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The purposes and teaching of Applied Ethnobotany

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THE PURPOSES AND TEACHING OF APPLIED ETHNOBOTANY

Abstract

The aim of this paper is to provide recommendations for the teaching of Applied Ethnobotany - which is Ethnobotany applied to conservation and sustainable development. There are several fundamental reasons for applying the approaches and methods of Applied Ethnobotany for these purposes. First, they allow the knowledge, wisdom and practices of local people to play fuller roles in identifying and finding solutions to problems of conservation and sustainable development. Second, local people are fully involved in investigations, so that there is a better chance of 'buy in'. Third, realistic case-studies of ways of balancing conservation with use become available, which is valuable for informing the development of realistic national policies. Over 100 people - many practising ethnobotanists or educators - have been consulted, partly through special workshops or studies undertaken for this purpose. They have been in China, the Dominican Republic (covering eight Latin American countries), Ethiopia, Kenya, Malaysia, Pakistan, Tanzania and Uganda.

Reviews of the history of Ethnobotany and its teaching are included. Ethnobotany is being increasingly recognised as an important subject for conservation and sustainable development, but has several weaknesses, including often a lack of rigour in its teaching. The histories of Botany, Forestry, Agriculture and Medicine are also reviewed, to show how they have evolved as taught subjects and professional disciplines. Some of the specific ways that Applied Ethnobotany can be useful to these professions are indicated.

Several matters which developers of courses or programmes should consider are discussed. They include the challenges posed by interdisciplinarity, possible types of courses and programmes (including lengths and levels), institutional contexts, enrolment requirements, staffing, and material resources. The three types of courses and programmes which seem to be most generally useful are: (1) introductory courses within undergraduate programmes (which might be in Agriculture, Anthropology, Botany, Forestry, Medicine, or indeed other subjects); (2) two-year MSc programmes (half taught classes: half individual research), leading to professional-level ability; and (3) short professional courses of five days to three months duration, often focusing on specific well-defined topics.

The core competencies required of applied ethnobotanists are considered, along with how they may be acquired. So far as knowledge is concerned, suggestions are made for compulsory and optional topics to be covered in programmes, as well as some suggestions about their detailed content. Methods of acquiring practical skills are discussed, as well as the importance of adopting attitudes and behaviour appropriate to the profession. A list of People and Plants publications is included, with a guide to where descriptions of particular topics, including methods, can be found within them.

We welcome your views on this paper, particularly whether you have found it useful in designing your courses (contacts given below).

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Contents

Rationale and methodology of this study

Why Applied Ethnobotany?

Ethnobotany has been defined as the discipline concerned with the interactions between people and plants (Jones, 1941). There are many aspects of Ethnobotany, including the ways that people name and classify plants, the values placed on them, their uses and their management. It reaches across the natural and social sciences. Plants have always been of central significance to human welfare and always will be. Plants provide people with food, fuel and medicine, as well as materials for construction and the manufacture of crafts and many other products. Their chemical and genetic constituents are being increasingly explored for human benefit. They are major parts of the physical worlds which people inhabit and in which they construct their realities. They lie at the base of food-webs, supporting most other forms of life. They are essential elements of ecological systems on all geographical scales, helping provide us with equitable climates, fertile soils and reliable supplies of water. The central role of plants in the everyday lives of rural people is obvious in developing countries, with the daily round of activities revolving around agriculture, the care of domestic animals, the gathering of fuelwood, the cooking and eating of largely plant-based food, the construction of buildings and fences, the use of herbal medicine, and so on.

Ethnobotany can be applied for many practical purposes, among which McClatchey and his co-authors have listed land-use development, agriculture, forestry, cultural conservation, education and the development of the health food and herbal medicine industries (McClatchey *et al.*, 1999). Our interest here is in Applied Ethnobotany, which we define as Ethnobotany applied to conservation and sustainable development. Applied Ethnobotany draws on both personal (including traditional) and scientific forms of knowledge, allowing comparisons and integration for the benefits of conservation and sustainable development. In the past, ethnobotanical studies have all too often been just academic exercises or have served only external interests, with the results benefiting neither local people nor conservation. Our approach is cross-disciplinary, participatory, and geared towards local problem-solving.

The fundamental strengths of applying the approaches and methods of Applied Ethnobotany are that:

- They allow the knowledge, wisdom and practices of local people to play fuller roles in identifying and finding solutions to problems of conservation and sustainable development.
- Local people are involved fundamentally in investigations so that there is a better chance of 'buy-in'.
- Realistic case-studies of ways of balancing conservation with use become available to inform the evolution of national and other higher level policies.

Among the particular challenges to which Applied Ethnobotany can contribute are (Campbell & Luckert, 2002; Cruells, 1994; Cunningham, 2001; Laird, 2002; Martin, 1995; Schultes & von Reis, 1995):

- Conservation of plants (including varieties of crops) and other forms of biological diversity.
- Botanical inventories and assessments of the conservation status of species.
- Sustainability in supplies of wild plant resources, including of non-timber products.
- Enhanced food security, nutrition and healthcare.
- Preservation, recovery and diffusion of local botanical knowledge and wisdom.
- Reinforcement of ethnic and national identity.
- Greater security of land tenure and resource ownership.
- Assertion of the rights of local and indigenous people.
- Agreements on the rights of communities in protected areas.
- Identification and development of new economic products from plants, for instance crafts, foods, herbal medicines and horticultural plants.
- Contributions to new drug development.

The betterment of rural livelihoods is a complex task and it is not suggested that Applied Ethnobotany is a universal panacea. Natural resource issues are only part of wider livelihood issues, and botanical issues only part of natural resource issues. There will always be uncertainties about how people will perceive their future options and the livelihood strategies that they will adopt. However, what is certain is that most rural people in developing countries will contin-

ue to be heavily reliant on local wild plants. Further, it is the poorest people, in particular, who will remain most dependent on resources of wild plants and who stand most to gain if these resources are managed in sustainable ways. Applied Ethnobotany can therefore play a significant part in the battle to relieve poverty.

The intention of the present paper is to provide information useful to those wishing to develop courses or programmes in Applied Ethnobotany. Many people have been consulted to produce the present synthesis, which certainly will require revision with time and as other experiences are incorporated. Each course or programme is expected to differ in detail, moulded as appropriate to the contexts of particular departments, universities and countries or regions. On the other hand, it is noteworthy that findings of the consultations undertaken for the present project show an unexpected degree of agreement about the contents of courses and programmes in Applied Ethnobotany and on how they should be taught. There appears to be an emerging consensus.

Ethnobotany is sometimes seen as a 'soft' subject, but, actually, it can and should be intellectually demanding for both staff and students. As Janice Alcorn has commented (Alcorn, 1995): "The ethnobotanical field worker observes the living system of which plant use is a part. Careful observation is not, however, an easy job. It requires looking at human activities and organisations from a plant's viewpoint and looking at plants and plant communities from a culturally informed as well as a scientific perspective. Only by looking at the material in this way can the ethnobotanical field worker recognise links between the subunits investigated by researchers in different disciplines. Methods of different disciplines reveal different aspects of the system under study … . It is up to the field-experienced worker to integrate the data and spot new areas requiring investigation."

Ethnobotanists are faced with a continuing learning process throughout their careers. There is much to gain from the sharing of experiences and ideas within countries and internationally, though barriers of language remain a challenge, as between anglophone and francophone Africa (Höft & Höft, 1997). Networking is an invaluable tool. No-one has all the answers. We believe that progress in developing courses or programmes in Applied Ethnobotany will depend greatly on the sharing of experiences and the learning of lessons by those who are practically involved.

It is anticipated that Ethnobotany will become a powerful field of scientific activity in the 21st Century (Botanical Society of America, 1995). Unusually for a modern academic subject, there are particular opportunities for innovative contributions from ethnobotanists from developing countries. The advantages of such ethnobotanists can include personal experience of the problems that rural people face, intuitive appreciation of local cultures, and knowledge of local languages. Ethnobotanical research requires relatively little equipment and is cheap compared with many other fields of science.

Ethnobotany is a key subject for conservation and sustainable development. Capacity-building in Applied Ethnobotany is urgently needed in developing countries because of the intimate links between rural people and local plants. This is not to say that Applied Ethnobotany is not also useful as a taught subject in industrial countries, including to train people able to explore the many, largely hidden, economic dependencies of people in such countries on plants and the implications of consumer cultures for conservation. Furthermore, some ethnobotanists from industrialised countries will become involved in collaborative research with colleagues in the developing world.

Sonia Lagos-Witte has written of the urgency of developing Applied Ethnobotany, noting (Lagos-Witte, 1994):

- The rapidity with which environmental damage occurs today.
- The rapid loss of floristic and cultural diversity.
- The state of absolute material poverty of most of the indigenous and peasant people of tropical regions.
- The demands of these people for solutions to their problems and to take active roles in making decisions about the management of natural resources and about the legal status of their traditions and knowledge.

Methodology

The present document is a product of the People and Plants Initiative of WWF and UNESCO, with the Royal Botanic Gardens, Kew, as an Associate. Many people have contributed to its formulation (Appendix 1). Several meetings and other activities were organised to provide opportunities for ethnobotanists and other interested people to present their experiences and ideas about how Applied Ethnobotany should be taught:

- A meeting was held on 20-21 August 2001 organised by Professor Pei Shengji at Kunming Institute of Botany, Chinese Academy of Sciences, to discuss curricula in Ethnobotany for China (Pei Shengji, 2002a).
- Sonia Lagos-Witte and Alan Hamilton organised a workshop on curriculum development in Applied Ethnobotany on 21-23 February 2000 at the Jardín Botánico

Nacional Rafael Ma. Moscoso, Dominican Republic (Lagos-Witte, 2002). This workshop was for representatives of Grupo Etnobotánico Latinoamericano (GELA), members of which attended from a number of countries in Latin America.

- A workshop was organised on 3-4 May 2002 by WWF-Pakistan and WWF-UK at Nathiagali, Pakistan, mainly to bring together experiences and ideas from people in Pakistan, but with attendance also by ethnobotanists from Uganda. Written contributions were received from several people from other countries (Shinwari, Hamilton & Khan, 2002).
- A session on curriculum development in Applied Ethnobotany was organised on 20 September 2002 by Professor Pei Shengji and Alan Hamilton at the 8th International Congress of the International Society of Ethnobiology, Addis Ababa, Ethiopia.
- John Kessy of Sokoine University of Agriculture, Tanzania, undertook a survey of experiences and views about the teaching of Ethnobotany in Kenya, Uganda and Tanzania, concentrating on Departments of Botany and Forestry (Kessy, 2002).
- A presentation on curriculum development in Applied Ethnobotany was made by Alan Hamilton on 15 October 2002 during the National Symposium on Ethnobotany and Economic Development in China, this being the first national-level meeting on Ethnobotany to be held in the country.

The project has benefited from some earlier experiences associated with the People and Plants Initiative. Sonia Lagos-Witte and collaborators carried out a survey in 1995 to determine the status and opportunities for teaching of Applied Ethnobotany in Central America (Lagos-Witte et al., 1995). A similar study was undertaken later in Malaysia (Saleh, 2000). The People and Plants Initiative has, itself, run many courses in Applied Ethnobotany, principally short courses for professionals, but also a more extensive three-part regional course in South-east Asia in 1997-1999.

Contributors to a session on curriculum development in Applied Ethnobotany on 20 September 2002 at the 8th Congress of the International Society of Ethnobiology, Addis Ababa, Ethiopia. From left to right: 1. Dr Khasbagan (China), 2. Dr Fasil Kebebeh (Ethiopia, Congress Organiser), 3. Prof Pei Shengji (China), 4. Dr Chusie Trisonthi (Thailand), 5. Dr Esezah Kakudidi (Uganda), 6. Prof Hu Huabin (China), 7. Prof Sanyu Devi Joshi (Nepal), 8. Dr Alan Hamilton (UK), 9. Prof Abhoy Kumar Das (Nepal).

Ethnobotany: scope and status

Ethnobotany: past and present

The first published use of the term 'Ethnobotany' was by John Harshberger in 1896, referring to a botanical culture revealed through archaeological research in the Mancos Canyon, Colorado, USA (Harshberger, 1896). From this start, the scope of the subject has expanded to include studies of modern cultures, greater interdisciplinarity and, more recently, greater attention to its applications to conservation and sustainable development. It is a science that has been rapidly evolving, a state of affairs that will likely continue for some time. Many early studies, as some still are today, were largely or entirely descriptive, being concerned essentially with documenting the local names and uses of plants (Cunningham, 1997; Etkin & Meilleur, 1993; Fernández, 2002; Fonseca, 2000; Martinez, 2002). Attention was commonly directed towards more indigenous communities rather than peasants (i.e. non-indigenous local people) (Prance, 1995), not infrequently with a bias towards medicinal plants. By and large, these studies have proved of little practical value to the local people who provided the information. For example, many studies of medicinal plants in Polynesia have been insufficiently interdisciplinary and with inadequate attention to local concepts of medical conditions to be of much value for devising improvements in healthcare (Etkin & Meilleur, 1993). Not infrequently, Ethnobotany has been used as a means of extracting knowledge of the uses of plants, especially as medicines, from communities, with the aim of developing new commercial products elsewhere.

Over the last decade in particular, Ethnobotany has tended to become more analytical, quantitative, cross-disciplinary and multi-institutional. Ethnobotanists are now much more engaged with questions of conservation, sustainable development, cultural affirmation, and the intellectual property rights of local and indigenous people (Botanical Society of America, 1995; Fernández, 2002; Martinez, 2002). A growing inclusion of ecology is leading to new insights into the origin and dynamics of tropical ecosystems (Prance, 1995). Several stages in the historical progress of the subject in Africa have been recognised (Cunningham, 1997):

1. an initial emphasis on recording vernacular names and uses;
2. a broadening to include more work on nutritional and chemical analyses of edible and wild plants;
3. investigations into the quantities of materials used and/or the frequency of use (from about 1960);
4. quantitative studies of human impacts on plant resources, particularly those entering commercial trade (from about 1990); and
5. valuations of plant resources (from about 1995).

Worldwide, some of the major developments have been:

- A widening of Ethnobotany from a focus on indigenous people to embrace all sections of humanity.
- A greater use of anthropological methods to comprehend better how, and why, people classify, value, and give symbolic significance to plants.
- A growing awareness that ethnobotanical knowledge should be appreciated as part of wider knowledge-systems or 'cognitive matrices'.
- Greater scientific rigour in terms of setting and testing hypotheses, and quantification.
- More emphasis on participatory research aimed directly at the identification and resolution of practical problems of conservation and sustainable development.
- Greater recognition of the intellectual property rights of local and indigenous people, especially respect for secret medical knowledge and acknowledgement of the need to provide a fair return of benefits to the local level when research aims at the identification of new commercial products.

Wade Davis has expounded on some of the challenges facing contemporary ethnobotanists (Davis, 1995): "Ethnobotanists must record not only lists of plant uses but a vision of life itself. This is the second and much more difficult task - to understand not just how a specific group of people uses plants but how that group perceives them, how it interprets those perceptions, how those perceptions influence the activities of members of that society, and how those activities, in turn, influence the ambient vegetation and the ecosystem upon which the society depends."

Apart from its theoretical significance, Ethnobotany is emerging as a subject of great practical value. Its application can lead to a strengthening of cultural diversity and conservation, greater sustainability in the exploitation of plant resources, and the development of new plant products. It has helped in Latin America (and doubtless elsewhere) to change the image of local people so that organisations that make decisions about development have more respect for the cultures and authority of rural communities,

resulting in a search for ways to collaborate under conditions of respect and equality (Robineau, 1996). Ethnobotanical research can sometimes be a form of cultural rescue (Caballero, 1986). It enables the recording and documentation of traditional knowledge about the empirical uses of plants - knowledge which is widely disappearing. The rescue and documentation of traditional knowledge can contribute to the strengthening of indigenous cultures. It can result in the demonstration of the value of cultural diversity within the context of the processes of globalisation, modernisation and integration of indigenous peoples into national societies (Robineau, 1996).

The People and Plants Initiative was started in 1992, as a partnership between WWF, UNESCO and the Royal Botanic Gardens, Kew. Its aim has been to build capacity in Ethnobotany among individuals and institutions in the developing world. It has tried to contribute to the development of Applied Ethnobotany and its practical adoption around the world. Activities have included the training of young ethnobotanists, support for the development of networks and courses, and the dissemination of case-studies and methodologies through the production and distribution of publications and videos (Appendix 2). There have been national or regional programmes with co-ordinated series of activities in several countries in Africa, Asia, Latin America, and the South Pacific.

Ethnobotany is closely related to several other subjects. One of these, Economic Botany (known as Plant Resources in China), has been established longer. It concentrates on plant products and their uses. The core components of courses in Economic Botany cover categories of plant product, such as wood, resin and fragrances, with less attention given to the social and cultural dimensions of using and managing plant resources than is the case with Ethnobotany. In practice, there can be considerable overlap in the contents of courses in the two subjects (McClatchey *et al*., 1999). Economic Botany is similar to Wild Plant Utilisation, a full programme of which is taught at Northeast China Agricultural University. Ethnoecology, a term introduced in 1954 (Conklin, 1954) and more concerned with the ecological basis of human relations with the environment, is less focused on botanical aspects of the environment than Ethnobotany or Ethnobiology. Conservation Biology is more strictly concerned with conservation than Ethnobotany. In practice, courses in the subject often have inadequate coverage, not only of plants, but also of the social, cultural, economic and communication aspects of conservation (Brown, 2001; Kanowski, 2001; Liras, 1994). These deficiencies are unfortunate, even if the prime interest of a conservation biologist is to protect species of charismatic animals, because the retention of suitable habitat generally requires support from the local populace, and this support is more likely to be forthcoming if conservationists pay attention to the needs of local people for plant resources, so important to their livelihoods (Cunningham, 1996b; Wild & Mutebi, 1996). Medical Botany, once a major part of the education of doctors in Europe, is still taught in some countries, for instance to students of integrated medicine in China, and in more than 30 universities and colleges teaching Traditional Chinese Medicine in the same country.

"Ethnobotanists must record not only lists of plant uses but a vision of life itself..."

Participants at a workshop on curriculum development in Applied Ethnobotany, 21-23 February 2002, Dominican Republic.

Geographical coverage and themes

The aim in this section is to give an indication of current activities in Ethnobotany, at least for parts of the world for which syntheses have proved more ready to hand. We realise that this is an unbalanced account and apologise for its deficiencies. One of our reasons for including this section is to demonstrate the magnitude of variations between countries. We consider the development of national capacity in Applied Ethnobotany as critical. Ethnobotany is a universal subject in terms of its theory, but it will contribute little to the intellectual life of a country or to the resolution of practical problems, unless it becomes well embedded within educational and training institutions, and in practice. This means the emergence of a critical mass of national ethnobotanists who are knowledgeable, active and ethical. Thus, the development of courses and programmes within countries is vital.

The number of published studies in Ethnobotany varies considerably across Latin America (Caballero, 1986; GELA, 2002). A sur-

Table 1. Rank order (1=highest) of number of studies on different themes in Ethnobotany in Latin America (Martinez, 1994). N = study by nationals; F = study by non-nationals; All = all studies (by nationals, non-nationals, and nationality not recorded).

	South America			Central America			Mexico			Caribbean			All Latin America		
	N	F	All	N	F	All	N	F	All	N	F	All	N	F	All
Archaeobotany	5	4	5	3	1	1	6	1	2	none	none	none	6	2	3
Medicinal plants	2	1	1	1	2	3	2	2	1	1	1	1	1	1	1
Edible plants	3	3	3	2	5	5	3	5"	6	2"	4	3	3	5	4
Cognitive studies	9	7	8	9	9	10	8	7	8	none	8	8	9	8	8
Forest use	7"	6	6	7"	6	6	7	9	7	2"	2	2	7	6	7
Agroforestry systems and homegardens	7"	8	7	5	7	7	1	5"	3	none	6	6"	4	7	6
Domestication and origin of agriculture	1	2	2	4	3	2	4	4	5	2"	5	5	2	3	2
Historical studies	6	9	9	none	8	8"	9	8	9	6	7	6"	8	9	9
Market studies	10	10	10	7"	none	8"	10	10	10	none	none	none	10	10	10
General	4	5	4	6	4	4	5	3	4	5	3	4	5	4	5

vey, published in 1994, of articles on Ethnobotany which have appeared in international journals revealed that 41% of all studies in Latin America have been in South America, 14% in Central America, 36% in Mexico and 9% in the Caribbean ($\sum$ = 2768) (Martinez, 1994). Mexico is easily the country with the greatest level of activity (36% of the total), followed by Peru (11%), Colombia (9%) and Guatemala (5%). There have been very few studies in the three Guyanas, Nicaragua, El Salvador or Uruguay. Mexico witnessed a major expansion in research in the 1970s and 1980s (Toledo, 1995). Another indication of relative national strength of Ethnobotany in Latin America is the distribution of members of the Grupo Etnobotánico Latinoamericano (GELA) (Table 2).

The survey of Miguel Angelo Martinez referred to above allows a ranking of the number of ethnobotanical studies in Latin America by theme (Table 1). The rank-order is as follows ($\sum$ = 2768): (1) medicinal plants; (2) domestication and origin of agriculture; (3) archaeobotany; (4) edible plants; (5) general ethnobotanical studies; (6) agroforestry and homegardens; (7) forest use; (8) cognitive studies; (9) historical studies; and (10) market surveys. There is little difference in this rank-order between the major sub-regions (South America, Central America, Mexico, the Caribbean), except that 'archaeobotany' is top of the order in Central America but last (with no studies) in the Caribbean, and that 'forest use' ranks second in the Caribbean. Foreign researchers were responsible for many of the earlier ethnobotanical studies carried out in Latin America, these researchers having been mainly from North America, the UK and France. Altogether, 52% of all studies recorded in this survey were carried out by non-nationals and 38% by nationals, national identity not being recorded in the other cases. Taking the analysis further and omitting the 'unrecorded' group, then it is clear that nationals are responsible for a much greater percentage of studies in South America (48%) and Mexico (47%) than in Central America (21%) or the Caribbean (22%). The only countries in Latin America in which nationals have been responsible for the majority of studies are those lying in or close to the Southern Cone (Argentina 90%; Brazil 67%; Chile 78%; Paraguay 61%; Uruguay 100%) and, additionally, Cuba (68%), Haiti (52%) and Guadeloupe (88%) (a French territory).

Two recent surveys carried out on behalf of the People and Plants Initiative have revealed something of the status of Ethnobotany in sub-

Table 2. Distribution of members of Grupo Etnobotánico Latinoamericano (GELA) in various Latin American countries (2002).

Argentina	50
Bolivia	7
Brazil	70
Chile	12
Colombia	36
Costa Rica	5
Cuba	28
Dominican Republic	4
Ecuador	6
El Salvador	2
Honduras	6
Mexico	208
Nicaragua	3
Panama	8
Paraguay	2
Peru	45
Puerto Rico	1
Uruguay	2

Saharan Africa. There is much variation in level of activity between countries and types of ecosystem.

One of the surveys deals with Western and Central Africa, in which the leading country in Ethnobotany is Cameroon, followed by the Democratic Republic of Congo and Nigeria (Dounias, Rodrigues & Petit, 2000). There have been very few studies in a number of countries, including Liberia, Mali and Mauritania. About half of all studies have been in the rainforest zone and about a quarter each in the Sudanian and Sahelian zones. Thirty per cent of studies concerned with the uses of plants have been on medicinal plants and 26% on food plants.

The other survey covers Eastern and Southern Africa (Höft & Höft, 1997). Nearly 30% of studies have been carried out in savanna, followed in order of frequency by wetlands, montane forest, woodland, lowland rainforest and then a number of other vegetation types. Nearly 50% of studies have been in protected areas, especially Forest Reserves and National Parks.

In India, Ethnobotany emerged as a distinct discipline in the early 1970s, when much documentation of the uses of plants by tribal groups in Central India was undertaken under the leadership of Professor S K Jain, Director of the Botanical Survey of India. The work was later extended elsewhere, for instance into the south of the country. A training course in Ethnobotany was initiated in 1988. Respect for Ethnobotany, as a significant subject for development, grew from the mid-1990s, with greater emphasis on applications to rural problems. Research in Ethnobotany has contributed greatly towards developing approaches for the enhancement of the use of indigenous knowledge in rural development. Interest in Ethnobotany has also been growing rapidly elsewhere in the subcontinent. Ethnobotanical research started in Nepal in about 1970 and has since become a popular subject of research (Joshi, 2002). As in India, there has been movement in other countries of the subcontinent during the 1990s, away from just documentation of local uses of plants towards more participatory approaches to the identification and solving of problems of plant conservation and sustainable use.

A survey of publications on Ethnobotany in Malaysia has shown the rank order of popularity of themes as: medicinal plants (57% of publications); general Ethnobotany (23%); edible plants (8%); culture, customs and beliefs (5%); indigenous crafts (3%); home-gardens (2%); household items and clothing (1%); and spices (1%) (Saleh, 2000). There has been a big increase in the number of theses in Ethnobotany produced in institutions of higher learning during the last 30 years, starting from only 4 in the 1970s, to 39 in the 1980s and 76 in the 1990s. The concentration of interest on medicinal plants is reflected in a big growth in the number of government research or university institutions involved in research into natural products. Eight of the 10 public universities in Malaysia now have their own natural product research laboratories. The main motives behind this development seem to be medical and commercial, that is the identification of new bioactive chemicals, contained within Malaysian plants, of value for new medical products. Research in Ethnobotany has been unevenly distributed by region and ethnic group, with most studies being on the Malay and Chinese communities in Peninsular Malaysia and few studies in Sabah or Sarawak.

Ethnobotany became a recognised academic subject in Thailand in 1990. Since then, 10 graduates have received MSc degrees from the Department of Biology, Chiang Mai University (Trisonthi & Trisonthi, 2002).

Modern Ethnobotany in China can be considered to be rooted in research beginning in the early 1960s on utilisation of wild plants and on traditional medicine. These efforts, carried out throughout the country, were designed for the development of botanically-related industries. The Barefoot Doctor Programme, starting in the late 1960s and which aimed to bring more effective medical services to the masses, was accompanied by a national inventory of Traditional Chinese Medicine (TCM). Numerous handbooks on many matters relating to TCM were produced, such as on the cultivation, harvesting, processing and uses of medicinal plants. It was not until 1978, following the opening up of China to the outside world, that Chinese scientists became aware of the subject of Ethnobotany, as it had developed elsewhere, and were able to read international journals such as the Journal of Economic Botany. A Chinese term for the word 'Ethnobotany' was first used in a publication in 1982. Meanwhile, Pei Shengji, who later become Director of Xishuangbanna Botanic Garden (1978), had been working on the documentation of the botanical cultures of the Dai, Hani, Jinuo, Yao and other minorities in Xishuangbanna Prefecture, Yunnan Province. This is the main site of tropical forest in China. A seminal event in the development and recognition of Ethnobotany as an applied science was the Second National Symposium on Rubber and Tropical Economic Crops, at which Pei Shengji managed to argue successfully against the wholesale replacement of tropical forest in Xishuangbanna with rubber plantations. He could do so because be came well armed with evidence from research of the value of produce from the rainforest to the people, both locally and potentially to the nation, and also concerning the beneficial influence of forest on surrounding hills for maintaining irrigation systems in the

plains. A further controversy, in the mid-1980s, this time over a government proposal to ban shifting agriculture, helped create greater national awareness of the values of traditional ecological knowledge and practices. A Department of Ethnobotany was established in 1987 within the Kunming Institute of Botany of the Chinese Academy of Sciences, perhaps the first such ethnobotanical institution world-wide outside the USA. A second institution dedicated to Ethnobotany was started in China in 1996, at Inner Mongolia Normal University. Today, Applied Ethnobotany is becoming widely recognised throughout China as an extremely useful subject for conservation and development.

Societies, networks and key events

The youthfulness of Ethnobotany is demonstrated by the recent dates of founding of related societies and networks, and of other events considered to be seminal to its national development according to local perceptions:

1959. Founding of the Society for Economic Botany (SEB).

1978. First Conference of the Society of Ethnobiology. The society draws its membership mainly from Canada and the USA.

1980. Founding of the Society of Ethnobotanists. The society has a base in India.

1981. Founding of China Association of Ethnomedicine and Folk Medicine.

1982. Founding of Traditional Medicine for the Islands (TRAMIL). Originally restricted to the Caribbean, TRAMIL expanded formally to include Central America in 1993 (but with collaborative efforts since 1984). TRAMIL supports the use of traditional medicine, notably through its validation through pharmacological and toxicological research.

1986. Founding of the Grupo Etnobotánico Latinoamericano (GELA), affiliated to La Asociación de Latinoamericana de Botánica.

1986. Onwards. Regular symposia on Ethnobotany organised within the framework of the Latinamerican Botanical Congress, held every 4 years.

1987. A symposium held by GELA is seen as the start of nationally-based Ethnobotany in Colombia (Martinez, 2002); GELA has also organised many other symposia.

1987. First National Training Workshop on Ethnobotany in China.

1988. Founding of the International Society of Ethnobiology (ISE).

1990. Founding of the Society of Ethnopharmacology.

Early 1990s. Launch of the GEF/FAO/UNDP initiative for institutional capacity-building for biodiversity conservation in East Africa, seen as giving a boost to Ethnobotany in the region (Kessy, 2002).

1992. Start of the People and Plants Initiative of WWF, UNESCO and the Royal Botanic Gardens, Kew. The aim of the initiative is to build capacity in Ethnobotany in developing countries.

1992. First International Ethnobotany Congress, Cordoba, Spain.

1994. Foundation of the Asociación Mexicana de Etnobiología.

1994. Founding of The Natural Products Research Network for Eastern and Central Africa (NAPRECA).

1995-1997. Training workshops in Ethnobotany held in Bangladesh, China, India, Nepal and Pakistan under the Hindu Kush - Himalaya Ethnobotany Project of the International Centre for Integrated Mountain Development (ICIMOD) in association with the People and Plants Initiative. These were the first national workshops in Ethnobotany held in several of these countries.

1996. Founding of the Ethnobotanical Society of Nepal (ESON).

1997. Founding of the African Ethnobotanical Network (AEN), affiliated to the Association pour l'Etude de la Flore d'Afrique Tropicale (AETFAT).

1997. Second International Ethnobotany Congress, Mérida, Mexico.

1997. Founding of the Uganda Network of Ethnobotanists and Ethnoecologists (UGANEB).

2000. Founding of the Sociedad Colombiana de Etnobiología.

2000. First National Workshop in Ethnobotany in Cuba (2000) (Fernández, 2002).

2000. Founding of the Kenya Ethnoecological Society (KES).

2001. Third International Ethnobotany Congress, Italy.

2002. Founding of the Pakistan Ethnobotanical Society (PES).

2002. Founding of the Tanzanian Society of Ethnoscience.

Ethnobotany as a taught subject

For the purpose of discussion, a distinction is made between a course and a programme. A course is taken to be a relatively brief period of study, for example a one-week course for professionals or a module within a programme (e.g. a unit of Ethnobotany within an undergraduate programme in Botany). A programme is longer in duration, being a subject of graduation or else a tailored package of several courses designed to give an effective education in Ethnobotany within the context of a wider degree programme.

