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Benefit-Sharing Case Studies:

Aristocladus korupensis and *Prunus africana*

Submission by the United Nations Environment Programme

Benefit-Sharing Case Studies:
Ancistrocladus korupensis
and
Prunus africana

1. In response to the Call for Case Studies on Benefit Sharing Arrangements by the Convention on Biological Diversity, and in accordance with Decisions III/11, III/14, III/15, and III/18, the United Nations Environment Programme commissioned the development of two case studies on benefit sharing arrangements.
2. The case studies analyze the access and benefit-sharing issues and give policy conclusions and recommendations using the indicative outline for case studies on benefit sharing arrangements prepared by the Secretariat to the Convention on Biological Diversity.
3. Case Study 1 examines the US National Cancer Institute (NCI)'s development of the anti-HIV compound michellamine B which is derived from *Ancistrocladus korupensis. A. korupensis* is a rainforest liana which is locally endemic, but spans the border between Cameroon and Nigeria. Original collections were conducted within the Korup National Park in Cameroon. The case study analyzes the process benefits provided by the NCI's investment in a domestication and cultivation program for *A. korupensis* within Cameroon. The case study also analyzes the legal issues surrounding the negotiations between the NCI, the Government of Cameroon, and other domestic stakeholders which spurred the inclusion of access and benefit sharing provisions within Forestry Law No. 94/01 and the implementing decrees of 1995. This case study was based on field work already conducted for WWF-I, in collaboration with WWF-Cameroon, but involving additional field study in Cameroon to update available information.
4. Case Study 2 focuses on *Prunus africana* , a rainforest tree species the bark of which has some limited traditional medicinal use, but is in greatest demand in the phytomedical markets in Europe for the treatment of prostate hyperplasia. Bark is unsustainably harvested in Cameroon, as in other parts of Africa, although systems have been devised to achieve sustainable harvests. *P. africana* has a long history of commercial use within the same region of Cameroon as the *A. korupensis*, but has resulted in a very different benefit sharing profile. This case study compares the types of benefits generated from two very different commercial sectors: the pharmaceutical and the phytomedical/herbal medicine industries, including examining the way in which each creates incentives for conservation. This case study was based on field work already conducted within Cameroon, but required some additional field study and limited involvement of researchers within Cameroon to update information on *P.africana.*
5. UNEP would like to acknowledge the work of Ms. Sarah Laird and Ms. Estherine Lisinge and the contributions of Mr. Steve Gartlan to the preparation and creation of these case studies. Case Study 1 has grown in part from a lengthy research process, begun in 1994 for WWF, and documented in Laird, S.A., A.B. Cunningham, and E. Lisinge. in press. *One in Ten Thousand? The Cameroon Case of Ancistrocladus korupensis*. in. C. Zerner (ed). **People, Plants, and Justice: Case Studies of Resource Extraction in Tropical Countries**. New York: Columbia University Press. Research for Case Study 2 included interviews with a number of individuals whom we would like to acknowledge. They include: Joseph Besong, Director, MCP Limbe; Del Vecchio , Director, Plantecam Mutengene; Tabi Philip, D/Director of

Forestry, MINEF, Yaounde; Ngatoum Donald, DDEF/Fako, Limbe; Nkefor Joseph, MCP Limbe; Bruno Njombe Ewusi, MCP Limbe; Nkuinkeu Robert, Plantecam, Mutengene; Ekati Etoma, President, Prunus Harvesters Union, Mapanja; William Mbanda, Financial Secretary, PHUM; Elio Collins Ngoisa, Chairman, Matango Union, Bokwongo; Lifanje Moaika, Secretary, MUB; Ngale Njie Daniel, Bokwongo village; Nyime Bernard Bille, President, Likoko Membea; Ngomba John, Ekonjo village; Amalanga Sylvestre, Coordinator for Exploitation, Plantecam; Ndgemba Jean-Louis, Head of Wildlife and PA's.

Case Study 1: *Ancistrocladus korupensis*:
A Species with Pharmaceutical Potential from Cameroon

Case Study 2: Sustainable Harvesting of *Prunus africana* on Mount Cameroon:
Benefit-Sharing between Plantecam Company and the Village of Mapanja

Conclusion: The *Ancistrocladus korupensis* and *Prunus africana* Case Studies from Cameroon:
Contrasting Benefit-Sharing in the Pharmaceutical and Phytomedical Industries

Benefit-Sharing Case Studies: [1] *Ancistrocladus korupensis* and *Prunus africana*

Sarah A. Laird and Estherine Lisinge

A United Nations Environment Programme (UNEP) contribution to the fourth meeting of the Conference of the Parties to the Convention on Biological Diversity, May 1998, in response to Decisions of the third meeting of the COP calling for benefit-sharing case studies.

