

Medicinal plant biodiversity and local healthcare: Rural development and the potential to combat priority diseases

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Background

Biodiversity and health linkages

The impact of environmental and landscape changes on health is now gaining attention in both public health and conservation arenas, where it is recognized that environmental disturbance impacts the ecological balance of the hosts of diseases as well as of disease-causing pathogens and parasites. The World Health Organization has recorded over 36 new emerging infectious diseases since 1976, many of which, particularly malaria and dengue, are the direct result of the influence of landscape on the ecology of disease (Taylor et al, 2001).

In the developing world, a large proportion of the rural population depends on biodiversity for their livelihood, nutrition and health. Changing forest land into agricultural fields may, in the short term, slightly enhance the nutritional status of the population, but also leads to a loss of important medicinal plants and can expose them to diseases resulting from ecosystem imbalance. It has been noted by the Harvard Project on Biodiversity and Health that human health, biodiversity and poverty reduction represent a nexus of interrelated issues that lie at the centre of human development, with biodiversity in turn being dependent upon human health (Epstein et al, 2003). It is clear that conserving forest biodiversity by valuing and harnessing it as medicine is consistent with poverty reduction and local public health prevention efforts.

Demand for plant-based medicines

The surge in global demand for herbal medicines has been followed by a belated growth in international awareness about the dwindling supply of the world's medicinal plants. Over-harvesting for commercial purposes, destructive harvesting practices, habitat loss resulting from forest degradation and agricultural encroachment have all been recognized as contributing factors. Policy interest (WHO, 2002) in the importance of traditional medicine in meeting the health needs of indigenous peoples, rural communities and the poor throughout the developing world has underscored the significance of this topic for the health of the poor and indigenous groups, as well as for meeting the pluralistic health requirements of more affluent consumers internationally.

More than a decade ago, a report by the World Wildlife Fund (WWF) and United Nations Educational, Scientific and Cultural Organization (UNESCO) (Cunningham, 1993) noted that in Africa, which has the highest rate of urbanization in the world, the larger the urban settlement, the larger the traditional medicine markets tend to be, thus placing pressure on rural stocks through unsustainable harvesting practices to meet burgeoning demand. The report noted that 'there is significant evidence to show that the supply of plants for traditional medicine is failing to satisfy demand' (Cunningham, 1993). In South Africa, between 400 to 550 species are currently sold for use in traditional medicine, of which an estimated 99 per cent originate from wild sources (Williams, 1996).

Despite recent awareness of the supply-side challenges of the herbal medicine boom, it is now 15 years since these issues were first given a global profile in the Chiang Mai Declaration of 1988 (Akerle et al, 1991). The Chiang Mai Declaration stated its recognition that medicinal plants are essential in primary health care, both in self-medication and in national health services, and expressed alarm at the consequences of loss of plant diversity. Expressing grave concern that many medicinally important plants were under threat, the Chiang Mai Declaration highlighted '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'. The Chiang Mai Declaration was followed in the subsequent decade and a half by several other declarations and sets of recommendations calling for the conservation, cultivation and sustainable use of medicinal plants.²¹

Consistent themes have been: the need for coordinated conservation action based on both *in situ* and *ex situ* strategies; community and gender perspectives in the development of policies and programmes; the lack of information on the medicinal plant trade; the need to establish systems for inventorying and monitoring the status of medicinal plants stocks, involving indigenous taxonomies and para-taxonomists where possible; sustainable harvesting practices; micro-enterprise development by indigenous and rural communities; and the protection of traditional resource/intellectual property rights.

