ESSAY 15E

Valuation of Extractive Medicines in Tropical Forests

Exploring the Linkage to Conservation

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The discovery of new pharmaceuticals from tropical forests to add to the war chest of modern medicine is an enticing reason to conserve tropical ecosystems. For example, the importance of the rosy periwinkle (*Catharanthus roseus*) in treating childhood leukemia and Hodgkin's disease is frequently cited in popular and scientific articles about the need for conserving rainforests. But another, perhaps more pressing, argument for conservation is the use of forests as pharmaceutical "factories" to produce local medicines used in primary health care.

New therapies for major diseases such as AIDS or cancer may be living in tropical forests. For various reasons, this potential is unlikely to result in significant conservation in the short term unless carefully constructed mechanisms are adopted. First, the development of a new pharmaceutical product from wild plants is a decade-long process, at best. Plants studied today, if found to be of value in medicine, will only yield royalties many years later, and cannot meet the immediate needs for money to support conservation activities.

Second, only a small fraction of plants studied actually reach the pharmacy shelves. Although there are undoubtedly numerous valuable chemicals to be derived from forests, these are hidden among tens of thousands of species and billions of hectares, and the net value of securing these areas may be small.

Third, when medicines are found, their extraction has historically led to destructive, not sustainable, use. *Pilocarpus* species, shrubby trees native to northeastern Brazil, are a case in point. The leaves of the trees are harvested by local people and processed by chemical companies to yield pilocarpine, a compound used in glaucoma treatment. The leaves have been wild-harvested from northeast Brazil for many decades without concern for continuity of the supply, and vast populations of *Pilocarpus jaborandi, P. microphylla,* and *P. pinnatifolius* are now extirpated.

Finally, local people traditionally have not benefited from discoveries of new medicines, and so have little incentive to manage forests to encourage discovery. Recent programs initiated by drug companies and developing countries address these last two points. However, it remains unclear to what extent these new efforts, while promising, will significantly contribute to global ecosystem conservation.

An additional, and more immediate, incentive for conservation may be the role of tropical forest ecosystems in providing traditional medicines and rural health care where local plants comprise 95% of the ethnopharmacopoeia. The World Health Organization estimates that 2.5–3.5 billion people worldwide use traditional medicines as part of their primary health care program. In Belize, Central America, where we are completing an inventory of ethnobotanical knowledge, up to 75% of the primary health care is provided by traditional healers using plant remedies. Both primary and secondary forests are sources of the plants processed into medicine. In many cases people known as "hierbateros" collect and sell these plants to the "curanderos," or traditional healers, actually providing the health care.

We conducted a series of forest inventories, combining ethnobotanical investigation with studies of the market value of the plants locally used in medicine (Balick and Mendelsohn 1992). We identified two 1 ha plots, one in a 30-year-old forest (plot 1) and another in a 50-year-old forest (plot 2). The two plots yielded 308.6 and 1433.6 kg dry weight, respectively, of medicines whose value could be judged by local market forces. Local herbal pharmacists and healers purchase unprocessed medicine from hierbateros and small farmers at an average price of U.S. $2.80/kg. Multiplying the quantity of medicines found per hectare by this price suggests that clearing a hectare of medicines would yield the collector between $864 and $4014 of gross revenue. Of course, the collector has costs he or she must bear to harvest this material. On a per-hectare basis, harvesting required 25 person-days on plot 1 and 80 person-days on plot 2. Given the local wage of $12/day, the total harvest costs for the plots were $300 and $960 respectively. When these costs are subtracted from gross revenue, the net revenue from clearing a hectare was $564 and $3054 on plots 1 and 2 respectively. However, the labor costs go back to the local economy, so they are not really lost from the system.

These value estimates of using tropical forests for medicinal plant harvest compare favorably with alternative land uses in the region; for example, milpa (corn, bean, and squash cultivation) in Guatemalan rainforest yields $288/ha. We also identified commercial products such as allspice, copal, chicle, and construction materials in the plots that could be harvested and added to the medicinal value. Thus, use of at least some areas of rainforest as extractive reserves for medicinal plants appears to be economically justified. A periodic harvest of medicinal plant materials seems a realistic and sustainable method of utilizing the forest. For example, with a 50 ha parcel of forest similar to the second plot analyzed, one could clear one hectare of medicines per year indefinitely.

As a postscript to our original study, the Belize Association of Traditional Healers is now negotiating with the government of Belize to allocate a 2430 ha parcel of land to be used as an extractive reserve for medicinal plants. Its management would be in the hands of the traditional healers and herb gatherers, with input from researchers. Larger-scale experiments aimed at developing

Principles of Conservation Biology, G.K. Meffe, C.R. Carroll et al. 1997.

sustainable extraction techniques for stems, roots, bark, and tubers would be carried out in this setting, in collaboration with local people who utilize these plants for health care.

On a global level, there are approximately 3 billion people using wild-harvested medicines. Assuming each person uses $2.50–$5.00 worth of medicine per year, the annual value of this resource could range between $7.5 billion and $15 billion. This is a significant aggregate value, and a large portion of it represents tropical forest species. The entire global pharmaceutical trade is estimated at $80–$90 billion annually. New drugs from tropical forests would have to compete for a substantial share of the modern drug market before they would be as valuable as the natural factory of local medicines. Thus, local rainforest medicines worth billions of dollars today could, if properly managed, have a more immediate effect on conservation than a new drug developed from a plant commercialized a decade from now.

Another issue is the replacement costs (substitution costs) of commercial pharmaceutical products when and if local plant resources become exhausted. The cost of replacing the type of primary health care delivery system now in place would be many times that of the present system; thus, a vast constituency ranging from individuals to governments has a vested interest in maintaining adequate supplies of forest medicines. One of the most effective and least expensive ways of accomplishing this is through in situ conservation of these resources in tropical forests.

We do not wish to underestimate the potential benefits of pharmaceutical drug discovery for tropical forest conservation. However, the importance of traditional medicines from tropical forests is another powerful argument for their conservation. Additional work is needed in order to properly understand and evaluate this issue and, if possible, harness it for maximum benefit to the conservation enterprise.