[1] Many individuals kindly contributed time and assistance to the creation of these case studies. We would like to thank in particular Steve Gartlan, WWF-Cameroon.

Case Study1: *Ancistrocladus korupensis:*
A species with pharmaceutical potential from Cameroon[2]

1. Overview

Ancistrocladus korupensis D.W. Thomas & Gereau is a woody climber found in the tropical forests of Cameroon and Nigeria. The epithet "*korupensis*" refers to *Korup*, the people, and the national park which bears their name in the Southwest Province of Cameroon. It was in the Korup National Park that *A. korupensis* was first collected in 1987, a forest vine with no reported local use, or name. *Ancistrocladus korupensis* was originally collected by staff of the Missouri Botanical Garden under contract from the U.S. National Cancer Institute's Natural Products Branch. Since that time, it has yielded the anti-HIV naphthyl-isoquinoline alkaloid michellamine B, and has generated a complex debate on access and benefit-sharing (ABS) issues associated with the commercialization of biodiversity (see, for example, Adams, 1993; Gustafson, 1993; Le Messager, 1993; Katz-Miller, 1993; and La Nouvelle Expression, 1995).

The main actors involved in this case study include:

- **The Korup National Park** - Original collections of *A. korupensis* took place in Korup National Park. Established in 1986, it covers 1,259 square kilometers, and is rich in biodiversity.
- **Local communities** - The people living in the Korup area, as in all of Southwest Cameroon, are a combination of "indigenous" villagers, settlers from Nigeria and the Bamenda Highlands, and migrant labourers. The main ethnic groups are the Bantoid Ekoi, including the Ejagham tribes, and Ibibio, including the Korup people; the Cameroon-Congo Bantu in the area include the Oroko tribes, and Mbo tribes to the east.
- **The Government of Cameroon (GoC)** - The GoC ministries most directly involved in biodiversity prospecting-related issues are The Ministry of Environment and Forestry (MINEF) and the Ministry of Scientific and Technical Research (MINREST), although a number of other government ministries, such as the Ministries of Industrial and Commercial Development, Health, Higher Education, Justice, Finance, as well as the Prime Minister's office have become involved in the *A. korupensis* case to varying degrees. Today, the bulk of responsibility for *A. korupensis* and other medicinal plants lies within the Prime Minister's Follow Up Commission for the Exploitation and Conservation of *A. korupensis,* and MINEF
- **University of Yaounde** - The University of Yaounde participated in research on the distribution and cultivation of *A. korupensis,* in collaboration with the Missouri Botanical Garden, and has been an on-going collaborator in various stages of the process. The University's Center for Health Sciences signed the NCI LOI in 1992, but this was later revoked. The Center for the Study of Medicinal Plants in Yaounde was involved in initial collections of *A. korupensis* and assisted, along with the National Herbarium, in efforts to re-collect the active species.

[2] This case study has grown in part from a lengthy research process, begun in 1994 for WWF, and documented in Laird, S.A., A.B. Cunningham, and E. Lisinge. in press. *One in Ten Thousand? The Cameroon Case of Ancistrocladus korupensis*. in. C. Zerner (ed). **People, Plants, and Justice: Case Studies of Resource Extraction in Tropical Countries**. New York: Columbia University Press.

- **The National Cancer Institute (NCI)** - The NCI of the United States began an intensive plant collection program in tropical and sub-tropical regions around the world in 1985. In 1987 it initiated a program for the discovery and development of drugs for the treatment of AIDS. NCI collects plant material through contracted collectors; in 1986 contracts were awarded to the Missouri Botanical Garden for collections in Africa and Madagascar; the New York Botanical Garden for collections in Latin America; and the University of Illinois at Chicago for collections in southeast Asia. The NCI uses a Letter of Collection as the basis for agreement of collaboration and compensation between NCI and organizations in countries of origin (Cragg et al, 1994).
- **Missouri Botanical Garden** - The Missouri Botanical Garden, primarily a scientific and public education institution, conducts some commercial collections, including those in Africa and Madagascar for the NCI. A subcontracted collector for Missouri Botanical Garden first collected *Ancistrocladus korupensis* in Cameroon in 1987.
- **Purdue University** - Purdue University received a three year NCI contract for research into the feasibility of propagation and cultivation of *Ancistrocladus korupensis* at the Korup National Park headquarters.

