LOCAL ENVIRONMENTAL KNOWLEDGE

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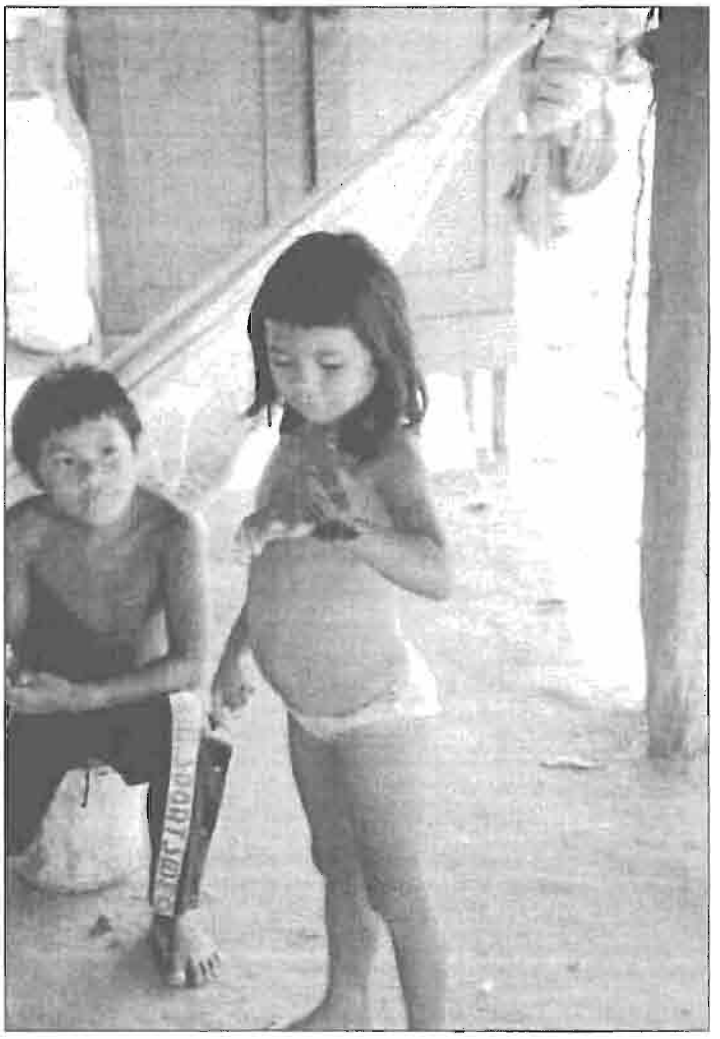

Les "savoir" sur l'environnement s'acquièrent dès le plus jeune âge. Petite fille Wayana jouant avec son oiseau apprivoisé. Elae - Guyane Fr. - 1998 - (cliché S.Bahuchet)

Pour un tribu comme les Ankave (Gulf Province, PNG), le commerce de nappe d'écorce de Ficus battues demeure la principale source de revenus monétaire (1993). Jeune porteur de noix d'arbre sur le départ. (cliché P. Lemonnier)

1. At the time the original APFT programme was planned it had already become clear from existing anthropological and development literature that indigenous knowledge[1] of the environment was extensive, profound and essential for effective development among rural tropical peoples. Ineffective "top-down" models were being replaced by "farmer-first" approaches, relying on various kinds of `participatory strategy'. However, we recognise that there are dangers in the uncritical use of so-called `indigenous knowledge' acquired through RRA (Rapid Rural Appraisal) techniques, and in the repackaging of it in simplified forms for widespread adoption (Ellen and Harris 1997). APFT work (e.g. Solly in Mekas, Cameroon ; Ellis in Haia, and in SIP Vanimo-Kilimeri, both Papua New Guinea) has been critical of quick fix methodologies, while providing focussed documentation on the environmental knowledge of rainforest peoples in particular, and demonstrating ways in which this might be effectively integrated into development plans to ensure sustainable futures on the basis of scientifically substantial work rather than superficial rapid assessment or token "participation".

