Convention on
Biological Diversity

Secretariat

Ref: SCBD/STTM/JPLD/ia

16 July 2001

NOTIFICATION

Dear Madam/Sir,

Subject: **Peer review of a document on harvesting of non-timber forest resources and forest biological diversity.**

At its fifth meeting, held in Nairobi, Kenya, from 15 to 26 May 2000, the Conference of the Parties (COP) to the Convention on Biological Diversity adopted decision V/4 on forest biological diversity.

In paragraph 14 of the decision, the COP requested the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to consider the impact of, and propose sustainable practices for, the harvesting of the non-timber forest resources, including bush meat and living botanical resources. To assist SBSTTA in its work, the Secretariat of the Convention on Biological Diversity commissioned a study to the Center for International Forestry Research (CIFOR).

I have the pleasure to invite you to take part in the peer review process of a document prepared by CIFOR on the "Sustainable management of non-timber forest resources: a review with recommendations for the SBSTTA". The purpose of this peer review is to solicit your comments on the overall balance and soundness of the scientific, technical and socio-economic aspects covered by the document.

I would be grateful if you could review the attached document and submit your comments **no later than 3 August 2001.**

Yours sincerely,

Hamdallah Zedan
Executive Secretary

To: Experts concerned by Forest Biological Diversity and Non-Forest Timber Resources and CBD National focal points

Attachment: Sustainable management of non-timber forest resources: a review with recommendations for the SBSTTA.

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Sustainable management of non-timber forest resources: a review with recommendations for the SBSTTA

CIFOR [1]

Executive summary

If policy on sustainable management of non-timber forest resources is to be implemented successfully, then recognition that there is no "one size fits all" policy is essential. Policies and their implementation practice have to be tailored to local ecological, economic, cultural and political circumstances. This complexity and the diversity of species used are added to by two other factors. Firstly, that the "catch-all" nature of the terms "non-timber forest resources" or "non-timber forest products" (NTFP), which refer to all natural resources from forests apart from sawn timber. Secondly, the fact that NTFP conservation and use sits at the confluence of at least probably more Articles of the CBD than probably any other component of natural resource use.

In the past, plant and bush-meat use values to people have either been disregarded, or if taken into account, then the emphasis has either been on the values of plants or wildlife, rather than both together. In southern African savannas where community-based natural resources management programmes have been developed, the emphasis has been on wildlife rather than plants, fungi or edible insects. In tropical forests, the opposite has tended to be true, with plant products taken into calculations of forest value rather than animals. Whether NTFP or bush meat use is considered from the perspective of local livelihoods or conservation, species loss through overexploitation benefits neither local people nor conservation in the long term. When a conservation area becomes the focus of high impact harvesting, overexploitation also undermines the primary goal of any protected area: the maintenance of habitat and species diversity. If even monitoring shows that forest or woodland cover aren't decreasing, what is happening beneath the canopy may be quite different: populations of high value, vulnerable plant and animal species can be disappearing due to species specific overexploitation. This situation is rarely taken into account in protected area management. This review therefore makes the following recommendations to SBSTTA:

- to achieve a balance between conservation and sustainable use of NTFP's and animals hunted for bush meat, there is a need to consolidate protected area networks and establish and maintain corridors (Article 8a);
- ecosystem level planning and the management of harvested or hunted populations must take place through a process of consultation which takes relevant scientific, local and indigenous knowledge into account. Ecosystem level and harvested/hunted population management plans need to be developed with an understanding of the social, economic, ethical, religious and political factors that either encourage resource conservation or lead to resource depletion. Development and implementation of effective conservation and resource management plans may need legislative reform before managed use of NTFP's provides and incentive for conservation as a form of land-use (Article 8(k));
- land-use planning and siting of infrastructure (roads, new settlements) both need to take protected areas, their adjacent conservancies or co-management areas and the requirements for maintaining viable populations of valued, but vulnerable species into account. Legislative change, technical support and economic incentives for ecological restoration of wildlife corridors and for the control of invasive plant and animal species may be necessary for maintenance or re-establishment of viable populations of indigenous plant and animal populations;
- A folk taxonomy initiative should therefore be formed as a separate, new component within the current Global Taxonomy Initiative, which has been established as a means of promoting taxonomy and taxonomic tools for implementation of the Convention (Articles 7 & 12);
- Sustainable levels of harvest of popular, less resilient plant and animal species need to be established and monitored as part of an adaptive management process. This can be achieved through creative partnerships between scientists and local resource-users and requires Technical co-operation (Articles 18 and 25c);
- Appropriate and economically viable monitoring systems should be developed and established at the landscape level (remote sensing, aerial photograph analysis) and local level (indicator species) (Article 7);
- Integrate non-timber product uses into forest inventory and management;

[1] Paper prepared by Robert NASI and Tony Cunningham

- Conservation through cultivation or farming of wildlife which is economically viable and on a sufficient scale to take the pressure off wild stocks;
- *Ex situ* conservation needs to be implemented for some high value, high vulnerability species (Article 9).

In summary, the complex, crosscutting characteristic of sustainable management of NTFP should not been seen as a problem. There is a great opportunity, given the political will, for implementation of measures that can make a major contribution to the three main objectives in Article 1 of the CBD and to human welfare.

