biosphere (MAB) Reserve in southwestern Sri Lanka.

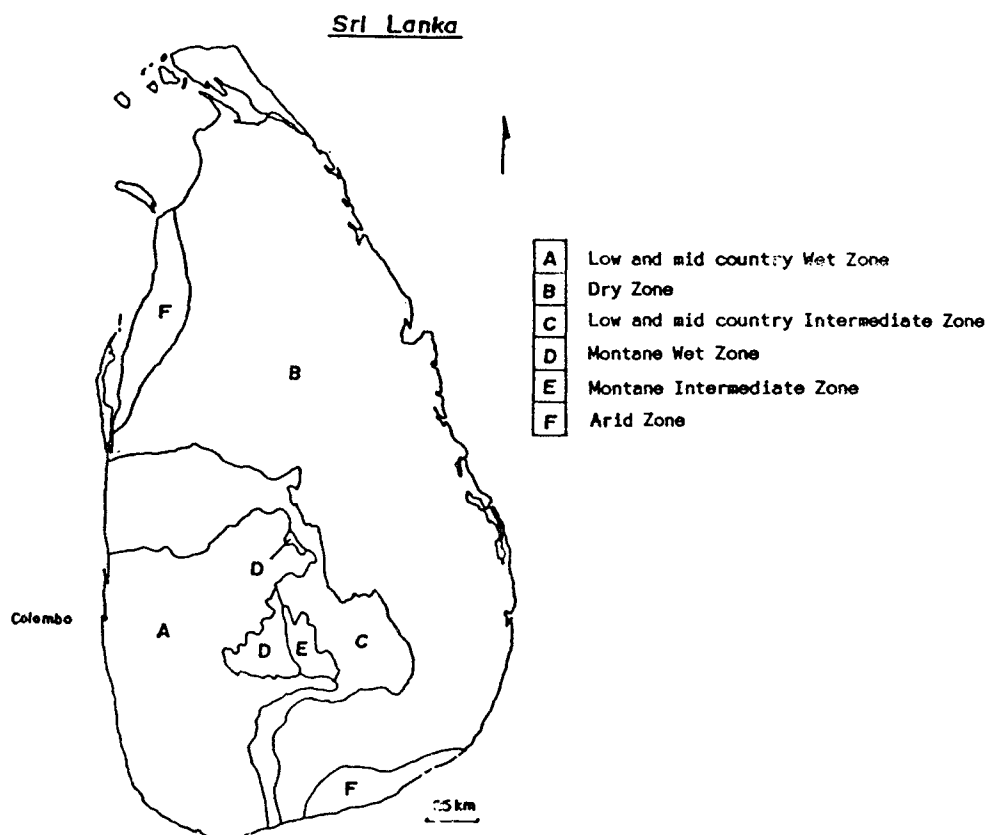
The previous year (1992) I had lived with a Sinhalese family in a tiny village (population 72) adjacent to the reserve's buffer zone. A buffer zone is to a forest reserve what a no-fly zone is to a nation-state. Cross it, get caught, and suffer the consequences. The consequences of entering Sinharaja to collect the energy necessary to cook the family's evening meal or to cut a woody vine to fix the handle of a broken hoe is imprisonment, a fine or both — serious, even if not as threatening as a surface-to-air missile.

The people living in and around Sinharaja collected forest products and firewood from the reserve long before it was designated one. Declaring Sinharaja a forest reserve and later a MAB Reserve and World Heritage Site essentially cut the local population off from a large supply of their firewood, raw materials for fashioning household supplies and tools, and a number of food and medicinal plant species with historical significance in the village economy. The Forest Department and environmental-interest groups did little to compensate or to assist the population after winning their 1978 battle to save Sinharaja from loggers. When I wrote my ICWA proposal, I contemplated studying the rationale for denying people access to their basic needs and what could be done to assist a community that has had its daily routine turned upside-down for the benefit of the global population and future generations. I still grapple with the ethical issues of justice, fairness, responsibility, rights vs. needs, and inconveniencing a few for the greater good. I still believe in protecting unique landscapes and the biodiversity contained therein. I do not know how much closer I am to understanding how we can balance biodiversity conservation with the right to self-determination and economic development, but in Sri Lanka's case I have seen how far we have come.

I returned to Sinharaja last month for the first time since I left in November 1992. Within a few days of my return I did not need a multi-colored map generated from the latest satellite imagery to know that there was less forest cover — I could hear it and see it. In our village of Pitikele, a 45-minute walk from the Forest Department base camp in Kudawa, we can hear traffic. Neither our village nor the road has moved, but something is missing in between. Trees. Rubber trees and pine trees are not nearly as popular as knee-high tea bushes. Since pine trees belong to the State, they cannot be cut legally and are felled only in selected areas to widen the muddy path leading to the village. The price of tea continues to rise. Extensive rubber holdings on the

Figure 1: Bioclimatic Zones of Sri Lanka

Zones A & D comprise the area referred to as the wet zone.