2. APFT has encouraged from the outset the importance of *seeking synergies between natural and social science* approaches to understanding the future of rainforest peoples. In Cameroon, Carrière (an ecologist) has been collaborating with Cogels (an anthropologist) on the impact of Ntumu land use on forest dynamics ; in Papua New Guinea, Ellis has been working amongst the Pawaia people with biologists from the Research and Conservation Foundation, while Klappa has been collaborating with Menzies and other biologists from the University of Papua New Guinea. Henfrey, trained as a zoologist and working in Guyana, has been exploring the potential use of Amerindian Wapishana knowledge of their biota as a cost-effective instrument for rapidly providing data valuable for the conservation and management of natural resources by local people, government and NGOs. Central to our work is the notion of "co-evolution": that biodiversity and human knowledge and patterns of use are intrinsically linked, and that the knowledge local peoples have can lead to effective solutions to developmental problems, as well as providing lessons for development elsewhere, contributing to science and yielding commercial applications. The profitable insights possible from joint interdisciplinary research at the natural/social science interface is evident in the work of Elias, Rival, and Fox in Guyana, who have integrated insights from plant genetics, ethnobotany and social anthropology, as well as showing the effectiveness of ACP-EU collaboration in demonstrating the continuing practical importance of knowledge of manioc (*Manihot esculenta*) land races and their mode of innovation and transmission. Similarly, APFT work in Tikar SIP on the forest-savannah boundary of central Cameroon has profitably built upon ecological and palaeoecological analyses undertaken within the ECOFIT programme. This demonstrates that while bioclimatic factors influencing the forest ecosystem at 8000 BP show little evidence of human modification, this latter is essential to understanding forest change over the last 200 years and must be built into models of future ecosystem evolution.

3. *The anthropic character of tropical rainforest.* APFT research has expanded our knowledge of the way in which peoples living in and on the margins of rainforests inadvertently and deliberately sustain forest and modify it in useful ways. It is now clear that indigenous practices of forest-fallow cultivation and arboriculture have often created and maintained forest rather than destroyed it (Balée 1989 ; Ellen 1998 ; Fairhead and Leach 1996 ; Wilkie 1987; Kocher Schmid 1998 and APFT Final Report for SIP Vanimo-Kilimeri), increased its diversity through the cultural transmission of species and varieties from elsewhere, and increased the density of useful plants and animals (see box 1). Similarly, Laden (1993) has shown how the density of species supplying NTFPs is higher along Mbuti trails in the former Zaire than in unvisited forest, while Dounias (1993) has demonstrated the non-random distribution of wild yams in central African forests. Working in three continents has highlighted the variability of rainforest environments and the importance of recognising local differences for the implementation of effective policy. Traditional subsistence strategies are generally sensitive to these ecological differences, and local peoples have often had a long-term impact in creating distinctive patterns of biotopes : patches of bamboo, sago swamp forest, characteristic distributions and high densities of all kinds of useful trees and other plants, as well as animals (see e.g. Ellen 1998 ; Kocher-Schmid 1998; cf. Ichikawa 1999).

4. The work of APFT has underlined the importance of recognising the strong correlation between *biodiversity and cultural diversity.* In areas where local subsistence and resource management strategies have been depleted or replaced, local languages lost and subjected to greatest acculturation from outside, knowledge of biodiversity declines, and with it the effective means of identifying and maintaining biodiversity (Clay 1991 ; Gadgil, Berkes and Folke 1993 ; Hyndman 1994 ; McNeely 1993 ; Wilson 1992) . We can see this in APFT data from the Kilimeri area of Papua New Guinea collected by Klappa and Schiefenhoevel. This crucial link is now recognised by conservation experts working in ACP countries.

Box 1: Why peasants in southern cameroon protect trees in swidden fields

The protection of trees in slash-and-burn plots has often been observed, but seldom rigorously analysed. Stephanie Carrière's study sponsored by APFT has shown how Ntumu preferentially spare useful trees and those which are characteristic of old secondary forests. Such practices increase the number of these species over time and enhance the value of the forest. Indeed, it is proposed that long-term swiddening may be responsible for the abundance of valuable timber trees which make the land tempting to outside logging operations. Moreover, associations between trees and crops - now sometimes called 'agroforestry systems' -have been shown to reduce the risks of declining soil fertility in the face of increasing population pressure, and contribute to the regeneration of fallow and mature forest. But not only are these effects observed, Carrière is also able to show that Ntumu understand the ecological principles upon which these strategies are based, and that such knowledge is embedded in other aspects of their culture.