There is no doubt that the number of courses in Ethnobotany is increasing. A survey of the teaching of Economic Botany in the USA, undertaken in 1963, found 110 universities offering single courses in this subject, though only 5 at graduate level (Bartoo, 1964). A growing demand from students was reported. There were no courses actually entitled Ethnobotany, which at the time had yet to be regarded as a distinct academic subject in its own right. There were no specialised programmes in Economic Botany, but the author drew special attention to two universities of special merit, Harvard - with progressive teaching by Richard Schultes involving laboratory and fieldwork and access to good research facilities - and Iowa State - which offered the most in-class lecture time. A subsequent survey in 1996, not restricted to the USA, showed that, by then, Ethnobotany had often become recognised as a distinct subject (McClatchey *et al*., 1999). A major finding was a growth in the number of programmes in Economic Botany or Ethnobotany from 2 in 1963 (Harvard and Iowa) to 30 in 1996. It was noted that Ethnobotany, especially concentrating on medicinal plants, was becoming fashionable. It was also found that there was a trend away from teaching these subjects to just students of Botany, with an increase in the number of students enrolled registered in non-botanical departments or inter-disciplinary programmes.

The 1996 survey identified 135 institutions worldwide offering courses in Economic Botany or Ethnobotany (McClatchey et al., 1999). The largest number was in North America (70 courses; 23 programmes), the equivalent figures for other regions being South America (7; 5), Europe (6; 1), Asia (3; 0), Australia (1; 0) and Africa (0; 0). A similar predominance of courses in the USA was also a finding of a small internet survey of Ethnobotany courses conducted in 2001 by Florent Bernard and Mark Nesbitt of the Royal Botanic Gardens, Kew, and one of the present authors, Alan Hamilton: 19 out of the 35 courses or programmes detected were in the USA. Neither of these surveys should be regarded as definitive, both likely underestimating the number of courses outside North America. Nevertheless, it is probably true that there are many more courses in the USA than in any other country, a reflection of the large number of universities and students, and the popularity of interdisciplinary subjects. Judging by a remark that many of the courses are 'shallow' (McClatchey *et al*., 1999) and by descriptions of the courses on their websites, it is evident that many courses in Economic Botany and Ethnobotany in the USA are intellectually undemanding, being aimed at general 'liberal arts' students. The first programme devoted to Ethnobotany in the UK was launched in 1998. It is a 1-year MSc programme taught collaboratively by the Department of Anthropology of the University of Kent at Canterbury, the Durrell Institute of Conservation and Ecology and the Royal Botanic Gardens, Kew (Ellen, 2002).

A survey of 1995 confirmed the leading position of Mexico within Latin America as a centre for the teaching of Ethnobotany, noting the contributions of the Universidad de Chapingo and the Centro de Investigación Cientifica de Yucatán, the latter linked to researchers from the Universidad Nacional Autónoma de México (UNAM) (Lagos-Witte et al., 1995). The same survey identified two universities in Central America providing significant courses on useful plants, namely the Universidad Nacional Autónoma de Nicaragua-Léon (UNAN) and the Universidad de Panamá. Federal universities in Brazil teaching Ethnobotany are shown on Table 3.

A survey published in 1997 confirmed that there were very few ethnobotanical courses in Africa, even though it was estimated that about 1500 students were currently learning something about the subject (Höft & Höft, 1997). There were no courses at that time in East Africa, where, more recently, there have been some significant developments (Kessy, 2002). The most adventurous efforts have been in Uganda, where the Department of Botany, Makerere University, has initiated a full three-year undergraduate programme in Ethnobotany. This is possibly the first such programme in the world. Unfortunately, the programme at Makerere is only open to private students, the level of fees being such as to likely deter many potential students from applying. The Department of Botany at Makerere is also considering starting an MSc programme in Ethnobotany. The Faculty of Forestry and Nature Conservation at Makerere includes a course in Ethnobotany in its BSc (Forestry) programme and it is likely that Ethnobotany will also be included in two MSc programmes being developed, one in Agroforestry and the other in Rural Resources and Development (a joint programme with the Faculty of Agriculture). The Department

Table 3. Representation of Ethnobotany in federal universities in Brazil (Stern da Fonseca, 2002).

Region of Brazil	Number of federal universities	No. of federal universities with courses in Ethnobotany	Departments in which courses in Ethnobotany are taught	Components in other courses	Courses in which Ethnobotany forms a component
North	6	0		2	Agriculture Biology
North-east	10	4	Botany Health Pharmacology	5	Aquatic Science Biology Pharmacy Ecosystem Sustainability
Central-west	4	0		2	Biology Conservation of Biological Diversity Health and Environmental Science
South-east	13	3	Botany (x2) Horticulture	6	Agriculture Biology Botany (Ecology) Pharmacy
South	6	1	Botany	2	Biology Botany Pharmacy
Total	**39**	**8**		**17**	

of Botany, Kenyatta University, plans to start an MSc programme in Ethnobotany in the near future, while the Department of Botany, Nairobi University, is considering starting an undergraduate course in the subject. Both of these departments in Kenya currently teach elements of Ethnobotany in other programmes, as is also the case with the Department of Botany of the University of Dar es Salaam in Tanzania and the Department of Crop Science and the Faculty of Forestry at Sokoine University of Agriculture in the same country. There is no full course in Ethnobotany in Tanzania.

Ethnobotany has been introduced widely into undergraduate and postgraduate curricula in Botany in universities and colleges in India, but so far we know of no specific programme leading to the award of a degree or diploma specifically in the subject. Recently, the University of Tribhuvan in Nepal has created an elective course in Ethnobotany, and many students in the country have opted to do research for their dissertations on the subject (Joshi, 2002). In the case of Pakistan, there were no courses in Ethnobotany in 1996, but, by 2002, ethnobotany courses had been introduced at AJK University, Balochistan University, Fatima Jinnah Women's University (Rawalpindi), Islamia College (Peshawar), Malakand University, NWFP Agricultural University ('Applied Ethnobotany' and 'Advances in Ethnobotany') and at the University of Peshawar. There are no ethnobotanical courses within programmes of forestry in Pakistan, although components of the subject are covered as parts of 'Plant Taxonomy' and modules on forest utilisation (Khurshid & Mahboob, 2002).

In Thailand, the first programme at PhD level incorporating Ethnobotany as a major element was established at Chiang Mai University in 1999 (Trisonthi & Trisonthi, 2002). It is entitled 'Biodiversity and Ethnobiology'.

Ethnobotany, as a taught subject for graduates, was first established in China in 1987, in the Department of Ethnobotany of the Kunming Institute of Botany, Chinese Academy of Sciences. About 25 students have studied or are currently studying for MSc or PhD degrees. More recently, a number of other institutions have started to teach the subject, including the Southwest Forestry College (where a course in Ethnobotany became incorporated into the Social

Table 4. Courses in Ethnobotany and related subjects in universities in Malaysia (Saleh, 2000).

University	Faculty, school, department or programme	Title of course	Student enrolment
Universiti Kebangsaan Malaysia, Bangi	School of Environmental and Natural Resources Sciences	Ethnobotany plants, people and life	Elective course for non-science students
Universiti Malaya, Kuala Lumpur	Institute of Biological Science	Ethnobotany	Compulsory for Biomedical Technology students
		Taxonomy and medicinal plants	Compulsory for Biomedical Technology students
		Formulation and herbal medicine preparation	Compulsory for Biomedical Technology students
		Alternative medicine	Compulsory for Biomedical Technology students
Universiti Sains Malaysia, Penang	School of Pharmaceutical Science	Traditional medicine and pharmacognosy	Elective course
Universiti Putra Malaysia, Serdang	Faculty of Forestry	Non-wood forest products	
		Agroforestry	
Universiti Malaysia Sarawak, Kota Samarahan	Plant Resources Science and Technology Resource Chemistry Programme	Ethnobotany	Compulsory for second year students
		Natural product chemistry	

Forestry Programme in 1992), the National University of Pharmacy, Inner Mongolia Normal University (where the teaching of Ethnobotany to graduates in the Mongolian language commenced in 1998) and many medical colleges and universities. Each university or college initially designed its own course, but there is now movement towards adoption of a common curriculum following a workshop held under the auspices of the present project in August 2001 (Pei Shengji, 2002b).

Ethnobotany is not a major taught subject in universities in Malaysia, but is increasing in importance (Table 4) (Saleh, 2000). Ethnobotany is not offered as a specific subject in the major forestry schools in Malaysia (Saleh, 2000).

How Ethnobotany can be strengthened

Ethnobotany urgently needs development as a taught subject and professional discipline. Lists of perceived weaknesses can make daunting reading (Box 1). It has been suggested that all of these are due to its youthfulness (McClatchey et al., 1999). Part of the problem is not so much to due to weaknesses in Ethnobotany *per ipse*, but rather to the frequent failure of ecologists, geneticists and other specialists to acknowledge the contributions that Ethnobotany has made to their subjects.

The perception that Ethnobotany is not a 'hard core science' is a reflection, in part, of methodological weaknesses in conservation more widely. Much conservation, as practised on the ground, is based on personal experience or intuition, rather than with its directions and activities being firmly supported by evidence. There is often little monitoring of success, or evaluation of effectiveness. Results are rarely widely disseminated. There is a need to find more effective ways of operating (Pullin & Knight, 2001; Stevens & Milne, 1997). A comparison has been made with medicine, a discipline similar to conservation in that action is often required urgently in the absence of precise information (Pullin & Knight, 2001). The practice of medicine is said to have undergone an 'effectiveness revolution' in some countries in recent years through improvements in the criteria upon which strategies in public health, or for the treatment of individual patients, are based. The People and Plants Initiative is currently exploring ways to establish a network charged with identifying and disseminating more effective practices in Applied Ethnobotany.

Specific ways of improving standards, suggested by ourselves or others, include:

- Exchanges of case-studies, analyses and ideas between ethnobotanists.

The results of a questionnaire survey with 300 respondents sent out on behalf of the African Ethnobotanical Network gave the three principal reasons for improved networking as: (1) provide information on research; (2) exchange ethnobotanical methods; and (3)

Box 1. Some perceived weaknesses of Ethnobotany.

1. In general (mainly after McClatchey *et al*. 1999):

- A 'soft' subject, not a 'hardcore science'.
- Shallowness or poor orientation of courses.
- Lack of respect for the discipline; not appreciated by other professional people or government officials.
- Lack of research funding.
- Lack of good mentors.
- Lack of jobs.
- Poorly developed methodologies.
- Lack of national critical masses of ethnobotanists.
- Few networks, including working relationships, in developing countries.

2. In Latin America, in particular (GELA, 2002):

- Lack of support for research on society/environment relationships, which are not seen as important.
- Little motivation for inter-disciplinary approaches in academia or professional fields.
- Difficulties of determining priorities.
- No consensus on methods.
- Few in-depth courses.
- Lack of formation of human resources.
- Low local academic levels of some contributing disciplines.
- Inadequate dissemination of results.

enable contacts with colleagues (Höft & Höft, 1997).

- Support and develop an ecosystem-based approach to conservation and sustainable development, as a basic orientation for the development of Applied Ethnobotany (see below and Figure 1).
- Promote standardisation in the levels of rigour expected of courses and programmes in Applied Ethnobotany, within countries and internationally (Kessy, 2002).

Achievement of a measure of standardisation will give potential employers better ideas of what to expect of graduates and should enhance the mobility of graduates in the job market.

- Raise awareness of the value of Applied Ethnobotany within universities and educational ministries, and among potential students and employers.

Awareness-raising among potential students and employers needs to proceed simultaneously. There is considerable concern among students in Ethnobotany in East Africa about their prospects of employment (Kessy, 2002).

- Promote greater rigour in research in Ethnobotany, including through the formal stating and testing of hypotheses on people/plant relations (Cunningham, 1997).
- Strengthen an existing trend towards greater quantification (Cunningham, 1997; Martinez, 1994).

A survey of ethnobotanists active in Africa revealed that only 15% appeared to use statistics in their teaching (Höft & Höft, 1997).

- Increase 'hardcore scientific elements' such as Phytochemistry (Kessy, 2002).

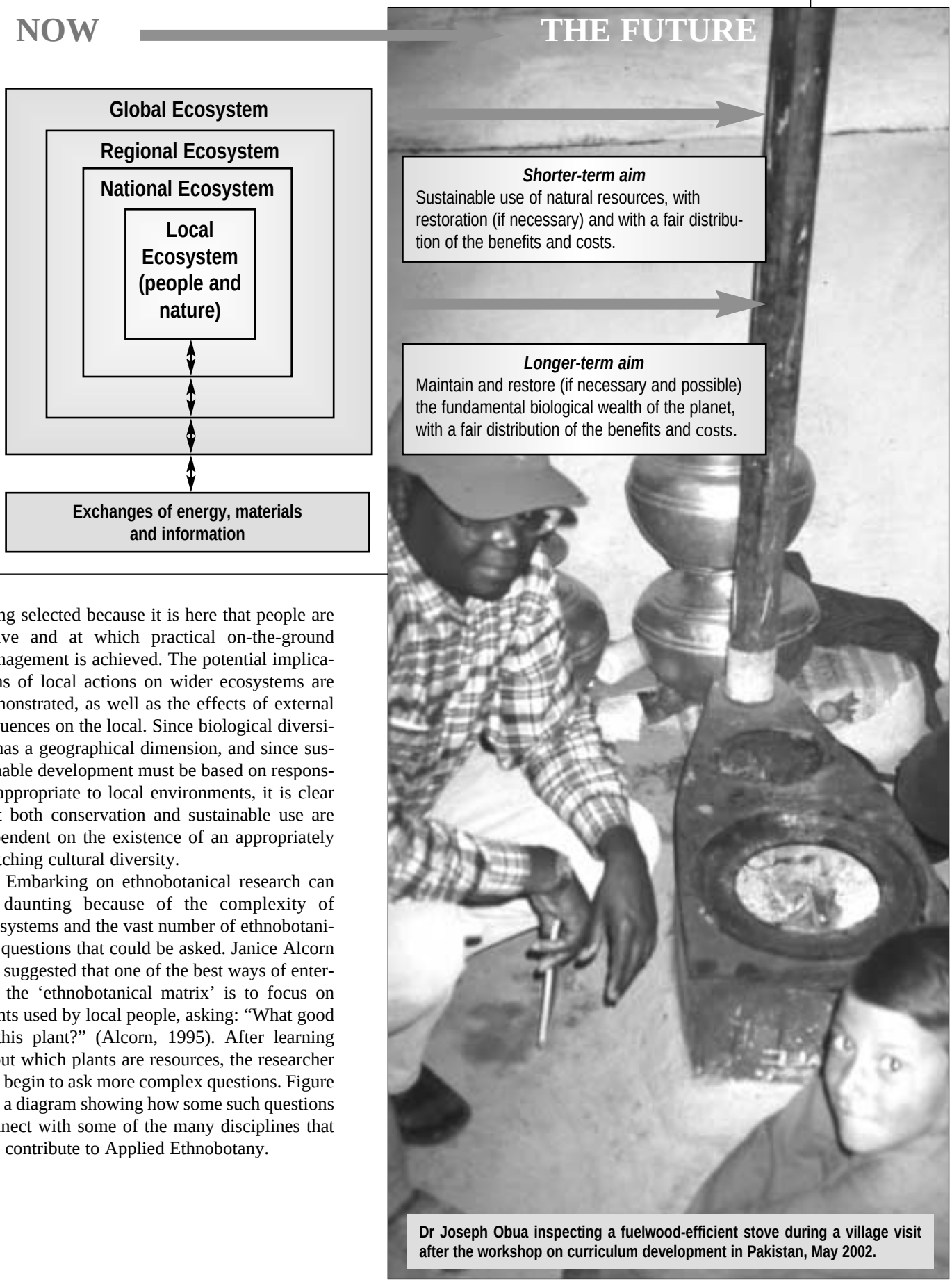
This might increase the acceptability of Ethnobotany as a 'real science' in some universities, making it easier for courses and programmes to be approved (Kessy, 2002).

The People and Plants Initiative is promoting Applied Ethnobotany as a distinct form of Ethnobotany because we believe that Ethnobotany has a major role to play in conservation and sustainable development. Our concern is especially with developing countries, where plants growing locally are so important in rural economies and cultures, where there are often concentrations of biodiversity, and where the few resources available for higher education need to be carefully targeted. We are not against 'pure research', as such, or work on more esoteric aspects of Ethnobotany, but warn of the danger of universities becoming 'ivory towers' and mere 'talking shops' of little relevance to the lives of people outside their gates.

In advocating Applied Ethnobotany and an ecosystem-based approach to conservation and sustainable development, we point out that people/plant relations are so central to human livelihoods that courses or programmes in Ethnobotany could potentially cover a vast range of topics. Unless there is focus, almost anything could be taught - hence, we suspect, the low opinion in which the subject is held in some quarters. The paradigm question has been alluded to by Victor Toledo, asking whether Ethnobotany is an isolated discipline, closed within itself, or rather part of a new interdisciplinary trend loosely tied to the problems of production and politics (Toledo, 1995). He writes: "This trend makes mere academic contributions (ie, knowledge for knowledge itself) or basic science cease to be the main objective(s) of research; instead they become intermediate products along the way to goals of applied character." Toledo sees a connection with the appearance of a new type of ethnobotanist in Mexico, one that is less specialised, less politically naïve and more conscious of his or her social role: "Two factors have played a critical role in this metamorphosis: the participation of these new ethnobotanists in multidisciplinary research groups, and their recognition that the Indian groups with which they work are the most exploited and marginal sector of Mexican society."

Figure 1 is a model of an ecosystem-based approach to conservation and sustainable development. The centre of attention is the local ecosystem of people and nature, the local level

Figure 1. Model of an ecosystem-based approach to conservation and sustainable development, incorporating an ethical dimension.

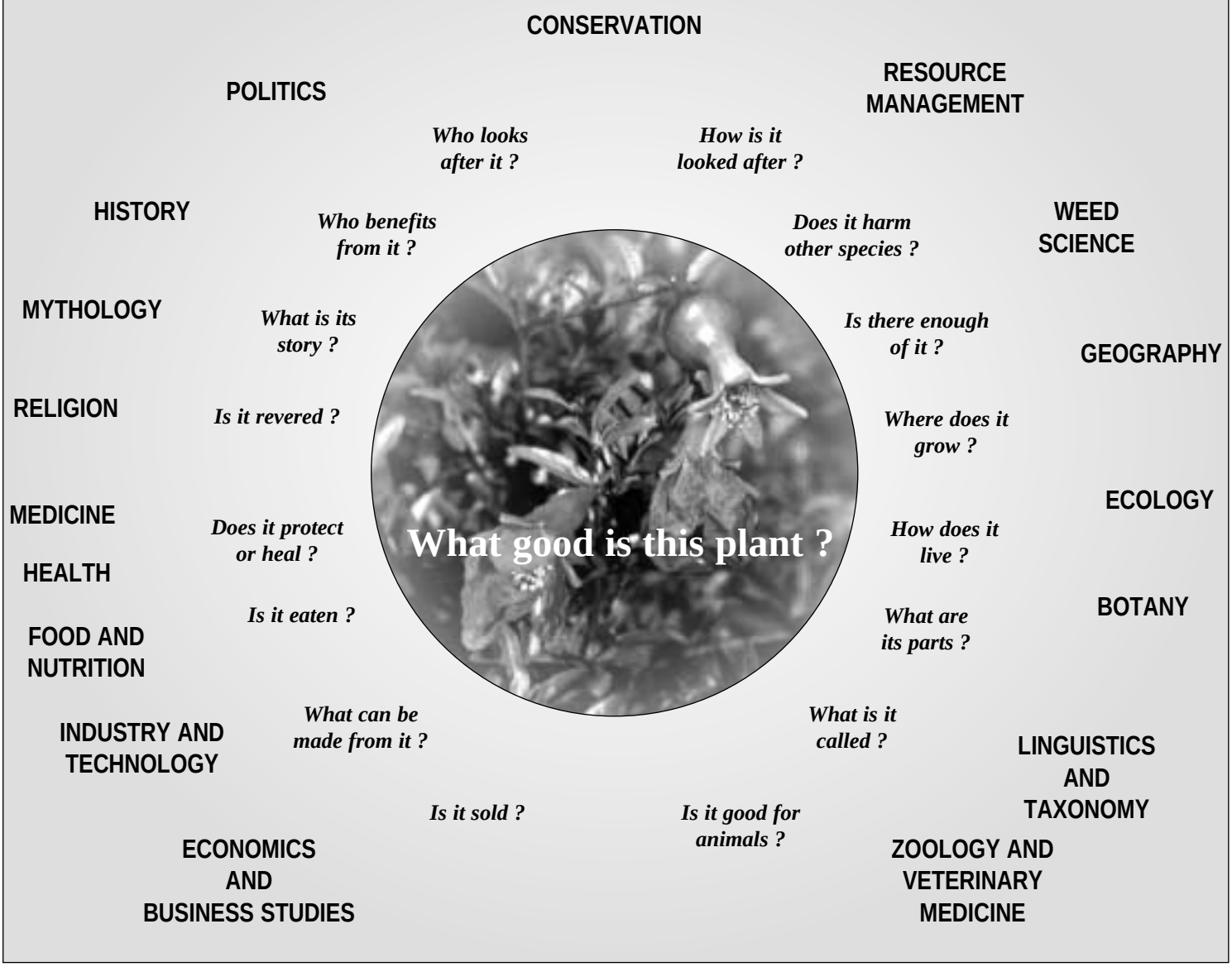


being selected because it is here that people are active and at which practical on-the-ground management is achieved. The potential implications of local actions on wider ecosystems are demonstrated, as well as the effects of external influences on the local. Since biological diversity has a geographical dimension, and since sustainable development must be based on responses appropriate to local environments, it is clear that both conservation and sustainable use are dependent on the existence of an appropriately matching cultural diversity.

Embarking on ethnobotanical research can be daunting because of the complexity of ecosystems and the vast number of ethnobotanical questions that could be asked. Janice Alcorn has suggested that one of the best ways of entering the 'ethnobotanical matrix' is to focus on plants used by local people, asking: "What good is this plant?" (Alcorn, 1995). After learning about which plants are resources, the researcher can begin to ask more complex questions. Figure 2 is a diagram showing how some such questions connect with some of the many disciplines that can contribute to Applied Ethnobotany.

Dr Joseph Obua inspecting a fuelwood-efficient stove during a village visit after the workshop on curriculum development in Pakistan, May 2002.

Figure 2. Some key questions and disciplines relevant to Applied Ethnobotany. A simple question provides a practical way to enter the 'ethnobotanical matrix'. Developed from an idea of Janice Alcorn (Alcorn, 1995).



Participants at the International Workshop on curriculum development in Applied Ethnobotany, Nathiagali, Pakistan, 3-4 May 2002.

Relevance of Applied Ethnobotany to Botany, Forestry, Agriculture and Medicine

Professions to which Applied Ethnobotany can contribute

The real-life interactions of people with plants often do not conform neatly to the ways that academic disciplines and related professional fields are organised. The reality of rural socio-ecology in developing countries is that agricultural systems are not strictly dissociated from forestry systems, nor are concerns about health divorced from wider social and environmental affairs. A professional understanding of the constraints governing access and use of plant resources requires a knowledge of Sociology, Anthropology and Economics as much as Botany and Ecology. People living in rural communities in developing countries may obtain food, shelter, medicine, fuel, fodder and other resources from plants that are 'wild' as well as from those that are cultivated, straddling the domains of the forester and the agriculturalist. There is often less distinction between food and medicine than is normal in the West. Individual wellbeing is felt to be closely connected to the social and spiritual worlds, requiring appreciation by researchers of local worldviews and religious beliefs, as well as of more material factors. The training of ethnobotanists must obviously extend across the boundaries of disciplines, as traditionally defined.

Fields of knowledge in academia have tended to become increasingly specialised over recent years. This is a reflection, in part, of the huge quantities of information on a vast diversity of specific topics that exist today and a growing specialisation of occupations, especially within industrial societies. Disciplines and related professions concerned substantially with plants have shared in the information explosion, sometimes with dramatic consequences. On the one hand, scientific knowledge about plants has contributed to the introduction of high-yielding varieties of crops and thus to the explosion in the size of the human population. However, on the other hand, benefits from science have accrued disproportionately to people living in richer, industrialised and largely urban countries, or to more privileged people in the developing world (Toledo, 1995). Scientists have paid comparatively little attention to the problems of conservation and development faced by the majority of humankind, especially the many poor people who live in developing countries.

The search for answers to many of the problems of conservation and sustainable development associated with rural people in developing countries requires a more holistic and participatory approach to research than has conventionally been the case. Research approaches need to correspond more closely to the multi-dimensional realities of people's lives. Fundamental requirements are acknowledgement of the knowledge and wisdom of local people and their close engagement in the identification of problems and potential solutions. Applied Ethnobotany, an interdisciplinary subject, is well placed to surmount the divisions imposed by the narrowness of many modern academic fields and professions concerned with human livelihoods and the environment. We encourage those people who wish to develop courses in Applied Ethnobotany to study the origins and determine the biases of botanically-related academic disciplines and professions in their countries (Table 5). There is little doubt that these disciplines and professions in developing countries have been strongly influenced in their histories by cultural and economic forces emanating substantially from elsewhere. Centres of economic strength and scientific endeavour, notably in Europe and North America, have contributed disproportionately to the shaping of modern academia and the professions all over the world.

The histories of Botany, Forestry, Agriculture and Medicine are briefly reviewed below to show something of how these subjects have evolved. The intention is to provide a rough global picture to help those interested in developing teaching in Applied Ethnobotany. Aspiring teachers are encouraged to carry out investigations of the histories of these and other plant-related subjects in their own countries. They should analyse their appropriateness, as currently taught and practised, to meet the challenges of conservation and sustainable development.

Botany: past and future

Scientific Botany, as it emerged in Europe during the Renaissance, was closely tied to medicine and pharmacy (Heywood, 1991). Written records of the uses of plants, especially as medicines, date much further back in China, Ancient Greece, India and, comparatively recently, the medieval Arab world (Dash, 1995; Eldin & Dunford, 1999; Hernández Bermejo & García Sánchez, 1998). The Condition of the Flora of the Southern Region written by Ji-Han in the 3rd century AD covers South China and part of Indo-China, with accounts of about 80 species of plants providing edible fruits, nuts and other products. The first botanic gardens in the western tradition were physic gardens attached to schools of medicine. They were created for the use of students and for the production of medicines. Examples include the 16th century botanic gardens of Pisa, Padova and Florence in Italy. Even in the 18th and early 19th centuries, most botanical instruction in universities in the USA was to medical students (Rudolph, 1996). The teaching of Botany in China, as a formal subject, began in the early part of the 20th century and only during the last 50 or so years in much of Africa.

The Age of Discovery and the spread of the European empires were accompanied by a new interest in collecting and cataloguing all types of plants (Ng, 2000). Knowledge of the natural world was seen in a general philosophical way as a key ingredient in the acceleration of human 'progress' (James, 1998). More immediately, there was intense interest in finding plants of economic worth for national or personal enrichment. Many botanical gardens and arboreta in the tropics, such as Pamplemousses on Mauritius (founded 1736) and Peradeniya in Sri Lanka (1821), originated as testing grounds for crops or as holding grounds for plants in transit. Major botanical gardens in the colonial homelands, such as the Royal Botanic Gardens, Kew (founded privately in 1759, becoming a state property in 1840), formed the hubs of international networks of collection and testing.

Many specialist branches of Botany have emerged over the last 200 years, including Anatomy, Cytology, Ecology, Genetics, Molecular Biology and Physiology. Ecology, the science concerned with the study of living beings 'at home', emerged as a distinct discipline in the late 19th century, founded on older traditions of natural history. The need to take account of the major roles of people in shaping the structure, floristic composition and dynamics of vegetation in Europe became rapidly apparent, but the equivalent massive influence of people on tropical vegetation, including tropical forest, has been recognised only more recently. Ecologists working in the tropics have tended to concentrate their research on types of vegetation thought to be more natural. Ethnobotany has been instrumental in showing that agricultural and 'wilder' types of vegetation are often thoroughly interlinked through economic and cultural ties (Prance, 1995).

A major trend in Biology, including Botany, over the last decades has been a significant expansion in some countries in the teaching of Microbiology, Molecular Biology, Genetics, and related subjects. The loser has been 'Basic Botany', more or less synonymous with 'whole plant Botany' (as it has been called). Basic Botany, covering fields such as Anatomy, Ecology, Morphology, Systematics and Taxonomy, has been in serious decline in the USA (Botanical Society of America, 1995). Systematic Botany has virtually disappeared as a taught subject in British Universities and many students are no longer taught to identify plants (Smith, 2002a). The same is reported from the Netherlands and Spain (Groen & Valdes, 2002). One consequence is that Departments of Botany have often been merged with Departments of Zoology into Departments of Biology, within which 'whole plant Botany' has tended to receive even less attention than 'whole animal Zoology' (Botanical Society of America, 1995; Rudolph, 1996). The result is graduates in Botany or Biology who have little ability to work professionally with 'real plants'. "The production of botanists who can't tell a composite from an orchid or leaf anatomy from stem anatomy is unconscionable. And common. … Regardless of speciality, botanists should have a broad background in all major phases of botany" (Botanical Society of America, 1995).

It is reported from the UK that the decline in 'whole plant Botany' at universities is further reflected in schools (Hershey, 1993; Lock, 1994; Reiss, 1994; Smith, 2002b; Uno & Bybee, 1994). Also in the UK, there has been a reduction in the popularity of Biology, both in schools and universities (Lock, 1994; Lock, 1996). A consequence is that the requirements for entry to departments of Biology in universities have been lowered. Lock believes that the decline in the UK is not related to job prospects, of which few pupils are said to have any idea. He suspects that it is rather more to do with the image and nature of the subject. 'A level' Biology (taught at senior secondary level) has apparently come to be seen as boring. He believes that GCSE syllabuses (taught at junior secondary level) no longer place stress on those things that make living things intrinsically interesting - their forms, anatomy, variety, location, behaviour and ecology. Biology has become too similar to Chemistry or to exercises in processing data. Two comments made by experienced educators at a meeting of the Linnean Society in April 2002 help to explain why many students are losing interest in field

Table 5. Analytical framework to assist in the design of courses and programmes in Applied Ethnobotany. Consultation with academics and professionals engaged in the various fields will be useful for completing the table. We suggest that the acquisition of information to complete the table can usefully constitute a class exercise for more advanced students of Applied Ethnobotany.

Profession	History of the discipline in the country	Potential relevance to conservation and development	Implications for the teaching of Applied Ethnobotany
Botany Forestry Agriculture Horticulture Medicine Pharmacology Conservation (Others)			

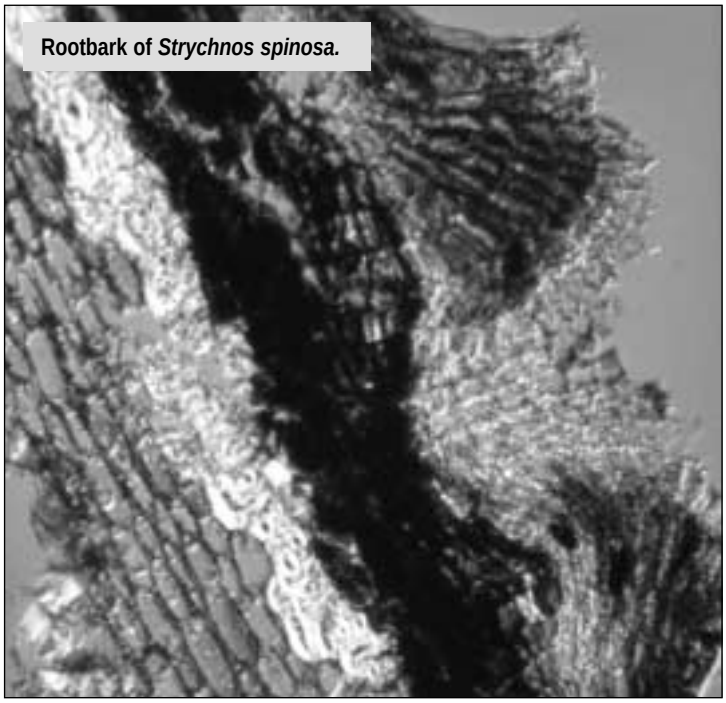
Botany: "I've watched generations of pupils being completely turned off Biology by the national curriculum"; "Botany is not 'cool' - it takes too many years to master".

