



A Remedial Treasure In Our Tropical Timberyard?

Arnoud P. van Seters, MD, PhD

Considering the yearly loss of tropical rain forests (4-5 times the size of the Netherlands) one can easily foresee the complete disappearance of this biotope, with the exception of a few protected areas scattered around the globe. The enormous tropical fauna and flora, including known and unknown medicinal plants, will be decimated. Indigenous medical knowledge has little chance to survive. Rainforest deforestation poses a clear threat to human safety by causing landslides, floods, desertification, and the spread of malaria. The extinction of medicinal plants and medicine men, however, presents a more hidden health risk to both developing countries and (newly) industrialized societies. This article focuses on the role medicinal plants play in both modern and traditional health care systems. These plants also represent an important class of so-called non-timber forest products that provide a sustainable and economically viable alternative to the ongoing destructive exploitation of the rainforests.

Biodiversity and Medicinal Plants

Rainforests contain no less than 60% of all higher plant species known on earth and they provide all that is needed for human survival, including remedies for disease. Through evolution plants have developed

large numbers of chemical substances to defend themselves against insect pests. Some of these agents can also act within the human body against microorganisms and other pathogens and represent an important source of natural drugs. Their highly complex molecular structures often surpass the imagination of the chemical scientist and cannot easily be reproduced in the laboratory.

More than 35,000 plant species worldwide are being used in various human cultures for medical purposes (Table 1) and they are subjected to uncontrolled local and external trade [1]. So far, fewer than 40 tropical species have been incorporated into modern medicine and only a fraction of the tropical flora has been thoroughly analysed for pharmaceutical activity. Therefore, the annual extinction of 3,000 plant species is a matter of great concern as it could imply the loss of a potential drug against an incurable condition such as dementia, cancer, influenza, or AIDS.

The health impact on the basic needs of developing countries is equally important and will be discussed separately.

Medicinal Plants In Traditional Health Care

Health care and botany have evolved as inseparable domains of human activity: the medicine man (shaman) is often regarded as the first professional in human history. Whereas western medicine, as taught in most medical schools around the world, has largely switched from natural to manufactured drugs, plant products are still of paramount importance for the health care of developing countries.

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In traditional therapies, herbs are administered along with chants, dances, and spiritual ceremonies to expel bad spirits and to help reharmonize the sick person with his or her environment (Table 1). Plants, however, also serve a less metaphysical role as anti-conceptives in indigenous birth control or to counteract tangible pathogenics such as fungi and parasites (e.g., worms, malaria).

In tropical forests, medicine men and women are particularly knowledgeable about the recognition and treatment of common disease. In Amazonia, at least 1,300 plant species are used as medicines, poisons, and narcotics [2]. Traditional healers are also renowned botanists and have a great talent for locating the requisite plant from the green vastness that makes up their natural pharmacy.

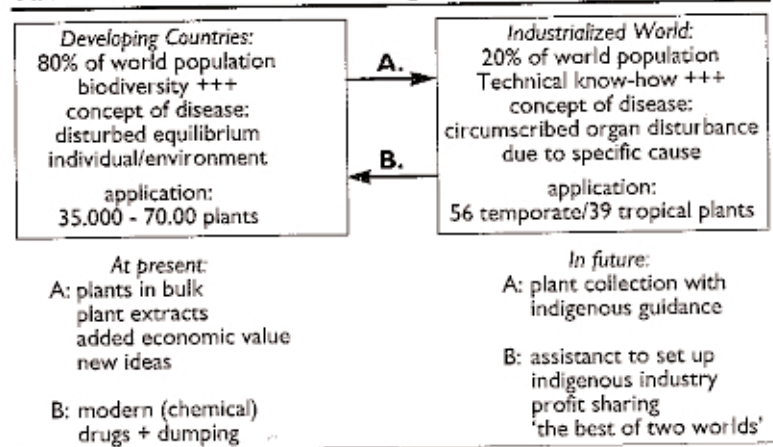
In Latin America and Africa this knowledge has largely remained oral history and needs to be handed down from father to son or mother to daughter. At present, younger generations often have far different ambitions and, therefore, these traditional skills are doomed to get lost even faster than the plants themselves (Figure 1). This is why ethnobotanists compare the death of a shaman to the loss of a national library and invest much effort to assemble this database into written accounts. Recent examples of such endeavours are "The Healing Forest" by Schultes and Raffauf [3] on Amazonian indians and "Rainforest Remedies, One Hundred Healing Herbs of Belize" by Arvigo and Balick [4].