5. Current work underlines the *variety of rainforest subsistence strategies and the relationship between this and bodies of local knowledge*. However, the subsistence base of any one population is best seen as a combination of strategies and it is sometimes dangerous to draw strong distinctions between, say, forest foragers (hunter-gatherers), long fallow (swidden) cultivators and permanent cultivators of various kinds. Sometimes the management practices employed with respect to forest species look very much like cultivation, and many forest species may be technically domesticates or semi-domesticates. The permeability of the cultivation/foraging boundary is well illustrated in our work in the Kilimeri area of Papua New Guinea, and in southern Cameroon (see box 2). Similarly, farmers may possess a more extensive formal knowledge than foragers of forest products to enable them to cope with the greater subsistence risks associated with agriculture. It is, therefore, important to study populations with different social and subsistence profiles within the same environment who may share, exchange and modify transferred knowledge. Some institutions of knowledge exchange between very different kinds of cultural group have ancient roots, e.g., those connecting pygmy and Bantu in central Africa (Bahuchet 1993).

6. *The consumption of rainforest produce.* The particular significance of rainforest products (timber and NTFPs) varies depending on ecology and cultural variables, but universally the range of products known about and used is wide. Sago is important in several research sites in Papua New Guinea, manioc in Guyana, and APFT workers have been examining patterns of production and knowledge for both of these (e.g. Coiffier 1993 ; Elias and Rival n.d.). In general terms, forest plants are important for construction purposes, and forest edge plants and regrowth for medicines (Grenand 1992 ; Kocher-Schmid 1991 ; Etkin 1994). Klappa, working in Krisa, a settlement in SIP-Vanimo-Kilimeri, has been paying special attention to this. Most products are important for local consumption but some are traded. In New Guinea historic trade in NTFPs is mainly local (e.g. megapode eggs), and poorly-developed regionally ; while in central Africa the bush meat trade is economically very important, while in southeast Asia rattan and bamboo extraction is of commercial significance. In a few cases (see box 3) knowledge of irregular reproductive patterns has been exploited as a useful strategy in times of hardship. The problem with many ethnobiological studies is that while they describe what people know about plant and animal resources, they all too rarely provide data on how much of that knowledge is actively used. One measure of the danger of extinction of local knowledge may, therefore, be derived by comparing the extent to which knowledge is actually used. However, much (perhaps most) ethnoecological knowledge has only occasional and long-term adaptive advantages. Consequently, if knowledge and actual resources are permitted to erode because of perceptions of their short-term unimportance, this may be damaging for the long-term survival of populations (Dounias 1996)

Box 2: Garden hunting in relation to swiddening

Tropical forest agriculturalists are never just farmers in the strict sense. Agricultural activities closely intermingle with hunting and gathering activities which take place within more general agro-ecosystems. A good example of this is "garden hunting", where farmers hunt and trap animals attracted to the vicinity of swiddens as sources of food. Studies by Dounias among the Mvae and the Njem of Southern Cameroun show that traps used in swiddens are different (and more diverse) from those set in forest. Also, by maintaining trees in their fields (see box 1), farmers not only encourage forest regeneration but also contribute to the secondary forest mosaic, which in turn forms a rich habitat for a wide range of animals, and which serve to disperse seed. Garden hunting of animals which can tolerate human proximity may represent a sustainable alternative to other forms of hunting, and thus reduce pressure on more endangered species.

7. Our work has highlighted the existence of *different kinds of knowledge*, the importance of distinguishing them, but also of showing their interconnections. Thus, in looking at pragmatic forest knowledge we must distinguish what people know about

individual species or varieties ; their knowledge of ecological systems (plant interaction, dynamics of various kinds of landscapes, dynamics of watershed systems, seasonality, food chains, pest ecology) ; and knowledge of the general principles of plant and animal biology. In the past research on indigenous knowledge has tended to emphasise the first of these, though increasingly it is apparent that the application of insights from the second two may substitute for detailed knowledge of the first (see box 4). It is important to distinguish also levels of environmental knowledge in the same population. Commonly applied knowledge shared by all the members of the community must be distinguished from *more specialized knowledge shared by only one category of users,* such as initiates, elephant hunters, etc. An example of the extremity of this distribution of knowledge would be that of individual healers: knowledge which is hidden, secret, and transmitted to very few people. Important practical questions arise as to which of these are the most important to preserve, or- indeed - what we mean by "preservation" when it is evident that knowledge is dynamic and changing. It is certainly important to preserve the specific knowledge of a given plant by a given specialist, but it is also important to preserve the whole cultural framework of plant/animal recognition, and classification, independent of any one specific use.