Source: de S. Wijesinghe et al. 1993. *Biological Conservation in Sri Lanka: A national status report*. IUCN: Colombo.

left-hand side of the path leading into the village are being felled with the intention of replanting the land in tea. There are several new houses along the path, all with tea-landscaped compounds. In our village there has been quite a bit of land-use change in the past three years. Pitikele's residents have energy and spirit. "Scrubby" areas along the jungle paths leading from house to house and along the river are now economically productive.¹ A hill-side blackened by a fire that somehow, escaped and scorched some pine trees is awaiting transformation. The family responsible for this latest clearing is moving cautiously. Replanting might take some time as the newly-cleared land is a source of contention. It appears Nimal's family cleared this land before Sunil's family had the opportunity to. Now Sunil's children are throwing stones at Nimal's children and stealing their freshly-washed clothes as they dry on the line. "If we plant tea seedlings now, the next morning they might be destroyed," Nimal's wife told me. Planting tea seedlings grown from cuttings was too risky at the end of my February visit. It

coincided with the rice-harvesting season, to which all human energy was devoted.

The benefits of cash-crop cultivation are evident. Four families now have television sets, color ones at that, that they run off car batteries (there is no electricity). Few are the families without personal dual-cassette stereos with detachable speakers. The houses in 1992 that had roofs thatched with *beru* leaves or coconut fronds have found a substitute: large sheets of tar paper. Of the five new houses built in the village, four are constructed of cement with plastic-paned windows and steel hinges. Cement is modern; wood and mud covered with a white lime-paste, like the traditional Sinharaja house, is not. People eat well, two or three red-rice-based meals a day. Moreover, people now have money to spend on the extras: powdered milk and malted drinks, instant noodles and white bread. Packaged and processed food was out of reach just three years ago. The village economy and lifestyles are changing.

1. This rush to plant tea is not restricted to the Sinharaja region. In the wet-zone districts of Kalutara and Kegalle, the government hopes to expand new tea lands by 200 and 130 hectares respectively in May and June. A non-refundable subsidy of Rs. 50,000 (US\$1,000) will be allocated per hectare in order to encourage tea growers. While villagers near Sinharaja are damned for their tea cultivation, their colleagues in other areas of the biologically-rich wet zone are rewarded. Government policies such as this are equally to blame for deforestation in Sri Lanka, but since they are implemented for the sake of the motherland's economic development, many officials look the other way. *Daily News* 25/3/96. p.5. and 27/3/96. p.2.

How do the residents of Sinharaja's fringe view the reserve? No one could have given me a more simple and straightforward explanation than one of my favorite Pitikele children did. "Because of Sinharaja, the wild boar comes and destroys our rice fields," he said matter-of-factly.

"That is so," I said. "However, because of Sinharaja," — and I tilted my head in the direction of the table — "you were able to buy that very nice radio."

We had just finished a discussion about what he had been doing while I was away. A week or two of manual labor at the Sinharaja research station allowed him to buy a portable Japanese stereo system, a possession he is quite proud of. Give and take is part of every relationship. Living at Sinharaja is no different. Sinharaja's residents have made larger contributions to a wider community than they probably realize and have waited so long for returns that they have almost given up hope of receiving any.

By virtue of its designation as a protected area, extra attention in the form of social services arrives at Sinharaja. The State, through the Forest Department (FD), is trying to compensate the local population for economic losses associated with protection status and to promote (or reward?) local people for supporting conservation efforts. Many of the health-care services coordinated by the FD should be provided by the Government in the first place. The medical camps coordinated by the FD not only bring services directly to this rural area but also create environmental awareness among the medical-community volunteers. Sinharaja's primary school children are particularly fond of the Japanese who over the past three years have given them toothbrushes and white school-uniform shirts. An organization called OISCA-International, a Japanese-based international

NGO, sponsors a children's forest program. The environmental education program promotes creating forests in partnership with children. In 1994 the children of Kudawa school received a comic-book warning about forest destruction and planted *puwak* (Areca nut; *Areca catechu*) seedlings around their school's compound.

Celebrating 40 years of UNESCO's Humid Tropics Programme

Last week, in Kandy I attended a Regional Seminar on Forests of the Humid Tropics of South and South-East Asia sponsored by the MacArthur Foundation, NORAD (Norwegian Agency for Development Cooperation) and the Natural Resources, Energy & Science Authority of Sri Lanka in Kandy. Forty years ago to the day, the first symposium with a similar name was held. At that very same conference the International Advisory Committee for Humid Tropical Research was founded. The original Kandy symposium set forth a short-term research strategy that included termite problems, preparation of regional floras, chemistry and biology of tropical soils and preparation of a method of integrated research in the humid tropics. Today's agenda revolves around threats to biodiversity and the sustainable use of biodiversity. Since Sinharaja is a humid tropical forest in the host country, focus on a field trip to Sinharaja were seminar highlights.