Moreover, traditional healing in distant areas has come under pressure from novel diseases (e.g., influenza, tuberculosis) that often have revealed the superiority of "white man's capsules." This course of events has greatly affected the prestige of the local healers and has also opened a market for expensive and less necessary western drugs. Apart from posing a heavy drain on foreign cash reserves, easily available and often equally effective traditional equivalents have thus been forced into disuse and oblivion.

Although western medicine has been integrated to some extent with ancient Asiatic health care systems, it has become the dominant method in most larger hospitals around the world. In non-hospital care, traditional and modern systems operate independently without a clear hierarchy, whereas in rural areas only traditional healing and herbal self care may be at hand. Hence, developing countries maintain a great demand for medicinal plants that often come from the forests.

In the future, the use of these plants can be expected to increase further due to population growth and attempts to upgrade traditional health care by the World Health Organisation (WHO). WHO's campaign

Table 1. Medicinal Plants Connecting Two Separate Societies



"Health for All by the Year 2000" has made conservation of medicinal plants into an important issue (Figure 2) [5]. This same initiative has launched a first step toward a more rational use of herbal recipes in the Caribbean, following a recent pharmacological evaluation as to their effectiveness and safety [6].

Medicinal Plants In Industrialized Societies

Since the second half of this century, "chemical" drugs supposedly have replaced plant products in mainstream medicine. This development is in line with the prevailing concept of disease (Table 1), the belief in human-initiated progress, and the quest for pure therapeutic substances that contain no more than one active principle.

On closer analysis, however, more than 25% of all prescription drugs in Organisation for Economic Cooperation and Development (OECD) countries (contrasted with 60% in Eastern Europe) prove to consist of unmodified or slightly altered higher plant products [7]. They embrace such important therapeutic categories as anticonceptives, steroids (e.g., prednisone), and muscle relaxants for anaesthesia and abdominal surgery (all made from the wild yam); quinine and artemisinin against malaria; digitalis for heart failure; and the anticancer drugs vinblastin/vincristin, etoposide, and taxol. These agents cannot be fully synthesized in a cost-effective manner. Therefore, their production requires reliable supplies of plant material, either from plantages or from the wild. Such is the case for the wild yam (*Dioscorea composita* Hemsl.), which cannot be cultivated and is exported from Mexico and other countries in quantities of hundreds of tons.

These few examples should make one realize how much modern drug delivery depends on sustainability and how vulnera-

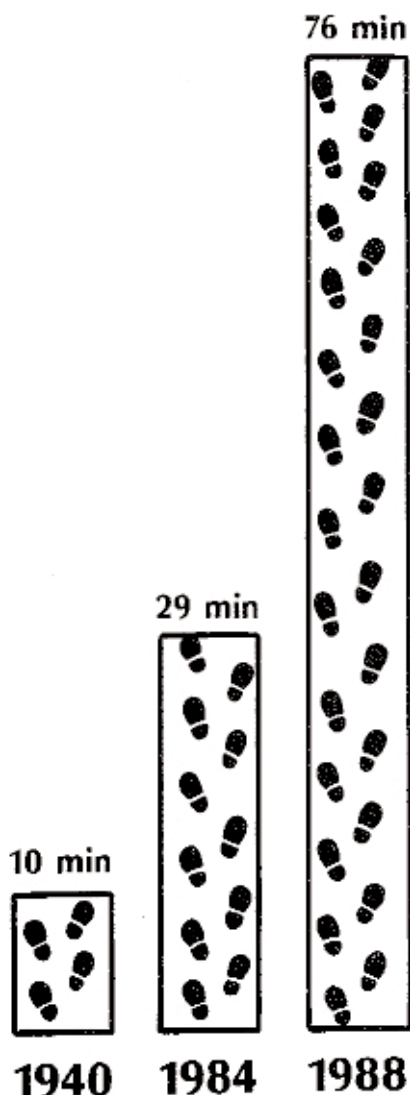


Figure 1. For shaman Don Eligio Panti from Belize deforestation has multiplied the time required to collect a daily supply of medicinal plants [21]

ble it is to the exhaustion of natural resources. This awareness is even more pertinent to clients of health stores and herbalists, since natural nonprescription formulae may contain rare and even endangered wild plants that -- often unjustly -- are regarded as more

Table 2. Market Value of Timber and Non-Timber Forest Products (NTFP)

Product	US \$/Myr	Reference	Year	Comments
Vinblastin/vincristin	100	[15]	1985	world sales, profit 88%
Pilocarpin	29	[16]	1989	sales in USA
SP-303	100	[17]	1994	expected USA sales*
Jamu	1000	[18]	1992	Indonesia, local markets
Paranuts	216	[19]	1983	Brasilian exports to USA
Essential oils	63	[19]	1983	importation into USA
Ratan	8	[20]	1983	exports from Indonesia
all NTFPs	127	[20]	1983	exports from Indonesia
Timber	6850	[21]	1987	world exports

*for RS-virus only; combined world sales of Provir and Virend could be 10 times higher

powerful than their cultivated analogues [8]. So far only three species have been listed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) [1].