Sustainable management of non-timber forest resources: a review with recommendations for the SBSTTA

CIFOR [2]

1. Introduction

The broad terms "non-timber forest resources" or "non-timber forest products" (NTFP) refer to all natural resources from forests apart from sawn timber. Wickens (1991), for example, considered non-timber forest products to be *"all the biological material (other than industrial round wood and derived sawn timber, wood chips, wood-based panel and pulp) that may be extracted from natural ecosystems, managed plantations, etc. and be utilised within the household, be marketed, or have social, cultural or religious significance"*.

Sustainable management of NTFP sits at the confluence of more Articles of the CBD than probably any other component of natural resource use. A feature of sustainable management of NTFP is the high diversity of species used (Articles 5, 6 & 7), the local and indigenous knowledge linked to those uses (Article 15, 8j) and the varying tenure arrangements and economic incentives for conservation (Article 11). In addition, NTFP trade networks are often complex, with serious impacts on species populations (Articles 3, 5 and 11), requiring innovative assessment, monitoring and conservation methods (Articles 7, 8, 9, 14, 16 & 18). NTFP use occurs across a wide spectrum of biogeographic, ecological, economic, social and historical circumstances across (and within) different continents and vegetation types. Palms and bamboos for example, are amongst the most useful tropical plant resources, yet are poorly represented in Africa (1.7% of palm species; 0.3% of bamboo species) compared to other parts of the tropics. Differences across continents are equally evident when it comes to animals used as bush-meat: the absence of non-human primates in Australia, yet diversity of marsupials; the high diversity of bovids, ungulates and other large herbivores in Africa; or the occurrence of pangolins in Africa and Asia, but not South America all clearly influence the patterns of bush meat use. Policies and their implementation therefore have to be tailored to local circumstances. Simplistic, "one size fits all" policies can do more harm than good and should be avoided.

The relevance of many CBD Articles and decisions to NTFP use offers a great opportunity, given the political will, for implementation of measures that can make a major contribution to human welfare and the three main objectives in Article 1 of the CBD. In industrialized countries, NTFP use is often viewed as a marginal activity. In many developing countries, it is quite the opposite. NTFP are in daily use throughout the tropics, commonly providing resources crucial to people where no other social security is provided by the state. In a typical African country, only one person in ten has a formal job (The Economist, 2000) and economically important species provide a source of informal sector income. Edible wild foods (fruits, wild vegetables, fungi, bush meat and insects) commonly provide dietary supplements (Cunningham and Davis, 1997). Fuelwood or charcoal, not electricity or oil is the major source of household energy (Leach and Mearns, 1988). Nine out of ten people live in informally built houses; eight out of ten people consult traditional healers (Ake Assi, 1988).

2. The importance of NTFP and wildlife to people

In *terra firme* forest in Amazonia, for example, Prance et al (1992) recorded that 78.7% of tree species were used by the Ka'apor and 61.4% by the Tembe indigenous peoples. In their study of edible fruits sold in the marketplaces of Iquitos in the Peruvian Amazon, for example, Vasquez and Gentry (1990) recorded over 57 wild-collected fruit species being sold. The diversity of medicinal plant species entering local or international markets is even higher. In Indonesia, Siswoyo et al. (1994) list 1260 species of medicinal plants being sold, many wild-collected species from forests. In South Africa, 400-500 species are sold for traditional medicines, 99% wild harvested (Cunningham, 1988, 1991; Williams, 1996). In Germany, Lange & Schippmann (1997) have documented 1543 medicinal plant species comprising 854 genera in 223 families in import or export trade, 70-90% of which are primarily harvested from the wild (Lange, 1997). In their study of marketplaces in Mexico, Bye and Linares (1985) found that of the 114 species sold, 28 species were gathered from wild habitat, 52 species gathered from anthropogenic vegetation types, 32 species were domesticated and 2 species were non-domesticated species in cultivation.

[2] Paper prepared by Robert NASI and Tony Cunningham

By contrast to medicinal and edible plant use, most bush meat obtained by hunters in tropical forests comes from a relatively small number of large-bodied species, normally the larger ungulates and primates (Bennett & Robinson, 2000). Two species, the common woolly monkey and collared peccary make up 44% of the wildlife biomass harvested by the Huaorani in Ecuador (Mena et al., 2000). Similarly, in Sarawak, Malaysia, three ungulate species, bearded pig and two barking deer species, comprised 80% of biomass hunted (Bennett et al., 2000) although at least 26 mammal species, 12 bird species and 5 reptile species are regularly eaten. In Colombia, for example, Maracá Indians killed at least 51 bird species, including 10 hummingbird species (Ruddle, 1970) and the Sirionó Indians of Bolivia hunt 23 mammals species, 33 bird species and 9 reptile species. In the Central African Republic, hunters using snares capture 33 mammal species, 7 reptile species and 3 bird species (Noss, 2000) and in the Lobéké area of Cameroon, hunters took at least 36 animal species (Fimbel et al., 2000).

Table 1: Important products derived from non-timber forest resources[1].