The case of *Ancistrocladus korupensis* raises a range of issues associated with benefit-sharing, and highlights the importance of:

- National frameworks for biodiversity prospecting relationships, including: 1. a national ABS strategy for genetic resources; 2. drafting and effective implementation of ABS measures; and 3. the establishment of an implementing authority with a well-defined remit and available funds to achieve the set objectives.
- Non-legislative ABS approaches, such as research agreements, institutional policies, and professional scientists' codes of conduct which outline researchers' responsibilities to governments, parks, research institutions and local communities in countries in which collections take place;
- The integration of benefits resulting from the R&D process into ABS measures, since the odds of developing a commercial product remain small, and these benefits often include or contribute substantively to capacity-building and technology transfer.

Benefit sharing in this case grew from the R&D process, which involved the development of large-scale sustainable supplies of raw plant material, and more minor scientific collaboration in the area of natural products research. However, a benefit sharing plan, or framework for collaboration, was never articulated. The GoC has still not signed an agreement which covers all plant collections undertaken in Cameroon on behalf of the NCI . Research on michellamine B is currently stalled due to toxicity, however this compound might still be of interest in the future. The development of the case since 1987, including the following highlights, can provide insight into the process through which benefit sharing arrangements are agreed upon, and the changing national and international policy contexts in which they currently develop:

- 1987 - Original collections of *Ancistrocladus korupensis*
- 1990 - Identification of promising compounds by NCI
- 1992 - Signing of a first agreement between NCI and a Cameroon institution
- 1993 - Increasing involvement in the case on the part of the GoC

- 1994 - Formation of the Prime Minister's Follow-Up Commission for the Exploitation and Conservation of *Ancistrocladus korupensis*.
- 1994 - Inclusion of general language relating to ABS and genetic resources in the 1994 Forestry Law (94/01),
- 1996 - Inclusion of general language relating to ABS and genetic resources in the framework law for environmental management, Law 96/12

The issues addressed in this case study are relevant to the following access and benefit sharing provisions of the Convention on Biological Diversity (UNEP/CBD/COP/3/20; UNEP/CBD/COP/3/Inf. 53; UNEP/CBD/COP/4/22; UNEP/CBD/COP/4/23):

- Article 1
- Article 15.5 (access and prior informed consent)
- Article 15.4 (access on mutually agreed terms)
- Article 15.6 (full participation in research)
- Article 15.7 (equitable sharing of research results, and benefits from commercial and other use)
- Article 8j (sharing of benefits arising out of the use of knowledge, innovations, and practices of indigenous and local communities)
- Article 16.3 (access to, and transfer of technology)
- Article 17 (exchange of information)
- Article 18 (technical and scientific cooperation)
- Articles 19.1 and 19.2 (participation in research and access to results and benefits from biotechnology)
- Articles 20 (financial resources)
- Article 21 (financial mechanism)

Benefit sharing with relevance to this case has also been addressed by several decisions of the COP, including: II/18, III/5 (Financial mechanism), III/14 (Implementation of Article 8j), III/15 (Access to genetic resources), III/16 (Transfer and development of technology), III/17 (Intellectual property rights), and III/18 (Incentive measures).

2. Description of the context

2.1 Cameroon's Biodiversity

Cameroon is classified as one of the world's "mega-diversity" countries. It contains a mosaic of diverse habitats, with moist tropical forest predominating in the south and south-east, montane forest and alpine savannah in the highlands, and sub-Sahelian savannah and near desert in the far north (Letouzey, 1985). The flora is comprised of more than 9,000 species of plants, of which more than 160 are endemic (WCMC, 1994). Wildlife is similarly diverse, with an estimated 297 species of mammals, 849 species of bird, and 190 species of reptile (Audubon Society, 1996). The Sahelian savannah has a low level of botanical diversity, but supports abundant mega-fauna, including endangered species such as the black rhinoceros and the savannah elephant (Gartlan, 1989). There are at present seven national parks, including Korup, and seven faunal reserves designed to protect these habitats and associated biodiversity, representing 13% of national territory, although many are not fully protected.