New Drug Development As An Incentive To Forest Conservation

Natural drugs and medicinal plants, along with other non-timber forest products, already yield an important economic value (Table 2). They compare favourably in monetary terms with logging and cash cropping and they provide better prospects for sustainability [9,10]. The pharmaceutical industry has recently rediscovered the tropical rainforests as an unmatched source for new drug development, which promises additional revenues [11]. Thousands of plant extracts on all continents are being screened for activity against HIV and human cancer in the laboratories of the U.S. National Cancer Institute. Merck, Sharpe & Dohme, a New Jersey-based pharmaceutical company has paid \$1 million U.S. for research rights in Costa Rica and has agreed to contribute 25% of future profits made on local plants to rainforest conservation in Costa Rica [12].

Shaman Pharmaceuticals Inc., a pioneer in ethno-directed natural product research since 1989 and now supported by Eli Lilly Inc., considers indigenous people as partners and only collects plant samples on the indication of a shaman. This approach appears to be more effective than random collection methods [13] and has already resulted in the discovery of three novel drugs. Before long, one of these drugs, SP 303 (Table 2), will become available as a neat monocomponent drug against herpes simplex and respiratory syncytial (RS) virus; SP 303 also holds promise for the treatment of influenza and other virus diseases. SP 303, soon to be known as Provir and Virend, originates from an ordinary weed in Peru that can be harvested in a sustainable way. The world market value may be no less than \$1 billion U.S. per year. Part of the profits will be returned to local Indian communities [14] to support cultural and health care projects, as well as nurseries for endangered medicinal plant. As a further consequence, the prestige of the shaman will be upgraded in western eyes.

Conclusion

In the year 1995 plant diversity is still indispensable for human well being and provides all or a large number of the remedies we require. Tropical rainforests excel as natural pharmacies by virtue of their enormous, largely untapped, sources of plant material, along with the available indigenous knowledge of its

medical use. By connecting the issues of biodiversity and human health, these resources are at the focal point of a new argument for more effective rainforest conservation. Prudent marketing of rainforest products, however, requires a high degree of sustainability and a permanent dialogue with the native populations concerned. Medicinal plants may help to build a bridge between quite different medical systems, providing us with the best of both worlds and allowing their practices to become more complementary.

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Figure 2. The Chiang Mai Declaration as drawn up in 1988 at the International Consultation on Conservation of Medicinal Plants [5].

The Chiang Mai Declaration

Saving Lives by Saving Plants

We, the health professionals and the plant conservation specialists who have come together for the first time at the WHO/IUCN/WWF International Consultation on Conservation of Medicinal Plants, held in Chiang Mai, 21-26 March 1988, do hereby reaffirm our commitment to the collective goal of "Health for All by the Year 2000" through the primary health care approach and to the principles of conservation and sustainable development outlined in the World Conservation Strategy. We:

- Recognise that medicinal plants are essential in primary health care, both in self-medication and in national health services;
- Are alarmed at the consequences of loss of plant diversity around the world;
- View with grave concern the fact that many of the plants that provide traditional and modern drugs are threatened;
- Draw the attention of the United Nations, its agencies and Member States, other international agencies and their members and nongovernmental organisations to:
 - The vital importance of medicinal plants in health care;
 - The increasing and unacceptable loss of these medicinal plants due to habitat destruction and unsustainable harvesting practices;
 - The fact that plant resources in one country are often of critical importance to other countries;
 - The significant economic value of the medicinal plants used today and the great potential of the plant kingdom to provide new drugs;
 - The continuing disruption and loss of indigenous cultures, which often hold the key to finding new medicinal plants that may benefit the global community;
 - The urgent need for international cooperation and coordination to establish programmes for conservation of medicinal plants to ensure that adequate quantities are available for future generations.

We, the members of the Chiang Mai International Consultation, hereby call on all people to commit themselves to Save the Plants that Save Lives.

Chiang Mai, Thailand
26 March 1988

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