²¹ These include the Arusha Declaration (Mshegeni et al, 1991), the WWF/UNESCO People and Plants Initiative statement on the causes of medicinal plant biodiversity loss and possible remedial strategies (Cunningham, 1993), the 1995 recommendations of the Global Initiative For Traditional Systems (GIFTS) of Health (Bodeker, 1996), the Bangalore Declaration of 1998 (<http://ece.iisc.ernet.in/ernet-members/frlht.html>), the Neemrana Vision Statement of November 1999 (http://source.bellanet.org/medplant/infodoc.php?op=showdoc&infodoc_id=4), the Nairobi Declaration of 2000 (Burford et al, 2000), the Joint Declaration for the Health of People and Nature resulting from the WWF/TRAFFIC symposium at the Hannover 2000 Expo, whose signatories include representatives of industry, practitioners' associations, the International Council for Medicinal and Aromatic Plants, WWF, IUCN and TRAFFIC (<http://www.traffic.org/news/expo2000b.html>), and the 2001 Global Plant Strategy of the CBD (<http://www.iucn.org/themes/ssc/news/globalplantstrategy.html>).

Issues relevant to local, national, regional and international communities

Local

Throughout the non-industrialized world, hundreds of millions of rural households are estimated to use medicinal plants for self-medication. While reliable data are scarce, it has been estimated that in India approximately two million traditional health practitioners and around 800 million health care consumers use over 7,500 species of medicinal plants (FRLHT, 2002). Community-based methodologies for gathering reliable data on patterns of use of medicinal plants along with baseline data on their local conservation status do exist and are prerequisites for establishing effective strategies for sustainable use. Evaluation of such projects has highlighted a model for self-sufficiency in family medicines through the production of home herbal gardens, data from which highlight that significant public health benefits have resulted (Hariramamurthi et al, 2007).

The role of biodiversity in sustaining human health and well-being is perceived in non-Western societies in terms that are often spiritual and that certainly reflect deep cultural world views (Bodeker, 2000). Traditional health systems are based in world views or cosmologies that take into account mental, social, spiritual, physical and ecological dimensions of health and well-being and that place central importance on the concept of balance – within the individual and between the individual, society and nature. Imbalance arises with the breaking of the interconnectedness of life and results in discomfort and disease. Native Canadian societies are reviving traditional healing knowledge as a means of revitalizing the culture and spiritual well-being of their people. The *vegetalista* tradition of the Peruvian Amazon is also undergoing revitalization, thus expanding an appreciation in the region for the spiritual underpinnings of biodiversity.

Traditional health systems have organized frameworks for classifying plants, animals, landscapes and climatic conditions in relation to their effects on health and disease. These taxonomies have much in common with one another and represent a culturally-relevant empirical framework for assessing medicinal plant biodiversity. The Ayurvedic system of India identifies organizing principles (*doshas*) that underlie physiological makeup, disease and biodiversity, and uses six tastes to determine the *doshic* properties of plants. The Maya of Mexico have a framework that uses taste, or an organoleptic approach, to assess the suitability of plants for specific categories of conditions.

Food and medicine are often viewed interchangeably. Food is medicine. Diet is the basis of health. The Barasana people of northwest Amazonia and the Aka pygmies of central Africa classify food and medicinal plants according to their hot or cold properties (as is also the case in traditional Chinese medicine), and also use taste categories bearing similarities to those in other traditions.

Revitalization movements are drawing on traditional medical knowledge to develop integrated modern and traditional health care projects (Neumann and Bodeker, in press). In some instances, modern medical workers return to their communities and learn traditional ways, incorporating these into current practice. These movements and other groups have drawn attention to the shrinking availability of medicinal plants to supply the burgeoning need for herbal medicines in non-Western societies and in the

industrial countries. Conservation and horticulture programmes are emerging as vital components of the revitalization of local health traditions. The Chiang Mai Declaration of 1988 drew world attention to this. The absence of policy development in support of the Chiang Mai Declaration is regrettable. This underscores the need for coordinated effort by all engaged in medical plant use to generate new policies, mechanisms and resource flows to preserve the biodiversity used in caring for the health of the majority of the world's population.