2.2 Economic activities based on forest biological diversity

Forest accounts for approximately 46.3% of the surface area of Cameroon. At 22 million hectares its forest area is second only in size to that of Zaire

in Africa. The forest zone contains more than 300 tree species, 60 of which are commercially exploited on any scale. Five species account for 70% of national production. The timber sector represents the third largest foreign currency earner, following oil and agriculture (cocoa, coffee, etc.). In 1991, the timber sector represented 4% of GNP, generating 32 billion CFA in export. In 1994, its contribution to GDP was 4.5% and in 1996 was 6%. The production and export of timber products has increased markedly in recent years. In 1975 export figures were at 423,000 tons, but by 1996 this number had grown to 1.8 million tons. Cameroon is the sixth largest timber exporter in the world. Europe and Asia (increasingly of late) dominate the market for Cameroonian timber products. While in July 1995 only 5% of logs were sent to Asia, this monthly percentage went up to 40% in June 1996 (figures SGS-Cameroon) and to 60% by the end of the year. The main destinations were China, Thailand, Taiwan, the Phillipines and Japan. For 1996 as a whole, the following countries were the main importers of logs (in order of importance): Italy, France, Thailand, Japan, Spain, China, Philippines, Portugal, Taiwan and The Netherlands (S. Gartlan, pers.comm., 1997). The accelerated scale of timber harvesting has had a marked negative impact on local biodiversity (Sikod, 1996; World Bank et al, 1990 ; GoC - MINEF, 1995).

Numerous medicinal species are also exported, including *Prunus africana*, *Voacanga africana*, *Pausinistalia johimbe*, and *Strophanthus gratus* (Sunderland, 1997; Cunningham and Mbenkum, 1993; Plantecam annual report, 1996-97). These species are sold to phytomedical and pharmaceutical companies primarily based in Europe, and to a lesser extent companies in North and South America, and Asia. Cameroon's role is largely one of raw material supplier. Some prospecting for new product development is also underway by pharmaceutical, phytomedical, and cosmetic companies.[3] It is difficult to acquire information on sectors working with medicinal species, however, because despite the inclusion of access and benefit sharing provisions in the 1994 Forestry Law and 1996 Framework Law, implementation has not yet been effected, and there does not exist a central oversight and coordinating body for these activities, as there is for the timber products sector.

Cameroon's biodiversity also provides a wide range of forest products which are consumed locally, such as medicinal plants, spices, fruits, fibers, construction materials, wild foods, and bush meat. The value of these products in the national economy has not been adequately assessed to date, but is thought to be significant (Malleson, 1993; Okafaor, 1992; Thomas et al, 1989; Laird and Sunderland, 1996).

2.3 The Species: *Ancistrocladus korupensis*

The Ancistrocladaceae is an unusual family of about 20 species of forest climbers from tropical Africa and Asia, in the single genus Ancistrocladus. There is growing scientific interest in this genus, in part due to the uncertainty that remains with regards to the relationship between the Ancistrocladaceae and other plant families. However, interest has mainly been piqued because of the presence in many species of a unique group of chemical compounds, the naphthyl isoquinoline alkaloids (Gereau, 1997; Bringmann, 1986; Bringmann et al, in press; Manfredi et al, 1991; Hallock et al, 1994). Although the recently described *A. korupensis* (Thomas and Gereau, 1993) appears to have no local use in its native range in Cameroon,

[3] The National Cancer Institute collection program, which ran in Cameroon for a number of years, is no longer active, but other companies - such as Shaman Pharmaceuticals and Estee Lauder Co. - have more recently become interested in Cameroonian species.

there are several records of local peoples' use of other *Ancistrocladus* species in traditional medicine. For example, *A. abbreviatus* , a species very similar to *A. korupensis*, is used in the treatment of measles and fever in Ghana (Iwu, 1993; Irvine, 1961).

Ancistrocladus korupensis is a tall canopy liana with stems sometimes exceeding 10 cm diameter and up to 25 m tall. The sparingly branched main stems climb by means of numerous short, hooked, lateral branches. Leaves of the lateral branches are borne in dense evergreen rosettes, and each leaf apparently lives for over one year. Mature leaves contain the highest concentrations of the alkaloid michellamine B. Little is known of the phenology, although flowers have been collected in November, and dense crops of fallen fruit were seen in February - March 1993 (Thomas and Jato, 1993; Thomas et al, 1994). Density of stems is estimated at 1-2 mature climbers per hectare. The area in which *A. korupensis* is known to grow lies at 50 - 160 m above sea level with highly-acidic (pH ca. 3.9-4.5), leached, and infertile soils with a high sand content (60-91%) and little clay (Thomas and Gereau, 1993; Thomas et al, 1994; Gereau, pers. comm., 1995).