The teaching of Botany, whether at school or university, does not have to be boring or seem irrelevant. Gabriell Paye has developed an approach to teaching Botany in high schools in Boston, USA, starting from a reference that students can relate to - useful plants in their own cultures (Paye, 2000). Activities include ethnobotanical interviews (learning about plants from family, friends and neighbours), learning how to collect and identify plants, and studies of plants as sources of food and medicine, including simple tests of the ingredients and physiological activities of bought products. She reports that, when she taught Botany using a traditional textbook approach, the interest and information retention levels among students were much lower. "In contrast, by entering the world of science through a personal experience of ethnobotany, students gain a real sense of how important plants are in their lives. I find that when they are fuelled by this enthusiasm, they are more willing to then delve into other aspects of botany."

We have seen no analysis of trends in the teaching of Botany in developing countries, but, from our experience, there has sometimes not been the drastic decline in 'whole plant Botany' evident in the developed world. Basic Botany is still a major component of programmes in Botany in China, Nepal, Pakistan and Uganda. However, there has been a recent decline in the number of students taking science at A-level in Uganda, probably reflecting a perception among students of a lack of opportunities for employment and the absence of science teaching in virtually all private schools (the number of which has grown greatly during recent years) (Mucunguzi, 2002). The reduction in Biology in schools in Uganda means that it has become harder to find eligible candidates for programmes in Botany or Ethnobotany.

The relative resilience of Basic Botany, in at least some developing countries, certainly has advantages for Applied Ethnobotany. However, developing countries have their own, often severe, educational constraints. Not least of these are shortages of finance and, sometimes, of highly trained staff. National policies in poor countries often favour an emphasis on mass education, especially as delivered through primary schools, squeezing resources for universities even further than would otherwise be the case. There are no government grants available for postgraduate training in Uganda. There has been a recent major expansion of private schools in many developing countries catering for the inadequacy of state-supported systems. Many of these do not teach science, mainly because of the expense involved in setting up and running laboratories. There is a serious problem of graduate unemployment in many developing countries

"... by entering the world of science through a personal experience of ethnobotany, students gain a real sense of how important plants are in their lives."



Rootbark of *Strychnos spinosa*.

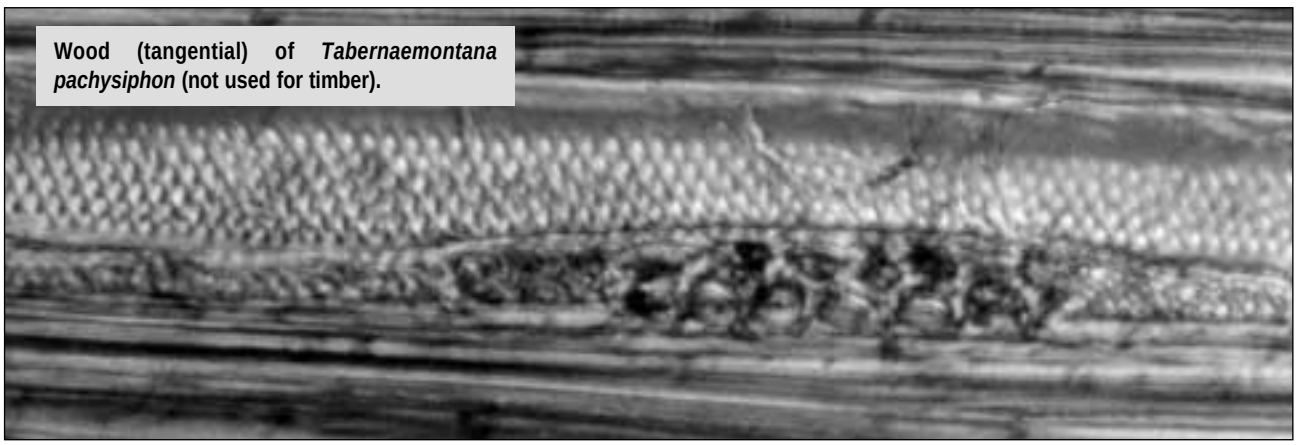
and better students tend to opt for subjects such as Medicine, in which there is a perceived greater chance of employment. Botany is often the loser.

Given the central importance of plants to development and conservation in developing countries, it is evident that there should be a place for Botany as a major taught subject. However, many Botany programmes need to change to make them more relevant. In the words of Dr Patrick Mucunguzi of the Botany Department, Makerere University, Uganda: "Botany needs to be taken to the community". Although Microbiology and related fields are fashionable in well-resourced countries, it is difficult for researchers in developing countries to make major contributions in these fields. Equipment is often obsolete or not functioning, and sometimes supplies of water and electricity in laboratories are intermittent. However, Applied Ethnobotany is relatively cheap, and there are many opportunities for practical work. The task today is to develop Applied Ethnobotany to a more advanced state and to persuade officials in universities and governments that the subject is worthwhile. This is best achieved through examples of its successful application.

Forestry: past and future

Modern Forestry originated in Germany where the first forestry school was established in 1789. This tradition of forest management developed and spread around the world. Becoming known as Scientific Forestry, it became the predominant influence in forestry education and practice in many countries for 200 years (Nelson, 1999; Tsouvalis, 2000). The primary aim of Scientific Forestry is to maximise the yield of money from a forest, especially through the production of timber (Burley, 2001). 'Scientific foresters' are trained to select species or provenances of timber trees of economic worth and to manage them systematically. They learn how trees should be planted or encouraged to regenerate, how their growth can be promoted, and their optimal times of felling.

Scientific Forestry was introduced into India in 1864 with the appointment of the first Inspector General of Forests, from Germany (Ray, 1994) and thereafter spread to other colonial territories. It was introduced into Uganda in 1929 following an advisory visit by a forestry official from India (Hamilton, 1984). In Britain, forestry received little systematic attention from the government until after the First World War, an event instrumental in raising awareness of the need for a home-grown 'strategic reserve' of timber. The Forestry Commission was founded in 1919 and has since become a major landowner. Conifers, such as sitka spruce *Picea sitchensis*, were favoured for planting, given their high potential rates of growth and their ecological suitability for planting on the poorer quality of land which tended to become available. Although British forestry policy in the tropics was normally centrally concerned with timber, this was not entirely to the exclusion of other considerations. Forest Reserves were established



Wood (tangential) of *Tabernaemontana pachysiphon* (not used for timber).

in upland areas to protect water catchments and the needs of villagers were recognised by allowing them to collect 'minor forest products', for their own use, free-of-charge or with payment of small fees.

The roles of forests and foresters have been radically re-thought in many countries during the last 20 years (Brown, 2001; Burley, 2001; Obua, 2002b; Ray, 1994; Tsouvalis, 2000). Forests have increasingly come to be seen as serving multiple functions. There have been upsurges of interest in social, community and participatory forestry, in non-timber forest products (NTFPs) and, generally, in trying to find ways to engage all stakeholders, especially local communities, in forest management (Aumeeruddy-Thomas et al., 1999; Burley, 2001). The history of graduate-level forestry education in Uganda provides an example (Obua, 2002a). A Forestry programme was started at Makerere University in 1970, initially taking students from the whole of East Africa. The curriculum concentrated on Scientific Forestry for the next 20 years and it was only in 1990 that a 'people element' started to be seriously introduced. In Pakistan, the importance of medicinal plants has become recognised by the Pakistan Forest Institute, with the Biological Sciences Research Division becoming engaged in a variety of research and promotional activities, including surveys of use and trade, and cultivation trials.

Several factors have been responsible for these developments. In some cases, there can be a questioning of the authority of Forest Departments, especially when they have come to exercise control over very extensive territories (Nelson, 1999). Ninety-three per cent of the forest area of India is under government control (Ray, 1994). The political legitimacy of Forest Departments can be diminished when foresters are suspected of benefiting personally from their positions of power, a major issue in some countries. Another cause of change has been a growing realisation that governments cannot control the often serious problems of forest loss and degradation which are occurring in their countries without the support of local people. There is also a better general understanding of the values of forests, apart from as sources of timber, and non-utilitarian values have become better appreciated by officials.

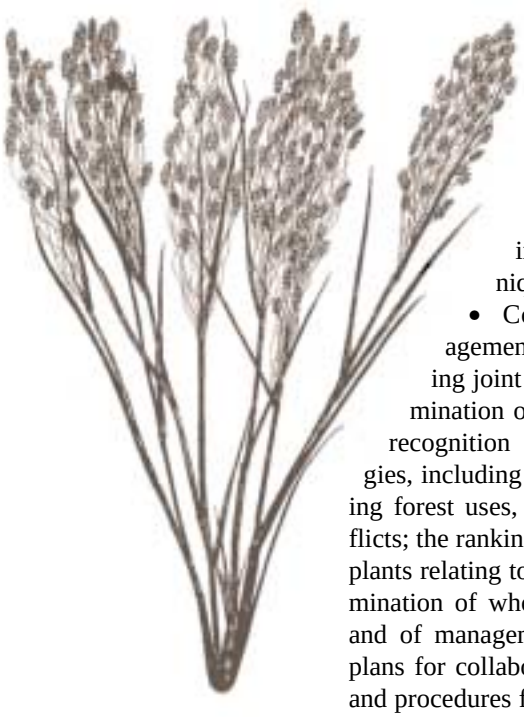
The older generation of foresters frequently labelled products from forests, other than timber, as 'minor forest products', a term which has contributed to a failure to recognise their significance to local people, or the impact of their collection on the forests. Even timber harvested by non-mechanical means could be ignored. An example is provided by the history of forestry on the East Usambaras, Tanzania, where there was a major outcry in the 1980s about the impact of mechanical logging, which was certainly highly destructive (Hamilton & Bensted Smith, 1989). What did not become clear until surveys were well advanced was that the volume of wood being harvested annually by mechanical means (about 10,000 m^3 a-1) was equalled by that being harvested by pit-sawing (about 10,000 m^3 a-1) and much less than that being harvested for poles and fuelwood (about 80,000 m3 a-1) (FINNIDA, 1988). The Usambara study did not provide quantitative information of non-wood products, though these are certainly important to local people (Kessy, 1998). Research in the region of Uxpanapa, Mexico, revealed that 82% of products obtained from the rainforest were non-wood rather than wood (Toledo, 1995).

There has, therefore, been a call for the training of foresters to be expanded beyond the traditional emphases on forest protection and production of industrial timber (Sharma, 1994). A major purpose of a GEF/FAO/UNDP biodiversity project, active in East Africa since the early 1990s, has been to encourage greater account to be taken of community uses of plant resources in the education of foresters (Aloo & Rodgers, 1995; FAO, 1996; Hall, 1994; Rodgers, 1995). Few working foresters, it has been said, have the skills needed for the tasks now in hand (Burley, 2001). A survey in the USA found that employers of forestry graduates have found it necessary to retrain them to understand and practice a style of forestry that is broader and more integrative than in the past (Sample *et al*., 1999). Among the new social skills required are the abilities to build teams and communicate effectively, and to negotiate with stakeholders in the identification and solving of disputes (Box 2) (Harmon, McKinney & Burchfield, 1999; Sample *et al*., 1999). With reference to East Africa, the following major thematic areas and components are regarded as key areas in which forestry students should be educated to be able to work more effectively with communities (Aloo & Rodgers, 1995; Hall, 1994).

In Pakistan, the importance of medicinal plants has become recognised by the Pakistan Forest Institute

- Socio-economic issues: formal and informal village institutions; non-governmental organisations; stakeholder analysis; indigenous knowledge and beliefs; methodologies for acquisition of socio-economic data, including through questionnaires.
- Non-timber forest products and Ethnobotany: categories of non-timber for-

Eragrostis tef



est products; traditional systems of resource management and harvesting; field assessment of products used and who uses them; estimates of the impact of collection on plant populations; market surveys; gaining a landscape perspective of change; methodologies for acquisition of data including time-lines, inventories and other techniques.

- Collaborative forest management: guidelines for facilitating joint forest management; determination of the extent of forests and recognition of sub-units; methodologies, including forest walks for determining forest uses, users, managers and conflicts; the ranking of uses and of damage to plants relating to particular uses; the determination of who should be the managers and of management rules; preparation of plans for collaborative forest management and procedures for approval.

Triticum monococcum

In addition to these new requirements, graduates in forestry should have a good grounding in traditional forestry science (Burley, 2001). How then can these multiple demands be accommodated within courses (Brown, 2001)? Rigorous forestry courses are expensive, with demands for specialised staff and laboratory, as well as field trips (Tombaugh, 1998). A response of some educators has been to increase the length of undergraduate courses in Forestry from three to four years, as in Uganda (Obua, 2002a). Another response, at least in the USA, has been an increase in the number of less specialised programmes in natural resources and environmental science (Tombaugh, 1998). These are cheaper than traditional forestry courses, but are said to produce graduates who may have degrees in Forestry, but lack the practical basic knowledge and skills to manage forests on the ground.

Forestry, like Biology, is proving increasingly unattractive to students in some industrialised countries (Burley, 2001). There is a perception that Forestry is more physical than intellectual, and more of a male than a female occupation: "In Britain and many other countries there is a common perception that forestry comprises nasty men with nasty chain saws cutting nasty straight lines of nasty exotic species." (Burley, 2001). An equivalent decline is not reported from at least some developing countries, such as Pakistan and Uganda, where degrees in Forestry are still seen as relatively likely to lead to jobs in the context of generally high graduate unemployment (Mucunguzi, 2002; Obua, 2002a). The growth of social and environmental forestry in Uganda has attracted an increasing proportion of female students, many having previously been put off, it is said, by an image of forestry as "difficult manual work in thick forest" (Obua, 2002a).

Box 2. Technical competences required of forestry graduates in the USA. They are in rank order, based on responses from 257 potential employers (Sample *et al.*, 1999).

1. Ethics.
2. Written communication.
3. Oral communication.
4. Silvicultural systems.
5. Managerial leadership.
6. Collaborative problem-solving.
7. Forest ecology.
8. Resource management planning.
9. Forest inventory and biometry.
10. Tree and other plant species identification.

Forestry today needs to demonstrate its appeal to values that have wide resonance in society. It should generate intellectual excitement and attract bright people. The incorporation of Applied Ethnobotany into Forestry curricula and its use as a tool by professional foresters will help move the discipline in the right direction. Work with communities to evolve improved methods of managing trees and other plants has many potential benefits for conservation and sustainable development.

Agriculture: past and future

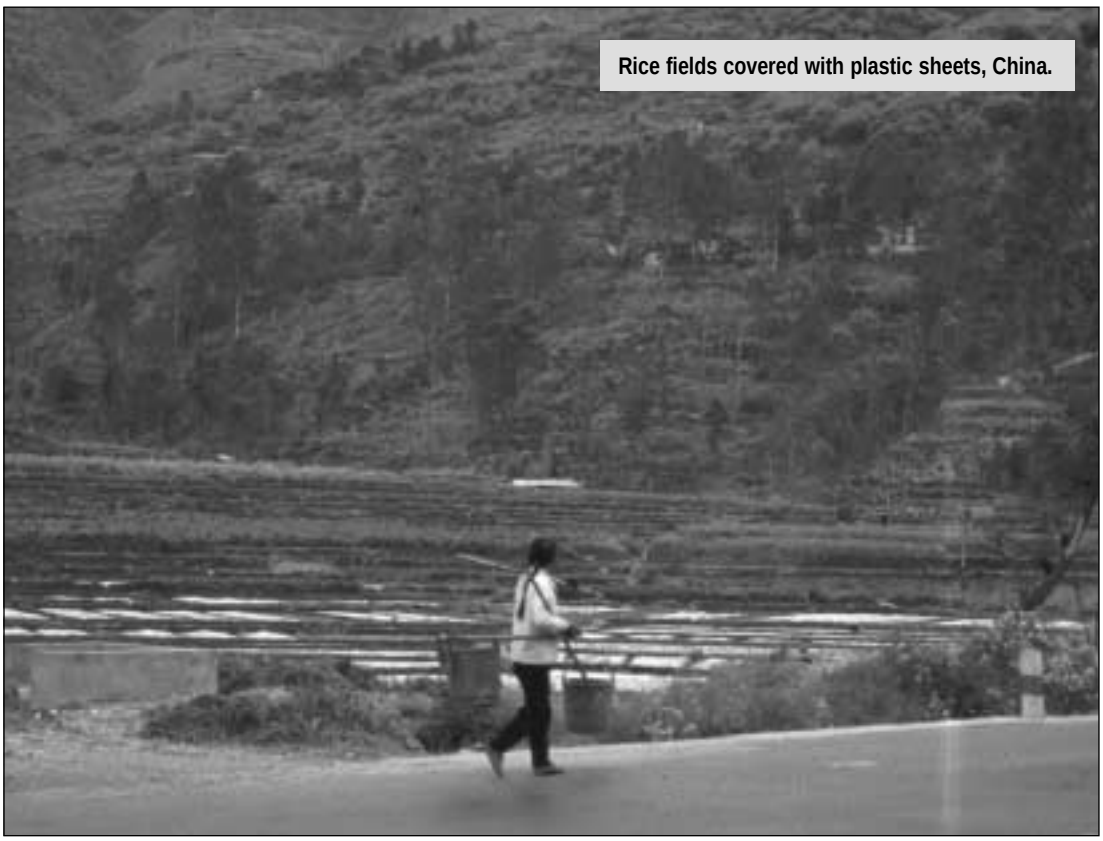
Agriculture provides the great bulk of food supporting people on Earth. Despite a very high percentage of terrestrial primary production being devoted to this cause, 700-800 million people still lack adequate access to food. It is not hard to predict that demands for food will rise sharply, not least because the size of the human population itself is predicted to grow, from its present 6 billion to 8.3 billion in 2025. There is considerable disagreement about how best to meet this challenge, a problem compounded by the likelihood of considerable environmental uncertainty, for example due to climatic change (Pretty, 1998). The area under cultivation could expand by 20-40% by 2020 (Pretty, 1998).

There have been dramatic changes in agriculture in many parts of the world over recent centuries and decades. Some of these followed

the opening up of the world by European exploration and colonisation from about 1500, for example, with maize and the potato being introduced into the Old World, and wheat and sugarcane into the Americas. Science has become a major force for change over the last 150 years, during which time advances in chemistry and biology, including genetics and plant physiology, have led to significant developments in soil science, crop-breeding and pest-control. The last 50 years, in particular, have seen a major intensification of agriculture in some regions, involving the introduction of high yielding varieties of crops, much use of agricultural machinery and major increases in inputs of water, chemical fertilisers, pesticides and fossil energy. Such agriculture is referred to as 'intensive', though ironically it is often called 'conventional' by agriculturalists. (There is a parallel here to the abrogation of the term 'conventional' by Western Medicine, relegating other, more ancient and often more widely used, systems of medicine to the semantically less worthy category of 'alternative').

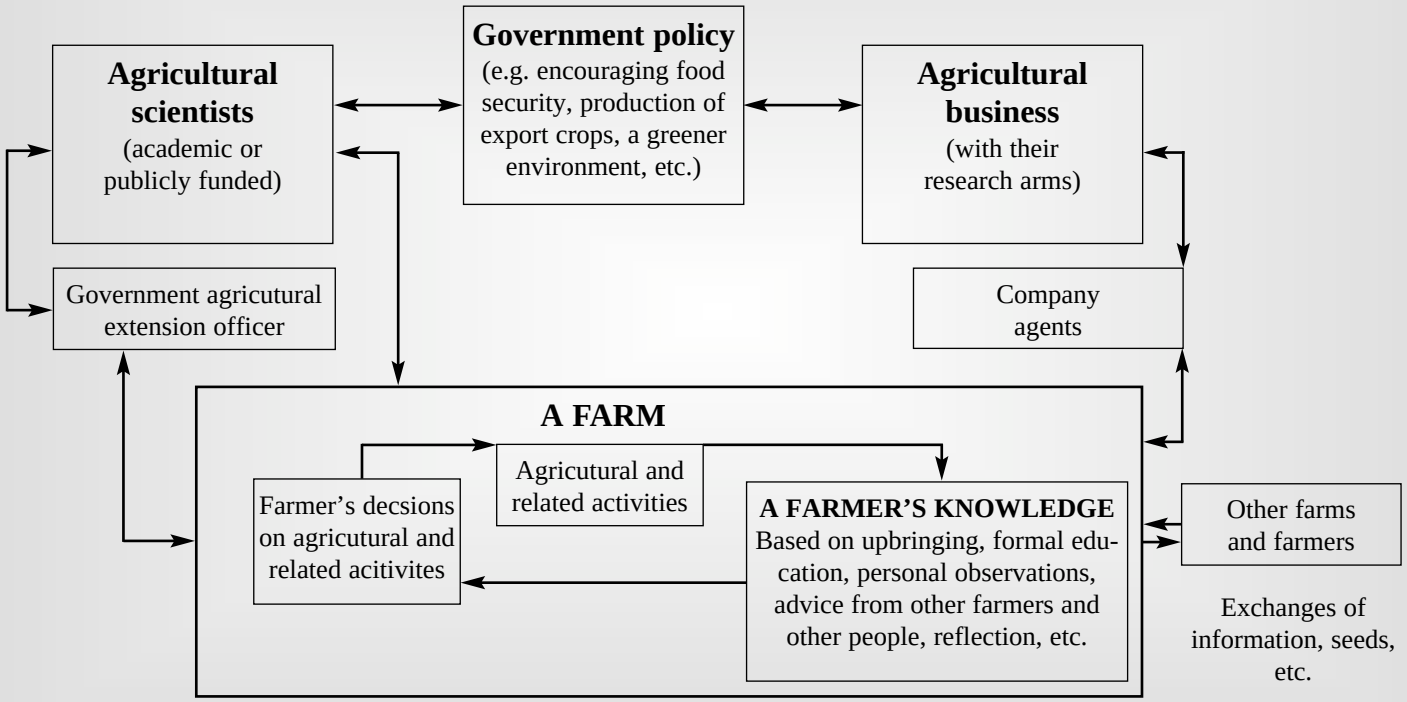
The practice of agriculture involves continuing learning by farmers (Figure 3). Individual research and suggestions from friends and neighbours must have always been normal parts of farming life. The first records of provision of more formal agricultural advice are associated with pre-industrial states, such as those of Mesopotamia (dating to c.1800 BC), Ancient Egypt, Ancient Greece, the Roman Empire and Imperial China (from 600 BC) (Jones & Garforth, 2002). The major motivation appears to have been the desire by the state or of powerful factions within it to enhance their interests, a parallel with the way that agricultural research and education have developed in more modern times. Powerful forces driving agricultural research and education over the last 150 years have included the desires to attain higher yields or financial profits from crops, these forces themselves being based on the aims of providing high or reliable incomes to farmers (e.g. in the European Union), food security (again in the EU) or hard currency through the sale of exports (many tropical countries, some of which have economies heavily reliant on one or a few 'export crops').

Agricultural education can be designed for different 'levels' in agricultural systems. In practice, as it has evolved over the last 150 years, a 'conventional' model of agricultural development has emerged which sees science as the source of innovation, technology as the application of science, and development as a result of the transfer of new technologies to the farmer (Röling & Wagemakers, 1998a). If there is a problem, then science will find the answer. Three levels of agricultural education have emerged from this thinking, namely those designed respectively for the training of agricultural scientists, extension workers, and farmers. 'Extension education', as a general educational concept, dates back to around 1850, when the universities of Oxford and Cambridge in England began to consider how they could serve the educational needs, near to their homes, of the rapidly growing populations in industrial urban areas (Jones



Rice fields covered with plastic sheets, China.

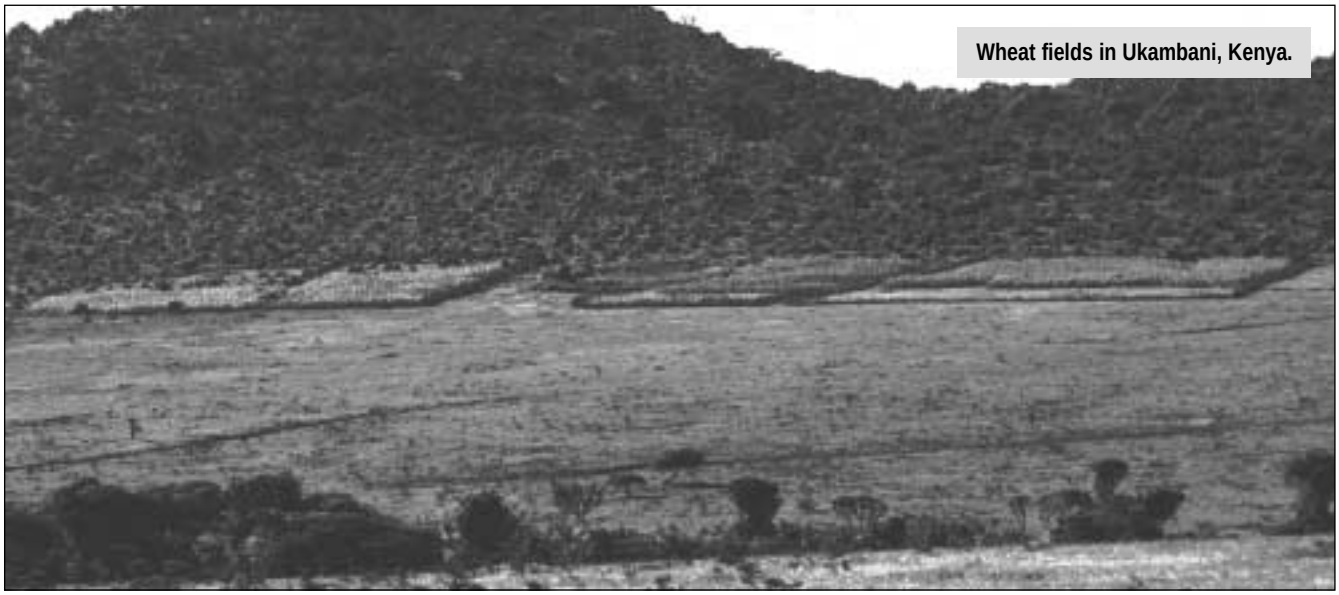
Figure 3. Simplified schemata of a farmer's knowledge and its influences.



& Garforth, 2002). From this beginning, extension services have become a common feature of more wealthy societies, being developed not only for agriculture but for many other aspects of life, such as the environment, care of old people, family planning and so on (Röling, 1988). 'Extension science', at least as an academic field, has tended since the 1970s to move away from a conventional model of 'how do we get them to do want we want' towards a participatory approach. In the case of farming, this means that farmers are supposed to be more involved in defining the types of research undertaken and the contents of information packages provided to them (Röling, 1988).

One of the foundations of modern developments in agricultural research and education was the establishment by 1800 of agricultural societies throughout much of Europe. Members of these societies, known as 'improvers', were generally aristocrats, their agents, or 'men of science'. They were motivated by the desire to improve their wealth or to apply science to agriculture (Jones & Garforth, 2002). Agricultural science evolved rapidly during the 19th century, with notable contributions by Justus von Liebig at Giessen in Germany and through the initiation in 1843 of agricultural experiments at Rothamsted in England (Jones & Garforth, 2002). The Royal Agricultural Society of England was founded in 1838 with the aim of promulgating the results of scientific research (motto: Practice with Science). The agricultural colleges which then became established in Europe served a small minority of young landowners and farmers. The first agricultural college in the English-speaking world was the Royal Agricultural College, opening in England in 1845, many of its later students leaving with their diplomas to fill posts in the Colonial Agricultural Administrations (Royal Agricultural College,). The example of the Royal Agricultural College was followed by the founding of similar institutions in Canada (Guelph University, Ontario), New Zealand (Lincoln University, Christchurch), the USA (Cornell University), and Japan (Tokyo University).

Some of the earliest modern agricultural extension services to reach to 'lower' levels within agricultural communities were started in Ireland (from 1847), Württemberg in Germany (from about 1855), Denmark (1870) and Great Britain (1890) (Jones, 1994; Jones & Garforth, 2002). The first wholly state-funded agricultural extension service was established in France in 1879. Two significant developments in the USA were the passage of the Morrill Act (1862), also known as the Land Grant College Act, and the formation of Farmers' Institutes. The latter, which were societies in which farmers organised meetings for their own edification, became popular after 1860. The Morrill Act established institutions in each state to educate people in practical professions, including agriculture. By 1900, a system of agricultural extension work had become well-established across much of North America (Jones & Garforth, 2002). Two agricultural colleges were opened in the mid-1870s in



Wheat fields in Ukambani, Kenya.

Japan, at first staffed by Western teachers; by 1900, agricultural research and extension work were well under way. A law was passed in Japan in 1910 requiring farmers to adopt the technical guidance and recommendations of extension workers, an extreme case of the 'compulsion school' of extension (Jones & Garforth, 2002). The first British colony to appoint a Director of Agriculture was Zanzibar (1896). The Imperial Department of Agriculture for the West Indies was created in 1898 and, from 1906, every province in India was required to appoint a Director of Agriculture to organise agricultural research and demonstration farms (Jones & Garforth, 2002). Very little scientific research or education was carried out in Africa before 1914 (Jones & Garforth, 2002).

Farmers vary in their openness to agricultural advice or new technologies. Some farmers who are more 'progressive' tend to be those with more education, exposure to the mass media and access to resources (Röling, 1988). The greatest successes with agricultural extension services have been where conditions have been most favourable for industrial agriculture - as has proved to be the case over much of Western Europe and North America, with their high levels of financial resources and often good quality soils, and in irrigated areas of Asia (Castillo, 1998). The Green Revolution, a term used for the major changes in Asia resulting from intensification of agriculture, helped turn India from being an importer of food to self-sufficiency. The earlier years of extension services could be particularly productive, because then there could be special opportunities to apply new technologies starting from traditional bases. Greece is an example, with the first 15 years of extension services after their introduction in 1950 being especially fruitful (Koutsouris & Papadopouos, 1998).

Until recent decades, agricultural research and extension have generally been regarded as public goods and these services have been provided by governments or charitable societies free-of-charge or for nominal payments. Other kinds of organisation have since become increasingly engaged, notably agriculture-related commercial companies, agricultural commodity marketing boards (concerned to assure the supply and quality of their products), agricultural development projects, and non-governmental organisations (Jones & Garforth, 2002). The private sector has taken an increasing role in the breeding of new varieties of crops, the development of agricultural chemicals, and in making of these available to farmers. The private sector today accounts for 80% of the global market in the breeding and distribution of seeds, though the public sector remains predominant in some countries such as India and Japan (ten Kate & Laird, 1999). Globally, the private sector has become increasingly dominated by a few multinational companies during the last decade. Government extension services have often been reduced, or payments required for their services (particularly in the North, as in the Netherlands) (Jones & Garforth, 2002; van Weperen, Proost & Röling, 1998).

Sustainable agriculture is based on recognising and building on locally-available resources and natural processes

Large parts of the world have benefited little, or not at all, from modern developments in agricultural research, education and extension. These are especially those rain-fed agricultural areas which lie in countries with few financial resources, including almost the whole of Africa, large parts of Asia and Latin America, and sub-

stantial parts of Europe. Indeed, some of these places have suffered from deteriorating environments, as periods of fallow in systems of shifting agriculture have been reduced, more land has been cleared of forest, soil erosion has increased, and soil fertility declined (Castillo, 1998).