Unsustainable harvesting practices by herb gatherers, often for commercial purposes, has resulted in the depletion of many medicinal species in otherwise healthy forests. This shift from a subsistence to a commercial focus in harvesting is also accompanied by a lengthy marketing chain that offers very low rates of return to gatherers. Gatherers of the bark of *Prunus africana* in Madagascar, for example, are paid negligible rates compared to the rates received by middlemen in the trade chain from where it is bought by Spanish and French companies for use as a herbal medicine for benign prostatic hypertrophy (Walter and Rokotonirina, 1995). In Mexico, collectors are reported to receive a mere 6 per cent of the consumer price for medicinal plants (Parrotta, 2002). With such low rates of return, gatherers feel a financial pressure to harvest large volumes of plant material. Low prices also discourage cultivation as, with less effort, plants can be gathered from the wild and sold at the same rate (Bodeker and Burford, 2006).

Traditional knowledge can be a fundamental starting point in conservation strategies. In characterizing the medicinal properties of plants, indigenous taxonomies often ascribe identity and spiritual values to plants (Posey, 2000). The apparently polar values of honoring and using, revering and understanding, harvesting and conserving are seen as compatible partners. Andean shamans, for example, characterize plants in their own gardens with a greater degree of discrimination and more diverse information than is found in Western botanical categories. Their gardens at the same time reflect a knowledge of ecosystem management and represent symbolically the interrelationships between plants, humanity and the cosmos (Pinzon and Garay, 1990). Such indigenous knowledge and value systems may have a central role in providing the value base necessary for the acceptability and viability of local medicinal plant conservation strategies. Equally, new models of trade are called for to ensure a fair return to gatherers and producers of medical plants.

National

While forestry policies have focused on trees and the forest canopy as priorities for conservation, they have largely overlooked the forest under-storey and ground level non-timber forest products (NTFPs). Some national forestry departments, for example those of India and China, have devised mechanisms for regulating unsustainable removal of NTFPs, based on both their wider commercial value and their local economic value. Clearly there is a need for forestry and environment departments to assign priority to the promotion of medicinal plant diversity within programmes such as tree planting and the rehabilitation of forest and boundary areas. Historic mistrust between communities and forestry departments, stemming from the exclusion of local communities from forests, represents a significant barrier to be overcome if partnerships for joint conservation efforts are to be established.

Improved transportation networks near and into areas of tropical forest biodiversity have increased trade, thus creating national supply chains and collection points for what was previously more of a locally-based market system. A report from Nepal (Aryal, 1993) notes that:

Hundreds of varieties of herbs in all incarnations – leaves, roots, stems, extracts – continue their journey from remote crags to staging posts in the hills and then to the Tarai. Through a time-tested network of legal and illegal routes, the bundles and sacks are heaved onto trucks, they hop on international flights, board trains and find berths in cargo vessels.

If local gatherers are to secure a fair price for their work and participate willingly in sustainable harvesting and local cultivation, new models of trade are called for that will shorten marketing chains. Cooperatives of gatherers supplying direct to manufacturers or linked chains of local bio-enterprises combining cultivation with managed wild harvesting and value-added processing may offer new directions. These could offer enhanced levels of returns to local communities and hence a more sound basis for the sustainable management of medicinal plant resources. Such bio-enterprise development is promoted by the UN Conference on Trade and Development (UNCTAD) and is viewed as a novel way of converting the economic potential of biodiversity into conservation initiatives and sustainable development opportunities (UNCTAD, 1998).

Other national factors of significance include inadequate regulatory infrastructure, absence of legal protection, including community and intellectual property rights (IPR) protection (Bodeker, 2007), and inadequate access to appropriate technology for harvesting, processing, storing and plantation development. Steps to redress this could include identification and protection of threatened species through national legislation and implementation of international trade regulations via the Convention on International Trade in Endangered Species (CITES), as well as promotion of good-practice regimes within industry that are supportive of long-term sustainability rather than simply short-term sustainable production. There is also a clear need for national policies on acknowledging and legalizing traditional health practitioners, mechanisms for screening and admission of certain herbs as medicines, and significant investment in national research on the effectiveness of local herbs.