Research agendas have changed in the past 40 years. What happened to termite research? Several research papers on termite control, the role of termites in soil formation, standardization of the effects of termites, wood vs. non-wood eating termite species were published after the first seminar. However, the effects of termite-produced methane on global warming, raised

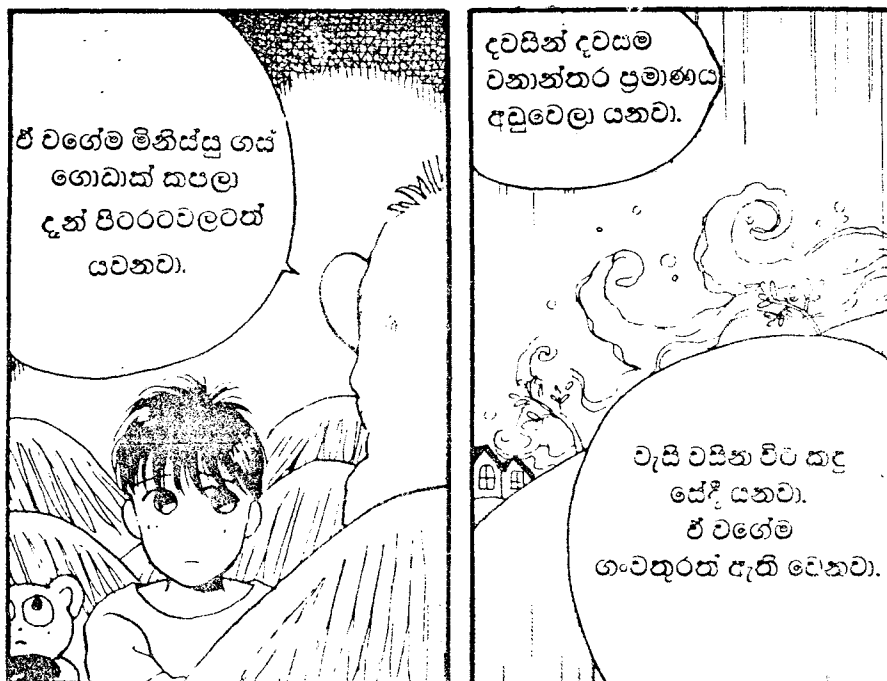


Figure 2: Comic books create environmental awareness for primary school children. These two illustrations translate from Sinhala as (L to R) "Like that, people cut down many trees and now send them to foreign countries." "Having become less day, by day, the primary forest goes." "When it rains the mountain washes away. Like that, flood become."

Source: Let's plant a seedling. Let's create comfort. OISCA.



Kandyan dancers escort in the seminar's honored guests and coordinators.

by an observer, had not been an issue. According to Dr. Michel Batisse, "In 1956 we were not ever thinking about global warming. In fact many persons were convinced another Ice Age was coming."

Since tropical rain forests are storehouses for biodiversity their destruction causes significant concern. According to Dr. T.C. Whitmore, an expert on Southeast Asian forests, their attrition "is leading to extinction on a scale similar to the five natural mass extinction events during the Phanerozoic, most recently at the Cretaceous/Tertiary boundary 66 million years ago."

Fig. 3: Global change occurring since the first Kandy Symposium

	1956	1996	%
World Population (95% in LDC)	2.6 billion	5.9 billion	110
Tropical Forest cover (million hectares) ²	2281	1160	-27
Tropical rain forest (million hectares)	868	680	-22
Removal of tropical timber (Mm3)	42	175	400
Export of tropical timber (Mm3)	8	30	1100

Global warming and carbon sequestering were tangential to the 1996 seminar, and we speculated about the consequences. Tropical countries at the moment are a net source of carbon, not a carbon sink. Forests are second only to the ocean in carbon sequestering; every patch of growing forest is balanced by a patch of forest in decay, maintaining a neutral carbon balance. Dr. Batisse outlined the management options for carbon miti-

gation based on the Intergovernmental Panel on Climate Change as:

- (1) a. Control of deforestation in the short-term
b. Protection of forests
- (2) Storage management: plantations and regeneration as a medium-term solution. Fast-growing trees like those usually found in plantations whose timber is used for pulp or construction will increase carbon sequestering, whereas replacement by a vegetation with a lower biomass will usually mean an addition of carbon dioxide to the atmosphere (Whitmore, 1996).
- (3) Substitution management: use wood instead of using fossil fuels³

Something unusual is going on up there in our atmosphere. Within the past year Japan, Mexico and the northeastern United States have witnessed unusual snowfall; Brazil, its worst drought in a century; and London its hottest summer since 1659. We in Sri Lanka are facing our own dilemma — a drought. The intermittent monsoon season in March is extraordinarily late. Effective from March 22 the Ceylon Electricity Board (CEB) set three four-hour-interval rotating power-cuts island-wide between 6a.m. and 6p.m. Without these power cuts the CEB postulated that there would be absolutely no electricity by April 22. Now, a week after the power cuts commenced, power use has actually increased because citizens have changed their routines to fit around power cuts. I am guilty. These days I work past 11p.m. because I have power. The lights are on so I can see and the fan runs on low because it still is warm. I did not need lights or a fan two weeks ago when I could start working at 6:30a.m.