Despite its successes, intensive agriculture is not without its problems. Some of these are social. They include a massive erosion of local rural cultures, including knowledge of plants and their uses. Many millions of rural people have been displaced from their previous places of abode through the consolidation of land-holdings and the introduction of mechanisation. Often moving to rural areas which are marginal for agriculture or to city slums, many of these people or their descendants now live precarious existences on the edges of survival. Environmentally, there are many problems with intensive agriculture, such as worries concerning its massive use of water, energy and chemicals, and its side effects of loss of soil fertility and structure, soil erosion, damage to human health, and pollution. Since 1970, the worldwide rate of application of nitrogen fertilisers has increased by seven times and contributions from humans are now the same as all natural inputs to the nitrogen cycle. Half to two-thirds of nitrogen fertilisers now enter non-agricultural ecosystems with serious consequences for terrestrial, freshwater and marine ecology (Tilman, 1998). The full financial costs of industrial agriculture are currently little met by farmers or consumers, but rather passed on to others, including future generations. Accordingly, farmers and the public are little aware of the deleterious consequences of their farming practices or patterns of consumption. High-input farming is often favoured through financial incentives, as in North America and the European Union. Apart from causing local environmental degradation, this is an obstacle to agricultural development in developing countries, where progressive farmers are faced with high tariffs for their exports and may even be undercut in their home markets through the dumping of 'food aid'.

The concept of 'sustainable agriculture' is today gaining ground. This refers to new approaches to agricultural research, education and extension. Sustainable agriculture is based on recognising and building on locally-available resources and natural processes, including encouraging nutrient recycling and biodiversity, and limiting the use of external inputs of agrochemicals and non-renewable energy (Röling & Wagemakers, 1998b). A basic principle is full participation of farmers and rural people in all processes of problem analysis and technology development, adaption and extension (Pretty, 1998).

Ethnobotany can certainly make important contributions to the development of more sustainable agriculture. This is most obviously so in the case of low input agriculture, where the 'conventional' approach of 'telling farmers what to do' has not been very successful, and where there is general recognition of the desirability of applying participatory methodologies for the identification and solution of problems (Jones & Garforth, 2002). Systems of low input farming have to be intimately adapted to the local environment; local knowledge is a crucial ingredient in formulating potentially successful pathways of change. The case for Ethnobotany in the development of intensive agriculture is perhaps less obvious, given that industrial farming has resulted in a major reduction in plant diversity (large areas of uniform, virtually weed-free, crops) and that most industrial farmers know relatively little about their local plant worlds, at least in comparison with their more traditional colleagues. Industrial farms are biologically much simpler than traditional farms. Even so, there are considerable advantages to involving industrial farmers fundamentally with research. It has been found in the Netherlands that many farmers currently following industrial practices are coming to recognise the value of more sustainable agriculture (van Weperen et al., 1998). They wish to learn more about the details of the natural world as they seek to enhance and benefit from the biological diversity on their farms.

In summary, knowledge of Ethnobotany can be useful to agricultural scientists and extension workers for them to better:

- Learn about the perceptions, values and knowledge of farmers about their crops and other plants.
- Be able to co-experiment with farmers on new practices, including crop breeding.
- Facilitate exchanges of information between farmers.

Medicine: past and future

This account draws extensively on The Greatest Benefit: a Medical History of Humanity from Antiquity to the Present by Roy Porter (Porter, 1997) and Green Pharmacy: a History of Herbal Medicine by Barbara Griggs (Griggs, 1981).

Measures taken to retain good health or treat ailments are partly personal matters. Family tradition is an important influence. Women commonly take much of the responsibility for the well being of children and other members of their households. Societies also contain specialists held to have special medical knowledge.

A tripartite classification of traditional medical systems is recognised in China: (1) Traditional Medical Systems, with documented knowledge, pharmacopoeias for doctors, and institutions for training doctors; (2) Traditional Medical Knowledge, which is orally transmitted and widely used in China at household level and

by ethnic minorities; and (3) Shamanistic Medicine, practised by some ethnic minorities and in remote Han Chinese villages, involving a mixture of spiritual and herbal practices and which can only by applied by specialist practitioners (shamans). More formal medical systems (including Traditional Medical Systems, as defined above) are associated with literate societies. One or more of these systems may be endorsed by the state and other forms of medicine discouraged or even prohibited. Their practitioners must demonstrate familiarity with the texts and may be required to pass examinations. Formal medical systems include:

- Traditional Chinese Medicine, one of its earliest texts being Sheng-Nong's Herbal, recording plants used possibly as far back as 3000 BC though written later (Pei Shengji, 2001).
- Kampo, Traditional Japanese Medicine.
- Tibetan Medicine, associated with Bon and Buddhism (Lama, Ghimire & Aumeeruddy-Thomas, 2001).
- Mongolian Medicine, associated with Buddhism and with similarities to Tibetan Medicine.
- Dai Medicine, associated with Theravada Buddhism and practiced in South Yunnan Province, China.
- Ayurveda, normally associated with Hinduism, but with Buddhism in Sri Lanka. The earliest mention of the medicinal use of plants in Hindu culture is in the Rigveda, written before 1600 BC.
- Siddha, associated with Tamil-speaking areas of India.
- Unani, the Islamic system of medicine common in the Indian sub-continent. Unani, like Western Herbal Medicine, is rooted partly in the medicine of Ancient Greece.
- Uigur Medicine, practised in Northwest China, and associated with Islam.
- Western Herbal Medicine, practised in Europe, North America and elsewhere. It is poorly standardised compared to some other medical traditions, with much variation between countries and individual practitioners.
- Homeopathy, developed by Samuel Hahnemann (1755-1833). It differs from the above systems in that it uses minute quantities of botanical and other ingredients in its medicines - substances that are often poisonous when taken in larger quantities.
- Western Medicine, the principal officially-recognised system in most countries. Western Medicine is sometimes referred to as Orthodox, Conventional or Allopathic Medicine, in contrast to terms used for the other traditions, such as Traditional, Herbal, Complementary, or Alternative.

Plants provide the predominant ingredients of medicines in most medical traditions. The total number of species used worldwide may be 35,000-70,000 (Farnsworth & Soejarto, 1991) out of a total of more than 250,000. It has been estimated that 10,000-11,250 types of plants are used in China (He & Gu, 1997; Pei Shengji, 2002a; Xiao & Yong, 1998), 7500 in India (Shiva, 1996), 2237 in Mexico (Toledo, 1995) and 2500 traditionally by North American Indians (Moerman, 1998). The great majority of species of medicinal plants are used only in folk (orally-transmitted) medicine, the more formal medical systems utilising relatively few: 500-600 commonly in Traditional Chinese Medicine (Pei Shengji, 2001), 1106 in Tibetan Medicine (Pei Shengji, 2001), 1250-1400 in Ayurveda (Dev, 1999), 342 in Unani and 328 in Siddha (Shiva, 1996). There are considerable overlaps in the plants used by some of the formal systems, as would be expected from their histories and geography. Thus, there is considerable sharing between Western Herbal Medicine and Unani, and between Unani, Ayurveda and Tibetan Medicine. In the 8th century AD, Trisong Detsen, King of Tibet, called a conference of medical experts from China, Dolpa, India, Nepal, Persia, Tibet and other parts to discuss the evolution of improved medicine, drawing on various traditions. This resulted in the development of Tibetan Medicine, based on the pre-Buddhist Bon tradition of Tibet and incorporating elements from elsewhere, including from the medicine of Ancient Greece.

Medicine deals with matters close to the core of the human persona, and attitudes towards health and healing are strongly influenced by wider worldviews. Pragmatic actions to maintain health or combat disease are underlain by deeper appreciations of the causes of good or ill, and how personal fortune may be influenced. Worldviews associated with small-scale societies link the individual closely to society, nature and the spirits. Illness is a social not just a personal concern. Divination can be used to ascertain the root-cause of ailments. The formal medical systems include their own theories of health and healing. Many of these theories emphasise the value of maintaining balance between the physical, mental and emotional aspects of living. Greek Medicine and Unani make reference specifically to four psycho-physiological conditions (or humours) to be kept in balance, translated as blood, bile, phlegm and choler. Ayurveda and Tibetan Medicine refer to three, for example wind, bile and phlegm in the case of Tibetan Medicine (Lama et al., 2001). Prescriptions for conditions presented by patients in formal systems of Asian medicine may include recommendations for adjustments in mental atti-

tudes, behaviour or diet, in addition to recommended medicines (no clear distinction between food and medicine is recognised in these traditions).

Reductionist science has been a strong influence over the development of Western Medicine. Although the value of an holistic approach is acknowledged, treatments tend to be disease- rather than patient-centred, and less tailored to the particular needs of the individual than with other medical traditions (Fabrega, 1990; Grol, 1983). Diagnosis of ailments tends to concentrate on searching for internal physical or chemical malfunctions or invasions by harmful organisms. Treatments are designed to repair the internal machinery or control the invaders. The 'basic sciences' contributing to medical treatments are more Biochemistry and Physiology than Sociology or Religion.

Western Medicine owes much to the Ancient Greeks. A fundamental principle, ascribed to Hippocrates (BC c. 460-377), is that health and disease can potentially be understood through reasoning about nature without the need to refer to the supernatural. Theophrastus (BC c. 371-c. 287) prepared treatises on plants describing some 500 species and varieties, while Dioscorides (AD c. 40-c. 90) provided detailed botanical descriptions, with the aim of helping doctors select the correct herbs. Galen (AD 131-200) built on and systematised existing knowledge, and his prolific writings dominated formal medicine in Europe for 1500 years. The centre of learned medicine in Europe and its vicinity later passed to the Islamic world, where it flourished from c. 800-1300. Medieval Islam contributed fundamentally to preserving and synthesising Greek medicine, Galen being particularly revered. Notable Arab scholars included Hunayn al-Ibadi (809-873), who translated many major Greek works into Arabic, and Ibn Said, known to the West as Avicenna (980-1037), whose encyclopaedic Kitab al-Qanun became the authoritative text in both Islam and Latin Christendom. The Arabs translated not only from the Greek but also from the Persian, Sanscrit and Syriac, and their pharmacopoeia came to include botanical medicines from the East, such as senna, unknown to the Greeks. The Islamic tradition of medicine continues in use today, predominantly among Muslims in the Indian sub-continent, where it is known as Unani (from Ionian, referring to Ancient Greece). Its practitioners are called hakims.

Greek Medicine, benefiting from the efforts of Islamic scholars, entered Western Europe from the 11th century through translation into Latin from the Arabic or Greek. A key role in this translation was played by Constantine the African (d. 1087) based at Salerno in south-western Italy, then the leading medical centre in Europe. The Renaissance brought an admiration of the Classics and retranslation from around 1500 AD of the works of Galen and others so that their wisdom could be available in its 'original pure form'. Concern that the right plants were being used in medical preparations led to the establishment of the first Chair in Botany, at Padua in 1533, and the first botanic gardens, at Pisa and Padua (1544-5). Meanwhile, the botanical pharmacopoeia was further expanded with additions from the Americas and the Far East. America yielded coca, guaiac, sassafras and tobacco, and India aloe, ginger and sandalwood.

Western Medicine has increasingly concentrated on using chemicals to treat ailments, and its directions have become greatly influenced by the research and promotion of pharmaceutical companies, some of which have achieved enormous political and economic power. The 19th century witnessed systematic advances in the understanding of drugs (Pharmacology) and, from the 1860s, the roles of microorganisms in causing infectious disease. Pharmacognosy, a new branch of science, emerged, being specifically concerned with the isolation of 'active principles' from plants. Among the early isolates were morphine (1803), strychnine, quinine and caffeine (1818-1821), codeine (1832) and cocaine (1860). Aspirin was first synthesised in 1899, inspired historically by investigations into the healing properties of the bark of the willow Salix. However, Western Medicine had little to offer against bacterial infections until the discovery of sulpha drugs in the 1930s and antibiotics (extracted from fungi) in the 1940s. Today many pharmaceutical drugs contain compounds derived directly from plants, modified from compounds found in plants or inspired in their development by plant chemicals. Fifty-seven percent of prescriptions filed in the USA during a 9-month period in 1993 contained at least one major active compound "now or once derived or patterned after compounds derived from biologi-

cal diversity" (ten Kate & Laird, 1999). Again in the USA, 25% of all prescriptions dispensed from community pharmacies between 1959 and 1980 contained plant extracts or active principles prepared from higher plants (Farnsworth et al., 1985). They include reserpine (lowers blood pressure), extracted from serpent-root *Rauvolfia serpentina*, ephedrin (a decongestant), from the shrub *Ephedra*, digitalin (used for heart disease) from foxglove *Digitalis*, and vinblastine and vincristine (for treating childhood leukaemia and Hodgkin's disease), from the rosy periwinkle *Catharanthus roseus*.

The spread of Western Medicine was aided in its supremacy by association with the political and economic power of the West. Western Medicine became part of the 'civilising colonial mission'. Ayurvedic medicine was suppressed in state-funded medical colleges in India after 1835 and local medical traditions, with their 'witchdoctors', denounced in Africa. Even in China, never under full colonial rule, Western Medicine came to be seen as progressive. The Kuomintang Government decided that Traditional Chinese Medicine was unscientific and passed a law in 1929 making its practice illegal (Griggs, 1981). The increasing nationalisation of medicine during the 19th and especially the 20th centuries has given even further impetus to Western Medicine. Until recently, but only in some countries, national healthcare systems have devoted all, or nearly all, their resources to the promotion and delivery of Western Medicine, ignoring other traditions.

Many people lack adequate access to medical systems associated with the more formal medical traditions, at least in their 'purest' and 'most advanced' states. A large section of the population in the USA receives inadequate medical services, while everywhere in the developed world there is constant debate about how to cope with remorselessly rising demands for higher expenditure on healthcare. Although governments in most developing countries spend all or nearly all their health budgets on Western Medicine, its actual provision can be lamentable. There are, commonly, shortages of doctors, particularly in rural areas, hospitals sometimes barely function, and patients are frequently expected to purchase their own drugs, themselves often sub-standard or adulterated. Over half the population of Haiti has never seen a doctor (Hilaire, 2002). Partly in consequence, it is estimated that 70-80% of people worldwide rely chiefly on herbal medicine to meet their primary healthcare needs (Farnsworth & Soejarto, 1991; Pei Shengji, 2001). Even in Europe, up to at least the 18th century, only the rich could afford to see formally trained medical practitioners (Griggs, 1981). This, together with a growing distrust in the complicated theories and preparations of formal medicine, lay behind a strong interest in 'simples', that is medicines made from single ingredients, often native plants. There was a fashion in herbals (guides to uses of medicinal plants), such as Gart de Gezundheit (1485) by Peter Schoeffer, Herbal or General Historie of Plants (1597) by John Gerrard and The English Physician (1653) by Nicholas Culpeper. In fact, even these herbals were available to relatively few people in these still largely illiterate societies. Poorer people in Europe followed local traditions, now largely lost, and visited village herbalists. There was a strong empirical element in these treatments (Hatfield, 1999) in contrast to the often dubious theories of the medical establishment, influenced by astrology, the Doctrine of Signatures, and Galen.

The effectiveness of medical systems, including specific treatments, is a major area of concern, including for governments with their responsibilities for national healthcare. The public needs to be protected from recommendations stemming from poor quality research or the designs of charlatans. Testing the efficacy of herbal medicines can be complex. In vitro tests may fail to reveal active constituents because these may only form during internal digestion. Herbs active as mixtures may be ineffective or even toxic if taken alone. Herbalists often question the therapeutic value of substituting herbal preparations with single chemicals. Statistical proof of efficacy may be difficult to determine if medicines are tailor-made for individual needs, as is common in non-Western traditions, rather than being taken as standardised aliquots, the normal practice with Western drugs.

Psychology can play a major role in healing, the effectiveness of a prescription being not purely a question for physiologists. Reasons given for treatments are embedded within wider worldviews embracing more fundamental concepts of the sources of good and ill. Such reasoning can be alien to those from other cultures. What is wrong with a charm or, for that matter, the white-coated physician and 'magical' tests and apparatus of Western Medicine if patients believe in their effectiveness and this aids recovery? Is it necessarily unhelpful for people to believe that seeds with combinations of red, white and black colours have healing or protective properties, as is common in Africa (Cunningham, 1996a; Cunningham, 1997)? The problem for those con-

cerned with improving public health is to strike a sensible balance between respect for people's beliefs and customs, and recommending improvements based on theory and experimental results.

Medicine can be strongly influenced by religion, ideology or nationalism. The quasi-religious status accorded to some written traditions of medicine can prevent rigorous questioning and impede advance. Galen's system dominated medicine in Europe for 1500 years and, for all its worth, largely paralysed further medical development. Nationalistic sentiment favoured recognition of Ayurveda as an official medical system in Sri Lanka following political independence from Britain. Almost everywhere the power of 'science' is acknowledged, but today there are differing understandings of the meaning of the term. Some supporters of non-Western medicine claim that their systems are scientific, being validated by centuries of experimentation. In seeking ways forward, it is important that scientists maintain open minds, that they try to understand the biases of their own scientific traditions, and that they keep in mind the cultures and socio-economic circumstances of those whom they wish to benefit.

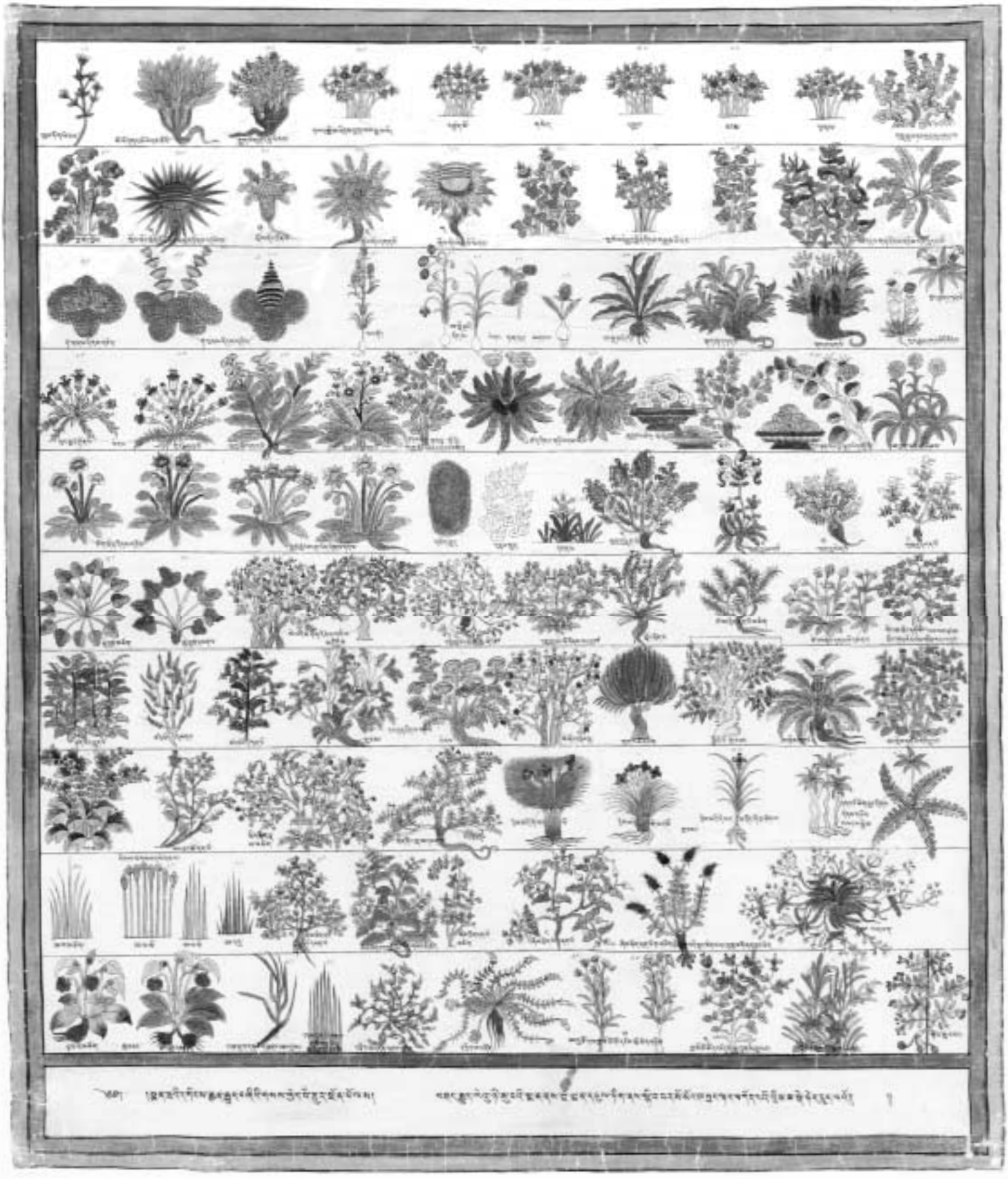
There are many uncertainties in predicting how medicine will develop, but it may be supposed that:

- Western Medicine will continue to develop rapidly, in view of its close relationship with the rapidly developing sciences of Biochemistry, Microbiology and Genetics, the special support which it receives from governments, and its association with economically and politically powerful pharmaceutical companies. Western Medicine will become further fragmented, with more specialities. Research will continue to concentrate, as it has in the past, on the maladies of people in the developed world.
- Western Medicine, especially in its more advanced (and increasingly very expensive) states, will remain unavailable to large numbers of people, particularly in developing countries. There will be barriers of expense, culture, poor quality of drugs and an inadequate number of doctors, especially in rural areas. It is estimated that worldwide only 15% of pharmaceutical drugs are consumed in developing countries (Toledo, 1995).
- The majority of people in developing countries (growing in absolute numbers) will continue to rely on non-Western medicine for much of their primary healthcare. At the same time, there will be continuing declines in traditional knowledge about medical plants and in traditional medical systems, for example in Asia (Farnsworth & Soejarto, 1991; Lama *et al.*, 2001; Pei Shengji, 2001).
- The use of 'alternative medicine', based largely on plants, will grow in industrialised countries due, in part, to dissatisfaction with Western Medicine. The market for herbal medicine and related products (food supplements, etc.) has been growing extremely fast, at around 10-20% annually in Europe and North America in recent years (ten Kate & Laird, 1999).
- There will be increasing governmental support for non-Western medicine in developing countries, for economic and cultural reasons.

Some governments are beginning to pay more attention to non-Western systems of medicine. Traditional Medical Systems (that is Chinese Traditional Medicine, Tibetan Medicine, Mongolian Medicine, Tai Medicine and Uguar Medicine) have become recognised officially in China after the establishment of the People's Republic (1949). The Chinese government also recognises the usefulness of Traditional Medical Knowledge (folk medicine as practised in homes and villages) but discourages Shamanistic Medicine. There are, today, 36 universities teaching traditional medicine in China (Pei Shengji, 2002b). In 1967, a society was formed in Japan to support Kampo, Traditional Japanese Medicine. It now has 10,000 members and 200 preparations have been cleared for prescription by the National Institute of Health as well as by insurance companies. In 1970, the Indian Parliament passed the Indian Central Council Act, establishing a Central Council for Ayurveda. This was followed by the accreditation of courses at colleges and universities. An initiative by WWF at Dolpo, Nepal, to encourage sustainability in the harvesting of medicinal plants, linked to the strengthening of Tibetan medicine (Lama *et al.*, 2001), is being watched with interest elsewhere in the country. There are research centres in all three East African countries charged with the study of traditional medicine, including its potential to contribute to national systems of healthcare. They are the Centre for Complementary Medicine and Biotechnology in Kenya, the National Chemotherapeutics Laboratory in Uganda, and the Institute of Traditional Medicine, Muhimbili Medical Centre, Tanzania (Kessy, 2002). The medical establishment in the UK, as embodied in the British Medical Association, has traditionally opposed 'alternative medicine', but in 1988 the Royal Society of Medicine recommended bridge-building with other traditions. In Mexico, there have been efforts to educate doctors about traditional medicine, register traditional medical practitioners, and provide herbal remedies for sale to communities (Aguilar, 2002). The TRAMIL network in the Caribbean and Central

America is undertaking research aimed at authenticating and recommending herbal medicine to treat common ailments.

Individual doctors and some governments have adopted, or are considering for adoption, integrated (syncretic) medicine, drawing on Western and other traditions. In fact, even in Western Europe, there are long established variations in the degree to which herbal treatments are used in conventional medicine. For example,



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they are much more part of normal practice in Germany than in the UK. The impetus towards integrated medicine can stem from desires for greater medical effectiveness, financial limitations, or the wish to affirm local cultures. Resistance to co-operation can stem from any of the traditions, but most often from the Western. The involvement of governments is important because this can lead to a more systematic approach. Actually, it is common practice around the world for some Western-trained doctors to recommend herbal or other 'alternative' treatments and for some practitioners of other traditions to prescribe Western drugs. An excellent example of integrated medicine has been set by China, where, from the days of Chairman Mao Tse-tung, a goal has been set of developing a national medical system drawing on the best of Western Medicine and indigenous medical traditions. The approach has been empirical and pragmatic, and today integrated knowledge has become fully implemented throughout the country (Pei Shengji, 2001). Experience of introducing herbal medicine into an orthodox setting in the UK has been described by Sue Eldin and Andrew Dunford (Eldin & Dunford, 1999). Their approach to integration involves regular discussions between the general practitioners, practice nurses and a herbalist. They report that the herbalist deals with an increasing number of 'heartsink patients' (representing about 50% of consultations). These patients have problems that are not easy to define or treat through Western Medicine.

Applied Ethnobotanists, working on their own or with sympathetic Western-trained doctors or other specialists, have many potential roles to play in the development of improved systems of healthcare and related issues of conservation and sustainable development. They include contributions towards (Cunningham, 1997; Elisabetsky & Costa Campos, 1994; Lagos-Witte, 1994; Pei Shengji, 2001; Robineau, 1996):

- Documentation and understanding of non-Western systems of health and healing.
- Training physicians to work with traditional medical practitioners.
- Identification of treatments, based on local medical traditions, to recommend for wider adoption. Such work helps reduce consumption of pharmaceutical drugs, which can be very expensive in developing countries. It can also lead to the substitution of imported medicinal plants or pharmaceutical drugs with locally-based medications.
- Development of healthcare systems and practices which draw on both Western and other types of medicine.
- Research into active principles in plants, including for the benefits of national healthcare and economies. This can lead to the discovery of new drugs. If discoveries are based on local medical knowledge, then research should be undertaken according to recognised ethical standards, with a fair and appropriate distribution of the benefits of research and commercialisation to relevant parties (Laird, 2002).
- The recording of toxic traditional medicines so that traditional healers might be persuaded to substitute safer plants or reduce the quantities administered.
- Increased national autonomy regarding the planning and management of health policies.
- Understanding changes in economies, societies and cultures relating to the management and use of medicinal plants.
- Identification of species of plants in need of conservation. Particular attention needs to be given to plants in trade, for which the danger of over-harvest is greatest.
- The establishment of schemes to conserve, sustainably harvest, or cultivate medicinal plants.

Courses and programmes in Applied Ethnobotany: matters to consider

The challenges of interdisciplinarity

Ethnobotany is multidisciplinary in that knowledge and skills pertaining to many disciplines are needed by ethnobotanists. It is interdisciplinary, especially as an applied subject, in that synthesis between the disciplines is essential to ensure successful identification and resolution of real-life problems of conservation and sustainable development (Jacobson & Robinson, 1990).

Interdisciplinarity presents considerable challenges for staff and students. If several members of staff, with varying backgrounds, are responsible for delivering the bulk of the teaching of a course or programme in Applied Ethnobotany, each concentrating on his or own area of speciality, then all of them must make every effort to select those aspects of their subjects which are most relevant to Applied Ethnobotany and take every opportunity to explain connections. It is not enough to leave synthesis to the students. If this happens, then many students will fail to make the necessary connections and they will not become useful applied ethnobotanists.

A course or programme in Applied Ethnobotany should provide an education which will assist its graduates to identify and find answers to problems in the real world. Such problems rarely fall neatly into the discrete disciplines into which modern academia is divided (Jacobson & Robinson, 1990). Applied ethnobotanists should have an understanding of relationships between the botanical, ecological, social, economic and political dimensions of managing plant resources and conserving botanical diversity.

A successful course in Applied Ethnobotany will often involve staff drawn from different departments or faculties. They must learn how to communicate with one another (Jacobson & Robinson, 1990). Those involved should not be discouraged by initial problems. Experience in the initial development of an interdisciplinary approach shows that this can be unstable and unproductive for several years due in large measure to differences in philosophical outlook between disciplines, including in underlying paradigms (Jacobson & Robinson, 1990). There are barriers of terminology. Modern fields of knowledge are often so specialised and ridden with jargon that they are almost impenetrable to others. They tend to emphasize specialisation rather than lateral thinking (Jacobson & Robinson, 1990).

The range of materials which could usefully be covered in courses in Applied Ethnobotany is immense, especially considering the many contributory disciplines. The problem has been paraphrased as 'breadth versus depth'. The danger is that graduates may end up knowing a little about a lot and be masters of nothing (Brown, 2001). While there are strategies to help deal with this, an element of 'what to leave out' is probably unavoidable (Kanowski, 2001). There is, therefore, a need to identify the core competences required of an Applied Ethnobotanist.

The educational challenges encountered in Applied Ethnobotany are actually reflected in many professional fields (such as Forestry and Medicine) concerned with finding practical answers to human problems (Kanowski, 2001; Sample *et a*l., 1999; Tombaugh, 1998). Programmes in Forestry have been expanded in their coverage of topics in recent years to accommodate new subject matter now seen as essential (Ginger, Wang & Tritton, 1999). The world today is subject to rapid ecological, economic and cultural change. All professionals have to be adaptable and learn how to cope with a constantly shifting agenda, including finding ways to cope with the modern explosion of ideas and information. There is often less security in jobs and more individuality in career-trajectories than in the past. Learning today must be seen, even more than before, as a matter for continuing pursuit throughout life. Staff teaching courses in Applied Ethnobotany are just as much faced with these challenges as are their students. As with Forestry, much learning will be self-learning, and courses and programmes should be structured to encourage this (Burley, 2001). Major aims of courses and programmes in Applied Ethnobotany, as with Biology (Liras, 1994), should be to teach students how to think, how to identify problems, how to explore them and how to acquire information or assistance from specialists, as necessary for the tasks in hand. As with Forestry (Kanowski, 2001), there are major roles for in-service professional courses and professional networks.

A more problem-orientated approach to learning than is conventional has been advocated for interdisciplinary subjects (Brown, 2001; Kanowski, 2001; Liras, 1994). The idea is to develop professional competency through acquiring the ability to recognise problems and apply solutions in real social contexts in which there can be considerable uncertainty, instability and conflict. It is a recognition that every problem in professional practice is unique and requires an open-minded and fresh approach, rather than merely applying standard techniques in a mechanical way. While some lectures may still be given, for example covering basic theory and concepts (Liras, 1994), most learning in a problem-orientated programme is self-directed or tutor-facilitated in small groups. The emphasis is on action and interpretation rather than on theory and memory. Students build the ability to learn through exercises in solving problems under the guidance of experienced practitioners. While certainly there should be elements of problem-orientated self-learning in interdisciplinary subjects, there can be considerable constraints to embracing this approach whole-heartedly (Kanowski, 2001). They include the need for exceptional degrees of competency and commitment from staff, who must devote more time and effort to support individual students than is conventionally the case. Costs also increase, especially if there is much individual fieldwork. The commitment of several departments to this approach may be needed, which may be difficult to achieve. The extra effort required of students can be a major challenge if they are faced with economic difficulties, which is often the case. Furthermore, students may find it hard to cope with a full-blooded problem-orientated approach if they are used to learning by rote, all too common in education in some countries.