Category	Important products (lists not exhaustive)
Food products	Nuts. Brazil nuts, pine nuts, malva nut, walnuts, chestnuts Fruits. Jujube, sapodilla, ginkgo, bush mango Edible fungi. Morels, truffles and other mushrooms Vegetables. Bamboo shoots, reindeer moss, various “green” leaves, palm hearts Starches. Sago Birds' nests Oils. Shea butter, babassu oil, illipe oil Maple sugar
Spices, condiments and culinary herbs	Nutmeg and mace, cinnamon, cassia, cardamom, bay leaves, oregano, etc.
Industrial plant oils and waxes	Tung oil, neem oil, jojoba oil, kemiri oil, akar wangi, babassu, oiticica and kapok oils. Carnauba wax.
Plant gums	Gums for food uses. Arabic, tragacanth, karaya and carob gums. Technological grade gums. Talha and Combretum gums.
Natural plant pigments	Annatto seeds, logwood, indigo.
Oleoresins	Pine oleoresin Copal, damar, gamboge, benzoin, dragon's blood, and copaiba oil. Amber
Fibres and flosses	Fibres. Bamboo, rattan, xateattap, aren, osier, raffia, toquilla straw products, cork, esparto, Erica and other broom grasses. Flosses. Kapok.
Vegetable tanning materials	Oak, mimosa, chestnut and catha/cutch.
Latex	Natural rubber, gutta percha, jelutong, sorva and chicle.
Insect products	Natural honey, beeswax, lac and lac-dye, mulberry and non-mulberry silks, cochineal, aleppo galls, kermes
Incense woods	Sandalwood, gaharu.
Essential oils	
Plant insecticides	Pyrethrum, Derris, Medang and Peuak Bong.
Medicinal plants	Around 5000 to 6000 botanical entering world market every year
Animals and animals' products	Ivory, trophies, bones, feathers, butterflies, live animals and birds, bushmeat, etc.

[1] modified from Iqbal (1993).

2.1 Economic values

Despite the immense importance of non-timber forest plant resources, their value is rarely taken into account in land-use planning (see table 2). Nor are the economic values of these products and the services they provide are rarely taken into account in assessing Gross Domestic Product (GDP). These omissions need to be corrected, as NTFP make particularly significant contribution is made to household incomes of the rural poor. Rural people, moving from a subsistence lifestyle to a

cash economy, have relatively few options for generating income. They can sell agricultural or pastoral produce, work for a cash wage in agriculture or industry, or retail goods in local or regional marketplaces. For the rural poor without land or livestock, harvesting of wild resources is a common option. Wild and naturalized plants provide a "green social security" to billions of people in the form of low cost building materials, income, fuel, food supplements and traditional medicines.

Cash income from the sale of NTFP can be very variable, however, even for the same resource category. Earnings vary from a few dollars for *ad hoc* sales to several thousand US$ per year. In rural Madhya Pradesh, India, for example, NTFP provide 40-63% of total annual income (Tewari and Campbell, 1996). Across seven study areas in southern African, wild plant resources contributed US$194-$1114 per household per year (Shackleton et al., 2000). In general, returns to labour from NTFP sales are usually higher than the average local agricultural wage, with income usually higher for externally marketed products. Subsistence values are often also high, particularly for poorer rural households. In Zimbabwe, for example, Cavendish (1997) calculated that these subsistence ("non-market") values contributed 35% of total household incomes.

Table 2: Some examples of NTFP international trade values[1]

Products from NTFP	World's import (million US$)	Notes
Natural rubber	4,221.8	Tropical moist forest regions, from intensively managed plantations, agroforestry systems and natural stands (extractive reserves) of *Hevea brasiliensis*
Honey	206.5	Worldwide product from intensively or extensively managed and wild resources
Ginseng roots	389.3	Tropical or subtropical, both from wild and plantations
Gum Arabic	141.3	Tropical arid regions, mostly from wild or extensively managed natural stands of *Acacia senegal* and *A. seyal*
Rattan	118,987.0	Tropical rainforests, mostly from natural stands, few plantations in Asia
Essential oils	319.4	Various regions, both from wild and cultivated resources
Cork	310.7	Mediterranean regions from managed natural stands and plantations of *Quercus suber*
Mushrooms	206.5	Temperate and sub-tropical both from wild and cultivated populations
Brazil nuts	44.3	Amazonian rainforests, from wild or semi-intensively managed natural stands of *Bertholetia excelsa*
TOTAL NTFP	11,108.7	

[1] modified from FAO (1995b) – original data from UNCTAD database

2.2 Nutritional values

Starchy staple food from a few species of cultivated plants form the bulk of peoples food in the tropics - either rice, maize, sorghum or millet (Gramineae), cassava (Euphorbiaceae) or potatoes (Solanceae). In some parts of the tropics, the starchy staple foods are from sago palm (*Metroxylon sagu*), taro (*Colocasia esculenta*) or arrowroot *(Maranta arundiacea*). Bush meat commonly provides an important protein source in the tropics and gathered plant foods an important source of dietary supplements to the starchy staple diet. Even where there has been a change from a hunter-gatherer lifestyle to pastoralism or agriculture, hunting and gathering remain important to a high proportion of rural households in African woodlands (Campbell

et al, 1991; Cunningham, 1988a; Wilson, 1990) and tropical forests (Koppert et al., 1993). Wild plant foods are well known from studies in Africa, Asia and Latin America to be a valuable source of these nutrients deficient in starchy staple diets, particularly nicotinic acid from wild spinaches (Santos-Oliviera and Carvalho, 1975), vitamin C from wild fruits (Quin, 1959; Wehmeyer, 1966) and protein from *Sclerocarya birrea, Schinziophyton rautanenii* and *Tylosema esculenta* seeds and edible insects (Quin, 1959).