Box 3: Knowledge of mast-fruiting as acoping strategy
Local environmental knowledge is not abstract, but culturally embedded and linked to long-term and spatially conscious conceptions of environmental variability. Dove and Kammen show how forest-dwelling peoples of Borneo understand the dynamics of mast-fruiting of dipterocarps, triggered by slight climate fluctuation, in places attributable to the El Niño Southern Oscillation (ENSO). These events are irregular and local, but result in the mass flowering and then fruiting of different dipterocarp species, which provides a windfall source of food for humans through direct consumption, the marketing of edible nuts, and indirectly through the additional food released for game animals upon which humans are dependent. In the language of sustainability, the value of such long-term though irregular sources of food, which supplement normal subsistence practices, are greater than short-term timber extraction which destroys the possibility of the mast al together (Dove and Kammen 1997).

8. Our work has emphasised the importance of *understanding technical knowledge in a broader cultural context.* Sometimes there is a tension between specific practical and general symbolic knowledge, as the work by Henfrey shows for Wapishana ethnozoology and that of P. and F. Grenand for the Wayãpi of French Guyana (Grenand and Grenand 1996 ; Grenand 1998) ; sometimes the non-technical and symbolic context is essential for its effectiveness. Similar embeddedness of cultural values in technical knowledge has been shown by Fabienne Tserikiantz in Vanuatu, by various researchers

in the Kilimeri area of PNG, and by Joiris (1998) for the Baka of southern Cameroon, especially in relation to elephant hunting. There had been a tendency in some earlier work to disembed indigenous knowledge and assume that it is free-floating and transferable. We recommend that such assumptions be very closely scrutinised.

9. *Local knowledge of environmental resources exists in a social context*, and is socially distributed. Not all persons are equally knowledgeable (see section 7), and important knowledge is passed through social networks. Elias, Fox and Rival are showing through their work the importance of social mechanisms for transmitting genetic variability in Manihot between Makushi women in Guyana. We have similar data for *Metroxylon sagu* (Siuta, Topni, Ellis) and *Pandanus brosimos* /jiulianettii (Kocher Schmid 1991: 179-83) in Papua New Guinea, and for taro in Vanuatu (Tzerikiantz). Our network analyses in Krisa, PNG (Kortendick) suggest the local political constraints on the flow of information which affect transfers of knowledge concerning resources. In her work, Klappa notes that what researchers might consider to be environmental `knowledge' is not considered locally to be knowledge at all. In Krisa such knowledge could not be described, for example, using Tok Pisin (the national language) gloss `save'. Knowledge in this sense is more often oral history which establishes claims to land or rights of extraction. Similarly, care of the forest, in Tok Pisin `lukautim bus', is always interpreted in terms of boundary issues rather than in terms of environmental issues. For Africa on this issue see Leclerc (1999), who shows for the Baka of southern Cameroon that territoriality is not only determined by resource distribution but is also (if not mainly) fixed by social organisation. Nature is not an entity separated from social life.

Box 4: The implications of baka expert knowledge of yam ecology and biology

Baka Pygmies in southern Cameroon harvest semi-domesticated yam tubers from the forest (Dounias 1993 ; McKey, Digiusto, Pascal, Elias and Dounias 1998). Using Baka knowledge of the role of ants in yam biology, Digiusto, McKey and Dounias have recently discovered that several wild yam species of the forest understorey have a complex biotic defense. During its growth phase the plant produces nectar rich in amino-acids and sugar, which is highly attractive to ants. However, the presence of the ants also protects the apex of the new growing stem from attacks by herbivorous insects. These observations of mutualistic interrelationships between yams and ants open up a new perspective on our understanding of vine growth and the role of starch-rich reserves stored underground by tuber plants. This may have a concrete application for pest control in cultivated yams, nearly 30 million tons of which are produced every year in the tropics.