Brown, referring to the ideas of Ramsden and Schön (Ramsden, 1992; Schön, 1987), has written of theories of learning which can underpin approaches to the education of professionals (Brown, 2001): "Ramsden (1992) defined learning as applying and modifying one's own ideas. It is, he maintained, not the passive receipt of authoritative knowledge. Learning in a professional context may require a slightly broader definition because much of what is learned may not be consciously 'known'. When asked how to identify a particular species of tropical tree few experts will be able to produce a list of defining characters. Most will simply recognise a tree from its 'Gestalt'. This is an example of what Schön (1987) has termed 'knowing-in-action', one of the essential components of skilful professional practice. Knowing-in-action is revealed in the spontaneous skilful execution of a complex task, but it can rarely be made explicit. It does not therefore constitute the conscious application of ideas or theories. This view of the way that professionals may work undermines the traditional epistemology of professional education. It suggests that professionals rarely 'solve' problems, but may simply recognise them and apply appropriate solutions. However, most problems in professional practice are not routine but are unusual, often unique. Standard actions produce unexpected results that the professional has to respond to. Schön (1987) claimed that the essential counterpart to 'knowing-in-action' is the capacity of the skilful practitioner to respond intelligently to the unexpected. Their actions are modified on the basis of reflection, leading to a revision of the personal ideas that underpinned the 'knowing-in-action'. A constant cycle of spontaneous action followed by reflection and modification of personal conceptions of the problem constitutes what Schön saw as professional artistry. There are obvious parallels between this view and Ramsden's (1992) description of learning as the application and modification of personal ideas."

Many of the challenges of interdisciplinarity faced in Applied Ethnobotany are paralleled in Conservation Biology, a related field. Conservation Biology is concerned specifically with biological conservation. The point of departure when devising courses or programmes in Conservation Biology therefore differs somewhat from that of Applied Ethnobotany. There is likely to be more emphasis on topics, such as loss of species and genetic diversity, and loss and fragmentation of habitats. There will likely be more attention given to 'traditional' conservation measures, such as protected areas, ex situ conservation, and re-introductions of species. Given that the starting point lies in the biological world, the logic of the approach of conservation biologists tends to begin by stressing the need for biological inventories and the preparation of 'Red Lists' of endangered species. Taxonomy is seen as a basic discipline and, accordingly, the shortage of taxonomists is particularly bemoaned (Botanical Society of America, 1995). In contrast, Applied Ethnobotany is embedded in an ecosystem-based approach to conservation and sustainable development, with an emphasis on the management of plant resources (Figure 1). Natural and human systems are seen as thoroughly intertwined. Thus, the perceptions, values, uses and methods of management of plants by all those people who are stakeholders in a particular ecosystem become fundamental considerations.

Being mostly motivated by an interest in plants and animals, there is a tendency for conservation biologists to focus on aspects of prob-

lems that interest them (that is the biological) and ignore other aspects (Meffe, Carroll & Pulliam, 1997). They often play little attention to the social, cultural and economic forces which must be understood and addressed if most problems of biological conservation are to be successfully tackled. This is ironic, given that many proximate problems in conservation, including management of more natural areas and 'wildlife', relate to the activities of local people, especially those who are financially poor (Saberwal & Kothari, 1996). There is a great need for 'human dimensions' to be included in courses in Conservation Biology, many of which are deficient in this respect (Jacobson & McDuff, 1998). Twenty-two per cent of 136 conservation organisations in the USA, responding to a survey, stated that human interaction skills are more important than scientific knowledge and skills for their employees (Jacobson & McDuff, 1998). A similar survey of public and private organizations that employ, or might employ, conservation biologists revealed that human interaction skills were held to be equally or more important to the work of conservation biologists than scientific knowledge and skills (Cannon, Dietz & Dietz, 1996).

Skills seen as desirable include the abilities to communicate with the public, assess the interests of stakeholders, communicate across disciplines, and work in interdisciplinary teams (Jacobson & McDuff, 1998). It is recommended that curricula in Conservation Biology should cover such matters as written and oral communication, explanations of the science and values of biodiversity to the lay public, group decision-making, interpersonal skills, group planning, leadership, and advocacy (Cannon *et al*., 1996).

Types of courses and programmes

As mentioned earlier, a course is taken to be a relatively short unit of study and a programme a subject of graduation. There is no international consistency in the structure of tertiary-level education or in the nomenclature used for degrees. We use the term 'undergraduate programme' for one leading to the degree of BSc or equivalent. Such a programme will typically be of three-year's duration and include only limited periods of individual research. The postgraduate programmes with which we are concerned here are those in which there is an element of group learning, i.e. they are not solely based on individual research. They will typically lead to the award of an MSc or PhD (or MPhil in some countries). MSc programmes are commonly two years in length, composed half of group learning and half of individual research, though one-year programmes are also found.

Assuming that the value of Applied Ethnobotany is realised, an initial question is whether it is sufficient for its teaching merely to be incorporated into courses or programmes in other subjects or whether it should be taught as a subject in its own right. It is common to teach elements of Ethnobotany within other courses, such as 'Taxonomy' in Botany programmes, 'Community Forestry', 'Non-Timber Forest Products', 'Agroforestry' or 'Natural Resource Management' in Forestry programmes, or 'Pharmacology' in Schools of Medicine. Such teaching is useful, but is it enough? We strongly advocate dedicated courses and programmes in Applied Ethnobotany, which we conceive as a unitary, if interdisciplinary, subject. The overall rationale of Applied Ethnobotany is unlikely to be appreciated by students if its subject matter is only encountered scattered throughout other courses. A dedicated course or programme in Applied Ethnobotany will help students to think across the boundaries of traditional disciplines, greatly enhancing their abilities to address real-life problems.

A principal conclusion drawn from our consultations is that a general programme in Applied Ethnobotany should be open, in principle, to students from a wide range of backgrounds. This should be a major consideration in the design of programmes and the setting of prerequisites for entry. Applied Ethnobotany can be a very useful specialisation for postgraduate students, not only botanists, but graduates in a variety of other disciplines, including Agriculture, Anthropology, Forestry, Medicine, Pharmacology, Sociology, as well as others. On the other hand, we accept that there can be value in tailoring undergraduate courses in Applied Ethnobotany to the requirements of particular programmes, such as Agriculture, Forestry and Medicine. There will be substantial common elements in such courses, whatever the discipline, and, if two or more departments in the same university are contemplating the introduction of courses in Applied Ethnobotany, then greater efficiency may be achieved through providing common taught components.

There are many possible types of courses and programmes in Applied Ethnobotany. The three considered most generally useful are (Figure 4):

- Programmes of one to three years duration.

The most widely recommended according to our survey is a two-year MSc programme consisting of a year of group learning and a year of individual research.

- Courses in undergraduate programmes, commonly with about 60 hours of teaching including 20-30 lectures and a limited amount of fieldwork.
- Short professional courses of five days to three months duration, preferably leading to the award of a certificate or diploma.

These could be run, for instance, for members of government departments and NGOs who wish to upgrade their knowledge. Professional courses should have well defined purposes and should normally be entirely or substantially field-based.

There can be scepticism about the value of undergraduate programmes in Ethnobotany, as expressed, for example, by staff at two universities in Kenya (Kessy, 2002). The principal argument is that the students will 'specialise' too early, reducing their opportunities for employment. To our knowledge, there are actually only two undergraduate programmes in Ethnobotany worldwide, these being mounted by the Department of Botany, Makerere University and Mbarara University of Science and Technology, both in Uganda (Kessy, 2002; Mucunguzi, 2002). The thinking which led to the development of the programme at Makerere should be a matter of reflection for academics working in botany departments elsewhere in developing countries. The historical context at Makerere is that graduates in Botany have typically become teachers of Biology or been employed by research institutes. However, in 1991, the entire education of aspiring teachers of Biology became transferred to the School of Education. The Department of Botany was no longer involved, and the opportunities of jobs for its

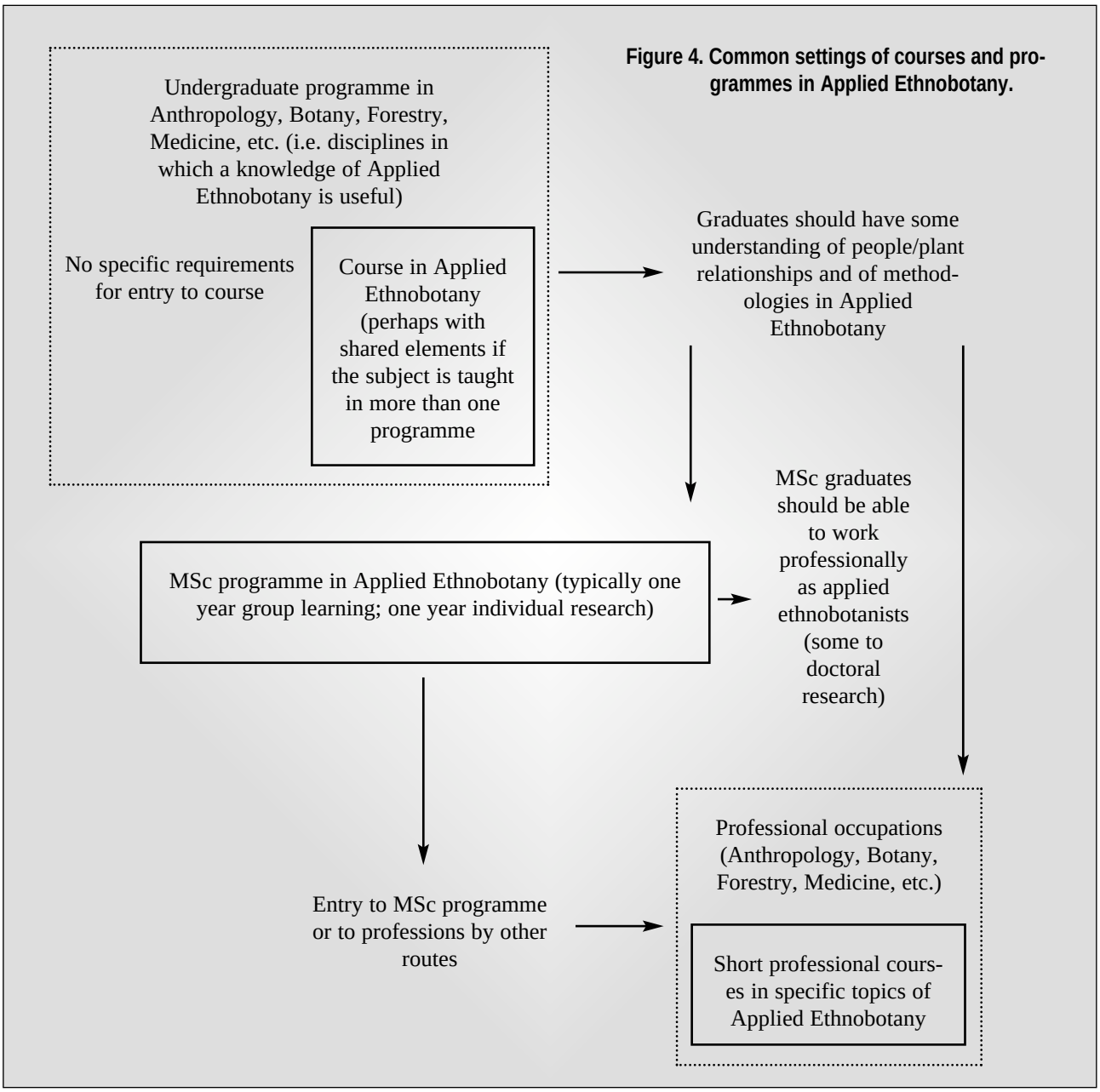


Figure 4. Common settings of courses and programmes in Applied Ethnobotany.

graduates accordingly reduced. Furthermore, in the mid-1990s, the Department of Botany undertook a survey of its graduates and found that most of those who had recently become employed were working either in research centres or in natural resource management. A common experience reported by the latter group was that most of the problems they encountered were community-related and yet, they complained, they had received no training for such work. Some members of staff of the department then decided to review, fundamentally, the purpose of an education in Botany within their national context. It was this that led to the development of the undergraduate programme in Ethnobotany, a subject conceived as being 'Botany for the People'. Traditional Botany is still being taught in parallel by the department.

Students completing postgraduate programmes in Applied Ethnobotany should be equipped to start work as professional ethnobotanists, though some may proceed to doctoral level. Apart from its value to the students themselves, and hopefully to those communities which participate in their research, an added benefit of doctoral research is the provision of case-studies which can be used in teaching.

A survey in East Africa has demonstrated that, at present, there is little connection between the pursuit of research at doctoral level in Ethnobotany and acceptance by the universities more generally of the value of Ethnobotany as a taught subject (Kessy, 2002). Choices of topics for doctoral research in East Africa overwhelmingly reflect the interests of individual members of staff. The key institutional factor regarding the acceptability of a research topic is its perceived potential to produce results considered to be 'major contributions to science'.

The purposes of courses and programmes

Each course or programme in Applied Ethnobotany needs defined purposes. These will be decided through internal processes within departments and universities. These discussions will be better informed if reviews exist of the status and potential applications of Ethnobotany within the country or region. Developers of courses and programmes are advised to consult members of relevant government departments, industries, research institutes and non-governmental organisations, discussions which could lead to the added benefits that they will become involved in teaching and of raising the chances of employment for the graduates.

Participants at our Latin-American workshop made the following suggestions about the purposes of certain types of courses and programmes (GELA, 2002):

- Undergraduate courses should be introductory in nature, having purposes such as educating students to understand relationships between people and plants, building the capacity to think across disciplines and encouraging students to undertake local ethnobotanical studies.
- Postgraduate programmes should produce professionals capable of carrying out practical activities. Master's courses should also be designed to lay a foundation for doctoral research, even though most graduates will not normally proceed to this level.
- Short professional courses should have specific objectives designed to enhance the capacities of participants in well-defined ways.

Institutional contexts

DEPARTMENTS OF COURSES AND PROGRAMMES

Courses and programmes in Applied Ethnobotany will typically be attached to particular departments and faculties, even though members of other departments and faculties may be involved in their teaching. Courses can be mounted by a variety of departments. Currently in Brazil, courses in Ethnobotany are taught within departments of Botany, Health, Horticulture and Pharmacology (Table 3) (Stern da Fonseca, 2002). As mentioned elsewhere, a single course might serve several departments, though with special components designed for the needs of particular categories of student.

If there is no department of Ethnobotany or related subject such as Economic Botany, Ethnoecology or Conservation Biology, then we recommend that programmes be mounted by departments of Botany or Biology. This is an acknowledgement of the botanical detail required in programmes (more so than in undergraduate courses) and the availability of scientific facilities such as herbaria.

CO-OPERATION BETWEEN DEPARTMENTS AND FACULTIES

Courses and, even more so, programmes, will benefit if members of different departments and faculties are involved in the teaching. Co-operation is not always easy to achieve. Universities vary in the degrees to which they recognise the value of interdisciplinary subjects such as Ethnobotany (Kessy, 2002). The fundamental educational philosophy of a university is likely to be reflected in the basic structures regulating teaching and the degree of flexibility possible between departments. When the desirability of co-operation between departments or faculties is unrecognised institutionally, then there may be added difficulties in timetabling.

The ways that students and courses are funded can affect the abilities of departments and faculties to co-operate (Kessy, 2002). In the case of Makerere University, Uganda, fees paid by students vary in amount by faculty, but are paid centrally, causing complications if there is a demand that they be distributed between faculties according to their contributions to interdisciplinary teaching (Mucunguzi, 2002). The problem is further compounded because some students at Makerere receive government grants, while others are entirely self-supporting. The latter group includes all students registered for the programme in Ethnobotany in the Department of Botany. Questions have arisen as to how the Department will pay for the time of lecturers of other departments and the rates at which they should be paid.

The level of fees can be a deterrent for private students. There is a trend towards an increasing number of self-financed students in many countries, a reflection of a global expansion in tertiary-level education and the incapacity or unwillingness of governments to bear the entire costs. The level of the fee payable by students to enrol in the programme in Ethnobotany at Makerere is a large sum in the local context. It may be noted that even then, the total of fees received does not meet all the costs of the programme, which has been subsidised from the core funds of the Department of Botany and some voluntary teaching by members of other departments.

INSTITUTIONAL AND PEER ACCEPTABILITY

Those wishing to start courses or programmes in Applied Ethnobotany must frequently convince their colleagues of the value of the subject. Many academics have not heard of Ethnobotany and know nothing of its potential usefulness. It is suggested here that proponents of Applied Ethnobotany emphasise its value for conservation and sustainable development. They should point out just how important plants are in local cultures, and the economic necessity of maintaining the base of plant resources. They should emphasise that plants are essential elements in all aspects of public health, including nutrition and the curing or prevention of ailments. They should be able to demonstrate that Applied Ethnobotany can contribute to the study of native plants and the conservation of traditional botanical knowledge. They should be able to provide examples of how Applied Ethnobotany can contribute to the relief of poverty and to social justice. Well-documented case-studies should be ready to hand.

In some cases, universities within countries share common syllabuses. For example, the same curriculum is followed by all four agricultural universities and six agricultural colleges in Pakistan. In such cases, the introduction of a new course must normally be agreed at a higher level than that of a single institution. This particular impediment has been surmounted by Dr Khan Bahadar Marwat of NWFP Agricultural University in Pakistan in the case of Ethnobotany, through his achievement in establishing, for his university alone, a Department of Weed Science (Marwat, 2002). Two elective courses in Ethnobotany, at elementary and more advanced levels, have been included in the programme.

Some members of staff may not appreciate the merits of working with colleagues from other departments (Jacobson & Robinson, 1990). They may not think beyond their particular subjects or even their own specialities within them. They may be intellectually enmeshed in particular par-

adigms - sometimes unconsciously - and this may limit their perceptions about the nature of scientific or other modern academic knowledge and the types of education or research that are 'authentic'. They are likely to be only vaguely aware of approaches and methods used in other subjects. In our experience, 'traditional botanists' often have little awareness of the importance of culture, land ownership and rights of access to natural resources for determining how 'wild' plants are used and managed. They know little about connections between agricultural and 'wild' ecosystems, and many do not appreciate the significance of human actions for moulding 'natural' vegetation. Sociologists and economists often fail to realise the roles of biological and ecological variables in determining relationships between people and plants, including the restraints that they impose over how plants can be used and managed. Conventional economists can adhere to the erroneous theory that natural resources are infinite or are perfectly substitutable with man-made capital (Hamilton, 2001). We have encountered resistance within an institute of environmental management in Uganda to the collection of socio-economic data for a study of the resilience of palms to harvest, seeing such work as insufficiently 'scientific'. Use of a questionnaire to ascertain the use of firewood collected from a national park in Tanzania was initially rejected by a department of Zoology because questionnaires were regarded as not being part of the toolkit of a zoologist.

Enrolment requirements

In principle, programmes in Applied Ethnobotany should be open to students from a wide range of backgrounds (GELA, 2002), though clearly requirements for enrolment should differ between undergraduate and postgraduate levels. A programme in Applied Ethnobotany is best regarded as a specialisation within Botany, though of an interdisciplinary nature. Non-botanists should be allowed to enrol, but they should have a genuine interest in plants, because otherwise they will probably find it impossible to reach professional competency.

It is a common experience that students of Ethnobotany are somewhat older than the average (McClatchey *et al*., 1999). A decision to study Ethnobotany, as a major subject, is a deliberate choice, rather than merely just one further step up an educational ladder in the same subject. Students are often attracted to Ethnobotany by its inter-disciplinarity, and concerns for the environment and the welfare of poor rural people (Toledo, 1995). Advantages of a broad admissions policy to a programme are that students are more likely to be well motivated and that everyone will benefit from the contributions of students hailing from a diversity of backgrounds.

The recommendation of an open-minded approach to admission to a programme should not be mistaken as a call to be 'soft'. A lack of rigour in admissions policy could lead to current or potential students questioning the strengths of courses (McClatchey *et al*., 1999) and also doubts on the part of potential employers. Each department must establish its own entry requirements, which may be institutionally constrained as, for example, in Brazil, Cuba and Mexico, in which it is normal for students to take written examinations for entry to postgraduate programmes. Other requirements which have been suggested for entry to postgraduate programmes include attainment of specified standards in undergraduate degrees, work experience and expressions of interest (GELA, 2002). The latter could be demonstrated through interview, or the submission of ideas for the individual research which the student will be required to undertake.

A flexible approach to admission to an elective course in Ethnobotany has been adopted by Fatima Jinnah Women's University, Rawalpindi, Pakistan (Rahim, 2002). This course, entitled 'Ethnobotany and its Application to Conservation in Environmental Science', was introduced in 1999 and is open to students from many disciplines, including Economics. There is no requirement for a background in Botany. In contrast, entry to the undergraduate programme in Ethnobotany run by the Department of Botany, Makerere University, Uganda, stipulates passes in two science 'A-levels' (advanced secondary school qualifications), one of which must be in Biology, Chemistry or Agriculture. Greater flexibility is exercised in the case of mature-aged applicants. Experience has suggested that the requirements for normal entrants are over-prescriptive, and they are likely to be revised (Mucunguzi, 2002).

Student assessment and course evaluation

Many methods can be used to assess the performance of students. Participants at our Latin-American workshop thought that forms of assessment do not differ, in principle, from those used for many other subjects (GELA, 2002). For courses at undergraduate level, there is likely to be an emphasis on written forms of assessment, such as essays, practicals (including fieldwork), and final papers. Students taking programmes should be assessed for their practical skills and personal aptitudes as well as their knowledge. Certificates of Attendance or Adequate Performance are desirable for professional courses to give pride in achievement and to provide evidence of attainment relating to opportunities at work.

Courses and programmes should be evaluated periodically to achieve incremental improve-

ments and for accountability (Jacobson & Robinson, 1990). Evaluators should consult the teaching faculty, students, the administrative staff of universities, and members of relevant external organizations. Once a programme is well established, there should be occasional surveys of the employability of graduates and their effectiveness in their occupations.

Staffing

The nature of staffing for courses and programmes in Applied Ethnobotany will depend upon the availability of interested individuals, the extent of their knowledge, their competency as teachers and the structural arrangements of universities, for instance relating to the ease of co-operation between departments and faculties.

It is likely that, for the present, the majority of staff involved will not have been trained primarily as applied ethnobotanists, but rather will have studied traditional subjects such as Anthropology, Botany, Ecology, Economics, Forestry, Medicine, Pharmacology and Sociology. Few will have been trained outside their own discipline (Jacobson & Robinson, 1990). If a course or programme is taught by staff, each with a background in a traditional discipline, then it is vital that they do not just teach their 'own' subjects in isolation, leaving integration to the students. Lecturers should make every effort to think across disciplines and encourage the same in students through provision of models, analyses and case-studies. Making the effort to learn beyond a relatively narrow discipline in which one has been trained and feels competent is a challenge (Ng, 2000), easier to handle if colleagues encourage one another to broaden their horizons. There will commonly be a need for staff development. One approach to developing expertise among staff is for a department to encourage doctoral research in Applied Ethnobotany, with the hope that the students, once graduated, will join the faculty (Mucunguzi, 2002).

A view was expressed at our Latin-American workshop that the core of the teaching in courses or programmes in Applied Ethnobotany can sometimes be covered by two or three members of staff, these having expertise in Botany, Ecology and Sociology/Anthropology (the first two of these sometimes being covered by the same lecturer) (GELA, 2002). Staff contributing to the undergraduate programme in Ethnobotany at Makerere University in Uganda include botanists, chemists, economists, lawyers, pharmacists and sociologists (Kessy, 2002). Co-operation between experts in different institutions, or even from different countries within a region, can be desirable to mount high quality courses, an idea being advocated by GELA. The MSc programme in Ethnobotany at the University of Kent at Canterbury draws upon the human and material resources of the Department of Anthropology, the Durrell Institute of Ecology, and the Royal Botanic Gardens, Kew - the latter situated at some distance, in London. If the concept of a core teaching staff is adopted, then it will often be desirable to engage experts in certain other specialised subjects, for example perhaps Ethics, Geographical Information Systems (GIS) and Statistical Methods.

The teaching of courses at undergraduate level is demanding, even though less detailed knowledge is needed compared with the postgraduate level, and the length of the teaching period is relatively brief. Courses will often be taught by one or a few lecturers. The challenge is to cover the broad range of the subject in a truly interdisciplinary way. The temptation should be avoided in departments of Botany to leave the entire teaching of a course in Applied Ethnobotany to a taxonomist, unless the person concerned has the necessary interdisciplinary knowledge and expertise in teaching. Courses in Ethnobotany are frequently taught by taxonomists, as in Malaysia (Saleh, 2000).

Visiting lecturers can contribute greatly to courses or programmes in Applied Ethnobotany, bringing in fresh perspectives and special expertise. The use of such lecturers is infrequent. Miguel Alexiades and William Bailey of New York Botanical Garden have served as visiting lecturers on courses in Ethnobotany in Brazil. Javier Caballero of the Botanical Garden of the Universidad Nacional Autónoma de México (UNAM) has taught Quantitative Methods in Ethnobotany around the world, including on behalf of the People and Plants Initiative. Sonia Lagos-Witte of the TRAMIL programme has served in Brazil, Colombia, Honduras, Indonesia and Nicaragua.

Ultimately, the initiation and success of courses or programmes in Ethnobotany will generally rely on the enthusiasm and energy of one or a few people who recognise the value of the subject and are committed to making its teaching a success. Their presence is critical for encouraging other members of staff and for promoting wider contacts. The key role of such 'energisers' is no different here than for the stimulation of intellectual activity generally. Surveying the history of Botany in the USA, the Botanical Society of America concluded that "Most botanists attribute their original interest in plants to another botanist or teacher able to convey the beauty and intellectual excitement of plant studies" (Botanical Society of America, 1995).

Analysing the development of Ethnobotany in departments of Botany and Forestry in East Africa, John Kessy has drawn attention to two contrasting schools of thought and approaches to teaching (Kessy, 2002). This is a contrast widely

mirrored elsewhere, including in the USA (Anderson, 1995). One school of thought is composed of teachers who are conservative in nature and content with traditional approaches, seeing Ethnobotany as essentially the same as Economic Botany, considered to be the study of the uses of plants. The other school - the 'daring school of thinkers' - has accepted that Ethnobotany can play a major role in conservation and sustainable development, and has tried to start innovative courses or programmes. Members of this school believe that Botany and Forestry have much to contribute to the future of their countries, but that they need to be overhauled to respond satisfactorily to modern challenges.

Material resources

Materials needed, or useful, for a course or programme include:

- Rooms for lectures, seminars and tutorials, with equipment such as blackboards, projectors, etc.
- Slides, videos, etc.
- Laboratories with microscopes, chemicals, etc.
- Computers and accessories, including word-processing and database programmes and access to the internet.
- An herbarium and equipment for collecting plants.
- An ethnobotanical collection.
- A map collection and cartographic facilities.
- Field equipment, especially for recording information (e.g. notebook, pencil), the demarcation of plots and marking of plants, the measurement of position (e.g. altimeter, compass, inclinometer, geographical positioning system (GPS), etc.), size (tape measures, callipers, etc.), height (e.g. inclinometer) and weight (balances of different capacities).
- Money. The lack of adequate finance is a crucial issue in developing countries (Kessy, 2002). Money is needed inter alia to pay staff, purchase equipment and consumables, obtain literature and support needy students. Funding can be even more of a critical issue with short professional courses than with undergraduate courses or postgraduate programmes because there may be no provision in regular budgets (Kessy, 2002).

Access to literature is crucial for both staff and students. Lists of required reading and background literature should be given to students. Students should be required to search out literature on unfamiliar subjects for themselves because the ability to do so will be invaluable to them later in life, including if they become professional applied ethnobotanists. There is a need for 'readers' (collections of relevant papers) for participants in short professional courses.

There may be potential gaps in the literature which local experts in Applied Ethnobotany should consider writing. If interesting research has been undertaken, but is unavailable in a suitable form, then, with the permission of the researchers (if required or ethically desirable), lecturers can perform a useful service through its proper documentation for students. Reviews of the status of Ethnobotany in countries and regions are extremely useful for giving orientation in Applied Ethnobotany, including in relation to its teaching. Similarly, national or regional directories of Ethnobotany are valuable reference materials. The People and Plants Initiative has prepared reviews of the status of Ethnobotany for Africa and Malaysia (Cunningham, 1997; Dounias *et al.*, 2000; Höft & Höft, 1997; Saleh, 2000). There is also a need for basic texts, honed to the needs of particular countries and courses (Kessy, 2002).

There is a severe shortage of literature in most developing countries, for instance in Africa (Höft & Höft, 1997; Kessy, 2002). The People and Plants Initiative has tried to help through producing and widely distributing publications and videos dealing with various aspects of Applied Ethnobotany (Appendix 2). We have found that some lecturers teaching Ethnobotany are relying heavily on these materials (Kessy, 1998; Marwat, 2002). For staff and students with access to the internet, we suggest a visit to the People and Plants website (see Appendix 2) which contains a link to the website of the Royal Botanic Gardens, Kew, where there is a listing of many other websites containing bibliographies on Economic Botany and Ethnobotany.

Electronic information is today assuming greater importance, although many ethnobotanists in many developing countries, including in Africa (Höft & Höft, 1997), lack access to the internet. The age of the computer and the development of the internet have only further widened the gaps in technology and information between industrialised and developing countries. Computers are often in very short supply in universities in developing countries and the cost of access to the internet can be prohibitive. (The dollar costs of internet access can be much higher in the developing world than in industrialised countries.) Course organisers should endeavour to find ways of increasing the accessibility of computers and the internet to staff and students.

Core competencies and their acquisition

Applied ethnobotanists should have:

- Adequate knowledge (bodies of relevant factual information).
- Skills (the ability to do things).
- Attitudes and forms of behaviour appropriate to the profession.

Many methods can be used in the teaching of Applied Ethnobotany, including lectures, seminars, tutorials, field and laboratory studies (demonstrative, or involving individual or group work), required reading, literature studies, and individual research. The choice of method may be constrained by institutional limitations, the abilities of staff or the availability of finance, equipment or access to transportation. Participants in our Latin-American workshop pointed out that different educational methods are appropriate to different aspects of courses, suggesting, for instance, that the fundamentals of theory in Botany, Ecology and Anthropology are best delivered in lectures, but that interactive seminars might be more useful for the teaching of Ethics.

Knowledge

Suggestions for topics to cover in courses and programmes in Applied Ethnobotany are given in the next sections (see also Box 4 and Appendix 3). The designers of courses and programmes will need to decide the level of detail to be covered in particular topics, always bearing in mind the need to maintain interdisciplinarity and the potential limitations of students possibly drawn from a diversity of academic backgrounds. Elective courses may be offered within programmes to students with particular interests.

Courses, mounted strictly for aspiring foresters, agriculturalists or other such specialised groups of students, will certainly have some common content, but should have a bias in some sections towards aspects of Applied Ethnobotany of particular relevance to their discipline.

Lecturers should identify aspects of contributory subjects, such as Anthropology, Botany, Economics and so on, which are particularly relevant to Applied Ethnobotany, rather than just teaching them in the 'standard' way. It is reported from East Africa that many students, even in regular Botany programmes, shy away from some subjects (e.g. Plant Taxonomy and Systematics), because they are taught too theoretically and with too much use of specialised language (Kessy, 2002). A more practical orientation, even in traditional programmes - let alone for students of Applied Ethnobotany - is thought likely to be more attractive to many students (Kessy, 2002).

It is strongly recommended that the teaching of the Social Sciences be tailored specifically to meet the needs of applied ethnobotanists. Concepts, such as theories of human behaviour, need to be applied to real-life issues of natural resource management (Gigliotti & Dietz, 1992; Jacobson & McDuff, 1998). Connections between socio-economic and ecological systems must remain at the centre of attention. This is similar to the challenge of teaching social issues in courses in Conservation Biology, in which case, it has been recommended, there should be a focus on the political, economic and cultural origins and patterns of human use of natural resources (Saberwal & Kothari, 1996).