2.3 Social and cultural values

The social and cultural values linked to foods and medicines are a reflection of the value placed on NTFP. Even airfreight is used to transport edible and medicinal plants, regionally or internationally to meet culturally driven demand. An estimated 105 tonnes of "bush plums" (*Dacryodes edulis*) and 100 tonnes of "eru" (*Gnetum africanum and G. buchholzianum*) leaves are exported, for example, from Cameroon, Congo, Gabon and the Democratic republic of Congo as foods for West Africans living in France and Belgium (Tabuna, 1999).

Western and traditional medicines are based on very different and well-documented views of health and disease. Traditional medicine takes a holistic approach where disease or misfortune result from an imbalance between the individual and the social environment while western medicine takes a technical and analytical approach. These different approaches to the causality of disease are one of the reasons why demand for traditional medicine continues in the urban environment even if western biomedicine is available. Another reason is that western medical care is more expensive and very limited in remote rural areas.

International trade in Chinese traditional medicines, in kava (*Piper methysticum*) to expatriate Pacific islanders living in North America or the African medicinal plant khat (*Catha edulis*) to Somali communities in Europe and North America are other examples. A recent survey amongst 70 Somali people in Liverpool, England, for example, found that 43% of men had used *khat*, with 39% chewing it on a daily basis (Berry, 1996). Remarkably for a product in long-distance trade, the young leaves of *Catha edulis* need to be chewed while still fresh for maximum effect - and for this reason, the price of *khat* rapidly drops with time. As a result, the trade has to be highly organised to get leaves from the farm to the end-user as soon as possible

3. Harvesting impacts

Virtually without exception, harvesting takes place in landscapes changed by people due to farming, fire or livestock, even where human population densities are very low. In the Brazilian Amazon, for example, with an average human population density of about 1 person/km2, at least 11.8% of *terra firme* forest is an anthropogenic result of swidden agriculture, human settlement and plant domestication (Balee, 1989, 1993). In all savanna systems, fire is a frequent source of disturbance (Scholes and walker, 1993). By the time of European contact, most of Australia, with a human population far lower than Amazonia, was being deliberately burnt as a means of managing food production density (Latz, 1995). Direct use of resources is thus superimposed upon the effects of natural and/or anthropogenic disturbance. In some cases this enhances species populations and in others, diminishes them. Many species of bamboo, thatch-grasses (*Hyperthelia, Imperata, Cymbopogon*), edible leafy greens (Acanthaceae, Amaranthaceae, Capparaceae) and sources of bark fibre (Tiliaceae, Malvaceae) are often widely distributed, light demanding plants whose populations increase in response to disturbance. Anthropogenic disturbance also occurs at smaller scales. Examples are the deliberate planting of useful species in forest patches or along paths such as by the Kayapó in Amazonia (Posey 1984), propagation of *Canarium* and *Landolphia* by Mbuti in the Ituri forest (Ichikawa 1999) or the protection of valued species, replanting the tops of wild *Dioscorea* tubers, transplanting palm suckers, on a sufficiently systematic basis for this to be considered 'rainforest management' (e.g.: Alcorn 1981).

In the past, under subsistence demand, harvesting of plant-based NTFP rarely resulted in species-specific overexploitation. Now, rural communities in many parts of Africa, Asia, Central Europe and the Americas are increasingly concerned about losing self-sufficiency as their local wild populations of favoured, popular plant species are cut down or dug up, bundled or bagged and transported to far-away regional markets. Similar concerns apply to animals used for bush meat, as the wildlife biomass of tropical forests is generally low. In Amazonia, for example, the protein intake of the Yuquí Indians dropped from 88 g to 44 g per person per day after large-scale invasions by colonists between 1983 and 1988 (Stearman 2000). Wildlife hunting may be sustained but only where human population densities are low (Bodmer et al, 1994). Based on a recent review of studies on hunting in tropical forest, Bennett and Robinson (2000) suggest that for people depending exclusively on wild meat, hunting may not be sustainable if human population densities >1 person/km2. Where people shift from subsistence to a cash economy, frequency and intensity of harvesting or hunting change rapidly, for example in response to commercial demand stimulated by increased access (e.g.: road construction for logging). The bush meat trade

(Bennett and Robinson, 2000) as well as some rattan, craft, horticultural and medicinal plant species all provide examples of this situation (Cunningham & Milton, 1987; Donaldson, in press; Dransfield, 1981; Nantel et al, 1996).

Whether NTFP or bush meat use is considered from the perspective of local livelihoods or conservation, species loss through overexploitation benefits neither local people nor conservation in the long term. Unrestricted access to valued but vulnerable species may provide a high initial harvest, but this will merely be a temporary "bonanza" followed by loss of local self-sufficiency and higher effort or prices to get the species elsewhere. In most cases, habitat loss is the initial underlying cause of threat. Increasingly, however, species specific over harvesting of some plant and animals is becoming a significant factor as habitats shrink and demand for valued, but vulnerable species increases. Substantial proportions of some of the world's most useful plant families are currently threatened either habitat loss or species-specific overexploitation (or a combination of these two factors).