2.4 The Location: Korup National Park

The Korup Forest Reserve was designated in 1937, covering 85,000 hectares. The Reserve and additional land covering almost 41,000 hectares, were incorporated into the Korup National Park, which was established by the Government of Cameroon in 1986. The National Park today covers 1,259 square kilometers and is rich in biodiversity. This forest area contains, for example, a butterfly fauna of over 1,000 species, the highest number for any similar area in Africa; butterflies are generally considered indicators of total biodiversity (S. Gartlan, pers. comm., 1997; Tchounkoue and Jenkin, 1989). In February 1988, a Project under WWF management was formed with the overall aim of conserving biodiversity within Korup National Park. Aspects of the Korup Project include parks management, conservation education, research coordination within the Park, and a rural development component, which is involved primarily in the 300,000 ha "Support Zone" surrounding the National Park. 172 villages lie within this area, 27 of these lying 3 km or less from the Park boundary and a further 7 villages are located inside the National Park.

Forested areas in West Africa which have of late become reserves or national parks, like the Korup National Park, are typically land which was either reserved by colonial forestry departments, depopulated by local conflicts in the centuries before colonial rule, or once served as boundary wildernesses between neighbouring pre-colonial societies (Richards, 1993). The Korup National Park includes previously abandoned farm sites, settlements, and forest managed for valuable species such as the oil seed tree *Baillonella toxisperma*, and during colonial and post-colonial times has served as a border traversed by traders and smugglers. These forested areas survive because they are old contested domains, no man's lands, or boundary wildernesses over which no single authority has been able to assert undisputed control. Local groups which settle in these areas are thus more "fluid" than those elsewhere, and are engaged in "competitive redefinition over time" (Richards, 1993; Richards, 1996; Burnham, 1993; Sharpe, 1997).

2.5 Local Communities

The people living in the Korup area, as in all of Southwest Cameroon, are a combination of "indigenous" villagers, settlers from Nigeria and the Bamenda Highlands, and migrant labourers. In the pre-colonial period the forest of the Southwest was inhabited by a large number of small

linguistic and cultural groups known in the ethnographic literature as: Bakweri, Bambuko, Bafaw, Balong, Bakundu, Balue, Bai, Mbonge, Ngolo, Batabga, Korup, Batoke, Mbo, Bakossi, Basossi, Elung, Ninong, etc. (Sharpe, 1994). Within the Korup Project area, the main ethnic groups are the Bantoid Ekoi, including the Ejagham tribes, and Ibibio, including the Korup people; the Cameroon-Congo Bantu in the area include the Oroko tribes, and Mbo tribes to the east (Thomas et al, 1989; Tchounkoue and Jenkin, 1989).

The 100 or so villages within the Korup Project area have largely mixed subsistence and cash crop economies. The primary cash crops are cocoa and coffee, with other cash and subsistence crops including cassava (*Manihot esculenta*), plantains (*Musa spp.*), bananas (*Musa spp.*), cocoyams (*Colocasia esculenta* and *Xanthosoma sagittifolium*), maize (*Zea mays*) and yams (*Dioscorea spp.*). The typical holding is between 5-10 hectares per household, with two or less hectares under full cultivation at any one time. Fishing and hunting (often within Park boundaries) are important subsistence and economic activities throughout the Korup Project area, and to a lesser extent the harvest of various forest products, such as cane, foods, spices, medicinal plants, and dyeing and carving materials for both subsistence and sale in local markets (see, for example, Malleson, 1987; Malleson, 1993; Okafor, 1992; Thomas et al, 1989; Wood, 1993; and Devitt, 1988). Timber extraction from concessions surrounding the National Park is also underway. However, the Ndian Division economy is dominated by the production of palm oil and kernels, largely through the Plantations Pamol du Cameroun (PAMOL), which was previously a subsidiary of Unilever, but also through oil palm smallholders (Tchounkoue and Jenkin, 1989; Wicks et al, 1986).

There does not exist a centralized administrative or organizational structure for the communities in the Korup area, which might assist in the determination and distribution of benefits in this case. Land tenure and forest management are determined on a village-basis, administered by chiefs and elders (in village councils) according to traditional laws, and each village has a "territory" recognized by others. All land in the Project area is or was claimed by villages, which will often have clear boundaries, particularly between different ethnic groups (Thomas et al, 1989; Tchounkoue and Jenkin, 1989; Wood, 1993).