As with Conservation Biology, students need to be versed in policy issues (Saberwal & Kothari, 1996). They should know about the wider political, legislative and economic dimensions which influence local relationships between people and plants. They should be aware of strategies used around the world for conservation and the promotion of more sustainable use of plant resources, and be able to analyse their suitability within their own national contexts. There should be studies of how traditional local institutions governing conservation and the use of natural resources have sometimes been replaced by the institutions of the state, and about the possibilities of reviving or establishing local institutions to complement initiatives of the state (Saberwal & Kothari, 1996).

Many mature-age students of Applied Ethnobotany are deficient in the basic sciences, such as Biology, Chemistry, Anthropology and Sociology (McClatchey *et al*., 1999). It will also be the case that most students, entering postgraduate programmes directly after graduation, will lack familiarity with some of the basic topics of Applied Ethnobotany. Most students, previously specialising in Social Science, will know little of Botany, and those coming from the Sciences lit-

tle of Social Science. It is suggested that staff organise special tutorials, seminars and lists of required reading to help students with deficiencies to catch up. In our experience, many students lacking a background in Botany can find Ethnobotany rather daunting, because so much detailed knowledge seems to be required. This is why an interest in plants is deemed essential for all students.

It might be thought that students who have already covered certain topics in their previous education might be permitted to skip more basic classes in these subjects. In most cases this would be a mistake (GELA, 2002). Unfortunately, subjects such as Taxonomy in programmes in Botany are often taught inadequately (GELA, 2002). Furthermore, Applied Ethnobotany requires a more practical orientation and a more interdisciplinary approach than is normal in traditional courses.

Organisers of courses will have to decide the level of detail in which Chemistry and other, largely laboratory-based, subjects are covered. It should be noted that Applied Ethnobotany should be focused on field issues and that many students taking programmes in Applied Ethnobotany may have little interest in, or aptitude for, Chemistry or laboratory research. On the other hand, there are merits of learning about methods of laboratory analysis relevant to Applied Ethnobotany and it is said that a good coverage of Chemistry will make the subject more acceptable in some universities, appearing more genuinely 'scientific' (Kessy, 2002). A possible approach is to mount optional courses in laboratory-based techniques and associated theory relevant to Applied Ethnobotany.

Ethical issues have gained prominence in Ethnobotany in recent years and need to be studied in courses and programmes. There are many sub-topics, including regarding the purposes and beneficiaries of research, the forms of relationships between ethnobotanists, members of local communities and other collaborators, and how rights to land or access to plant resources can be justified. Victor Toledo has written that many scientists assume that their work is somehow 'superior' to common pursuits. He mentions that raising questions about the ultimate aim of Ethnobotany can lead to radical ideological questions relating to the universal character or political neutrality of science (Toledo, 1995). Is it right, he asks, for ethnobotanists to approach people as "mere objects of research" (just as they might do plants), establishing a "partial and asymmetric relationship" - a result of "an encounter between a dominant and a dominated culture"? He notes the strong interest today in the discovery of new commercial products based on plants or knowledge of the uses of plants held by local people. He mentions that this tendency is encouraged by the ever-growing dominance of capitalism and the readiness of companies and other inventors to patent new products. How can benefits derived from new discoveries be shared justly and equitably with local people or for conservation, and what forms should such benefits take?

The ability to work effectively in the field requires many competencies on the part of applied ethnobotanists. They must have background knowledge relevant to the case in hand, the ability to work effectively with other people, knowledge of useful approaches and methods, and appropriate attitudes and behaviour. Some of this can be learnt, some is intuitive, and much depends on experience and a continuing willingness, and ability, to learn and reflect. There are protocols for working with communities (Alexiades, 1996; Cunningham, 2001; Martin, 1995) and theories about ways to involve people and deal with environmental disputes (Box 3) (Harmon *et al*., 1999; Kaplan, 1998).

It has been recommended that students of Ethnobotany should be required to take language training even in the case of more elementary courses (McClatchey *et al*., 1999). However, this would seem to be a context-specific matter, given the problems caused by variations in linguistic background between students and in selection of languages to learn in multilingual countries.

Practical skills

The ability to do things is fundamental for work in Applied Ethnobotany. Some of the most vital skills are also the most difficult to teach and learn. These fall into two interconnected sets - the ability to work effectively with other people, including in interdisciplinary teams, and the ability to recognise priorities and contribute to their solving.

Skills in communication are essential for applied ethnobotanists, just as they are for others involved in the management of natural resources (Harmon *et al*., 1999; Sample *et al*., 1999; Touval & Dietz, 1994). Good ethnobotanical work often depends on collaboration between different specialists; the education of the ethnobotanist should therefore be concerned with learning how to form and work in teams (Davis, 1995; Prance, 1995). Applied ethnobotanists need to be able to maintain effective communication with local people throughout the entire process of research, from the initial identification of issues, through the gathering of information and analysis of results, and to the identification of recommendations for follow-up action.

The ability to recognise priorities and contribute systematically to their solution is partly a matter of leadership, and the ability to mobilise fellow researchers and communities. Qualities

Box 3. Suggested concepts and skills to be covered in a course on 'Public involvement and dispute resolution' (Harmon et al., 1999).

(See Kaplan for a detailed description of an undergraduate course on 'Environmental Negotiation', including a bibliography of hands-on, role-playing exercises: Kaplan, 1998).

- The causes of environmental conflict.
- Strategies for assessing and analysing complex, multiparty environmental disputes; how to judge the 'ripeness' of disputes and the willingness of affected interests to resolve disputes through alternative processes.
- The range of processes available to resolve public disputes or develop public policy, and the value of a comprehensive decision-making system.
- Strategies for public involvement in decision-making.
- Strategies for selecting an appropriate public involvement or dispute resolution process.
- Principles of collaborative problem-solving and the step-by-step process for building consensus.
- Practical strategies for communication, negotiation, facilitation and mediation.
- Techniques for resolving disputes over scientific and technical information.
- Strategies for deciding when third-party assistance is needed and how to obtain it.
- Strategies for implementing and monitoring agreements.
- Guidelines for designing systems for resolving chronic, recurring environmental disputes.

required include the abilities to obtain adequate background knowledge of a site and its wider context, to observe and obtain information and opinions from local people, to select logical sequences of activities to tackle the issues identified, and to form teams of people with appropriate skills (Davis, 1995).

The ability to identify and solve practical problems, working collaboratively with other people, is an art for which some students will inevitability come better equipped than others. In common with the education of foresters (Sample et al., 1999) and other environmental managers, this is a matter of life-long learning. The incorporation into curricula of case-studies, role-playing exercises and participation in real-world situations can help develop these skills (Harmon *et al*., 1999; Sample *et al*., 1999). Specific educational tools that have been suggested include research projects that integrate social and ecological issues, workshops and seminars involving interactions with members of outside agencies, the involvement of professionals from outside groups in student graduate committees, and student internships with agencies and organisations (Jacobson & McDuff, 1998). The subjects of problem-solving and communication should not be relegated to elective courses, as is sometimes the case in schools concerned with natural resource use (Harmon et al., 1999).

There are several skills associated with the acquisition and production of written materials which ethnobotanists should acquire. They include the abilities to use libraries, journals and the internet, to make inquiries of databases, write scientifically, and to produce informative diagrams and maps.

Fieldwork should form an essential component of courses and programmes in Applied Ethnobotany (McClatchey et al., 1999), just as it should in Botany, Biology and Conservation Biology (Cutter, 1993; Saberwal & Kothari, 1996). Fieldwork was seen as a 'crucial' component of undergraduate programmes in the Biological Sciences by 79% of university departments which responded to a survey in the UK (Cutter, 1993). Unfortunately, the serious shortages of finance and transport in many developing countries limit the amount of fieldwork that may be possible (Kessy, 2002). Opportunities for fieldwork will anyway be greater with postgraduate programmes than undergraduate courses. Postgraduate programmes should include a period of group fieldwork of one to three weeks duration, perhaps based at a research station, and an extensive period, typically of about a year, devoted to supervised individual field research (GELA, 2002).

Specific suggestions for field visits during general undergraduate courses in Ethnobotany include (Kessy, 2002; Lagos-Witte, 2002): visits to various types of ecosystems to gain some familiarity with their plants, ecology and human relations; ethnobotanical walks with local people; surveys of plant products in homes; visits to markets and plant-based industries; interviews with traditional doctors; visits to (and perhaps the creation of) ethnobotanical gardens; and visits to herbaria.

Specific research methodologies should be taught through instruction in class and through practical experiences. Descriptions of methodologies specific to particular topics should be fully integrated into relevant lectures, seminars and field exercises. Emphasis should be placed throughout on how to collect and analyse data of good quality.

A very large number of methodologies can potentially be used in Applied Ethnobotany - a

reflection of its interdisciplinary nature. Many of them are described or mentioned in materials produced under the People and Plants Initiative (Appendix 2; see also Appendix 3 for details about where they might fit into programmes). Some methodologies in Applied Ethnobotany are more specifically ethnobotanical, while others are borrowed or adapted from contributory disciplines. In the case of 'standard' techniques associated with contributory disciplines, lecturers and students need to acquire the ability to reflect on whether the methods should be used in their 'standard' forms or whether it is better to adapt them, especially in relation to the contributions that local knowledge can make to deciding what, where and how to record. The results of such reflection, transformed into practice, will often be an improvement in the usefulness of the data and a saving in time. Even decisions on the categories of information to note on plant specimens collected as vouchers, possibly regarded as a rather simple and standard matter, will benefit immensely from knowledge of the ways that local people perceive the parts and values of plants, and of their knowledge of geography and ecology (Martin, 1995). The sampling of vegetation or plants to determine their distributions and other features requires selection of the locations and sizes of sample plots, and of features to record within them. Selection of all of these variables can benefit from local knowledge, for example through inquiry about local perceptions of vegetation types and their origin, the distribution of vegetation types or plants of interest, and the features of particular types of plants regarded as being of significance (Cunningham, 1996b). In contrast to 'standard' methodologies in ecology, the applied ethnobotanist will often want to record plants that have been harvested, perhaps now represented only by dead or sprouting stumps (Cunningham, 2001).

In the case of programmes, it is strongly recommended that these should include a course dedicated to scientific methodology, including the setting and testing of hypotheses and associated statistical methods (GELA, 2002). The potential advantages of quantification include repeatability, representivity and generation of new hypotheses (Caballero, 2002). Apart from improved quality of data, a further advantage of quantification is that the results of research can be more convincing to some potential beneficiaries, especially more educated people, whether in communities, government departments or other agencies. The biggest challenge in quantification is said to be in making sense of ethnobotanical knowledge (Ellen, 2002).

Quantitative techniques should be applied sensitively. Statisticians ignorant of field realities can propose sampling strategies for research in Applied Ethnobotany which may seem admirable from the mathematical viewpoint, but are impractical under field conditions or take inadequate account of local knowledge. Applied ethnobotanists are faced with the task of finding practical answers to real-world problems. They must be able to cope with complexity and must allocate time to various research tasks with the aim of establishing a convincing overall picture. The use of quantitative techniques in Applied Ethnobotany will therefore not always be absolutely perfect from the perspective of the statistical purist, yet they may be adequate for applied purposes. The applied ethnobotanist needs to retain an holistic perspective, best achieved through setting aside periods for reflection and discussion in between periods of more intensive collection of information or data. Certainly, those teaching 'Quantitative Methods in Applied Ethnobotany' or involved in the examination of students should have had experience of Ethnobotany applied to real problems.

There is a danger that the production of figures somehow 'proves' that the information is reliable. Sarah Laird (pers. comm.) has compared the relative reliability of quantitative and qualitative methods of gathering information during research into the values of plants to local people in Cameroon. She writes that "many results obtained using quantitative, particularly rapid techniques, are valuable as indicators of community relationships with plants, but often fail to reveal important categories of use and more complex perceptions and relationships to nature. Basic problems - such as the ability for older individuals to identify species from herbarium specimens, which lack the characteristics used locally for identification such as smell, architecture and colour, or limits to the researcher's knowledge of local classification and use - are often buried within, and warp, so-called 'quantitative' data sets. Although greater quantification can help in efforts to improve standards in Ethnobotany, without a strong qualitative ground in local culture and use, quantitative methods can distort as much as reveal local relationships." Applied Ethnobotanists must also be aware that, unless care is taken, quantification may create barriers to communication with local partners, mystified by unfamiliar terms and academic approaches to problem-solving.

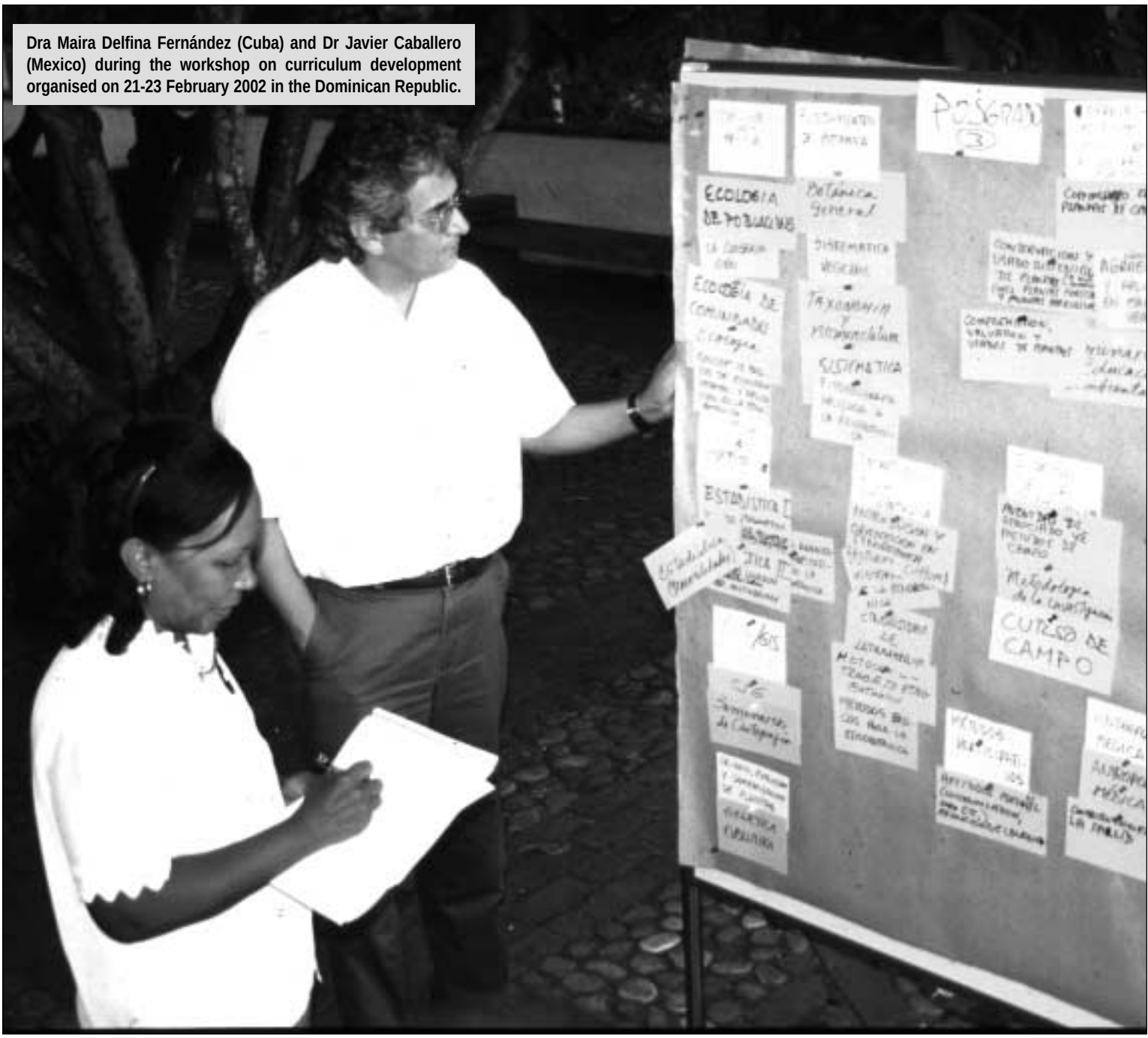
Attitudes and behaviour

Applied ethnobotanists should approach their work with an understanding of their abilities and limitations - confident yet humble. They should realise that many local people will have much more knowledge of most aspects of local plant worlds and societies than researchers could ever discover. At the same time, they need to be cognisant of the contributions that they themselves

can (and should be able to) bring to dialogues with local people. These are likely to include wider perspectives of issues of conservation and sustainable development, knowledge of relevant national and international policies and national regulations, access to published scientific information and outside specialists, and knowledge of methodologies used in the natural and social sciences.

Many of the assumptions brought by applied ethnobotanists when they start work at a new site or on a new problem will likely prove to be false or misleading. Previous assessments of the distribution and conservation status of species of plants, based on available scientific knowledge, may well prove inaccurate in the light of local knowledge (Martin *et a*l., 2002). Preconceived views of priorities in conservation and sustainable development may well differ radically from those of local people.

Above all, researchers need to respect local cultures, even if there are facets of them with which they do not agree, or find uncomfortable. This can be just as much of a challenge for national researchers, some of whom will have cultural backgrounds different from those of their local collaborators, as it can be for researchers from other countries (Toledo, 1995). Applied ethnobotanists do not need to sacrifice their own beliefs and motivations (without which they would hardly have embarked on challenging journeys), but rather should share them with local people as the foundation for honest discourse.



Dra Maira Delfina Fernández (Cuba) and Dr Javier Caballero (Mexico) during the workshop on curriculum development organised on 21-23 February 2002 in the Dominican Republic.

Suggested topics of undergraduate and postgraduate courses and programmes in Applied Ethnobotany

Suggested topics of undergraduate and postgraduate courses and programmes in Applied Ethnobotany are shown in Box 4. These following points should be noted:

- Build your own curriculum. The list of suggested topics given here is provided to stimulate thought. The suggestions should not be regarded as proscriptive. The topics given should not be regarded as a list of lectures (various teaching methods should be used). Equal time should not be allocated to each topic (they deserve varying lengths of treatment).
- Variations. The footnotes in Box 4 give suggestions specific to different types of courses and programmes.
- Possible subjects to cover within each suggested topic are mentioned in Appendix 3.

Our suggestions are based on evidence stemming from two exercises:

1. Recommendations made in several workshops held specifically for this project, and also at a congress and a symposium, and through a survey (see first section of this document). We also consulted an earlier study on curriculum development in Applied Ethnobotany in Central America (Lagos-Witte *et al*., 1995) and a review of Ethnobotany in Malaysia (Saleh, 2000). We have also studied the results of an earlier international survey of courses in Economic Botany and Ethnobotany (McClatchey *et al*., 1999). The latter was based on responses from 160 undergraduate or graduate students and 187 members of faculty. The authors of this earlier analysis believe, as we do, that it is justifiable to suggest 'proposed elements' of a curriculum, a conclusion which they reached from their own survey, earlier research by Bartoo (1964), and their teaching experience. A summary of recommendations made in several of these sources is given in Appendix 4, with some simplifications and reclassifications to facilitate comparisons.
2. Compilation of topics mentioned in the books and working papers of the People and Plants Initiative, concentrating on methodologies (Appendix 3). This approach has the advantage of a bias towards more practical applications of Ethnobotany. Additionally, descriptions of methods and case-studies can be looked up easily by those with the materials or, for some resources, access to the internet. It should be noted that the books and working papers produced so far by the People and Plants Initiative do not adequately cover all aspects of Applied Ethnobotany, for instance there is inadequate coverage of Medical Ethnobotany, food, nutrition, and issues of tenure and control over plant resources.

Our consultations have revealed a fair degree of common ground concerning the topics which should be covered in postgraduate programmes in Applied Ethnobotany. The consensus is not absolute, as would be expected with such a young subject, geographical variation in issues of conservation and sustainable development, and varying academic and professional cultures. The most significant differences between the various sources concern:

1. the extent to which 'background' subjects (such as basic Botany, Ecology and Social Science) are included as distinct components; and
2. the degree to which social and biological components are fully integrated within particular topics (or covered largely separately).

The proposals stemming from our Chinese workshop show the highest degree of integration between the natural and social sciences, compared with those stemming from the other consultations mentioned above.

Topics in undergraduate programmes will not be very different from those in postgraduate programmes (McClatchey et al., 1999), but there will likely be less emphasis on quantitative methods and less time for fieldwork. McClatchey and colleagues (1999) consider that the broad coverage of topics in general undergraduate courses in Ethnobotany will not be greatly different from those covered in general undergraduate programmes, though topics will be covered in much less detail. We concur.

Undergraduate courses, restricted to students reading particular subjects (e.g. Agriculture, Forestry or Medicine), are a different case. There will be some common ground, whatever the subject, but it is appropriate for parts of the courses to be biased toward topics of particular relevance, as suggested in Box 4.

Box 4. Suggested topics of undergraduate and postgraduate courses and programmes in Applied Ethnobotany.

These are suggestions: course developers should build their own curricula.
Refer to the footnotes, which contain suggestions about variations for different types of courses and programmes.
Refer to Appendix 3, which contains lists of possible subjects to include under each topic.

Introduction to Applied Ethnobotany
Overview of Applied Ethnobotany
National/regional Ethnobotany
Introduction to field approaches and methods

Basic background knowledge
Botany
Ecology
Social Science

Plant resources and cognition
Perceptions, knowledge and values of plants
Plant resources and plant products

Contributions to conservation and sustainable livelihoods
Conservation and sustainable development
Contributions of Ethnobotany to sustainable forest management[1]
Contributions of Ethnobotany to sustainable agriculture[1]
Contributions of Ethnobotany to food and nutrition
Contributions of Ethnobotany to healthcare

Policy and ethics
Policy and Applied Ethnobotany
Ethics in Applied Ethnobotany

Information handling and scientific methodology
Access to sources of information and preparation of written materials
Scientific methodology and quantitative techniques in Applied Ethnobotany[2]

Plant-based products: composition, validation and innovation[3]
Validation and discovery of plant-based medicines[4]
Composition of human and livestock food[5]
Properties of wood, fibres and other plant materials[6]

Footnotes

1. Topics similar to these two can be included as relevant to particular cases. They could cover, as examples, the Contributions of Ethnobotany to the sustainable management of pastures, wetlands, coastal zones or urban environments.
2. Especially for more advanced students, e.g. those taking postgraduate programmes.
3. Topics in this category could be optional for general students of Applied Ethnobotany, but could be compulsory for particular categories of student, as suggested below (4-6). Other topics could be added for other categories of student, such as those studying Horticulture, Urban Planning or Veterinary Medicine.
4. Possibly compulsory in courses for students of Medicine.
5. Possibly compulsory in courses for students of Agriculture and Medicine.
6. Possibly compulsory in courses for students of Forestry.

Short professional courses

Short professional courses are invaluable in a world of change, in which much new information is being produced. They are particularly useful in developing countries, where professional people may have little chance of acquiring fresh information through channels common in richer parts of the world, with their abundant and available publications and easy access to the internet. Furthermore, many professionals working in rural areas in developing countries become intellectually isolated, with few opportunities to discuss issues with their peers. Links made on courses can be very valuable opportunities to exchange experiences, renew contacts made as students, and boost morale.

The lengths of short professional courses will vary, depending on the purpose. Shorter courses of four to ten days are useful if the purpose is to learn about specific topics. An ideal topic is one in which there is an urgent need for practical results to achieve conservation or development, with the findings of research undertaken during the course being of direct practical value. To illustrate this type of course, Abigail Agwilar has organised short courses in the Maya region of Mexico for doctors who wish to learn about local concepts of health and ailments, and the roles of traditional medical practitioners. The People and Plants Initiative has mounted many shorter courses, with topics ranging from methods of monitoring the use and impacts of harvesting wild plant resources, the creation of an ethnobotanical database, to methods for studying trade in wild plants.

Longer short courses of one to three months are useful for providing professionals with a more rounded background in Ethnobotany. Topics might include such subjects as the relationships between people and forests, the sustainable management of forest resources, or even an introductory course on Applied Ethnobotany in general.

Shorter courses should generally be largely or entirely field-based, while longer courses, likely to be more constrained by funding, should be at least partly so. Substantial elements of courses should consist of 'learning by doing', with field exercises on defined topics undertaken jointly by groups, typically with about 6 members. Exercises should be preceded, and followed, by discussions, respectively of purposes and methodologies, and of analyses and results.

Readers of key publications, preferably peer-reviewed, should be made available to participants in advance of courses. The addresses of internet sites where further information can be obtained at little or no cost should be provided.

The quality of a course will depend greatly on the quality of its participants, including its facilitators. Individual selection of students is desirable, which may be achieved, for instance, through requiring aspiring participants to prepare two-page letters of application, enclosing their curricula vitae. The number of participants in shorter courses should not exceed about 25, though slightly larger numbers may be workable on those that are longer. Two or three facilitators will often be adequate on shorter courses. One of these should be a specialist on the topic under consideration with experience at the location where the course is held, while another could have a more theoretical background, being able to provide wider context and be able to indicate how similar work could be undertaken elsewhere.

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References

Aguilar, A. (2002). Unpublished contribution at *Taller Latinoamericana Desarrolla Curricular de Etnobotánica Aplicada*, 21-23 February 2002, Dominican Republic. Jardín Botánico Nacional Dr. Rafael Ma. Moscoso.

Alcorn, J. B. (1995). The scope and aims of ethnobotany in a developing world. In *Ethnobotany: evolution of a discipline* (ed. R. E. Schultes and S. von Reis), pp. 23-39. Chapman and Hall, London, UK.

Alexiades, M. (1996). Selected guidelines for ethnobotanical research: a field manual, pp. 306. New York Botanical Garden Scientific Publications, New York, USA.

Aloo, T. & Rodgers, A. (1995). Forest people interactions: a manual for forest students and practitioners, East African Forest Field Workshop, Tanzania, August 1995, pp. 145. Food and Agriculture Organization of the United Nations, Dar es Salaam, Tanzania.

Anderson, E. F. (1995). Ethnobotany and the liberal arts. In *Ethnobotany: evolution of a discipline* (ed. R. E. Schultes and S. von Reis), pp. 183-186. Chapman and Hall, London, UK.

Aumeeruddy-Thomas, Y. A., Saigal, S., Kapoor, N. & Cunningham, A. B. (1999). *Joint management in the making: reflections and experiences.* People and Plants working paper 7. UNESCO, Paris.

Bartoo, H. V. (1964). A survey of college courses of economic botany. *Economic Botany* 18, 291-310.

Botanical Society of America. (1995). *Botany for the next millennium*. Botanical Society of America, Columbus, Ohio, USA.

Brown, N. (2001). A critical review of forestry education. In *Meeting between universities, the Forestry Commission and the Institute of Chartered Foresters*, pp. 5. Unpublished report, Edinburgh.

Burley, J. (2001). Changing forestry education - a UK view. In *Meeting of International University Forest Education Leaders*, 4 December 2001. Unpublished manuscript, University of British Columbia, Vancouver, Canada.

Caballero, J. (1986). Etnobotánica y desarrollo: búsqueda de buevos recursos vegetales. In *Memorias del IV Congreso Latinoamericano de Botánica*, Medellín, ICFES: Simposio de Etnobotánica: Perspectivas en Latinoamérica, pp. 79-96, Bogotá, Colombia.

Caballero, J. (2002). Unpublished contribution at *Taller Latinoamericana Desarrolla Curricular de Etnobotánica Aplicada*, 21-23 February 2002, Dominican Republic. Jardín Botánico Nacional Dr. Rafael Ma. Moscoso.

Campbell, B. M. & Luckert, M. K. (2002). *Uncovering the hidden harvest: valuation methods for woodland and forest resources*. Earthscan, London, UK.

Cannon, J. R., Dietz, J. M. & Dietz, L. A. (1996). Training conservation biologists in human interaction skills. *Conservation Biology* 10, 1277-1282.

Castillo, G. T. (1998). A social harvest reaped from a promise of springtime: user-responsive, participatory agricultural research in Asia. In *Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty* (ed. N. G. Röling and M. A. E. Wagemakers), pp. 191-213. Cambridge University Press, Cambridge, UK.

Conklin, H. C. (1954). An ethnoecological approach to shifting agriculture. *Trans. New York Academy of Sciences* 17, 133-142.

Cruells, M. G. (1994). La docencia de la etnobotánica en la facultad de ciencias, VI Congreso Latinoamericano de Botánico, Mar del Plata, Argentina. In *Monographs in Systematic Botany*, vol. 68 (ed. R. Fortunato and N. Bacigalupo), pp. 235-245. Missouri Botanical Garden Press, St Louis, Missouri.

Cunningham, A. B. (1996a). Medicinal plants and miombo woodland: species, symbolism and trade. In *The miombo in transition: woodlands and welfare in Africa* (ed. B. Campbell), pp. 166. Center for International Forestry Research, Bogor, Indonesia.

Cunningham, A. B. (1996b). *People, park and plant use: Recommendations for multiple-use zones and development alternatives around Bwindi Impenetrable National Park, Uganda*. People and Plants working paper 4. UNESCO, Paris.

Cunningham, A. B. (1997). Review of ethnobotanical literature from eastern and southern Africa. *Bulletin of the African Ethnobotany Network* 1, 23-87.

Cunningham, A. B. (2001). *Applied ethnobotany: people, wild plant use and conservation*. Earthscan, London, UK.

Cutter, E. G. (1993). Fieldwork: an essential component of biological training. *Journal of Biological Education* 27, 3-4.

Dash, V. B. (1995). *Fundamentals of Ayurvedic medicine*, 7 edition. Konark Publishers Pvt Ltd, Delhi, India.

Davis, E. W. (1995). Ethnobotany: an old practice, a new discipline. In *Ethnobotany: evolution of a discipline* (ed. R. E. Schultes and S. von Reis), pp. 40-51. Chapman and Hall, London, UK.

Dev, S. (1999). Ancient-modern concordance in Ayurvedic plants: some examples. *Environmental Health Perspectives* 107, 783-789.

Dounias, E., Rodrigues, W. & Petit, C. (2000). Review of ethnobotanical literature for Central and West Africa. *Bulletin of the African Ethnobotany Network* 2, 5-117.

Eldin, S. & Dunford, A. (1999). *Herbal medicine in primary care*. Butterworth-Heinemann, Oxford, UK.

Elisabetsky, E. & Costa Campos, L. (1994). Etnofarmologia como interface de relaçôes entre indústria, academia e sociedades, VI Congreso Latinoamericano de Botánico, Mar del Plata, Argentina. In *Monographs in Systematic Botany*, vol. 68 (ed. R. Fortunato and N. Bacigalupo), pp. 209-214. Missouri Botanical Garden Press, St Louis, Missouri, USA.

Ellen, R. (2002). Development of teaching ethnobotany at the University of Kent at Canterbury, UK. In *Unpublished contribution at the Sixth Congress of the International Society of Ethnobiology*, 20 September 2002, Addis Ababa, Ethiopia.

Etkin, N. L. & Meilleur, B. A. (1993). Ethnomedicine in Polynesia: past trends and future directions. *Journal de la Société des Océanistes* 96, 19-27.

Fabrega, H. (1990). The concept of somatization a cultural and historical product of Western Medicine. *Psychosomatic Medicine* 52, 653-672.

FAO. (1996). *Forest conservation techniques: a training and awareness manual for East African universities*. Food and Agricultural Organization of the United Nations, Dar es Salaam, Tanzania.

Farnsworth, N. R. *et al*. (1985). Medicinal plants in therapy. *Bull. World Health Organisation* 63, 965-981.

Farnsworth, N. R. & Soejarto, D. D. (1991). *Global importance of medicinal plants. In The conservation of medicinal plants* (ed. O. Akerele, V. Heywood and H. Synge), pp. 25-51. Cambridge University Press, Cambridge, UK.