Regional and international

There is high medicinal plant use across regions, with Asia representing the greatest volume of medicinal plants use, both domestically and for export. India, which reportedly harvests 90 per cent of its medicinal plants from uncultivated sources, has an estimated 9,000 manufacturing units using almost 1,000 of 7,500 known medicinal species, with an annual domestic market valued at almost US\$1 billion. Due to habitat loss and over-exploitation, approximately 1,000 medicinal species are under threat in India, where export of raw material and finished herbal products is valued at around US\$100 million per year (FRLHT, 2002). China, which harvests an estimated 80 per cent of its medicinal plant material from wild sources, exports an estimated 32,600 tons of medicinal raw material each year (Parrotta, 2002). Extensive and historic trade routes exist, with the trade itself characterized by secrecy and generational control over territory, gatherers and access to purchasers. Increased global demand has brought traders into contact with international regulatory regimes, not least of which is CITES.

This has led to the recognition that endangered species cannot be exported and that conservation and cultivation strategies must be established as a matter of urgency in order to at least maintain export levels. In 1994, the Government of India banned export of more than 50 species believed to be threatened in the wild (Government of India, 1997). This was subsequently reduced by about a third following strong representation from the herbal industry, which argued that such restrictions would damage a lucrative area of India's trade with the West.

In response to this situation, new approaches to medicinal plant production have emerged. In Asia, these are large-scale programmes of commercial production, while in other regions, activity is more piecemeal and on a project basis. Critical factors influencing regional development are the presence or absence of policy, the volume of international trade in medicinal plants, the political will to forge necessary partnerships between the public and private sectors and civil society, and a significant absence of dedicated funding to catalyse such action.

Regional and international issues have been identified and responded to by major institutional actors:

- The IUCN Medicinal Plant Study Group has focussed on the identification, management and protection of regionally and globally threatened species;
- TRAFFIC and CITES focus on the monitoring and regulation of international trade;
- WWF and the Rainforest Alliance promote education and the regulation of international production-to-consumption chains, for example via certification schemes;
- WWF, IDRC, and others concentrate on the development of capacity and best practices. The WWF/UNESCO programme People and Plants is an important programme in this respect.

The Global Environment Facility (GEF) appears to be the leading source of international support for broad-based programmatic development. Of at least eight GEF medicinal plant conservation projects, four are in Africa (Egypt, Ethiopia, Ghana, Zimbabwe), one is in the Eastern Mediterranean region (Jordan), two are in Asia (India, Sri Lanka) and one multi-country project is in the Caribbean. Other organizations and funders long active in supporting model medicinal plant conservation and sustainable use projects include TRAFFIC, IUCN, IDRC, the Rainforest Alliance, MSPG, DANIDA and WWF/UNESCO's People and Plants programme. The model projects of the 1990s are now waiting to be expanded into full regional strategies for comprehensive, ecosystem-based management of medicinal plant biodiversity in the 21st century. The path to this is as yet unmapped, but is undoubtedly a priority need.

Priority disease areas: HIV/Aids and malaria

Traditional medicine has a central role to play in combating new and re-emerging diseases. Global priority is currently placed on combating malaria and HIV/Aids, and new partnerships between the communities of traditional medicine, public health and health research are being formed. Two diseases are addressed below, but partnerships are being developed with other diseases such as tuberculosis and control of vector-borne diseases such as trypanosomiasis.

Partnership with the traditional sector in HIV/Aids prevention and management

As the Aids crisis leads an increasing number of countries to question their priorities in health expenditures, there is an emerging awareness that traditional health practitioners (THPs) can play an important role in delivering an Aids prevention message. There is growing recognition that some THPs may be able to offer treatment for opportunistic infections. At the same time, there are concerns about unsafe practices and a growth in claims of traditional cures for Aids. Partnerships between the modern and traditional health sectors are a cornerstone for building a comprehensive strategy to manage the Aids crisis (Bodeker et al, 2006).

Africa

In Uganda, where there is only one doctor for every 20,000 people, there is one traditional health practitioner per 200–400 people (Green, 1994). In such settings, partnerships may be the only way that effective health care coverage can be achieved in managing the twin epidemics of Aids and malaria. Clearly, such partnerships not only make good public health sense but, based on a growing body of pharmacological evidence, may also yield important preventive and treatment modalities.