3.1 Dealing with diversity, coping with uncertainty

It is often assumed that NTFP are sustainably harvested and that this "green social security" will always be available to resource users. This is not always the case. In many parts of the world, local people are losing access to valued plant and animal species, either through overexploitation and habitat destruction or loss of access as former harvesting areas are included within national parks or forest reserves. For all interest groups, whether resource users, rural development workers or national park managers, it is far better to have pro-active management and to stop or phase out destructive harvesting in favour of suitable alternatives before overexploitation occurs, than to have the "benefit" of hindsight after resource depletion.

A problem is that little is known about tropical plant species, let alone their population biology, standing stocks or yields. Tropical forests, for example, are remarkably diverse, yet poorly studied by scientists. Many tropical species are undescribed and even less is known about the population biology or ecological interactions between species. Even if encouraging new initiatives such as the Global Taxonomy Initiative were implemented tomorrow, we still need to find ways in which to prioritise NTFP species as components in the implementation of conservation and sustainable use plans.

Due to the diversity of tropical ecosystems and NTFP uses, our limited “scientific” knowledge and the ecological and taxonomic insights held by knowledgeable local and indigenous people, it is recommended that more use should be made of folk taxonomists. Where formally trained taxonomists are not (and unlikely to become) available, local folk taxonomists can be remarkably effective. In India, for example, local people in selected areas are involved in “community biodiversity registers” (Gadgil, 1996; Ministry of Environment and Forests, 1997) in a process that documents biodiversity at a landscape level and the processes driving change. This experimental process is worth pursuing in other parts of the world.

The greatest contribution by folk taxonomists will probably be in the inventory and population biology of useful species such as edible or medicinal plants or animals. In Australia, where reptiles are commonly hunted for food, local folk taxonomy can be crucial at filling gaps in knowledge about reptile-taxa (Baker and Mutitjulu Community 1992). Kinabalu Park in Sabah, Malaysia, with over 5000 plant species has long been a famous site for botanical richness, enabling a comparison of the number of palm species collected by professional botanists visiting Kinabalu from the 1850's onwards with those made by community-based collectors. They, in just 3% of the time in which professional botanists were active, were able to increase known palm genera by 82%, species and infraspecific taxa by 65% and the number of collections by 103% (Martin et al, 2001).

Vulnerability or resilience to harvesting are influenced by level of demand and by common biological characteristics: life form (plants) or body size (animals), growth rate, reproductive biology, geographic distribution, habitat specificity, population density, etc. (Cunningham, 1991; 2001; Peters, 1983; Peters, 1994). Harvesting of leaves, flowers or fruits (or eggs) from widely distributed, fast growing, fast reproducing species occurring at high densities in a range of habitats is obviously of less concern than the killing of large, slow growing, infrequently reproducing species.

The effects of harvesting on a plant population depend on what part of the plant is harvested and on the quantity, intensity and frequency of harvesting. Most harvesting has some effect, but extirpation is infrequent and extinction even rarer, usually as a product of habitat destruction coupled to commercial harvesting of restricted range species. Although the response of individual plants is a useful guide to estimate harvesting impact, it is crucial to avoid getting side-tracked when seeing destructive harvest at the individual level and to take into account geographic distribution, habitat specificity, growth rates, conflicting uses, reproductive biology and management costs.

Harvested populations in turn need to be viewed in terms of abundance, distribution and response to disturbance at the landscape level (Cunningham, 2001). A seemingly low impact use, such as harvesting of fruits for example, may have a high long-term impact on populations of some species, either because of long-term impact on seedling recruitment (Peters, 1994) or because fruit collection involves tree felling. On the other hand, even if harvesting bark, roots, stems kills some individual plants, it may have little impact on the populations of fast growing, fast-reproducing species.

4. Underlying causes

Forest and woodland fragmentation results in harvesting and hunting focusing on the remaining source areas, including national parks (and even botanical gardens!!). In terms of people's harvesting, a decline in area covered by vegetation types with characteristic species associations is highly significant to conservation and resource management programmes. For this reason, understanding of what drives deforestation (Kaimowitz and Angelsen, 1998) and resultant policy change are directly relevant to sustained use of NTFP.

Firstly, this represents a decline in wildlife species (Cuaron, 2000) and in the availability of plant species that was or would have been used by local people. Working in 2.7 million ha area of southern Mexico and northern Guatemala, for example, Cuaron (2000) showed a declining trend in habitat availability for 32 (59%) of the 54 wildlife species. Secondly, it means that the remaining blocks of vegetation become the focus for more frequent and intensive harvesting of high value species, for both bush meat (e.g.: Fitzgibbon et al., 1995) and plant products (e.g.: Cunningham, 2001). Periodic assessment of the extent and rate of loss (or expansion) of habitat at a landscape level using aerial photographs or satellite images are a common, cost-effective way to monitor the success or failure of conservation programmes, but they do give the full-picture. Forest or woodland cover may not change at all - but underneath the canopy, populations of high value, vulnerable plant and animal species can be disappearing due to species specific overexploitation: the "empty forest" phenomenon described by Redford (1993) for wildlife. This situation is rarely taken into account in protected area management. For these reasons, monitoring at a large spatial scale needs to be combined with monitoring of a high value "indicator" species at a population level to give a comprehensive picture.