3. The Case History: Process for Establishing Arrangements and Objectives of the Benefit-Sharing Arrangements

3.1 Collections and Sourcing-Related Research

Collections and early research

Ancistrocladus korupensis was first collected by botanists in the early part of this century near Oban in the Cross River State of Nigeria (Talbot 1726, BM), but was not identified to the species level. The second collection (Thomas 6889, MO, YA) was made in 1987 in the Korup National Park, about 50 km from Talbot's locality. The Thomas collection was a voucher for a .5 kg sample of dried stems and leaves, collected under a Missouri Botanical Garden (MBG) - National Cancer Institute (NCI) contract. These collections were conducted in conjunction with the Center for the Study of Medicinal Plants, Yaounde (Thomas and Gereau, 1993; Jato and Thomas, 1993).

A number of years later, in 1990, researchers at NCI discovered that extracts from *Ancistrocladus korupensis* inhibited the ability of HIV to

kill human cells; the HIV-inhibiting alkaloids michellamine A and B were subsequently isolated (Manfredi et al, 1991). Following on this research, NCI sought out additional supplies of what it thought was *A. abbreviatus* Airy Shaw, a species wide-spread in west and central Africa (Thomas et al, 1994). Missouri Botanical Garden collectors in central Africa (including Gabon and the Central African Republic) conducted subsequent collections of *A. abbreviatus, A.ealaensis*, and *A. letestui*, however these samples showed no activity against HIV. The original voucher specimen was re-examined, and it was found that the species in question was in fact new to science. Cameroonian scientists from the National Herbarium, the Center for the Study of Medicinal Plants, and other institutions, were hired to locate the species in Cameroon. In 1991, the original collector was able to recollect *A. korupensis* in Korup National Park. In 1992, the inflorescence axis was found, confirming that the species was not *A. abbreviatus*. In June 1992, the Ancistrocladus Project technician at Korup found *A. korupensis* fruit, and in early 1993 both fruit and flowers, which led to the description of *A. korupensis* as a new species (Thomas, pers. comm., 1995; Jato, pers. comm., 1995; Thomas and Gereau, 1993).

Development of a sustainable supply: botanical and horticultural research

In 1992, after michellamine B was approved for pre-clinical development at the NCI, the Missouri Botanical Garden, in conjunction with the University of Yaounde, and funded by the NCI, expanded its research program in Cameroon in order to assess the density and distribution of the population of *Ancistrocladus korupensis*. They found that *A. korupensis* is very localized in its distribution, but within this area is fairly common (Thomas et al, 1994), with vines existing in localized patches.

Over the next few years, while research continued on the distribution and taxonomy of *Ancistrocladus korupensis*, large collections were made of the active species, and smaller collections of other *Ancistrocladus* species, for testing by the NCI. During this time, as part of work funded by the NCI, researchers in Cameroon also undertook preliminary propagation trials, and evaluated possible methods of production from wild and cultivated sources. For example, leaf harvesting trials began in April 1992 in forest under threat from shifting cultivation on the edge of the Ndian oil palm estate, outside of the national park (Thomas et al, 1994).

In February 1993, additional dried leaves were shipped to NCI for further testing. By then Korup Project staff were under the impression that a few tonnes of *Ancistrocladus korupensis* leaves might be needed per year, for the next few years, for testing purposes (P. Symonds, Korup Project, pers. comm., 1994). However, sourcing of raw leaf material presented a number of problems. The harvest of live plant material from a national park is not legal. Leaf harvesting trials had demonstrated that an interval of at least two years between harvests would be needed. In addition, the species is very localized in its occurrence and the leaves are difficult to reach in the forest canopy. In March 1993, researchers collected leaf litter in an effort to develop a more sustainable sourcing program. All samples sent to the NCI for testing contained a high level of michellamine B. This manner of leaf litter collection was further developed by the University of Yaounde, the Missouri Botanical Garden, and the Korup Project, and has proven successful. A more detailed description of the development of this sourcing strategy can be found in Thomas et al (1994).

From this point on, the Korup Project, the Missouri Botanical Garden, and the University of Yaounde, undertook an intensive collection and cultivation program for *A. korupensis*. In November 1993, Purdue University received the NCI contract for work on cultivation of *Ancistrocladus*

korupensis at Korup. This was a three-year program, designed to determine the feasibility of cultivating *A. korupensis*. The budget for this research program was subsequently scaled-back from original estimates due to severe budgetary cuts in the National Cancer Institute Developmental Therapeutics Program, but it was still by far the largest investment made by NCI in sourcing to date (Cragg, pers. comm., 1994). By investing in this research, despite uncertainty as to the future of michellamine B, NCI hoped to insure itself against the sudden supply shortages experienced when taxol (from the bark of *Taxus brevifolia*) passed into clinical trials.