In light of the widespread availability of traditional health care services and the reliance of the population on these services, it is inevitable that people suffering from Aids will turn to THPs for treatment. Collaborative Aids programmes have been established in many African countries, including Malawi, Mozambique, Uganda, Senegal, South Africa, Swaziland, Zambia and Zimbabwe.

Information sharing and educational programmes in South Africa have resulted in THPs providing correct HIV/Aids advice, as well as demonstrations of condom use. One such programme trained 1,510 THPs and it was calculated that during the first 10 months of the programme some 845,600 of their clients may have been reached with Aids and STD (sexually transmitted diseases) prevention messages. In similar programmes in Mozambique, traditional healers learned that Aids is transmitted by sexual contact, by blood and non-sterile razor blades used in traditional practice. In a follow-up evaluation, 81 per cent of those trained reported that they had promoted condom use with at least their STD patients (Green, 1997).

One of the challenges in such workshop situations is to move beyond 'training' to genuine information sharing. It has been noted that it is difficult to modify the manner in which health professionals teach about Aids – a style that tends towards the didactic and use of scientific jargon. Removing communication barriers such as these is a necessary first step in ensuring that training is an effective tool in mobilizing traditional health practitioners as partners in Aids control.

An important example of how this may be done was conducted in Brazil, where a face-to-face educational intervention by healers blended traditional healing – with its language, codes, symbols and images – with scientific medicine, and simultaneously addressed social injustices and discrimination. New information about HIV/Aids transmission was conveyed using languages and concepts intimately familiar to traditional health practitioners. A controlled evaluation found significant increases in Aids awareness, knowledge about risky HIV behaviour, information about correct condom use, and acceptance of lower-risk, alternative ritual blood practices among the 126 members of the trainee group, compared to 100 untrained controls. There were

significant decreases in prejudicial attitudes related to HIV transmission among the trainee group compared to controls (Nations and de Souza, 1997).

The Ugandan NGO, Traditional and Modern Health Practitioners Together Against Aids (THETA), was established in 1992 to conduct research on potentially useful traditional medicines with HIV-related illness and to promote a mutually respectful collaboration between traditional and modern health workers in the fight against Aids. THETA has conducted workshops to share knowledge on Aids prevention and also treatment of opportunistic infections using local herbal remedies.

Traditional healers participating in clinical observational studies of their herbal medicines have subsequently sought training in prevention, education and counselling issues, as well as in basic clinical diagnostic skills. A 1998 UNAIDS-sponsored evaluation of THETA found that it had reached 125 THPs (44 women and 81 men) in five districts of Uganda. Fifty thousand people were found to have benefited from the improved services offered by traditional health practitioners over a period of two years (Bodeker et al, 2006).

In South Africa, a follow-up of educational workshops found that some THPs reported that local medical staff had begun referring HIV-positive and STD patients to them for condom demonstrations and HIV counselling. All THPs reported having given condom demonstrations not only to clients but also to any member of their communities with potential interest.

Giving a perspective on the benefits from investment in this involvement of local traditional health practitioners in Aids prevention exercises, Edward Green (1994), an organizer of the workshops, reported that:

630 second generation healers had been trained in 12 workshops held in diverse parts of South Africa. The total direct cost of training these 630 was about \$23.30 per healer, or \$5.90 per day per healer. In addition to these 630 direct beneficiaries of training, up to 229,320 patients or clients of these healers may have benefited from Aids education within 7 months of the first generation training (calculated as 26 weeks times an average of 14 patients a week per healer [see below] times 630 healers trained). Not all these healers specialise in STDs or Aids, but most of them see a great number of at least STD patients. Finally, an inestimable number of friends, family members, and others in the local community (local associations, sports teams, youth groups, etc.) benefited from informal Aids education.

Health care consumers and THPs want information on the safety and efficacy of local treatments, their effect on opportunistic infections, and how to test claims of cure in an efficient and cost-effective manner (Bodeker et al, 2000).