2. Tree plantations have not compensated for this because they total only 40 million hectares.

3. Options 1 and 2 sequester 15% of fossil fuel emissions for 1990-2050 in the forest.



Science, Technology and Human Resources Development Minister Bernard Soysa delivered a passionate address on balancing Sri Lanka's desire to develop its economy and protect its environment

The Chief Guest at the Symposium, the Honorable Bernard Soysa, Minister of Science, Technology and Human Resources Development, gave an off-the-cuff welcome address, becoming more and more enraged toward the end. "Sustainable development is rubbish," he concluded. "This is just an alibi for not giving us [developing nations] the resources that we need, just like all that patronizing talk of safety nets that donor agencies give us. There are two truths: these donor agencies are too weak to address poverty alleviation; and developing nations are on a course of unsustainable underdevelopment. While there is majesty in protecting our environment, our resentment of the West sternly advising us not to destroy our own environments after Western nations have destroyed their own is not entirely valid. In our own country we have a low emphasis on implementation — we have plenty of management plans. Our private sector has not been responsive enough. I push technological innovation in the energy sector. However, I cannot find anyone to invest in better fuelwood technology⁴ or solar technology."

Who determines a forest's value?

Tropical rain forests and the biodiversity contained therein provide a multitude of services and goods: watershed protection, wildlife habitat, recreation and tourism, education, training and research, carbon sequestering, timber, and a host of non-timber forest products such as medicinal and ornamental plants, foods and genetic information. In 1986 there were zero publications with biodiversity in the title. By 1993 there were over 200. Biodiversity is successful because it crosses so many disciplines: science, technology, ethics, communications and the media. As

concerned citizens and stakeholders in today's complex geopolitical and socio-economic setting we must convince world leaders, politicians and the general public that standing timber is not standing in the way. As powerful a tool as economics might be in proving that forests should keep their leaves blowing in the breeze, "economic factors drive the loss of tropical forests, or at least great reduction of their biomass and biodiversity," said Dr. Jeffrey McNeely.

First, subsidizing petroleum-based energy and transport used in forestry operations hides the true cost of forest exploitation. Timber prices do not include the cost of replacing the oil consumed in forestry operations: harvesting, transport and processing. Second, the focus on forests for a single product, primarily timber, promotes commercially-valuable species and often ignores the benefits of watershed protection, wildlife etc. Third, forests are cut in response to global economic forces. The habitat alterations in Pitikele that introduced this newsletter, and government incentives to plant tea in the wet zone (footnote 1) are examples of the effects of international market prices on domestic land management.

Today there are 326 Man and the Biosphere Reserves (MAB) in 82 nations. Together with other types of protected areas, over five percent of the world's land surface falls under some sort of protected status. All together 45 percent of Sri Lanka's natural forest has been identified as protected areas to be managed for biodiversity and soil and water conservation; resulting in 14 percent of the land area being included under some form of protected status. The wet zone covers approximately 25 percent (approximately 1.6 million hectares) of the country, but it contains 94 percent of the island's

4. Fuelwood provides about 44 percent of the country's energy supply (Bandaratillake, 1996)

endemic flowering plants, making it the highest-priority area for conservation. Moreover, 55 percent of Sri Lanka's 17.5 million people live here. The wet zone experience may be a crucial case-study in the evolution of social, legal and institutional arrangements as nature conservation clashes with economic development. So many living things; too little space. Whatever competition already exists it is only going to get tougher. Thirty more forests in the wet zone have been identified by the government for conservation.

Horton Plains, one of Sri Lanka's many sanctuaries, is an extensive grassland interspersed with marshes and montane forest. The wetlands and streams flowing through Horton Plains create micro-habitats for multiple species of herbaceous ornamental plants. A few years ago the government launched a large-scale seed-potato scheme in Horton Plains. The natural tussock grass of the area never recovered. For unknown reasons the montane forest has been in a dieback stage for over 15 years. With forest dieback there is environment-altering microclimatic change. Often, indigenous species cannot regenerate. Microclimatic change in fact may create conditions favorable for establishment of a new cohort of species — both endemics and exotics. Currently there is an invasive bamboo species entering the ecosystem.

Invasive is an interesting word. I have never heard the term used in reference to an endemic species. Usually the species that ecologists and foresters refer to as "invasive," meaning "unwanted" and "undesirable," are exotic herbaceous species that are known to choke waterways and desired indigenous species and to get caught up in power lines. In Horton Plains the bamboo is growing along stream banks at such a rate that in a few more years the sweeping plains may be hidden and the aesthetic nature of the plains destroyed. There was considerable discussion about why an endemic bamboo coming into the system was so undesirable. Maybe through a series of ecosystem patterns and processes the bamboo is supposed to be there. Eventually someone in the Department of Wildlife Conservation might decide the bamboos' fate. Whatever the case, the Sri Lankan ecologist describing the scenario is anti-bamboo. However, as Dr. McNeely of IUCN quickly pointed out, "A Japanese tourist might find that bamboo most pleasing." In this case, the bamboo would not destroy the landscape aesthetic at all; it might become Sri Lanka's newest tourist attraction.

How do we decide to manage forest reserves and landscapes?