Purdue University's remit was to address the following objectives: 1.study the feasibility of the cultivation of the plant in order to develop a reliable biomass source from which to obtain sufficient quantities of michellamine B for clinical evaluation; 2. investigate the selection and propagation of high yielding phenotypes; 3. develop production systems to optimize the yields of michellamine B; and 4. examine the biology of the plant so that its growth and development, and the accumulation of the secondary product, can be predicted and understood.

3.2 The Government of Cameroon: Negotiation of the NCI Letter of Collection [4]

"...Under one such arrangement the National Cancer Institute is studying a vine in Cameroon that contains a potentially promising anti-HIV agent; should this particular substance fulfill its initial promise, Cameroon would realize significant benefits from development of this resource" - Tim Wirth, Undersecretary of State for Global Affairs, in April 1994 testimony before the U.S. Senate Foreign Relations Committee

In August 1992, under the auspices of their extended work for NCI in Cameroon, Missouri Botanical Garden staff met with staff at the University Center for Health Sciences of the University of Yaounde to discuss the NCI Letter of Intent, which was then signed in early 1993. This LOI was subsequently revoked by the Government of Cameroon because it considered the University an inappropriate body to represent the country's interests. It felt that such a document should be signed by a Minister in the GoC.

The GoC became actively involved in the case of *Ancistrocladus korupensis* in 1993. Following on the UNCED in 1992, and developments in this case, concerns relating to access and benefit sharing issues, as they related to the Korup Project, and Cameroon as a whole, were increasingly raised. Korup Project, WWF, and government officials entered into direct dialogue with the NCI, one result of which was the revoking of the University Center for Health Sciences and NCI LOI. However, although this document was determined to be no longer legitimate, there existed no substitute agreement or framework which outlined the terms of the NCI-GoC relationship, including the supply of raw materials for testing, as well as requirements for "fair and equitable sharing of benefits" with Cameroon, the Korup Project, and local communities in the Korup Project area.

Meanwhile, the variety and number of parties involved in the process expanded, causing confusion over roles and responsibilities; parties included the University of Yaounde, the many GoC Ministries, the Korup

[4] For general background and more information on the NCI LOC, and the NCI approach to access and benefit sharing issues see, for example: Cragg et al, 1994; Mays et al, 1993; Baker et al, 1995.

Project, the Missouri Botanical Garden, and Purdue University. It remained unclear who had final responsibility for negotiating and dealing with the practical realities of the NCI R&D effort, as well as brokering the various national and local interests involved.

In August 1993 an Inter-Ministerial Committee was established within Cameroon, and a meeting was held to address the issues raised by *Ancistrocladus*. The results of the meeting included: declaring *A. korupensis* a "national treasure"; restricting the number of multiplication plots of *A. korupensis*; prohibiting the export of live plant material and seeds; conducting research into capabilities within Cameroon for the establishment of research partnerships with NCI; and the establishment of three committees with well-articulated objectives: 1) production/exploitation; 2) laboratory research; and 3) legal aspects (see Box 1.). Unfortunately, the inter-ministerial committees did not follow up effectively on this initial meeting, largely because they failed to clarify their respective ministerial responsibilities in the case. This resulted in confusion surrounding negotiations with NCI.

BOX 1: Inter-Ministerial Committees Established in 1993 to Address ABS Issues Relating to *Ancistrocladus korupensis*

- The **Production and Exploitation Committee** was established to oversee the inventory of *A. korupensis*, the production of a monograph, and to research and establish the methods of harvesting and cultivation. It was agreed that all work on *A. korupensis* and other medicinal plants within the Korup area would be coordinated and supervised by the Korup Project in order to "safeguard the interests of the indigenous people of the area and the interests of Cameroon as a whole."

- The **Research Committee** was intended to study and develop a plan of action for the medicinal, chemical, and processing aspects of *A. korupensis*. The Committee was to look in to local capabilities with regards to exporting extracts rather than raw materials, the requirements of doing so, the site for such a body, the time-line for such program, and the potential for developing screening capabilities within Cameroon for local medicinal plants.

- The **Legal Aspects Committee** was to devise a first instrument of negotiation with NCI and subsequently draft a long term agreement. Initially, the Committee would draft a document based on the Manila Declaration, the Department of Conservation and Land Management, Australia draft agreement, and the NCI Letter of Collection. The Committee would reconvene to discuss this document.