There has been little official response from governments on this front. However, in one of the more forward-looking national programmes, the Uganda Aids Commission and the Joint Clinical Research Centre in Kampala have worked with traditional healers in evaluating several traditional treatments used locally. The research found traditional medicine to be 'better suited to the treatment of some Aids symptoms such as herpes zoster (HZ), chronic diarrhoea, shingles and weight loss' (http://www.aidsuganda.org/response/govt_sectors/cso_programs/theta.htm). THETA has conducted controlled clinical trials on a Ugandan herbal treatment for HZ. Comparing subjects with herbal treatments with controls using acyclovir, the conventional treatment for HZ, both groups were found to experience similar rates of

resolution of HZ attacks. The traditional medicine group had less super-infection and showed less keloid formation than did subjects on acyclovir. HZ pain resolved significantly faster in the herbal group. The investigators concluded that herbal treatment is an important local and affordable alternative in managing HZ in HIV-infected patients in Uganda (Homsy et al, cited in Bodeker et al, 2006).

A study conducted by the Blair Research Institute Clinic in Harare, Zimbabwe, evaluated the impact of traditional medicine in persons with HIV infection and assessed their quality of life with respect to HIV disease progression. There were 105 HIV-infected persons in the study, at various stages of HIV infection, of whom 79 per cent were on traditional herbal medicine and 21 per cent were on conventional medical care (CMC). Using the WHO Quality of Life Scale, it was found that the proportions of scores on five domains measuring different aspects of quality of life for patients on traditional medicine were much lower than those on conventional therapy ($p < 0.0001$, for all variables). The research team concluded that the data supported the role of traditional medicine in improving the quality of life of HIV-1 infected patients, although its pharmacological basis is unknown (Sebit et al, 2000).

While clinical research has been slow to begin in the evaluation of traditional herbal treatments for HIV-related illness, there has been screening for antiviral effects of locally used plants since the early 1990s. A recent study reported promising antiviral effects from selected Ethiopian medicinal plants. Asres et al (2001) found that the highest selective inhibition of HIV-1 replication was found with the acetone fraction of *Combretum paniculatum* Vent., and the methanol fraction of *Dodonaea angustifolia* L.f.. These afforded cell protection of viral-induced cytopathic effect of 100 per cent and 99 per cent, respectively, when compared with control samples. Asres et al (2001) found that the greatest degree of antiviral activity against HIV-2 was achieved with the acetone extract of *C. paniculatum* (EC₅₀ (32)). The 50 per cent cytotoxic concentration ranged from 0.5 mg/ml for the hexane extract of *D. angustifolia* L.f., the most cytotoxic of the extracts tested, to > 250 mg/ml for some extracts such as the methanol fraction of *Alcea rosea* L., the least toxic tested. While there is the obvious potential for commercial development of fractions of these plants as pharmaceutical leads, there is growing recognition of the need to evaluate such plants clinically in order to determine the viability of affordable, locally available medicines for managing HIV-related illness.

Asia

While much of the international focus on Aids in the developing world has been on Africa, there has been growing awareness of the rapid spread of the disease in Asia. Reflecting the concerns now beginning to be addressed in many African countries, India's national Aids policy (<http://www.indianembassy.org/policy/AIDS>) states under the heading Indigenous Systems of Medicine (ISM):

In a scenario where anti-retroviral drugs are extremely expensive, there is a great need to look into the indigenous systems of medicine (ISM), like Ayurveda, Unani and Siddha. Some of the medicines in these systems have the potential of reducing the viral load in the body of the patient thus ensuring a healthier and longer life with the infection. The Government has sponsored research projects in ISM and is receiving encouraging response. It will pursue a policy of sponsoring research in ISM for development of drugs which can serve the purpose of anti-retrovirals.