Sinharaja is well-utilized by research scientists. Within Sinharaja is a 50-hectare forest-dynamics plot for monitoring the natural process of succession in an undisturbed (by people) forest. This permanent plot at Sinharaja is just one of many sites across the globe supported by the Center for Tropical Forest Science at the Smithsonian Institution, for study of long-term ecological dynamics. The plot's yearly monitoring allows scientists to record both the gaps created by tree falls and



Every January and February the diameters of all the permanent plot's trees are measured. Each individual is identified according to its species level and given an XY coordinate for mapping purposes. Young women from the villages surrounding Sinharaja are hired to undertake the inventory at a rate of Rs. 110 (US\$2.00) per day.

other disturbance, and the herbaceous and woody species that colonize the gap. Understanding the building of a forest community within its gaps and along its edge is essential to its management. It is nearly impossible to manage for a particular tree or mix of forest species with limited information about growth rates and pollination vectors. Forests and landscapes must be managed scientifically so society receives the benefits they can provide (NB: Society varies over time and space. Management becomes value-laden by the managers or those with power, not necessarily by wisdom or knowledge.) The looming question for landscape managers is, "Do we understand enough about the components of these landscapes to manipulate them properly?"

"All biological processes are the product of evolution, and genetic diversity is the basis of the evolutionary process", stated Dr. Nimal Gunatilleke in his seminar presentation on genetic diversity and mating systems of different Sinharaja canopy-tree species. Forest fragmentation through timber extraction, habitat alteration, and introduction of exotic plant species affects genetic diversity, the fitness and fecundity of spe-

cies, and ultimately the health and stability of the forested ecosystem. Even though selecting and logging out the best timber trees is an accepted silvicultural practice, it reduces the gene pool for the character traits that we want the most, such as large diameter and straight bole. Land-use change adjacent to Sinharaja may reduce or even restrict gene flow. Since we do not know the pollination biology of all Sinharaja's species, there is an unknown possibility that some birds who disperse the seeds Sinharaja tree species nest in the very areas outside of Sinharaja that are being transformed into tea plantations. Likewise, bees are responsible for the gene flow between individual trees. Some bees have a range of only one kilometer. Forest fragmentation and landscape transformation do not necessarily assist them.

A healthy forest is made up of healthy trees. Inbreeding (kid-mating), another effect of fragmentation, leads to genetic erosion. Trees are like people — cross-fertilization between siblings who just happened to sprout up 10 yards away from each other can lead to sterility and increased susceptibility to disease. Studies conducted in the logged areas of Sinharaja have found genetic erosion in the species *Shorea megistophylla* (Sinhala name: *beraliya*) due to restricted gene flow. Not only is *beraliya* an important forest-canopy species, it also bears an edible fruit collected by Sinharaja's local population.

My field research in 1992 was a small portion of a larger study to establish a total economic value for Sinharaja. Economic valuation studies are meant to produce quantitative evidence proving to policy makers and to the public that the forest is worth more standing up than lying down. Economic values are placed on potential revenues from adventure tourism and the properties of medicinal plants as well as an array of other non-timber forest products (leaves, rattan, barks, roots and flowers) that have untapped material wealth for the betterment of the nation and the world. Hydrologic efficiency, carbon sequestering, existence value and values to future generations are among the values that are more difficult to quantify. But economists are still at it.

For a period of five months I conducted a time-allocation study using an anthropological technique called participant observation to try to estimate the value of non-timber forest products (NTFPs) extracted from the Sinharaja Forest by the villagers of Pitikele. I worked with 19 informants: the female head of each household. Ten hours a day, seven days a week I recorded the amount of time each informant spent collecting, processing and using NTFPs. I recorded the distance (in paces) and time spent traveling to collect these goods. The distance to the market was fixed for everyone. I would collect prices from shopkeepers at the end of the study. After combining market price with the distance and time traveled to collect and to process products, my adviser at University of Peradeniya and I would arrive at a value for these products from the forest. If the study worked, it could be replicated in several other Sinharaja villages to find a bet-

ter "average" and to include new products.

Our results were unexpected. In those five months I went to the forest only twice and at that, only into the buffer zone to collect downed branches for fuelwood. I was both surprised and disappointed. I randomly showed up at two different households every day. No one associated me with the Forest Department. I still do not think that women did not want to go with me to the forest for the reason that collection of forest products is illegal. What I found was that a limited number of seasonal products (from July to November) are collected from Sinharaja (lianas for tool and house construction and making rope, resin tapped from Shorea trees which does not have a high market demand, and three different fruits) by men and children. When a product was collected from the forest, no one was shy in telling about it. Furthermore, lianas are found only in the forest, not in the village area. As my female informants spent approximately 95 percent of their time in the village cultivating cash crops and homegardens, I wrote a paper on their homegarden systems. I came to the conclusion that perhaps the time-allocation method is not the best one for determining economic value. I cannot deny that if some one spends a considerable amount of time trudging barefoot through the forest (illegally at that) to procure a vine, root or flower, that that product has value. Maybe the economic quantification is the problem. Cultural value, though, does not have the credible tangible value of rupees and cents. Decision-making must be based on concrete fact, not abstract ideas and assumptions, especially in an election year!