4.1 Biological factors

Differences in climate, soil and vegetation type result in significant differences in the availability and use of NTFP across tropical Africa, Asia and Latin America. Large areas of the tropics are covered by sandy, nutrient poor soils. Examples are *terra firme* forest in Amazonia, heath (kerangas) forests in Borneo, in south-central Africa, Zambesian dry evergreen forests on Kalahari sands (dominated either by *Cryptocephalum*, *Parinari excelsa* or *Marquesia macruora*), the monodominant *Gilbertiodendron dewevrei* forests in the Congo basin and in eastern Africa, dry deciduous forests on coastal plain sands. In each case, the relatively low productivity of these forests, with consequently low carrying capacities for hunting communities, with Bennett and Robinson (2000) suggesting that hunting may not even be sustainable where human population densities are less than 1 person/km2.

In the case of wild plant use, yields from wild populations are often overestimated. Whether fruits, roots, bark or whole plants are involved, the potential yield from wild stocks of many species is frequently overestimated, particularly if the effects of stochastic events are taken into account. As a result, commercial harvesting ventures based on wild populations can be characterised by a "boom and bust" situation where initial harvests are followed by declining resource availability. In their work on American ginseng (*Panax quinquefolium*) in Canadian temperate forests, Nantel et al (1996) found the extinction threshold below 30-90 plants. The minimum viable population was estimated at 170 plants but only a dozen populations were larger than 170 plants, so most cannot support any harvesting if they are to be maintained in the long-term. The low level of extraction required to enable sustainable harvesting of wild populations of American ginseng (*Panax quinquefolium*) as well as wild leeks (*Allium triccocum*) in Canada (Nantel et al, 1996) and amla tree (*Phyllanthus emblica*) fruits in India (Shankar et al, 1996) all suggests that at current prices, sustainable harvest levels for these species were not an economic proposition for commercial gatherers.

4.2 Change in socio-ecomomic factors

Transport systems are reaching further and further into remote, resource-rich regions, catalysing settlement, and forest and woodland clearing. This results in loss of supplies of wild harvested species as habitat declines as well as increased trade in bush meat and wild plant species. For these reasons, Wilkie et al. (2000) highlight the need, through co-ordinated land-use

and infrastructure planning, to plan roads in a way that maximises local and national economic benefits while minimizing the negative effects road construction has on biodiversity.

Improved transport networks strengthen the link between rural resources and urban demand. They also result in an influx of outsiders, frequently disrupting traditional resource tenure systems and increasing the scramble for economically valuable resources. As cities grow, the markets within them exert a stronger and stronger pull on rural resources. Over the past century, there has been an unprecedented flood of people moving from rural to urban areas. At present, the highest rate of urbanisation, 6% per year, is in sub-Saharan Africa. In South Asia, the rate is 4% per year. Godoy and Bawa (1993) suggest that economic development "encourages rural to urban migration, lowers population growth, and supports more productive agriculture, all of which should decrease pressure on the forest as a source of livelihood". Since the 1960's, the growing demand from urban areas has catalysed NTFP trade, drawing in resources from rural areas to towns and cities, for favoured fuelwood, building materials, medicinal or edible wild fruit species. From first harvest to final sale, this trade in wild plants and bush meat for local, national or regional consumption forms part of an informal sector "hidden economy". This informal sector trade continues to be very important in the cities of many developing countries, as the urban-rural divide is rarely a clear-cut one. As a result, urbanisation has tended to increase rather than reduce the demand for wild plant resources, catalysing a commercial trade that stimulates over-exploitation.

International trade in NTFP is more obvious, as middlemen link the informal sector to an export sector for which export or import records are sometimes kept. For example, around 500 people, mostly women sell more than 700 metric tons of *aguaje* (*Mauritia flexuosa*) palm fruit each day in Iquitos (Padoch, 1988); of the 700 full-time NTFP traders in the daily urban markets of Kumasi, Ghana, 90% of whom were women, 100 traded in leaves of Marantaceae with the monthly demand for *Marantochloa* leaves exceeding US$47 000, 100 people, also mainly women, traded in medicinal plants, 65 were full-time bush-meat traders, 50 trading smoked meat, 15 fresh bush meat, selling an estimated 160 tons of meat/yr with an annual value of US$209 000 and 25 were full-time basket traders, selling 1000-5000 baskets/month (FAO, 1995a); in Gabon, the bush meat trade has been valued at $22 millions/yr for informal markets and $3 millions/yr from formal markets, with four tonnes of bush meat entering Libreville monthly (Inamdar et al., 1999).

The shift from subsistence use to commercial sale has important implications for resource management as it results in larger volumes being harvested, a higher frequency and intensity of harvesting and often affects resource tenure. In some cases, commercial harvesting strengthens resource tenure and the incentive to conserve individual plants. Commercial sale of wild fruits such as *Sclerocarya birrea*, for example, maintains the incentive to conserve wild fruit-bearing trees in parts of Africa where development of a social stigma against gathering wild fruits as a food resource is undermining the "traditional" practice of conserving wild fruit trees. In others, the shift from subsistence use to commercial harvesting weakens resource tenure and undermines customary controls of resource use.