Fernández, M. (2002). Unpublished contribution at *Taller Latinoamericana Desarrolla Curricular de Etnobotánica Aplicada*, 21-23 February 2002, Dominican Republic. Jardín Botánico Nacional Dr. Rafael Ma. Moscoso.

FINNIDA. (1988). *East Usambara forests and forestry: introduction, results of the forest inventory and management plan*. FINNIDA, Helsinki, Finland.

Fonseca, G. A. B. (2000). Following Africa's lead in setting priorities. *Nature* 405, 393-394.

GELA. (2002). Unpublished contributions at *Taller Latinoamericana Desarrolla Curricular de Etnobotánica Aplicada*, 21-23 February 2002, Dominican Republic. Jardín Botánico Nacional Dr. Rafael Ma. Moscoso.

Gigliotti, I. & Dietz, D. J. (1992). Human dimensions in wildlife management education: pre-service opportunities and in-service needs. *Wildlife Society Bulletin* 20, 8-14.

Ginger, C., Wang, D. & Tritton, L. (1999). Integrating disciplines in an undergraduate curriculum. *Journal of Forestry* 97, 17-21.

Griggs, B. (1981). *Green pharmacy: a history of herbal medicine*. Robert Hale, London, UK.

Groen, K. & Valdes, B. (2002). Unpublished contributions at a *Joint Meeting of the Botanical Society of the British Isles and the Linnnean Society*, London, UK.

Grol, R. (1983). To heal or to harm. The Royal College of General Practitioners, London, UK.

Hall, J. B. (1994). *Development of university forestry undergraduate and graduate curricula for the conservation and management of biodiversity*. Food and Agricultural Organization of the United Nations, Dar es Salaam, Tanzania.

Hamilton, A. C. (1984). *Deforestation in Uganda*. Oxford University Press, Nairobi, Kenya.

Hamilton, A. C. (2001). *Human nature and the natural world: from traditional societies to the global age*. NHBS, Totnes, UK.

Hamilton, A. C. & Bensted Smith, R. (1989). *Forest conservation in the East Usambara Mountains, Tanzania*. IUCN, Gland and Cambridge.

Harmon, W., McKinney, M. J. & Burchfield, J. A. (1999). Public involvement and dispute resolution courses in natural resources schools. *Journal of Forestry* 97, 17-23.

Harshberger, J. W. (1896). Purposes of ethnobotany. *Botanical Gazette* 21, 146-154.

Hatfield, G. (1999). *Memory, wisdom and healing: the history of domestic plant medicine*. Sutton Publishing Ltd, Stroud, UK.

He, S. A. & Gu, Y. (1997). The challenge for the 21st Century for Chinese botanic gardens. In *Conservation into the 21st Century* (ed. D. H. Touchell and K. W. Dixon), pp. 21-27.

Hernández Bermejo, J. E. & García Sánchez, E. (1998). Economic botany and ethnobotany in Al-Andalus (Iberian Peninsula: Tenth-Fifteenth Centuries), an unknown heritage of mankind. *Economic Botany* 52, 15-26.

Hershey, D. R. (1993). Plant neglect in biology education. *BioScience* 43, 418.

Heywood, V. (1991). Botanic gardens and the conservation of medicinal plants. In *Conservation of medicinal plants* (ed. O. Akerele, V. Heywood and H. Synge), pp. 213-228. Cambridge University Press, Cambridge, UK.

Hilaire, J. V. (2002). Unpublished contributions at *Taller Latinoamericana Desarrolla Curricular de Etnobotánica Aplicada*, 21-23 February 20, Dominican Republic, Jardín Botánico Nacional Dr. Rafael Ma. Moscoso.

Höft, R. & Höft, M. (1997). A profile of ethnobotany in Africa: results of an Africa-wide survey. *Bulletin of the African Ethnobotany Network* 1, 5-22.

Jacobson, S. K. & McDuff, M. D. (1998). Training idiot savants: the lack of human dimensions in conservation biology. *Conservation Biology* 12, 263-267.

Jacobson, S. K. & Robinson, J. G. (1990). Training the new conservationist: cross-disciplinary education in the 1990s. *Environmental Conservation* 17, 319-327.

James, L. (1998). *The rise and fall of the British Empire*. Abacus; Little, Brown and Co., London, UK.

Jones, G. E. (1994). Agricultural advisory work in England and Wales: the beginning. *Agricultural Press* 69, 55-69.

Jones, G. E. & Garforth, C. (2002). The history, development, and future of agricultural extension. www.fao.org.docrep/W5830E/w5830e03.htm.

Jones, V. (1941). The nature and scope of ethnobotany. *Chronica Botanica* 6, 219-221.

Joshi, S. D. (2002). Ethnobotany curricula in Nepal. In Unpublished contribution at the *Sixth Congress of the International Society of Ethnobiology*, Addis Ababa, Ethiopia.

Kanowski, P. (2001). Forestry education in a changing landscape. *International Forestry Review* 3, 175-183.

Kaplan, A. W. (1998). Integrating the undergraduate experience: a course on environmental dispute resolution. *Negotiation Journal* , 369-379.

Kessy, J. F. (1998). *Conservation and utilization of natural resources in the East Usambara Forest Reserves: conventional views and local perspectives*. Wageningen Agricultural University, Wageningen, The Netherlands.

Kessy, J. F. (2002). Curriculum development in ethnobotany in forestry and botany courses in East Africa. In *Proceedings of a Workshop on Curriculum Development in Applied Ethnobotany*, Nathiagali, 2-4 May 2002 (ed. Z. K. Shinwari, A. Hamilton and A. A. Khan). WWF-Pakistan, Lahore, Pakistan.

Khurshid, M. & Mahboob, R. (2002). Applied ethnobotany: curriculum development in Pakistan. In *Proceedings of a Workshop on Curriculum Development in Applied Ethnobotany*, Nathiagali, 2-4 May 2002 (ed. Z. K. Shinwari, A. Hamilton and A. A. Khan). WWF-Pakistan, Lahore, Pakistan.

Koutsouris, A. & Papadopouos, D. (1998). Extension functions and farmers' attitudes in Greece. In *Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty* (ed. N. G. Röling and M. A. E. Wagemakers), pp. 88-101. Cambridge University Press, Cambridge, UK.

Lagos-Witte, S. (1994). La etnobotánica en un enfoque interdisciplinario: un acercamiento a la participación de comunidades indígenas y campesinas? In VI Congreso Latinoamericano de Botánico, Mar del Plata, Argentina, vol. 68. *Monographs in Systematic Botany* (ed. R. Fortunato and N. Bacigalupo), pp. 215-224. Missouri Botanical Garden Press, St Louis, Missouri, USA.

Lagos-Witte, S. (2002). Latin-American workshop on applied ethnobotany. In *Proceedings of a Workshop on Curriculum Development in Applied Ethnobotany*, Nathiagali, 2-4 May 2002 (ed. Z. K. Shinwari, A. Hamilton and A. A. Khan). WWF-Pakistan, Lahore, Pakistan.

Lagos-Witte, S., Martinez, M., Guardado, J., Aguilar, S., Tinoco, R. & Dieke, J. (1995). *Consulta sobre desarrollo curricular de etnobotánica en universidades de América Central y directorio regional de personas e institutiones vinculadas con plantas útiles*. ENDA-CARIBE, Managua, Nicaragua.

Laird, S. (2002). *Biodiversity and traditional knowledge: equitable partnerships in practice*. Earthscan, London, UK.

Lama, Y. C., Ghimire, S. K. & Aumeeruddy-Thomas, Y. (2001). *Medicinal plants of Dolpo: amchis' knowledge and conservation*. WWF Nepal Program, Kathmandu, Nepal.

Liras, A. (1994). Teaching and learning the biological sciences and scientific education. *Journal of Biological Education* 28, 147-150.

Lock, R. (1994). Biology - the study of living things? *Journal of Biological Education* 28, 79-80.

Lock, R. (1996). The future of biology beyond the compulsory schooling age or whither post-16 biology. *Journal of Biological Education* 30, 3-6.

Martin, G. (1995). *Ethnobotany: a methods manual*. Chapman and Hall, London, UK.

Martin, G., Lee Agama, A., Beaman, J. H. & Nais, J. (2002). *Projek Etnobotani Kinabalu: the making of a Dusun ethnoflora (Sabah, Malaysia)*. People and Plants working Paper 7. UNESCO, Paris.

Martinez, M. (2002). Unpublished contribution at *Taller Latinoamericana Desarrolla Curricular de Etnobotánica Aplicada*, 21-23 February 2002, Dominican Republic. Jardín Botánico Nacional Dr. Rafael Ma. Moscoso.

Martinez, M. A. (1994). Estado actual de las investigaciones etnobotánica en México. *Bo. Soc. Bot. México* 55, 67-74.

Marwat, K. B. (2002). Curriculum development in applied ethnobotany in agricultural universities and colleges. In *Proceedings of a Workshop on Curriculum Development in Applied Ethnobotany*, Nathigali, 2-4 May 2002 (ed. Z. K. Shinwari, A. Hamilton and A. A. Khan). WWF-Pakistan, Lahore, Pakistan.

McClatchey, W., Alexandra, P., Flaster, T. & McClatchey, V. (1999). An evaluation of educational trends in Economic Botany. Website: www.cieer.org/ebdirectory/pdf/Eb001.pdf.

Meffe, G. K., Carroll, C. R. & Pulliam, H. R. (1997). *Principles of conservation biology*, 2nd edition. Sinauer Associates, Inc., Sunderland, Massachusetts, USA.

Moerman, D. E. (1998). Native North American food and medicinal plants: epistemological considerations. In *Plants for food and medicine*, 69-74 (ed. H. D. V. Prendergast, N. L. Etkin, D. R. Harris and P. J. Houghton), pp. 69-74. Proc. Joint Conference of the Society for Economic Botany and the International Society for Ethnopharmacology, London, 1-6 July 1996, Royal Botanic Gardens, Kew, UK.

Mucunguzi, P. (2002). Establishment and implementation of a Bachelor of Science degree programme in ethnobotany at Makerere University. In *Proceedings of a Workshop on Curriculum Development in Applied Ethnobotany*, Nathiagali, 2-4 May 2002 (ed. Z. K. Shinwari, A. Hamilton and A. A. Khan). WWF-Pakistan, Lahore, Pakistan.

Nelson, R. H. (1999). Scientific management: the religion of forestry. *Journal of Forestry* 97, 4-8.

Ng, F. S. P. (2000). *Biodiversity and Asian attitudes on knowledge*. Kuching, Malaysia.

Obua, J. (2002a). Teaching of ethnobotany in forestry: experience from Makerere University, Uganda. In *Proceedings of a Workshop on Curriculum Development in Applied Ethnobotany*, Nathiagali, 2-4 May 2002 (ed. Z. K. Shinwari, A. Hamilton and A. A. Khan). WWF-Pakistan, Lahore, Pakistan.

Obua, J. (2002b). Unpublished contribution at workshop *International Curriculum Development in Applied Ethnobotany*, 3-4 May 2002, Nathiagali, Pakistan.

Paye, G. D. (2000). *Cultural uses of plants: a guide to learning about ethnobotany*. The New York Botanical Garden Press, Bronx, New York, USA.

Pei Shengji. (2001). Ethnobotanical approaches of traditional medicine studies: some experiences from Asia. *Pharmaceutical Botany* 39, 74-79.

Pei Shengji. (2002a). A brief review of ethnobotany and its curriculum development in China. In *Proceedings of a Workshop on Curriculum Development in Applied Ethnobotany*, Nathiagali, 2-4 May 2002 (ed. Z. K. Shinwari, A. Hamilton and A. A. Khan). WWF-Pakistan, Lahore, Pakistan.

Pei Shengji. (2002b). Development of ethnobotany curriculum in China: review and proposed outline content. In Unpublished contribution at the *Sixth Congress of the International Society of Ethnobiology*, 20 September 2002, Addis Ababa, Ethiopia.

Porter, R. (1997). *The greatest benefit to mankind: a medical history of humanity from antiquity to the present*. Fontana Press, London, UK.

Prance, G. T. (1995). *Ethnobotany today and in the future. In Ethnobotany: evolution of a discipline* (ed. R. E. Schultes and S. von Reis), pp. 60-68. Chapman and Hall, London.

Pretty, J. N. (1998). Supportive policies and practice for scaling up sustainable agriculture. In *Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty* (ed. N. G. Röling and M. A. E. Wagemakers), pp. 23-45. Cambridge University Press, Cambridge, UK.

Pullin, A. S. & Knight, T. M. (2001). Effectiveness in conservation practice: pointers from medicine and public health. *Conservation Biology* 15, 50-54.

Rahim, S. (2002). Unpublished contribution at workshop *International Curriculum Development in Applied Ethnobotany*, 3-4 May 2002, Nathiagali, Pakistan.

Ramsden, P. (1992). *Learning to teach in higher education. Routledge*, London, UK.

Ray, P. N. (1994). Forestry education in Indira Gandhi National Forest Academy: present status and future perspectives. In *Forestry research and education in India* (ed. P. D. Dogra and R. C. Dhiman), pp. 154-162. Indian National Science Academy, New Delhi, India.

Reiss, M. J. (1994). The new core for A-level biology. *Journal of Biological Education* 28, 81-82.

Robineau, L. (1996). *Farmacopea vegetal Caribeña*, 1 edition. Enda-Caribe, Santo Domingo, Dominican Republic.

Rodgers, W. A. (1995). *A training and awareness manual for Tanzanian forest officers*, pp. 87. Forest and Beekeeping Division, Ministry of Tourism, Natural Resources and Environment, Dar es Salaam, Tanzania.

Röling, N. (1988). *Extension science: information systems in agricultural development*. Cambridge University Press, Cambridge, UK.

Röling, N. G. & Wagemakers, M. A. E. (1998a). *Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty*. Cambridge University Press, Cambridge, UK.

Röling, N. G. & Wagemakers, M. A. E. (1998b). A new practice: facilitating sustainable agriculture. In *Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty* (ed. N. G. Röling and M. A. E. Wagemakers), pp. 3-22. Cambridge University Press, Cambridge, UK.

Royal Agricultural College. Website: www.royagcol.ac.uk.

Rudolph, E. D. (1996). History of the botanical teaching laboratory in the United States. *American Journal of Botany* 83, 661-671.

Saberwal, V. K. & Kothari, A. (1996). The human dimension in conservation biology curricula in developing countries. *Conservation Biology* 10, 1328-1351.

Saleh, M. N. (2000). *Review on the status of ethnobotany in Malaysia*. WWF-Malaysia, Petaling Jaya, Malaysia.

Sample, V. A., Ringgold, P. C., Block, N., E. & Giltmier, J. W. (1999). Forestry education: adopting to the changing demands on professionals. *Journal of Forestry* 97, 4-10.

Schön, D. (1987). *Educating the reflective practicioner: towards a new design for teaching and learning in the professions.* Jossey-Bass, San Francisco, USA.

Schultes, R. E. & von Reis, S. (1995). *Ethnobotany: evolution of a discipline*, pp. 414. Chapman and Hall, London, UK.

Sharma, B. R. (1994). Forestry education: present scenario and future strategies. In *Forestry research and education in India* (ed. P. D. Dogra and R. C. Dhiman), pp. 172-178. Indian National Science Academy, New Delhi, India.

Shinwari, Z. K., Hamilton, A. & Khan, A. A. (2002). *Proceedings of Workshop on Curriculum Development in Applied Ethnobotany*, Nathiagali, 2-4 May 2002. WWF-Pakistan, Lahore, Pakistan.

Shiva, V. (1996). *Protecting our biological and intellectual heritage in the age of biopiracy*. The Research Foundation for Science, Technology and Natural Resources Policy, New Delhi, India.

Smith, D. (2002a). The teaching of systematics. In *How do we find and train the next generation of field botanists?*, Joint Meeting of the Botanical Society of the British Isles and the Linnean Society, London, UK.

Smith, M. (2002b). Opportunities within the school curriculum. In *How do we find and train the next generation of field botanists?*, Joint Meeting of

the Botanical Society of the British Isles and the Linnean Society, London.

Stern da Fonseca, V. (2002). Unpublished contributions at *Taller Latinoamericana Desarrolla Curricular de Etnobotánica Aplicada*, 21-23 February 2002, Dominican Republic. Jardín Botánico Nacional Dr. Rafael Ma. Moscoso.

Stevens, A. & Milne, R. (1997). The effectiveness revolution and public health. In *Progress in public health* (ed. G. Scally), pp. 197-225. Royal Society of Medicine Press, London, UK.

ten Kate, K. & Laird, S. A. (1999). *The commercial use of biodiversity*. Earthscan, London, UK.

Tilman, D. (1998). The greening of the green revolution. *Nature* 396, 211-212.

Toledo, V. M. (1995). New paradigms for a new ethnobotany: reflections on the case of Mexico. In *Ethnobotany: evolution of a discipline* (ed. R. E. Schultes and S. von Reis), pp. 75-88. Chapman and Hall, London, UK.

Tombaugh, L. W. (1998). The forces of change driving forestry education. *Journal of Forestry* 96, 4-7.

Touval, J. L. & Dietz, J. M. (1994). The problem of teaching conservation problem solving. *Conservation Biology* 8, 902-904.

Trisonthi, C. & Trisonthi, P. (2002). Ethnobotanical studies of the Karen and implications for the teaching of ethnobotany in Thailand. In Unpublished contribution at the *Sixth Congress of the International Society of Ethnobiology*, 20 September 2002, Addis Ababa, Ethiopia.

Tsouvalis, J. (2000). *A critical geography of Britain's state forests: an exploration of processes of reality construction*. Oxford University Press, Oxford, UK.

Uno, G. R. & Bybee, R., W. (1994). Understanding the dimensions of biological literacy. *BioScience* 44, 553-557.

van Weperen, W., Proost, J. & Röling, N. G. (1998). Integrated arable farming in the Netherlands. In *Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty* (ed. N. G. Röling and M. A. E. Wagemakers), pp. 102-121. Cambridge University Press, Cambridge, UK.

Wild, R. G. & Mutebi, J. (1996). Conservation through community use of plant resources. People and Plants working Paper 5. UNESCO, Paris.

Xiao, P.-G. & Yong, P. (1998). Ethnopharmacology and research on medicinal plants in China. In *Plants for food and medicine*, 31-39 (ed. H. D. V. Prendergast, N. L. Etkin, D. R. Harris and P. J. Houghton), pp. 31-39. Proc. Joint Conference of the Society for Economic Botany and the International Society for Ethnopharmacology, London, 1-6 July 1996, Royal Botanic Gardens, Kew, UK.

A moment of light relief during a workshop on curriculum development in the Dominican Republic, February 2002. Left to right:
Dra Olga Lucia Sanabrio Diago (Colombia)
Dr Jean Valbrun (Haiti) (at rear)
MSc Abigail Aguilar (Mexico)
Viviane Stern da Fonseca (Brazil)
Dr Miguel Martìnez (Mexico) (at rear)
Ing Sésar Rodríguez (Dominican Republic)
Lic Daisy Castillo (Dominican Republic)
Melina de Castro (Dominican Republic) (child at front)

Appendix 1. Contributors to this project

China. A workshop was organised to discuss Curriculum Development in Ethnobotany in China, organized by Professor Pei Shengji on August 20-21 2001 at the Kunming Institute of Botany, Chinese Academy of Sciences. After presentation of current teaching in Ethnobotany in various institutes, the idea was proposed of developing a 'Chinese Ethnobotany Curriculum'. Responsibilities for developing this were proposed, and a Collaborative Group for the project formed, with Professor Pei Shengji as Leader. Fifteen chapters are proposed in a planned publication. The participants at the workshop in Kunming were:

Prof Hu Huabin, Kunming Branch of Xishuangbanna Tropical Botanical Garden, the Chinese Academy of Sciences, Kunming

Dr Hu-Yin Hui, College of Life Science, Yangzhou University, Jiangsu Province

Dr Khasbagan, Deputy Director, Inner Mongolia Normal University, Huhhot, Inner Mongolia Autonomous Region

Prof Lu Shugang, Institute of Ecology, Yunnan University, Kunming

Dr Ou Xiao-Kun, Director, Institute of Ecology, Yunnan University, Kunming

Prof Qian Zigang, Chairman, Department of Pharmacy, Yunnan College of Chinese Traditional Medicine, Kunming

Prof Pei Shengji, Department of Ethnobotany, Kunming Institute of Botany, the Chinese Academy of Sciences, Kunming

Wang Juan, Southwest Forestry College, Kunming

Dr Wang Kanglin, Department of Ethnobotany, Kunming Institute of Botany, the Chinese Academy of Sciences, Kunming

Prof Yang Yongping, Department of Ethnobotany, Kunming Institute of Botany, the Chinese Academy of Sciences, Kunming

Prof Yang Yuming, Vice-President, Southwest Forestry College, Kunming

Yang Zhiwei, Department of Ethnobotany, Kunming Institute of Botany, the Chinese Academy of Sciences, Kunming

Latin America. The following participated in a workshop on Curriculum Development in Applied Ethnobotany organised by Sonia Lagos Witte and Grupo Etnobotánico Latinoamericano (GELA), together with Alan Hamilton of WWF-UK on 21-23 February 2002 at the Jardín Botánico Nacional Rafael Ma. Moscoso, Dominican Republic:

MSc Abigail Aguilar, Herbario Nacional, Instituto Mexicano del Seguro Social, México

Dr Javier Caballero, Jardín Botánico, UNAM, México

Lic Daisy Castillo, Departmento de Botánica, Jardín Botánico Nacional, Dominican Republic

Dra Maira Delfina Fernández, Instituto de Ecología y Sistemática, Havana, Cuba

Lic Ricardo García, Jardín Botánico Nacional, Dominican Republic

Dr Alan Hamilton, WWF-UK

MSc Jean Vilmond Hilaire, Université Notre Dame d'Haïti, Haïti

Dra Sonia Lagos-Witte (General Co-ordinator of GELA), Departmento de Botánica, Jardín Botánico Nacional, Dominican Republic

Lic Maritza Martínez, Laboratorio de Etnobotánica, Departmento de Biología, UNAH, Tegucigalpa, Honduras

Dr Miguel Angel Martínez Alfaro, Laboratorio de Etnobotánica, Instituto de Biología, UNAM, México

Lic Brigido Peguero, Enc. de Taxonomica y Exploraciones, Jardín Botánico Nacional, Dominican Republic

Guillermo Rivera Cáliz, Nicaragua (Workshop Moderator)

Ing Sésar Rodríguez, Enc. de Proyectos y Publicaciones, Jardín Botánico Nacional, Dominican Republic

Dra Olga Lucia Sanabria Diago, Universidad del Cauca, Colombia

Viviane Stern da Fonseca, Jardim Botânico do Rio de Janeiro, Brasil

Dr Jean Valbrun, Université Notre Dame d'Haïti, Haïti

Pakistan. The following attended an International Workshop on International Curriculum Development in Applied Ethnobotany organised at Nathiagali on 3-4 May 2002 organised by WWF-Pakistan and WWF-UK. Apart from those attending, a number of written contributions were received (indicated with an asterisk below):

Aziz Ahmad, WWF-Pakistan

Habib Ahmad, Government Postgraduate Jehanzeb College, Saidu, Swat

Dr Ejaz Ahmad, WWF-Pakistan

Dr Khalid Farooq Akbar, Government College Sahiwal

Dr Tasleem Akhtar, Pakistan Medical Research Council, Khyber Medical College, Peshawar

Prof Syed Irtifaq Ali, Botany Department, University of Karachi

Dr Muhammad Arshad, Botany Department, University of Arid Agriculture, Rawalpindi

Abdullah Ayaz, WWF-Pakistan

Shaheen Begum WWF-Pakistan

Dr Raza Bhatti, Department of Botany, Shah Abdul Latif University, Khairpur

Syed Fazl-i-Hadi, University of Peshawar

Ali Hassan Habib, WWF-Pakistan

Malik Tariq Habib, Botany Department, University of Azad Jammu and Kashmir, Muzaffarabad

Rauf Hameed, WWF-Pakistan

Dr Alan Hamilton, WWF-UK

Dr Gul Hassan, NWFP Agriculture University, Peshawar

* Prof Hu Huabin, Kunming Branch of Xishuangbanna Tropical Botanical Garden, China

Dr Muhammad Ibrar, Pharmacy Department, University of Peshawar

Muhammad Idrees, Pakistan Museum of Natural History, Islamabad

Muhmmad Ilyas, Mardan Model College, Mardan

Ali Ahmad Jan, WWF- Pakistan

* Prof Sanu Devi Joshi, Central Department of Botany, Tribhuvan University, Nepal

* Dr John Kessy, Sokoine University of Agriculture, Tanzania

Sofia Khalid, Department of Environmental Sciences, Fatima Jinnah Women's University, Rawalpindi

Dr Amin Ullah Khan, Government College, Lahore

Ashiq Ahmad Khan, WWF-Pakistan

Dr Mir Ajab Khan, Department of Biological Sciences, Quaid-i-Azam University, Islamabad

Dr Muhammad Khurshid, Ministry of Environment

* Dr Sonia Lagos Witte, Jardin Botanico Nacional, Dominican Republic

Zahid Hussain Malik, Botany Department, University of Azad Jammu and Kashmir Muzaffarabad

Dr Khan Bahadur Marwat, Weed Sciences Department, NWFP Agriculture University, Peshawar

Dr Patrick Mucunguzi, Botany Department, Makerere University, Uganda

Mumtaz Hussain Mughul, Department of Botany, University of Azad Jammu and Kashmir, Muzaffarabad

Dr Joseph Obua, Department of Forest Biology and Ecosystems Management, Makerere University, Uganda

* Prof Pei Shengji, Kunming Institute of Botany, China

Dr Muhammad Qaiser, Department of Botany, University of Karachi

Rabia, WWF-Pakistan

Audil Rashid, Botany Department, F.G. College (Men), Islamabad

Dr S. Shafiq ur Rehman, Department of Environmental Sciences, University of Peshawar

Muhammad Afzal Rizvi, Bait-al-Hikmah Research Institute, Hamdard University, Karachi

Mohammad Shaukat, WWF-Pakistan

Dr Zabta Khan Shinwari, WWF-Pakistan

Sirajuddin, Botany Department, Islamia College, Peshawar

Saima Suleman, WWF-Pakistan

Junji Takahashi, Genetic Research Institute, Pakistan (JICA Expert)

Muhammad Waseem, WWF-Pakistan

Muhammad Yousaf, Botany Department, Postgraduate College, Bannu

Saeeda Yousaf, WWF-Pakistan

Tanweer Zafar, Department of Botany, University of Azad Jammu and Kashmir, Muzaffarabad

Dr Zahoorullah, Pakistan Medical Research Council, Khyber Medical College, Peshawar

East Africa. Dr John Kessy of Sokoine University of Agriculture, Morogoro, Tanzania, undertook a survey especially for this project to ascertain experiences and views relating to the teaching of Ethnobotany in Kenya, Uganda and Tanzania. He concentrated on the teaching of Ethnobotany to students of Botany and Forestry, consulting the following people and institutions:

Joseph Chepyegon, Center for Complementary Medicine and Biotechnology, Kenyatta University, Kenya (Traditional Healer)

Dominic Byarugaba, Mbarara University of Science and Technology, Uganda (questionnaire response)

Amai Corn, National Chemotherapeutics Research Laboratory, Kampala, Uganda

Department of Botany, University of Dar es Salaam (various lecturers)

Dr Robert Höft, UNESCO Office, Nairobi, Kenya

Dr Catherine Lukhoba, Botany Department, Nairobi University, Kenya

Patrick Maundu, KENRIK, National Museums of Kenya, Kenya

Prof R. Mibey, Faculty of Science, Nairobi University, Kenya

Moi University, Kenya (questionnaire response)

Dr N.K. Mubiru, National Chemotherapeutics Research Laboratory, Kampala, Uganda

Institute of Traditional Medicine, Muhimbili Medical Center, Dar es Salaam (various members of staff)

Dr Justus Mwanje, Faculty of Environmental Sciences, Kenyatta University, Kenya

Prof A. Newton, Botany Department, Kenyatta University, Kenya

Prof Alloys Orago, Center for Complementary Medicine and Biotechnology, Kenyatta University, Kenya

Peter Ombaka, Center for Complementary Medicine and Biotechnology, Kenyatta University, Kenya (Traditional Healer)

Sokoine University of Agriculture, Tanzania (various lecturers)

Prof Stanley Waudo, Faculty of Science, Kenyatta University, Kenya

Malaysia. A review of the status of Ethnobotany in Malaysia was undertaken by WWF-Malaysia in 2000, supported by the People and Plants Initiative (Saleh, 2000). Many people were consulted. Those most closely involved were:

Agnes Lee Agama, WWF-Malaysia (Project Co-ordinator)

Reza Azmi, WWF-Malaysia

Dr Geoffrey Davison, WWF-Malaysia

Prof Dr Kamarudin Mat-Salleh, Universiti Kebangsan Malaysia (Technical Advisor to the project)

Prof Abd. Latiff Mohamed, Universiti Kebangsan Malaysia (Technical Advisor to the project)

Balu Perumal, WWF-Malaysia (Project Supervisor of the project)

M. Nazre Saleh (author)

T.F. Siew

Central America. The following were the authors of a consultation on curriculum development in Latin America undertaken in 1995 in association with the People and Plants Initiative (Lagos-Witte et al., 1995); many other people were consulted:

Jan Dieke, Programa TRAMIL - Centroaméricana/enda caribe

Lic Janeth Guardado Pineda, Programa TRAMIL - Centroamérica y Panamá

Sonia Lagos-Witte, Programa TRAMIL - Centroaméricana/enda caribe and Universidad Autónoma de Nicaragua Léon

Lic Maritza Martínez Molina, Universidad Nacional Autónoma de Honduras

Roberto Tinoco, Universidad Nacional Autónoma de Honduras

Ethiopia. A session on curriculum development in Applied Ethnobotany was organised on 20 September 2002 by Professor Pei Shengji and Alan Hamilton at the 8th International Congress of the International Society of Ethnobiology, Addis Ababa. Those presenting papers were:

Prof Abhoy Kumar Das, Institute of Forestry, Pokhara, Nepal

Prof Roy Ellen, Department of Anthropology, University of Kent at Canterbury, UK

Dr Alan Hamilton, WWF-UK

Prof Hu Huabin, Kunming Branch of Xishuangbanna Tropical Botanical Garden, China

Prof Sanu Devi Joshi, Central Department of Botany, Tribhuvan University, Nepal

Dr Esezah Kakudidi, Makerere University, Uganda

Dr Khasbagan, Inner Mongolia Normal University, China

Prof Pei Shengji, Kunming Institute of Botany, China

Dr John Kessy, Sokoine University of Agriculture, Tanzania

Dr Chusie Trisonthi, Chiang Mai University, Thailand

Appendix 2. Publications, videos and website of the People and Plants Initiative

Conservation books

Our books cover a range of topics in Ethnobotany, with examples of approaches, methods and case-studies.

Ethnobotany: a methods manual, Gary J. Martin, 1995, in Bahasa, Chinese, English and Spanish

Plant invaders: the threat to natural ecosystems, Quentin C.B. Cronk and Janice L. Fuller, 1995, in English (re-issued 2001) and Spanish

People, plants and protected areas: a guide to in situ management, John Tuxill and Gary P. Nabhan, 1998, in English (re-issued 2001), Spanish and Chinese (in prep.)

Botanical databases for conservation and development, Michael Berjak and Jeremy Grimsdell, 1999, in English. (Published by WWF - download from the People and Plants website)

Applied ethnobotany: people, wild plant use & conservation, Anthony B. Cunningham, 2001, in English, Spanish and Chinese (in prep.)

Uncovering the hidden harvest: valuation methods for woodland & forest resources, B. Campbell & M. Luckert (eds) (2001), in English and Spanish (in prep.)