The paper generating the most lively discussion and bringing us closer to the societal dimensions of biosphere reserves was that of Dayananda Kariyawasam, the present Additional Conservator of Forests, on forest dependency. The preliminary results of his Ph.D. research pointed to some unpopular conclusions: villagers view the forest as a region for farming (tea cultivation), not for foraging, and that as rural economies modernize, NTFPs play less significant roles in the village economy. Last year the Forestry Planning Unit underwent a strenuous effort to re-write the Forestry Master Plan. Under the plan, intense efforts will take place over the next ten years to increase rural incomes through the cultivation and sustainable extraction of rattans, edible plants and mushrooms, honey, bamboo, etc. According to the plan, "the commercialization of the rural economy and of the NTFP sector have resulted in a rising demand for many NTFPs" (p.235). The interesting term here is *many*. What is true is that the demand for certain economically-important products like rattan has increased. The "many" is really only an optimistic way of pushing the over-exploitation of a few specific products. Another interesting fact is that the commercialization of the rural economy through rattan furniture production is illegal because nearly the entire raw-material supply is found growing in protected areas like Sinharaja (p.242).

I do not wish to be misleading. Non-timber forest



*After tea, the two most important cash crops in Pitikele are jaggery, a solidified sugar boiled down from the sap tapped from the inflorescence of the kitul palm (*Caryota urens*), and latex tapped from rubber trees, pressed into sheets and smoked over the kitchen fire. Sixty percent of the nation's tea and 70 percent of its rubber — both export crops — are produced by smallholders like these living near Sinharaja.*



products play a role in the rural economy. However, they are not the panacea for alleviating rural poverty nor the most important incentive for villagers to protect forests, which is what we all have been not-so-secretly hoping.

Residents in the village where I work use forest products. However, they prefer farming to foraging; if they can expand their tea gardens (maybe even by encroaching upon the forest), they will do it. Kariyawasam found that 40 percent of his study population did not collect forest products as an income-generating activity. Of the families who collect and sell forest products, all were members of the lowest tier of three groups stratified by income. Even for the poorest households, NTFP sales accounted for only 32 percent of income. They

earned their living mostly by selling their labor to rich neighbors and plucking their tea.

According to current thought, the people living around Sinharaja should have incentives to preserve it because they receive a number of tangible and intangible benefits from its existence. If the population does not realize any tangible benefits from the conservation program, then it becomes very difficult to stop encroachment; this is precisely Sinharaja's problem. More people have cash and are buying substitutes for forest products. Why risk illegal collection of *beru* leaves and trouble oneself re-thatching the roof every two or three years when tar sheets are available at the Sunday market? The less Sinharaja's communities rely on the forest, the less likely they might be to conserve it.

There are other costs of tea culture. According to Kariyawasam, villagers are neglecting their traditional homegardens and crop diversification practices to grow tea. In my own studies I found that over 55 species of edible plants are grown in Pitikele's homegardens, utilizing several parts: leaf, root, seed, flower and shoot. Most of these homegardens are less than a quarter of an acre. Women intensified the capacity of their household plots to provide food and medicinal species for their families by means of careful planning and management. It would be a cultural loss if the recipes for many of the home-cooked curries were not passed down through the family or if the herbs were no longer cultivated or could not be identified by the younger generation.

Cultural change is nothing new. How many traditions are lost between grandparents and grandchildren living in America? We find ourselves mixed-up in a set of double standards. We do not want to keep rural people poor, but we want them to make a living the traditional way: collecting medicinal herbs growing wild in the forest, foraging for honey and mushrooms, tapping palm trees for sugar and liquor production and, in many Asian countries, cultivating butterflies for export. The butterfly example aside, these occupations, even when combined, are not where the money is for Sinharaja's residents.⁵ Kariyawasam's study is leading toward the shattering of a myth: not everyone at Sinharaja is as economically-dependent on non-timber forest products as we thought they were. His interesting initial results are a wake-up call that something needs to be done to address the needs of Sinharaja's local population and that the other amenity values associated with biodiversity conservation must be implemented so benefits start to accrue.

Even if we can substitute a nail for a vine or a mass-produced tablet for an herb, there is no substitute for the environment. Sri Lankan politicians are trying to simultaneously achieve the development objectives of poverty alleviation and environmental conservation. To do so, environmental science must be translated into (or perhaps better stated, reduced to) a language that policy makers understand. Policy makers like to see numbers indicating growth and savings. To that end, call in Dr. Kotagama, an economist by training

and the national coordinator for Sri Lanka's Biodiversity Action Plan (BAP). He is charged with the task of translating floral and faunal surveys (science) into optional possibilities for using biodiversity (an economic policy option).

How challenging is this? Dr. Kotagama illustrated the obstacles by giving us a pithy example. According to his economic model justifying the conservation of biodiversity, the potential medicinal value of flowering plants⁶ per hectare of natural forest is \$15/hectare/year. Average earnings from tea cultivation near Sinharaja are \$60 (Rs. 3000)/acre/month. Dr. Kotagama leveled with us during the question-and-answer session: he is not showing these exact figures to the policy makers. These details will be concealed in a larger, island-wide economic strategy. As if convincing politicians that biodiversity is important was not difficult enough, last week the President's office contacted and gave him a month to conduct an economic analysis of coastal areas to answer the question: mangrove forest or prawn farm? Financially, mangroves just cannot compete, especially when a nation is fighting a civil war and intends to enlist 10,000 new recruits by April 15 (*Daily News*). Prawn farming seems mighty promising.