Although access to markets is a key factor in realizing economic values of NTFP (Neumann and Hirsch, 2000), the ingenuity of people accessing markets if there is sufficient economic incentive should not be underestimated. The use of helicopters to (often illegally) transport the aromatic *gaharu* resins (*Aquilaria* trees) from remote South-Eat Asian forests to international markets is a good example (Momberg et al, 2000). If prices and profits are high enough, local traders will also make remarkable use of any transport network to get perishable species to the market. As road networks extend into more and more remote rural areas, so commercial harvesters or middlemen flow in, and favoured plant species flow out. Local gatherers often get a low and highly variable price for unprocessed plant material at the start of these complex marketing chains from rural gatherers harvesting wild species to urban consumers. Although income from *Prunus africana* bark sales is an important source of revenue to villagers in Madagascar, in some cases generating >30% of village revenue, the price paid to collectors is negligible compared to middlemen (Walter and Rokotonirina, 1995). In Mexico, Hersch-Martinez (1995) found that medicinal plant collectors only received an average 6.17% of the medicinal plant consumer price. In India, the extent by which the prices of NTFP's increased from along the marketing chain from the point of collection varied from an increase of 50% for *Decalepis hamilton*ii to 255% in soapnut (*Acacia sinuata*) sales (Hedge et al, 1996). On the basis of their study, Hedge et al (1996) considered that one consequence of low prices to harvesters can be overexploitation and conversely, increased income through value-addition and processing can provide an incentive to decrease harvest levels. For this reason, for example, Shankar et al (1996) have recommended an alternative flow of amla (*Phyllanthus emblica*) fruit in India from the forest source area to the Indian consumer, improving economic benefits to harvesters as a means of improving household income while reducing overharvesting of fruits. Their model is more widely applicable, as is the Joint Forest Management (JFM) system developed for NTFP harvest and timber production in *Shorea robusta* forests in West Bengla, India, which has also been applied in Nepal (Hobley, 1996). . Low prices paid for medicinal plants, whether for local markets or export, often

bear no relation to the real cost of resource replacement. Low prices also mean that few slow growing species are cultivated and that cultivation for profit is restricted to a small number of high priced and/or fast growing species.

4.4 Disappearance of cultural & religious values

The assumption tends to be that "economic development" means that electricity, kerosene or gas for lighting and household cooking is supplied at low cost to the majority of the urban population. However this is often not the case in the shantytowns that sprawl around the rapidly growing cities of most developing countries. The cultural and economic importance of wild plants to urban people is a crucial factor, which also has to be taken into account. Common examples in many cities in Africa, Asia and Latin America are the sale of wild-collected medicines, chewing sticks, indigenous foods and bush meats valued by urban people.

Cultural systems are even more dynamic than biological ones, and the shift from a subsistence economy to a cash economy is a dominant factor amongst all but the remotest of peoples. In many parts of the world, "traditional" conservation practices have been weakened by cultural change, higher human needs and numbers and a shift to cash economies. There are an increasing number of cases where resources which were traditionally conserved, or which appeared to be conserved, are being overexploited today. The people whose ancestors hunted, harvested and venerated the forests that are the focus of enthusiastic conservation efforts are sometimes the people who are felling the last forest patches for maize fields or coffee plantations, often on slopes so steep that sustainable agriculture is impossible. In others, local human populations have decreased due to epidemic disease or even urbanisation, with swidden agriculture only occurring on old secondary forest. While some resources are being over harvested due to cultural and economic change, the majority are still used sustainably, and the impact on others has lessened because of social change. In the most extreme cases, "islands" of remaining vegetation, usually created by habitat loss through clearing for agriculture, then become focal points for harvesting pressure, and sites of conflict over remaining land or resources.

5. Recommendations

5.1.1 To achieve a balance between conservation and sustainable use of NTFP, there is a need to consolidate protected area networks and establish and maintain corridors (Article 8a) through**:**

(i) Identification and legal protection of currently unprotected sites that are a priority for conservation of biological diversity and ecosystem processes and, where necessary, increase of the effectiveness of existing protected area management.

(ii) Putting in place land-use mosaics favourable to the conservation goals of the adjacent protected areas. The form this takes will vary with social, political and economic circumstances, comprising conservancies, “land care” groups, multiple-use zones, co-management areas or indigenous production forests. Firm, mutually agreed and enforceable regulations need to be established.

This should be planned at an ecosystem scale to create biological corridors for migratory species and maintain minimum viable populations of conservation priority species.

5.1.2 **Land-use and infrastructure planning (roads, new settlements) need to take protected areas, their adjacent conservancies or co-management areas and the requirements for maintaining viable populations of valued, but vulnerable species into account.** These should not block migration routes, result in the destruction of high conservation priority habitats or stimulate the overexploitation of high conservation priority species (such as rattan, medicinal plants or bush meat) through unregulated commercial trade.

5.1.3 **Ecosystem level and harvested/hunted population management planning must take place through a process of consultation that takes relevant scientific, local and indigenous knowledge into account.** This should include the recognition and role of cultural landscapes (with their botanical and cultural diversity) and include support to local or indigenous people trying to protect their biological and cultural heritage from external incursions such as industrial logging, large dams or industrial scale agriculture.