10. It is now well-known that tropical rainforest peoples have many *traditional mechanisms for the protection, regulation and sustainable production of natural resources*. Often these are reinforced by, or are part of, general ritual prohibitions. APFT recognises that some environmentalist literature has made improbable and untested claims for some of this knowledge, linking it to romantic notions of traditional wisdom and edenic ecological harmony. While distancing ourselves from such unsupported claims, we recognise that many traditional practices do serve as effective and useful regulators. Such mechanisms are often undermined or lost by the pressures of development, for example following logging in Papua New Guinea. However, there is encouraging evidence that some may be maintained or even modified in appropriate ways so that they can continue to serve a practical role, and indeed might be used as models for effective interventions elsewhere. Such mechanisms which promote biodiversity and sustainability include closed seasons for harvesting certain resources, socially patterned prohibitions on particular areas, trees, species and sacred groves, and are illustrated in particular by our work in New Guinea, e.g, in Kasua (Brunois, see regional report), the Kilimeri area (Siuta, see regional report) and Nokopo (Kocher-Schmid 1991 : e.g. 36 ; 283-290). But that these have positive conservation outcomes does not necessarily mean that this is their intention. Moreover, at the same time, radical social and ideological changes which disconnect people from their local environment (such as millenarian and other new religious influences in PNG), may actively prohibit traditional foods, such as pigs in parts of the Kilimeri area of New Guinea (Kocher-Schmid and Klappa 1999). Other radical changes affecting local regulation of resource extraction are discussed in the Tikar regional report, including where the development of sport and commercial hunting has targeted species which were previously protected, such as hippopotamus and bongo (Ngoundoung Anoko 1997).

11. *Commercial and economic applications of indigenous knowledge*. Rainforest peoples have knowledge of many products and uses which have a demonstrable commercial value. Historically, much knowledge has been appropriated by outsiders and is now the basis for multimillion industries. In some cases, local people have been able to harness this potential for their own advantage, but this is rare for the areas we have been working in. In Papua New Guinea there has been no significant development of NTFP industry, though there are nascent possibilities in butterfly farming, galip nuts, artefacts, and ecotourism relying on the knowledge ability of local guides (Sekhran and Miller 1994 : 206-217). In Africa (but in South America and southeast Asia as well) extractivist modes of production are more important (*Bertholletia excelsa* in Amazonia, *Prunus africana* and *Catharanthus roseus* for Africa and Madagascar, etc.), linking forests with cities (see Forest-City report by T. Trefon) and connecting with informal markets (Trefon and Defo 1998). All of these applications raise crucial issues of sustainability of extraction. Relatively few studies (e.g. Peters 1994) deal with the ecology of NTFPs relevant to this issue (data on density, abundance, reproductive dynamics, regeneration and growth conditions, impacts of harvesting, selection and yield, and so on). Complete information for a given NTFP would combine data on

ecological sustainability with that on economic, social and cultural sustainability, though thorough studies of this kind simply do not yet exist.

12. We have also focussed on *the sensitivity of local farmers to environmental change*. Modern farming methods and other changes encourage dependence on a narrower range of resources, and lead to an erosion of knowledge of domesticates and forest produce alike. It is clear that this loss is instituting a kind of poverty (of knowledge), diminishing control over local livelihoods and diminishing the options available for flexible response. The consequences of the 1997 El Nino perturbation have shown the long-term damage of too great reliance on single high-yielding crops. In Papua New Guinea, traditional strategies of varying the ratio of yam (dry soil) and taro (wet soil) are no longer widespread, knowledge of wild foods which were the traditional famine reserve is decreasing, while with severe food underproduction there is a tendency to rely on emergency supplies of food (for example, rice) from government or NGO sources, and to innovate with the wrong kind of crops. Population pressure is aggravating these difficulties. Conservation of the range of local landraces which offset susceptibility of new high yield crops to failure is a priority (see box 5). Indeed, much of the breadth of traditional knowledge of environmental resources, and the extent to which this knowledge is transferred between populations, arguably insures against long-term ecological oscillation of the kinds described, even if much of it seems irrelevant to survival at any one time (see section 6 above).