The global population benefits when forests are protected. For example, clearing the forest causes soil-carbon to oxidize, releasing carbon dioxide as well as nitrous oxide, a greenhouse gas, into the atmosphere. Countries like Sri Lanka bear the opportunity-cost of conservation because they cannot fell forests such as Sinharaja and export the sawn timber to Western countries or Japan. These countries, however, should recoup their losses from this conservation of biodiversity because all of the medicinal herbs, mushrooms, and value-added products like rattan furniture, left available for collection and processing, will add far more to the national economy (sustained income-stream) than that timber cut in one fell swoop. Likewise, these forest reserves, if marketed properly, will become tourist attractions allowing countries to earn foreign exchange from eco-tourism.⁷ These are just some of the ways that countries like Sri Lanka can try simultaneously to achieve the development objectives of poverty allevia-

5. Much of the reason that these products generate a low income is due to the fact that there are no, or only very weak, markets for these products. With the exception of sugar produced from tapping kitul palm, there is no formal market for any of these products. Another comment worth noting is a remark made over lunch by a ecologist. What this individual could never figure out about this strategy is a simple issue of supply and demand. If we base our conservation strategy on the collection and cultivation of non-timber forest products, will the "market" not become saturated, eventually resulting in a decrease in the product's price? What happens to the rural poor then?

6. The potential medicinal value of flowering plants is only one component of the total economic value of biodiversity. Both the Medical Research Institute in Colombo and the Department of Chemistry at the University of Peradeniya are involved in prospecting for biologically active chemicals for cancer and AIDS research from flowering plants at Sinharaja.

7. In a 1989 study, Peters, Gentry and Mendelsohn found that fruits, nuts, resins, etc. on one hectare of Amazonian rain forest in Peru were worth more (in dollars and cents) than the timber growing on that same hectare. Many people say that there is nothing eco-friendly about eco-tourism: too many people descend on small wildlife populations with too much intensity, psychologically disturbing the animals; or hotels are constructed quickly without any regulations too accommodate a growing number of bird watchers at the expense of the nearby wetland or coral reef. The Argentines are actually doing an environmental-impact assessment of the tourism they plan to manage in the Patagonia region (Beware of the Humans. *Newsweek* 4 March 1996 pp.36-39).

tion and environmental conservation. Someone just has to prove to the policy-makers that there is economic gain in the long-term.

The Conservator of Forests, Mr. Bandaratillake, chaired a section of the symposium dealing with sustainable utilization of tropical humid forest resources. In his wrap-up remarks he reminded us that it is illegal for anyone to collect anything from Sinharaja. (He proceeded to rattle off three Forest Acts declaring it so.) Apparently, overanxious forest officers are not posted along Sinharaja's boundary. During the question/answer/comment session, a Sri Lankan forester mentioned that there are small areas of state-owned reserve forest in the wet zone that are being encroached upon by tea farmers. Despite the fact that public awareness is high and farmers receive education about the environmental problems associated with deforestation, the encroachment continues. The speaker suggested to the Conservator that policing should increase.

Policing, however, is everything that forest management has been moving away from. It's why we have moved toward building "partnerships" with encroachers. *Policing* is 180 degrees away from *participation*. Will participation be a mistake?

Applying the biosphere reserve concept

Throughout this fellowship, my primary interest has been to seek out the perceptions of rights, responsibilities and actions of participants and agencies involved in nature conservation and rural development activities — the stuff often referred to as the "societal dimension." Far too often, soft science is ignored in action-research. The major weaknesses of applied anthropology and questions sociological in nature are that they often do not quantify their answers and merge them with natural-science information. This is necessary in natural-resource management, particularly if it is going to incorporate local people. The MAB network also falls victim; as "an interdisciplinary environmental-research program, natural sciences have tended to eclipse the social sciences in much of the research undertaken within the framework of MAB" (*Biosphere Reserves* 2:24). While this might be true in the case of Sinharaja, there are examples of natural science experiments with social consciousness.

Through UNESCO, the international network of biosphere reserves allows scientists and practitioners working in MAB and World Heritage Sites to exchange information about their research experiments. Biological research at Sinharaja may soon have positive long-term economic benefits for Sinharaja's peripheral communities, thanks to Dr. Savitri and Dr. Nimal Gunatilleke. Their experiments in the buffer zone of Sinha-

raja are based on replicating the natural process of succession within the forest. By removing two, three or five rows of pines in the pinus-plantation buffer zone, the Gunatillekes' have created new micro-sites to bring natural forest vegetation back to the buffer zone through enrichment plantings. Their work to convert the pinus plantation includes both a restoration and a production component. For both experiments, the pine stand acts as a "nurse" stand for the young seedlings and saplings. The restoration component includes planting a variety of indigenous timber and canopy-tree species from the family *Dipterocarpaceae*. The production study emphasizes market-oriented species such as mahogany, cardamom, the medicinal-creeper *Coscinium fenestratum* and rattan used in furniture production. Comparing the growth rates of species between two-rows, three-rows and five-rows of removal determines the micro-site conditions for the best growth performance. Should the Forest Department change the buffer zone's management and adopt the space and species-mix proven successful in the Gunatillekes' research, then the extent of pine plantation encompassing Sinharaja can be converted to natural forest species. Residents of peripheral communities can assist in the planting and active management of the buffer zone. Eventually it is hoped that the cane, palm and wild cardamom will encourage local industry.