The policy statement cautions about false claims of cures among unscrupulous practitioners and makes the point that 'Any medicine or system of treatment which cannot stand the test of scrutiny by the professional organisations like the Ayurveda Council cannot be accepted as a drug or a system of treatment in the country'. Clearly, drugs which are shown by rigorous research methods to have an effect can become part of a system of treatment in India. In our own work we developed a clinical trial protocol that takes into account Siddha medicine diagnostic categories for assigning medicines to people with HIV. Once patients are assigned to their Siddha body type and the Siddha classification of their disease stage, they can be randomly assigned within this framework to a treatment/no treatment/conventional treatment category (see Table 1) (Bodeker and Dvorak-Little, 2006). The conventional treatment category is not included in Table 1 since subject assignment is randomized and is independent of the Siddha body typology.

| | Patient Assignment | Stage I | Stage II | Stage III |
|-------|--------------------|---------|----------|-----------|
| Vatha | <i>Treatment</i> | | | |
| | <i>Control</i> | | | |
| Pitta | <i>Treatment</i> | | | |
| | <i>Control</i> | | | |
| Kapha | <i>Treatment</i> | | | |
| | <i>Control</i> | | | |

Table 1 Clinical trial model for assignment of patients according to their Siddha body type

Traditional Chinese medicine is also being used in HIV management, not only in China but also in Africa and in other parts of Asia, where traditional Chinese medicines are exported. In one study, qian-kun-nin, a Chinese herbal formulation considered to have anti-infection, antitumour, antiretroviral and immunomodulatory properties, was evaluated for its anti-HIV effects. Eight HIV-positive subjects were given oral qian-kun-nin capsules for 24 consecutive weeks in a single-blind design. Compared to baseline level, the plasma virus load decreased significantly at the end of week 12 ($p < 0.01$) and week 24 ($p < 0.01$). Four weeks after cessation of qian-kun-nin treatment, plasma virus load was still significantly lower compared to baseline ($p < 0.01$). Blood CD4 cell counts were increased significantly at the end of the week 12 compared to the baseline level ($p < 0.01$). No adverse effects were observed and no significant side effects were recorded in any subjects (Zhan et al, 2000).

This is one of many emerging studies that require adequate funding to ensure that the research methodology is sound. While these data appear to suggest that qian-kun-nin has therapeutic potential in the treatment of HIV-positive patients, clearly the trial

design and the sample size make it difficult to draw solid conclusions from the study. What this study does highlight is the potential for anti-HIV effects in traditional medicines and the need for standard operating procedures for the clinical evaluation of these medicines.

In Africa, Asia and elsewhere in the world, partnerships between modern and traditional health systems are being seen to be the clear way forward to build on existing community resources and to harness the potential therapeutic benefit of local and affordable treatments for HIV-related illness, as well as to screen out false claims and unsafe medicines and practices (Chaudhury, 2001; Liu, 2007).

Malaria

The emergence of multidrug-resistant strains of malaria that has accompanied each new class of antimalarial drugs may be viewed as one of most significant threats to the health of people in tropical countries. While there is widespread agreement that a fresh approach to the prevention and treatment of malaria is urgently needed, solutions have tended to focus on the development of new classes of drugs. More recently, there has been an emphasis on promoting combination therapy of existing drugs as a means of preventing resistance.

Historically, however, local communities in tropical regions have used local flora as a means of preventing and treating malaria (Bodeker, 2004). It can be argued that these traditional medicines, based on the use of whole plants with multiple ingredients or of complex mixtures of plant materials, constitute combination therapies that may well combat the development of resistance to antimalarial therapy.

Resistance, synergism and traditional medicines

While combination therapy in malaria, cancer and Aids is based on the principle of synergistic action among multiple drugs, little significance has as yet been given to the obvious point that all of the major antimalarials have been derived from plants and that combination existed in the traditional formulations before the process of extraction took place. For example, flavinoids in *Artemisia annua*, which are structurally unrelated to the antimalarial drug artemisinin, enhance the in vitro antiplasmodial activity of artemisinin.