Box 5: Landrace diversity of major starch staples

Agricultural change has usually been associated with the increasingly specialised production of high yield cultivars. Indeed, it has widely been argued that only with the adoption of such cultivars and the technology which goes with them (fertiliser, pesticides, cost-effective equipment for land preparation, harvesting and processing) is sustainable agriculture possible in the high density population heartlands of the third world. However, such strategies for sustainability assume a steady economic situation and a predictable climate, a highly controlled cultivation environment, and bring with them radical transformations in social organisation and culture. The history of the Green Revolution is testimony to this. The recent Asian economic crisis and El Niño southern oscillation have thrown such assumptions back into contention. By contrast, we now find that enclaves which have maintained a range of diverse traditional landraces have often been better at buffering instability. Indeed, diversification of crops in general and varied patterns of management tend to keep pest populations relatively low, even under conditions of intensive cultivation. Iskandar and Ellen, 1999 (a).

13. Finally, our work has demonstrated the important connections between local environmental knowledge, *identity and conceptions of property.* Increasingly, local peoples see environmental knowledge as part of their patrimony. The disappearance of natural species, names for natural species and knowledge of their use and significance is increasingly a concern for local peoples themselves. This is not only a pragmatic matter but connects with local people's sense of their own culture more generally (Kocher-Schmid 1993 : 793-798). The importance attached to the conservation and protection of cultural knowledge of the environment by local peoples is well reflected in APFT support for the documentation of Kwara'ae ethnobotanical knowledge in the Solomon Islands (Burt and Kwa'ioloa 1997 ; Kwaioloa and Burt 1997) and in the Pawaia area of Papua New Guinea as a result of local requests. Of course, local peoples are also concerned about the *expropriation of knowledge and intellectual property* by pharmaceutical and other companies and agencies, and APFT has been instrumental in supporting and disseminating discussion of these important issues, as well as operating within the UN Draft Declaration on the Rights of Indigenous Peoples (1993) and the Declaration of Belem (Posey 1997). See also Anonymous (1986) and Cunningham (1993) for Africa, and Aubertin and Vivien (1998), and Clüsener-Godt et al. (1992) for South America.

SUMMARY AND RECOMMENDATIONS

Box 6

1. Although the environmental knowledge of local peoples is not the solution to all problems of sustainable extraction, it can provide us with many useful lessons.

2. While local cosmological knowledge and pragmatic know-how may be connected in local representation, they should not be conflated in how we interpret how people think about their environment.

3. We should be wary of repackaging indigenous knowledge and simplifying it to enhance its transferability or to fit the paradigms and manuals of academics and development specialists.

4. Much rainforest has been historically conserved and enriched by modifying and using it.

5. We should beware of extreme models of ecological wisdom and ignorance attributed to local peoples.

6. Local knowledge is vital in conserving and preserving resources, often because it is the quickest way of knowing

.what there is that is worth sustaining. This is acknowledged in the IUCN World Conservation Strategy, the Brundtland Commission Report 'Our Common Future', and the United Nations Conference on Environment and Development (UNCED) Agenda 21.

7. Scientific knowledge is not inherently superior to local knowledge, and should complement and support it rather than replace it, especially where scientific solutions have palpably failed in the past. Preference should be given to 'hybrid technologies', the mixture of local and non-local (including scientific) know-how (see box 7).

8. The most valuable thing about local knowledge is that it is local.

9. Reliance on local knowledge reduces dependency.

Box 7: Baduy use of hybrid knowledge to maintain sustainable forest-fallow farming, West Java

Traditional Baduy sacred law prohibits the use of modern external inputs, such as chemical fertilisers, in their swidden farming. Ordinarily the consequences of this in a situation of acute forest pressure would be a decrease in fallow times, and an inevitable depletion of soil fertility. The Baduy (particularly Outer Baduy) employ several strategies to alleviate this problem, one of which is the introduction of Paraserianthes (Albizia) falcataria. By alternating this commercially valuable perennial leguminous tree with rice, soil fertility is maintained and the socio-economic position of the Baduy improved. As a result, swidden farming, which is considered by the Baduy to be central to their cultural identity, continues in a very nearly sustainable way, despite increasing population density and the continuing depletion of mature forest. Iskandar and Ellen, 2000 (b).

ENDNOTES

1. Alternatively, indigenous technical knowledge (ITK), traditional knowledge, folk knowledge, local knowledge, etc. None of these terms are self-evidently better than any other.

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