During our seminar's field trip to Sinharaja, Sunil Liyanage, the Deputy Conservator of Forests responsible for Sinharaja's management, described to us "forest-human conflict" over the Sinharaja resource. The first problem is people illegally extracting goods from the forest. The second problem is one of boundary. Since the reserve's boundary is ill-demarcated, villagers are encroaching upon the reserve to cultivate tea. Mr. Liyanage told of free medical camps for Sinharaja residents and the free distribution of improved wood-burning stoves by the Forest Department.⁸ However, when the South African delegate asked what the Forest Department had done to address resource utilization by local communities, Mr. Liyanage gave a vague answer, ducking the question.

This is not entirely his fault. The Forest Department, due to the lack of financial resources, staff and political will, has done little more than talk about the socioeconomic conditions of Sinharaja's peripheral communities, especially with regards to resource use. Dr. Coert Geldenhuys of the Division of Forest Science and Technology in Pretoria was perplexed; why had the Forest Department not even experimented with low levels of resource extraction to see how that might effect the resource base and the villagers' livelihood? Unfortunately, the Forest Department cannot conduct such experiments; under the National Heritage Act, nothing can be extracted from Sinharaja in any quantity under

8. The dissemination of improved fuelwood-burning stoves means little unless the recipients have been trained to install the stoves. I sponsored an improved-fuelwood-stove program in November 1992. Since then only 5 women have installed the stoves. Some women who still have not installed the stoves they bought after the 1992 demonstration took another free stove from the Forest Department. Why have they failed to install them? No time to break down their existing kitchen stove and replace it with the new one, they say. Why take another stove when you already have one that you do not use? Why not? It is free.

any circumstance. Only through an amendment of this act by Parliament can resource needs from the forest be addressed in their truest and fullest form.

I predict that such an amendment would never be proposed, let alone passed. For once, and perhaps only this one time, I find myself agreeing with a comment made to me last month by a senior government official. "The environmental lobbies would throw a tantrum and shout and shout and shout until it (development) was stopped," he said. This is exactly what nature conservation groups would do. It is highly unlikely they would suggest any sort of constructive advice toward compromise. They would not offer to assist the Forest Department in implementing projects that address resource-use problems. They would protest, "No changes to Sinharaja. It is our national heritage." I often wonder if they care or think about the people that sacrifice for that national heritage.

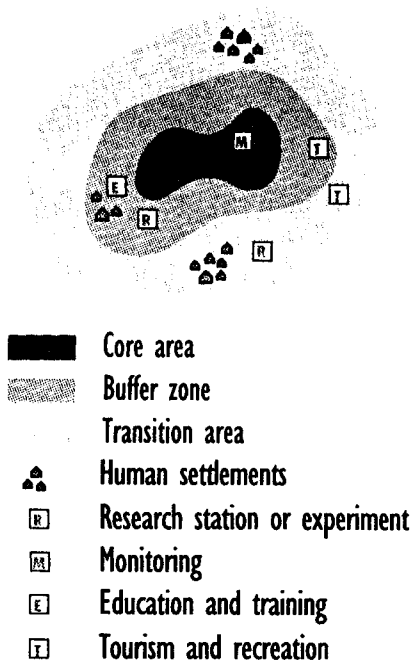
This second trip to Sinharaja with a group of international experts brings me full-circle. Biodiversity and forest conservation is a rich complex of issues including ethics, awareness, information and knowledge. For those of us who need to apply the biosphere-reserve

concept it is almost too easy to ignore complex social issues. This brings me back to the issue of accountability in the implementation of nature-conservation and rural-development projects that I discussed in my last newsletter. For all these years the Forest Department has not been held accountable for proper implementation of the biosphere-reserve concept to balance resource conservation with experiments in sustainable resource use by the government, nor has Sri Lanka's conservation community. Where have the conservation lobbies been?

Protected-areas management in Sri Lanka will be different in the future. The government's National Conservation Review identified 30 biologically-rich forest fragments in the wet zone (Figure 1) for conservation. Like Sinharaja each conservation forest will have a protected core zone meant to protect the natural qualities of the site and provide opportunities for education, research and monitoring (Figure 4). Unlike the situation in Sinharaja, residents of communities peripheral to these 30 conservation forests will be allowed to purchase permits and be given usufruct right to extract a variety of forest products including fuelwood and timber for local use from regions identified and zoned by the Forest Department as traditional-use areas. This is a step in the right direction — but where does it leave Sinharaja's 5,000 people? □

Figure 4: Schematic zonation of a biosphere reserve.

The core area is a legally protected example of minimally disturbed ecosystem characteristics. The buffer zone surrounds the core area and is managed in ways to protect the core area. The transition area, the outermost part of the reserve, is the dynamic zone of cooperation where conservation knowledge and management skills are applied. In these three interrelated zones, complementary activities of resource conservation and development of sustainable resource uses are carried out.



Source: *Nature & Resources*, 31(2): 13.

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