Elsewhere, synergism has been observed between the alkaloids of the antimalarial plant *Ancistrocladus peltatum*. A total alkaloid extract of this plant had far greater antiparasitic activity than any of the six alkaloids isolated subsequently. In studies on antimalarial plants from Madagascar, the alkaloids bisbenzylisoquinoline, novel pavine and benzyl tetrahydroisoquinolines, all were found to potentiate the antiparasitic activity of chloroquine in vitro and, in some cases, in vivo. Preparations of these plants are currently being tested as adjuvants to chloroquine therapy in Madagascar (Carraz et al, 2006). In Uganda, there are data indicating that a traditional Ugandan herbal remedy is effective against malaria (Willcox, 1999).

As with other conditions, people with malaria will often combine conventional drugs and traditional medicines, sometimes simultaneously or as first- or second-line treatments (Agyepong and Manderson, 1994; McCombie, 1996) with herbalists reporting their view that this combination gives an additional therapeutic effect

(Rasoanaivo et al, 1994). Perceived efficacy is an important reason for people using traditional antimalarial medicines. Affordability is another. However, when patients themselves were asked why they choose traditional medicine over conventional drugs, a study in Burkina Faso found that the cost of medicines accounted for only 50 per cent of respondents. Lack of faith in doctors was the reason for the other 50 per cent resorting to traditional medicine (Abyan and Osman, 1993). Elsewhere it has been reported that medical staff at Burkina Faso hospitals are less trusted as they are frequently young, do not speak the local languages, and are not courteous or welcoming to patients (Bugmann, 2000).

Several cohort studies have been conducted to evaluate the outcomes of traditional herbal treatments used by herbalists in managing malaria. A few of these have shown complete parasite clearance by day 7 (Phetsouvanh; Makinde et al; Mueller et al, all cited in Willcox and Bodeker, 2004). Phetsouvanh's study of the antimalarial effects of *Alocasia macrorrhiza* root decoction showed 100 per cent parasite clearance by day 7, without any recrudescence for the duration of follow-up (21 days), although this study has not been published or replicated. Makinde et al showed 100 per cent parasite clearance in adults by a leaf extract of *Morinda lucida*. However, there was not full parasite clearance from infected children. Further clinical studies on the antimalarial effects of plants have been reviewed by Willcox and Bodeker (2004).

The research initiative for traditional antimalarial methods (RITAM)

To redress this situation, a partnership was established in December 1999 between the Global Initiative for Traditional Systems (GIFTS) of Health and the Tropical Disease Research Programme of WHO (Bodeker and Willcox, 2000). Through the Research Initiative for Traditional Antimalarial Methods (RITAM) (www.gifts-ritam.org), individual scientists, traditional health practitioners and others have formed a partnership to investigate, evaluate and, where appropriate, develop traditional herbal medicines to combat malaria. Standard operating procedures have been developed for experimental, toxicological and clinical research on traditional antimalarials. A research network to evaluate the potential of classically prepared *Artemisia annua* has also been established by RITAM (Willcox et al, 2004).

Conclusion

As noted at the beginning of this chapter, the linkage between biodiversity and human health is well established. What is fundamentally important is that biodiversity offers solutions to local health concerns when managed sustainably and used in traditional ways to prevent and manage disease. To ensure that this potential is harnessed, there is a need for cross-sectoral coordination and integration.

Forest management and conservation must be integrated with programmes in other sectors: in health, to foster better use of plant materials; in education, to build awareness of the need for protection and judicious development; and in agriculture, to

strengthen farmer extension methods for plant cultivation. Such a strategy would give priority to ensuring affordability in local health care through sustainable medicinal plant production and to contributing to poverty alleviation through micro-enterprise development.

While small-scale projects are the crucible for new direction and progress at the community level, the importance cannot be underestimated of developing networks of projects across biodiversity zones, reflecting integrated and well-managed local, national and regional strategies. Dedicated research centres for the diverse bioclimatic zones, such as high altitudes, arid zones and the humid tropics, would contribute greatly to the global coordination of efforts. New funding mechanisms and commitments will be needed to support such developments. Nothing less than this is called for if the promise of 'saving the plants that save lives', rather than the threat of their loss – so poignantly outlined almost 20 years ago in the Chiang Mai Declaration of 1988 – is to become a reality.

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