Biodiversity and traditional knowledge: equitable partnerships in practice, Sarah Laird (ed.) (2002), in English and Spanish (in prep.)

Tapping the green market: certification and management of non-timber forest products, Shanley et al. (eds) (2002), in English

Copies can be ordered from:

(English)
Earthscan Publications Ltd.
120 Pentonville Road
London N1 9JN, UK
Tel. +44 (0)20 727 80433
Fax: +44 (0)20 727 8 1142
Earthinfo@earthscan.co.uk
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Working Papers

These cover a range of topics, including examples of fieldwork in which People and Plants has been involved. All are in English, with some available also in Spanish (S below) or French (F). Download from our website.

#1: *African medicinal plants - setting priorities at the interface between conservation and primary health care*, A.B. Cunningham, 1993 (S)

#2: *Sustainability of harvesting* Prunus africana *bark in Cameroon - a medicinal plant in international trade*, A.B. Cunningham and F.T. Mbenkum, 1993

3: *Local representations and management of agroforests on the periphery of Kerinci Seblat National Park, Sumatra, Indonesia*, Y. Aumeeruddy, 1994 (F,S)

4: *People, park and plant use - recommendations for multiple-use zones and development alternatives around Bwindi Impenetrable National Park*, Uganda, A.B. Cunningham, 1996 (F)

5: *Conservation through community use of plant resources - establishing collaborative management at Bwindi Impenetrable and Mgahinga Gorilla National Parks, Uganda*, R.G. Wild and J. Mutebi, 1996 (F)

6: *Quantitative ethnobotany - applications of multivariate and statistical analyses in ethnobotany*, M. Höft, S.K. Bark and A.M. Lykke, 1999

7: *Joint management in the making - reflections and experiences*, Y.A. Aumeeruddy-Thomas, S.Saigal, N. Kapoor and A.B. Cunningham, 1999

8: *Ethnobotany of the Loita Maasai: towards community management of the Forest of the Lost Child; experiences from the Loita ethnobotany project*, P. Maundu, D.J. Berger, C. ole Saitabau, J. Nasieku, M. Kipelian, S.G. Mathenge, Y. Morimoto, R. Höft, 2001

9: *Projek Etnobotani Kinabalu: the making of a Dusun ethnoflora (Sabah, Malaysia)*, G. Martin, A. Lee Agama, J.H. Beaman and J. Nais, 2002

10: *An economic evaluation of medicinal tree cultivation:* Prunus africana *in Cameroon*, A.B. Cunningham, E Ayuk, S Franzel, B Duguma and C Asanga, July 2002

Handbooks

The People and Plants Handbook is a source of information on applying Ethnobotany to conservation and community development. It is designed for people who work in the field, including park managers, foresters, students, researchers, and members of government and non-governmental organisations. Issues are available in English and Spanish. Download English versions from our website.

1: *Keeping in touch: journals, networks, newsletters, organizations and professional societies*, Gary J. Martin and Alison L. Hoare (eds), 1996

2: *Protecting rights: legal and ethical implications of ethnobiology*, Gary J. Martin, Alison L. Hoare and Darrell A. Posey (eds), 1996

3: *Returning results: community and environmental education*, Gary J. Martin and Alison L. Hoare (eds), 1997

4: *Measuring diversity: methods of assessing biological resources and local knowledge*. Gary J. Martin, Alison L. Hoare and Agnes Lee Agama (eds), 1997

5: *Cultivating the forest: the evolution of agroforestry systems*. Gary J. Martin, Agnes Lee Agama and Roger Leakey (eds), 1999

6: *Managing Resources: community-based conservation*. Gary J. Martin, Sasha Barrow, Patricia Shanley and Anthony B. Cunningham (eds), 2001

7: *Growing diversity: people and plant genetic resources*. Gary J. Martin, Sasha Barrow and Pablo Eyzaguirre (eds), 2001

8: *The newsletter of People and Plants*. Alan Hamilton and Martin Walters (eds), 2002.

Discussion Papers

The following may be viewed on our website:

Ethics, biodiversity and new natural product development, Anthony B. Cunningham

Fair deals in the search for new natural products, Sarah Laird

Videos

Most People and Plants videos are of about 25 minutes duration and are designed to demonstrate practical methodologies. Copies are available in PAL and NTSC formats.

People, gorillas and forests: ethnobotanical methods and multiple-use management in Uganda, A.B. Cunningham, 27 minutes. Describes steps towards involvement of communities in the management system of Bwindi Impenetrable National Park.

Saving the wooden rhino: ethnobotanical methods and Kenya's woodcarving industry; A.B. Cunningham, 25 minutes. Describes approaches and methodologies used to place the industry on a more sustainable basis.

Carvers, conservation and consumers, A.B. Cunningham, 11 minutes. Popular production describing threats to the sustainability of the hardwood carving industry in Kenya and steps taken towards mitigation.

Medicinal plants in the hidden land of Dolpo: working with Himalayan healers at Shey Phoksundo National Park, 26 minutes. Camera, script and direction: Yildiz Aumeeruddy-Thomas. Describes steps towards sustainable harvesting systems for medicinal plants and development of related healthcare.

People and Plants in practice, 25 minutes. Scripted and edited by Tony Cunningham; filmed by Tony Cunningham, Yildiz Aumeeruddy and Gary Martin. An introduction to the approaches and contributions of the People and Plants Initiative.

Tree Skin: methods for studying people's use of bark, 26 minutes. Camera, script and direction: Tony Cunningham. Editing: Nic Zimmermann & Pippa Hetherington

Copies are available from:

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www.nhbs.com

People and Plants website

Our website contains much useful information on Ethnobotany, including details of our projects. Many People and Plants publications can be downloaded. There are links to many other websites dealing with Ethnobotany and Economic Botany; this is one of the best websites for entry to the literature on Ethnobotany and Economic Botany. A newsletter gives regular updates on developments in the People and Plants Initiative.

http://www.rbgkew.org.uk/peopleplants/

Appendix 3. Possible topics to cover in courses and programmes in Applied Ethnobotany

The topics are listed in two columns, roughly cross-matching with one another. The left-hand column has been developed from recommendations at several workshops (see text) and other consultations. The entries in the right-hand column are topics described or mentioned in books or working papers produced by the People and Plants Initiative; they are mainly practical field methods.

Codes to publications (full citations in Appendix 2) (initial page numbers of relevant sections of the publications in brackets): Books: B1 Ethnobotany; B2 Plant invaders; B3 People, plants and protected areas; B4 Botanical databases for conservation and development; B5 Applied ethnobotany; B6 Uncovering the hidden harvest; B7 Biological diversity and traditional knowledge; B8 Tapping the green market. Working papers (all available on www.rbgkew.org.uk/peopleplants): W1 African medicinal plants; W2 Sustainability of harvesting Prunus africana bark in Cameroon; W3 Local representations and management of agroforests on the periphery of Kerinci Seblat National Park, Sumatra; W4 People, park and plant use; W5 Conservation through community use of plant resources; W6 Quantitative ethnobotany; W7 Joint management in the making; W8 Ethnobotany of the Loita Maasai; W9 Projek Etnobotani Kinabalu.

INTRODUCTION TO APPLIED ETHNOBOTANY

Overview of Applied Ethnobotany. Definition, history and branches of Ethnobotany. Relationship of Ethnobotany to other subjects. Applications of Ethnobotany. How people influence plants and plants influence people. Everyday/folk perceptions, knowledge and values of plants: their relevance to conservation and development. Local ecosystems: ecological, cultural, economic and political dimensions. The wider contexts of local ecosystems (national, regional, global). Competencies expected of applied ethnobotanists (knowledge, skills, behaviour). Research approaches in Applied Ethnobotany: different levels of participation; community involvement in definition of issues, and collection and analysis of information and data; use of results. Ethical aspects of Applied Ethnobotany. Use of the ethnobotanical literature.

National/regional Ethnobotany. History of peoples, economies and cultures in the country/region. History of use and management of land and plants; sources of evidence (archaeological, historical records, etc.). How people have influenced the vegetation and flora. National/regional histories of Economic Botany and Ethnobotany as research subjects. Case-studies of applications of Ethnobotany to conservation and sustainable development. Ethnobotanical societies, networks, publications and research centres.

Introduction to field approaches and methods
Preparations for fieldwork: B1 (6), B3 (33)
Attitudes of researchers: B5 (15)
Use of a field notebook and diary: B1 (36; 107)
Communication across cultural boundaries: B3 (78)
Relationships with local people: B7 (179)
Involving stakeholders in research: B6 (205)
Working with local people: B1 (96), B3 (33), B6 (217)
Selecting local collaborators: B1 (97)
Paraprofessional training: B3 (69)
Selecting the right field methods: B5 (12, 16)
Cross-checking information and data: B5 (19)
Analysis and presentation of results: B1 (17)
Return of results to communities: B7 (102), W9 (8)
Publication of results: B7 (77)

Introduction to field approaches and methods. Attitudes and behaviour of applied ethnobotanists. Identifying research sites and initial research questions. Preparation for fieldwork: background reading; consultations with experts and agencies; finding resources for research. Composition of ethnobotanical teams. Introduction to communities. Stakeholder analysis. Participatory appraisals of plant resources: users and uses. Working with local specialists in plant resources. Data analysis and writing up results. Using results: their return to communities; follow-up actions; community education and training. Identification of conflicts and resolution of disputes.	[3] **Participatory methods** Levels of participation: B6 (168), W9 (79) Participatory appraisals: B1 (3), B3 (31, 63), B5 (23), B6 (171, 186), W5 (18) Participatory action research: B3 (65) Participatory observation and open-ended conversations: B1 (107), B5 (28) Interviews: B1 (110), B3 (36), B5 (26) Role-playing: B6 (176) Questionnaires: B5 (29), B6 (192) Structured surveys: B1 (116) Stakeholder analysis: B5 (259) Surveys of community and household economy: B1 (183) Wealth ranking: B5 (25) Seasonal calendars: B3 (50), B5 (23)

BASIC BACKGROUND KNOWLEDGE

Botany. Introduction to plant forms, morphology, anatomy and physiology; plant geography. Taxonomy and systematics. Voucher specimens in Ethnobotany: collection; design of labels; recording information, including ethnobotanical data. Plant identification, including use of keys. Herbarium techniques.	**Botany** Collection and care of voucher specimens: B1 (28), B3 (87), B5 (18, 31) Recording data on plants, including ethnobotanical data: B1 (39), B5 (31), W9 (whole paper) Field taxonomy and local knowledge: B5 (32)
Ecology. Scientific and traditional ecological knowledge. Ecosystems: concept of the ecosystem; types of ecosystems; ecosystem components (including people); physical structure and functioning of ecosystems. Scientific and locally recognised categories of: vegetation, soils, landscape units. Toponyms. Historical and cultural reading of the landscape. National/local ecosystems: vegetation structure; major plant species; dynamics; human influences. Common field methods in ecology: use of transects and plots (and roles for local knowledge for influencing their siting, size and what to record).	**Ecology** Landscape patterns, including local knowledge: B5 (192), B5 (212) Changes in landscapes and land-use: W3 (10, 32) Disturbance: B5 (208) Ethnoecology, including locally recognised types of vegetation and management systems (including along the wild/domesticated spectrum); names for habitats and places: B1 (146), B3 (91), B5 (248), W9 (24) Vegetation sampling: B5 (159
Social Science. Major socio-economic modes. Social change. Social structures, including community institutions. Social norms, customs and rules. Customary and modern law. Land tenure and resource rights. Social distribution of benefits and costs associated with plant use and management. The causes of environmental conflict. Strategies for public involvement in decision-making. Field methods: participatory observation; interviews (including semi-structured); questionnaires.	**Social Science** Models of human behaviour: B6 (230) Ritual, religion and resource control: B5 (253) Social organisation: W8 (9) Institutions and their relationships: B5 (25), B6 (213) Land tenure and resource rights: B3 (71), B5 (233)

PLANT RESOURCES AND COGNITION

Perceptions, knowledge and values of plants. Plants as symbols and in rituals and myths; their places in cosmologies. Types of value placed on plants (non-utilitarian, utilitarian). Concepts of wild, managed, cultivated and domesticated plants. Traditional conservation of vegetation, species and individual plants. Origin, distribution and transmission of knowledge of plants; exchanges of knowledge between communities. Folk nomenclature and classification of plants. Recording local plant names. Methods for evaluating local knowledge: free-listing; use and importance values; ranking; cultural consensus; 24-hour recall; pile-sorting; triads, 1-hectare plots. Returning local knowledge to communities.	**Cognition** Perceptions of the environment: W3 (14) Use of folklore: B1 (112) Non-market values in developing countries: B6 (103), W8 (17) Customary conservation practices: B5 (223) Transcribing and analysing local plant names: B1 (202) Folk taxonomy: B1 (215), B5 (44), W9 (24, 37) Surveys and assessment of local plant knowledge; free-listing: B1 (213) 1-hectare plots: W9 (29) Erosion of local plant knowledge: W9 (73) Exchanges between communities: B3 (71) Ethnobotanical collections: B1 (59)

Plant resources and plant products. Contributions of plants to local livelihoods, and to wider economies (national, regional, global) - historically, today and potentially in the future. Categories of use of plant resources and of products made from plants: their association with types of ecosystem, economy and culture. Trade in wild and cultivated plants; market surveys. Plant-based industries. Economic valuation of plant resources. Validation of plant products: foods, medicines, fuelwood, building materials, fodder, etc. Ethnobotanical collections.

Assessments of plant resources
Inventories of ethnobotanical resources: B3 (93), W8 (17)
Value of plant resources to rural households: B6 (17)
The value of forest products: B1 (173)
Estimating plant resource use and determining priorities: B3 (75), W5 (16)
Ranking and scoring: B1 (123), B3 (57), B5 (25, 48), B6 (179), W5 (21), W8 (21)
Community mapping: B3 (41), B5 (23, 212), B6 (176)
Transect walks: B3 (48), B5 (23)
Timelines: B3 (50), B5 (23)
Marketing chains and markets: B1 (191), B5 (64), B6 (87)
Management of resources: B5 (whole book), W7 (21)

Micro-economics
Contingent valuation: B6 (110)
Revealed preference methods: B6 (125)
Benefits versus costs: B6 (17)

CONTRIBUTIONS TO CONSERVATION AND SUSTAINABLE LIVELIHOODS

Conservation and sustainable development. Biological conservation (emphasising plants): purposes and history. Sustainable development: definitions and practical approaches. Institutions involved in conservation and management of land and plant resources (household to international levels). Land-use assessment (different geographical scales) for conservation and sustainable use; zoning land for different purposes; corridors. Determining and monitoring of conservation status of plant species, plant varieties and vegetation types (emphasising roles of local knowledge). Protected areas. Ex situ conservation; re-introductions; restoration. Towards more sustainable resource use: improved in situ management; more efficient use of plant resources; identification and promotion of alternatives to over-harvested plant resources. Developing local industries based on plants. Green marketing and certification. Roles of education and awareness-raising.

Conservation and sustainable use
Local knowledge and botanical inventory: W9 (whole paper)
Assessing the conservation status of species: B5 (202), W9 (30)
Criteria for identifying priorities in plant resource conservation: B3 (103)
Characterising threats to plant resources: B3 (110), W8 (25)
Invasive species: B2 (whole book), B3 (109)

Enhancing livelihoods
New products: B1 (234)
Arts and crafts promotion: B1 (235)
Ecotourism: B1 (238)
Ethnobotany and education: B1 (231)

Contributions of Ethnobotany to sustainable forest management.
Forests: types, history, human influences, values. Legal status; perceptions of power, ownership, rights and responsibilities relating to forest land and forest plants. Plant products from forests, emphasising non-timber products. Determination of the users and uses of forest plants, including locations of sites of harvest and the amounts harvested or used: household and market surveys; field surveys with resource-specialists. Estimation of the impacts of harvesting on plant populations and wider forest ecosystems. Community institutions relevant to improved forest management. Collaborative/joint forest management.

Towards improved management of forest resources
Community-based natural resource management B5 (226)
Joint/collaborative resource management: W4, W5 and W7 (whole papers)
Problem analysis in joint resource management: W5 (10)
Making agreements: W5 (27)
Establishing improved management: B5 (222), B6 (235)
Making a management plan: B3 (116)
Monitoring: B3 (134, 145), B5 (176), W5 (30), W7 (16)
Cultivation as a substitute for wild harvest: B1 (25), W4 (whole paper), W5 (3)

Detailed studies of individual species used as resources
Selecting priority species for research: B5 (144)
Sites and sizes of sample plots: B1 (155)
Measuring and evaluating individual plants: B1 (159), B5 (96)
Ageing individual plants: B5 (115)
Quantities of plant products used: B5 (53)
Estimating harvesting impacts: B5 (126)
Estimating recovery rates of plants: B5 (53)
Supply versus demand: B5 (180), W4 (whole paper)
Demographics of plants and their monitoring: B1 (159), B3 (159), B5 (173, 184)

Contributions of Ethnobotany to sustainable agriculture. Production systems: plant gathering; swidden, permanent and plantation agriculture; unsubsidised and subsidised agriculture. Agroforestry; tree nursery establishment. Origin of agriculture; plant domestication. Participatory research with farmers, including documentation of agricultural plant resources and plant-breeding. Factors influencing decisions taken by farmers. Local plant protection and crop breeding. Conservation of crop landraces. Seed collection and management; community seed-banks.

Contributions to sustainable agriculture
Documenting agricultural plant resources: B3 (181)
Surveys of home gardens: B1 (169)
Documenting agroforestry systems: W3 (21)
Understanding farmers' decisions about landraces: B3 (193)
Farmer-based approaches to conserving landraces: B3 (198)
Establishing a community seedbank: B3 (204)
Participatory plant breeding: B3 (208)

Contributions of Ethnobotany to food and nutrition. Foods as parts of cultural systems. Sense of identity relating to food. Traditional concepts of health and nutrition. Contributions of biocultural diversity to contemporary food systems. Adaptations to urbanisation and other forces of change. Sources of essential nutrients. Major food plants of the world. Edible wild plants. Famine foods. Post-harvest issues of edible plants. Food processing.

Contributions of Ethnobotany to healthcare. Traditions of medicine, diet and health maintenance. History of plant-based medicine. Concepts of health and ailments; folk classification of conditions. Documentation of folk medicine. Authentication of traditional medicine; contributions of phytochemistry, pharmacognosy and physiology. Traditional medicine and national healthcare: regulation; training; integrated medicine. Ethnobotany and new drug development, including legal and ethical aspects. Conservation and sustainable use of medicinal plants: conservation status of species; legal aspects; trade chains and pressures on resources; in situ management (including in situ cultivation); cultivation; potential contributions of traders, manufacturers and consumers.

Contributions to healthcare
Ethnobotany and healthcare: B1 (238)
Roles of traditional medical practitioners: W1 (4)
Customary controls on medicinal plants gathering: B4 (4)
Commercial trade in medicinal plants: W1 (8), W4 (8)
Field-level impact of trade in medicinal plants: W4 (13)
Focus of management efforts: W4 (23)
Potential for cultivation: W4 (25)

POLICY AND ETHICS

Policy and Applied Ethnobotany. International, national and local policies relating to: conservation (including protected areas); sustainable development; forests (including recognised roles for communities); agriculture; land ownership and resource rights; health (including relating to traditional and integrated medicine); education (including recognition of local/indigenous cultural diversity). Policies, laws and regulations relating specifically to plants. Policies relating to intellectual property rights and benefit-sharing with respect to new commercial products from plants.

Policies
Convention on Biological Diversity: B7 (9)
Protected area policies: B7 (127)
Policies for conservation of medicinal plants and for healthcare: W1 (29)
Prior informed consent and research agreements with local people: B7 (179), W9 (12)
Biodiversity prospecting, including agreements and benefit-sharing: B7 (241) (see also Discussion Papers)

Ethics in Applied Ethnobotany. Who is Applied Ethnobotany for? Ethical basis of relationships between ethnobotanists and knowledge-holders in communities (including respect for secret knowledge). Questions of rights to own or have access to natural resources. Intellectual property rights; the patenting of indigenous knowledge. Distribution and forms of benefits due from commercialisation of new products based on plants or local knowledge of plant properties.

Ethics
Ethnobotany and ethics: B1 (239)
Responsibilities of researchers: B7 (12)
Values of participatory approaches in Ethnobotany: W9 (76)
Who benefits from plant use or conservation?: B3 (210), W5 (38)
The ethics of biodiversity research: B7 (whole book)

INFORMATION HANDLING AND SCIENTIFIC METHODOLOGY

Access to sources of information and preparation of written materials. Use of libraries, journals and the internet. Preparation and interrogation of databases. Scientific writing for reports and scientific papers. Preparation of informative diagrams and maps. Analyses of geographically referenced information.

Use of databases: B1 (14), B4 (whole book)

Scientific methodology and quantitative techniques in Applied Ethnobotany.
Finding practical solutions in interdisciplinary contexts. Common sense and questioning. Recognising priorities and developing efficient research strategies. Experimental design: hypothesis setting and testing. Cross-checking results. Sample disposition and sample size; what to determine within each sample; contributions of local knowledge to selection of these variables. Determining the distribution and abundance of plants, levels of harvesting and impacts of harvesting on plant populations; estimating the contributions of ecological, economic and cultural factors as determinants of these variables. Knowledge (and importance values) of plants held by different human populations; social and cultural determinants of these patterns.

Quantitative methods
Hypothesis testing: B1 (23)
The concept of data: W6 (3)
Comparison of several means: W6 (22)
Correlation and regression: W9 (28)
Classification and ordination: W6 (9)
Modelling: B6 (218)
Applications of linear models: W6 (30)
GIS: W9 (28)

PLANT-BASED PRODUCTS: COMPOSITION, VALIDATION AND INNOVATION

Composition, validation and discovery of plant-based medicines. Secondary plant metabolites: types, physiological effects. Active principles: isolation, chemistry, physiological effects. Phytochemical screening of medicinal plant extracts. Bioassays. Authentication of traditional medicines: clinical and other types of trials. Determination of efficacy, toxicity and dosage. Databases containing information on medicinal plants. Preparation of medicinal plant extracts and formulation of usable products. Standardisation and quality control of crude drugs. The psychology of healing. Strategies for new drug discovery. Synthetic products of plant compounds. Legal aspects of new drug registration.

Composition of human and livestock food. Analysis of diets, including food composition: carbohydrates, lipids, proteins, vitamins and minerals. Functional properties: antioxidants, fibre, glycemic index, digestibility. Poisonous and toxic plants. Deficiencies and diseases. Fodder crops: analyses of pasture quality.

Properties of wood, fibres and other plant materials. Functional morphology: stem, roots, leaves, flowers and fruits. Cellular structure of wood. Conductive system in seed plants. Wood pulp and paper production. Wood fuel. Wood products: density, dendrochronology, grain. Fibres: plants and products. Latex and rubber. Gums and resins. Tannins and dyes. Other 'minor forest products'. Economic aspects of production of wood and non-wood products.

Field and laboratory analyses
Field screening for biological activity: B1 (77)
Phytochemical analysis: B1 (68)
Nutritional analysis: B1 (75)

Appendix 4. Recommended topics of programmes in Ethno-

E=Ethnobotany

Type of Ethnobotany	Ethnobotany
Source:	**McClatchey *et al.*** (1999) *Italics = 'background' course.*
Introductory	
Local Ethnobotany	E. studies of specific local cultures.
Botany	Systematic botany. Biogeography. *Plant anatomy/morphology*.
Social sciences	Ethnography. *Cultural anthropology*. *Sociology*.
Ecology	Ecology. Ethnoecology.
Plant resources	Wild & cultivated plant resources. Plants used by different peoples (hunter-gatherers, agriculturalists, pastoralists). Origin & evolution of crops. Cultural significance of clothing, shelter & transportation. Foods as medicines.
Cognitive, linguistics	Traditional taxonomies; Linguistic E.; Plants in folklore.
Conservation and sustainable development	Botanical and cultural conservation; Sustainable agriculture.
Medical Ethnobotany	Traditional medicine; Human physiology.
Evaluation and innovation	Phytochemistry.
Ethics, policies	Ethics; Intellectual property rights; Plants & human rights.
Human interaction skills	
Education	
Languages	Language training.
Methods	Plant collection in a cultural setting. Plant identification. Field research methods (e.g. interviewing plant experts).

botany and Applied Ethnobotany according to various authors

Applied Ethnobotany	Applied Ethnobotany
Kessy (2002)	**Pei Shengji (2002)**
Introduction to E.	Introduction to E, incl. branches, history, relationships with other subjects.
	National (Chinese) E: history and current status.
Plant taxonomy.	Plant taxonomy.
Ecological Anthropology. Medical anthropology.	Community institutions. Land tenure & resource rights. Social norms & conservation.
Ecosystem types, distribution & functioning. Human roles in ecosystems: influence of culture. Human adaptation to forests. Food, health & society.	Traditional management of plant resources (forests, swidden agriculture, agroforests, home-gardens). Culture & landscape.
Plants & plant products important in history or to local economies in developing countries. Origin & evolution of crops.	Uses of plants for different purposes in various cultures. Cultural influences on plant use.
	Folk nomenclature and classification; Plants in folklore; Traditional ecological knowledge; Values placed on plants.
	Conservation, sustainable use & restoration relating to specific ecosystems (e.g. forest): traditional & scientific contributions; Conservation of traditional medicine; Roles of E. exchanges, projects with women & income-generating activities (e.g. tourism); Relationship between biological & cultural diversity.
Folk medicine. Relationship between medical practices & belief systems. Psychoactive plants.	Traditional medicine: knowledge-systems, history, cultural interpretation.
Chemistry of medicinal plants.	Traditional knowledge & new products.
Intellectual property rights.	Cultural and religious belief systems and nature conservation.
	Ethnoecological knowledge & environmental education.
Computer science & database management. Methods of collecting & analysing data.	Field documentation. Plant collection & identification. Participatory methods. Databases & data analysis. Statistics Laboratory studies.

Appendix 4. Continued

Type of Ethnobotany	Applied Ethnobotany
Source:	Lagos-Witte et al. 1995 and Lagos-Witte (2002)
Introductory	Introduction to E, incl. orientation, history, basic methods, interdisciplinary concepts.
Local Ethnobotany	Regional ethnobotany and history of peoples.
Botany	Plant taxonomy, systematics and identification; field keys. Phytogeography.
Social sciences	Introductions to anthropology & sociology. Cultural theory.
Ecology	Basic concepts in ecology. Population and community ecology. Relationships between people and the environment. Agroecology.
Plant resources	Categories of useful plants. Plant resources: appropriation, utilisation, trade; cultural influences. Non-timber forest products. Origin & evolution of crops.
Cognitive, linguistics	ndigenous taxonomies. Linguistics.
Conservation and sustainable development	Conservation & sustainable use (forest, agriculture). Plant trade & its sustainability. Contributions to health. Conservation of useful plants.
Medical Ethnobotany	Medical E.
Evaluation and innovation	
Ethics, policies	Relevant policies: conservation, development, health, etc.
Human interaction skills	Communication. Conflict resolution.
Education	Environmental education.
Languages	
Methods	Field methods in E. Research design. Statistics. Cartography & GIS.

Applied Ethnobotany

Shinwari et al. (2002)

Introduction to E; history of E; roles in plant conservation; role of E in sustainable development and poverty alleviation.

National plant resources.

Collection of voucher specimens; plant identification.

Social and anthropological aspects of plant use.
Tenure, religious and gender aspects of plant resource use and conservation.

Ethnoecological knowledge.

Plant resources (status, threats and conservation): timber, fuel, fodder, food, medical, etc.
Detailed studies on medicinal plants.
Plant resources in history and national economies.
Commercialisation of plant products.
Plant domestication.

Folk nomenclature and classification of plants.
Folk knowledge of plants.

Plant conservation.
Traditional management of plant resources.
Roles for E. in forestry.
Plant propagation and nursery establishment.

Medical E.

Intellectual property rights.

Participatory approaches.

Collection and analysis of biological and anthropological data.
Quantitative methods.

PEOPLE AND PLANTS WORKING PAPER 11, MARCH 2003

THE PURPOSES AND TEACHING OF APPLIED ETHNOBOTANY

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Already published in this series:

1. Cunningham, A. B. 1993. *African medicinal plants: Setting priorities at the interface between conservation and primary healthcare.* (This publication is also available in Spanish.)

2. Cunningham, A. B. and Mbenkum, F. T. 1993. *Sustainability of harvesting* Prunus africana *bark in Cameroon: A medicinal plant in international trade*.

3. Aumeeruddy, Y. 1994. *Local representations and management of agroforests on the periphery of Kerinci Seblat National Park, Sumatra, Indonesia*. (This publication is also available in French and Spanish.)

4. Cunningham, A. B. 1996. *People, park and plant use: Recommendations for multiple-use zones and development alternatives around Bwindi Impenetable National Park, Uganda.* (This publication is also available in French.)

5. Wild, R. and Mutebi, J. 1996. *Conservation through community use of plant resources: Establishing collaborative management at Bwindi Impenetrable and Mgahinga Gorilla National Parks, Uganda.* (This publication is also available in French.)

6. Höft, M., Barik, S. K. and Lykke, A. M. 1999. *Quantitative ethnobotany: Applications of multivariate and statistical analyses in ethnobotany*.

7. Aumeeruddy-Thomas, Y., Saigal, S., Kapoor, N. and Cunningham, A. B. 1999. *Joint management in the making: Reflections and experiences.*

8. Maundu, P., Berger, D., Saitabau, C. ole,. Nasieku, J., Kukutia, M., Kipelian, M., Kone, S., Mathenge, S., Morimoto, Y. , Höft, R. 2001. *Ethnobotany of the Loita Maasai: Towards community management of the Forest of the Lost Child. Experiences from the Loita Ethnobotany Project.*

9. Martin, G. J., Lee Agama, A., Beaman, J. H. and Nais, J. 2002. *Projek Etnobotani Kinabalu. The making of a Dusun Ethnoflora (Sabah, Malaysia)*.

10. Cunningham, A.B., Ayuk, E., Franzel, S., Duguma, B. and Asanga, C. 2002. *An economic evaluation of medicinal tree cultivation:* Prunus africana *in Cameroon*.

The People and Plants Initiative

was started in July 1992 by WWF, UNESCO and the Royal Botanic Gardens, Kew to promote the sustainable and equitable use of plant resources through providing support to ethnobotanists from developing countries.

The initiative stems from the recognition that people in rural communities often have detailed and profound knowledge of the properties and ecology of locally occurring plants, and rely on them for many of their foods, medicines, fuel, building materials and other products. However, much of this knowledge is being lost with the transformation of local ecosystems and local cultures. Over-harvesting of non cultivated plants is increasingly common, caused by loss of habitat, increase in local use and the growing demands of trade. Long-term conservation of plant resources and the knowledge associated with them is needed for the benefit of the local people and for their potential use to local communities in other places.

The diversity of traditional plant-resource management practices runs through a spectrum from "cultivation" through to gathering "wild" plants, all of which are included in the People and Plants approach.

Ethnobotanists can work together with local people to study and record the uses of plant resources, identify cases of over-harvesting of non-cultivated plants, find sustainable harvesting methods and investigate alternatives such as cultivation.

The People and Plants initiative is building support for ethnobotanists from developing countries who work with local people on issues related to the conservation of both plant resources and traditional ecological knowledge. Key participants organize participatory workshops, undertake discussion and advisory visits to field projects and provide literature on ethnobotany, traditional ecological knowledge and sustainable plant resource use. It is hoped that a network of ethnobotanists working on these issues in different countries and regions can be developed to exchange information, share experience and collaborate on field projects.

Please visit our website at:
http://www.rbgkew.org.uk/peopleplants

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