5.1.4 **Development and implementation of effective conservation and resource management plans may need legislative reform before managed use of NTFP provides and incentive for conservation as a form of land-use** (Article 8k). Examples are the development of national legislation in Namibia that recognizes community

rights to values derived from wildlife within co-managed conservancies. An example of the converse, is national legislation in Australia which denies indigenous people commercial access to indigenous species (birds, reptiles, marsupials) even where viable harvesting is possible as a more appropriate form of land use than sheep (ACIL Economics, 1997);

5.1.5 **Legislative change, technical support and economic incentives for ecological restoration of wildlife corridors and for the control of invasive plant and animal species may be necessary for maintenance or re-establishment of viable populations of indigenous plant and animal populations.**

5.1.6 **Training: recognize and strengthen the role of local people in inventory, research, monitoring and impact assessment processes (**Article 12):

- A folk taxonomy initiative should be formed as a separate, new component within the current Global Taxonomy Initiative, which has been established as a means of promoting taxonomy and taxonomic tools for implementation of the Convention. The role of local people in tropical taxonomy initiatives has also been recognized in Costa Rica (Janzen et al, 1993) and Brazil, concentrating on the collection and cataloguing of wasps, beetles, vertebrate parasites and fungi specimens. A recent example of this, concentrating on insect pollinators, is the document prepared by Brazilian Ministry of the Environment as a contribution for the implementation of Decision III/11 of the Convention on Biological Diversity which established a work program on the conservation and sustainable use of agricultural biological diversity (Dias, Raw and Imperatri–Fonseca, 1999).

- There is a great need for training (CBD Article 12a) of young professionals and the staff of agencies responsible for the management of NTFP and wildlife resources to work effectively with the local harvesters and their communities, private owners and those working for commercial enterprises. This will require **Technical and scientific cooperation (**Articles 18 and 25c).

5.1.7 **Appropriate and economically viable monitoring systems should be developed and established at the landscape level (remote sensing, aerial photograph analysis) and local level (indicator species) (**Article 7) Involvement of local people in this process, through both mapping and monitoring should be considered, particularly for countries with limited numbers of trained personnel. Efficient systems for data storage, analysis and the return of results to local people must accompany this process.

5.1.8 Integrate non-timber product uses into forest management: The opportunity for better co-ordinated inventory and management to avoid wastage should influence the choice of natural forest logging systems and how these influence non-timber forest products. Although many tree species have multiple uses aside from timber, this is rarely taken into account in forest inventory or management. Exceptions to this are forest departments in Finland, which uses double-inventory methods to develop management plans for berry yielding shrubs and for edible mushrooms (Saastamoinen et al., 1998) and the Nepal Forest department, which has recently included NTFP in its five-year planning process (Wong, 2000). There is a great opportunity for SBSTTA to stress the need for inclusion of NTFP in forestry planning processes, as logging impacts can have a far greater impact than harvesting on some NTFP.

5.1.9 Conservation through cultivation or farming of wildlife, which is economically viable and on a sufficient scale to take the pressure off wild stocks. Wild harvest is not always the answer, particularly under high demand. While managed sustainable use of wild populations is theoretically possible in high species diversity systems such as forests, it requires such high inputs of money and manpower that exploitative use is likely to occur and that cultivation can be a cheaper and more practical option. If cultivation is to be a success in providing an alternative supply source of overexploited plant species, then plants have to be produced cheaply and in large quantity. Most cultivation or wildlife farming will be competing with material harvested from the wild that is supplied onto the market by commercial gatherers, who have incurred no input costs for cultivation. Prices therefore increase with scarcity due to transport costs, search time and the long-distance trade. At present, low prices (whether for local or international pharmaceutical trade) ensure that few species can be marketed at a high enough price to make cultivation profitable. If cultivation does not take place on a big enough scale to meet demand, it merely becomes a convenient bit of "window dressing" masking the continued exploitation of wild populations. This is attained relatively easily in the case of medicinal species. The regional demand for *Scilla natalensis* (Liliaceae) in KwaZulu/Natal, South Africa, for example, was 300 000 bulbs/yr, which are at least 8 - 10 yr old from the wild. On a 6 yr rotation under cultivation at the same planting densities as Gentry et al (1987) used for *Urginea maritima*

(Liliaceae), 70 ha would be required (Cunningham, 1988). Due to their slow growth rates, the rotational area required for tree species would be far greater, with total area dependant on demand. Between 3200 and 4900 tonnes of *Prunus africana* bark are exploited annually for export to Europe. In ideal conditions, bark production rates of *Prunus africana* are similar of *Acacia mearnsii* plantations, which produce 28 tons/bark/yr from 12 yr old stands with 1 363 trees/ha. Before manufacture of the capsules, the bark extract is standardized to contain 13% phytosterols (Mediherb, 1991). Twelve-year-old trees have about 50% of the phytosterol content, so twice the current tonnage would presumably be required. If this is correct, then total annual world demand for *Prunus africana* bark could be produced by a total plantation area of 2743 - 4200 ha or a 12 year rotation of a total of 230 - 350 ha of trees felled and totally stripped of bark each year.

5.1.10 Raise importer, exporter and retail buyer awareness: Importers and consumers in importing countries need to become aware of whether the products they consume are harvested sustainably or not, and bear some responsibility for sustainable resource management. Programmes which raise awareness about the "ecological footprint" of long-distance trade from developing to developed countries or Certification programmes (as such the Forest Stewardship Council (FSC) which may be applied to some NTFP (Shanley et al, in press) are useful tools to achieve this goal.

5.1.11 ***Ex situ* conservation** (CBD Article 9): Secure *ex-situ* gene banks need to be developed. Commercially harvested, habitat specific, phylo-genetically distinct genera are an important priority (e.g. : *Panax* (6 species, all commercially harvested), *Warburgia* (4 species, all harvested) and *Aquilaria* (15 species, at least 7 of which are exploited for *gaharu*).

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