The Government of Cameroon ministries most directly involved in biodiversity prospecting-related issues are The Ministry of Environment and Forestry (MINEF) and the Ministry of Scientific and Technical Research (MINREST), although a number of other government ministries, such as the Ministries of Industrial and Commercial Development, Health, Higher Education, Justice, Finance, as well as the Prime Minister's office have become involved in the *A. korupensis* case to varying degrees. Today, the bulk of responsibility for *A. korupensis* and other "medicinal plants" lies within the Prime Minister's Follow Up Commission for the Exploitation and Conservation of *A. korupensis* and MINEF, but there remains a great deal of confusion as to respective responsibilities, and no real movement towards

the development of a competent national authority to oversee and implement permitting procedures for access and benefit sharing.

3.3 Intermediaries

The case of *Ancistrocladus korupensis* highlights some of the complexities and potential problems associated with the NCI-contracted collector model. Because NCI depends upon independent subcontractors to carry out collections, these subcontractors and their in-country collaborators determine the nature of benefits associated with the collection phase, and identify in-country beneficiaries. NCI can constrain and motivate collectors in particular directions through its contracts and funding, but remains largely ignorant of conditions within countries in which collections take place.

Collectors, in turn, are selected because of their abilities in plant collection and identification techniques, not because of their capacity to mediate the various national and local interests with regards to the commercialization of biochemical and genetic resources. Beyond the obvious need for contracted collectors to follow high professional ethical standards themselves, they must also often provide advice, information, brokering, and negotiation assistance in the early stages of R&D to local partners. This is an enormous job, and one for which most collecting institutions are not equipped, and for which funds are not budgeted. If institutions do not play this role (although this is changing as ABS-related capacity improves in many countries), the type of confusion and rumor that has typified the *A. korupensis* case is likely to result.

At the stage of collection, the NCI does not become directly involved in compensation and benefit sharing, although it supplies additional funds to their contracted collectors to allow for the implementation of short-term infrastructure- and expertise-building measures in countries of collection. These types of benefits can be written into research agreements and, had the Missouri Botanical Garden and the Korup Project established a better-defined working relationship early on, and preferably some form of research agreement, a package of R&D "process" benefits (see discussion below) might have been supplied to Korup as part of the plant collection process.

We must recognize, however, that until very recently standard research practices were based on very different sets of assumptions, and that many institutions are in fact responding to the Convention on Biological Diversity with improved policies on ABS issues (e.g. Missouri Botanical Garden, New York Botanical Garden, and the Royal Botanic Gardens, Kew). For its part, NCI is departing from past practices in many countries, and is entering directly into Memoranda of Understanding with source country collaborators, particularly in South and Central America, but also in South Africa, China, and Zimbabwe. The collaborations defined in these MOU's are far more involved, and place an emphasis on discovery taking place in the source countries, which means a larger and more significant package of benefits at each stage of the process. However, this approach requires a significant level of R&D capacity within source countries, and so is limited to around a dozen or so high-biodiversity, relatively high-capacity countries (Cragg, pers.comm., 1997).

3.4 Current Status

The NCI is no longer pursuing R&D on michellamine B due to its toxicity. Within the NCI research and development program it is effectively shelved, however NCI would like to find a company to conduct further research on what is still considered to be a compound of potential promise. The GoC has to date not signed the Letter of Collection, or an alternative document,

which would cover not only benefit sharing relating to *Ancistrocladus korupensis*, but to all of the materials collected in Cameroon for NCI, many of which might prove of value in the future (see Box 2.).

As we will discuss below, the 1994 Forestry Law (Law no. 94/01) and the 1996 framework law for environmental management (Law no. 96/12), have included language addressing access and benefit sharing issues, but no steps have been taken to implement these provisions.

BOX 2: Down the road...
SmithKline Beecham recently developed topotecan from camptothecin (isolated from the Chinese tree *Camptotheca acuminata)*, and a Japanese pharmaceutical company, Yakult Honsha Co. Ltd., has developed a soluble camptothecin derivative, CPT-11-irinotecan. Camptothecin was dropped from NCI clinical trials in 1972 due to its severe bladder toxicity, and for ten years research was put on hold, until the mechanism-of-action of the antitumor activity of camptothecin was understood. In the 1980's SmithKline Beecham developed a derivative of camptothecin - topotecan - which has lower toxicity and better selectivity (Carte and Johnson, 1993). This research was funded by the National Cooperative Drug Discovery grants for NCI, industry and academic collaboration. NCI sponsored clinical trials.

SmithKline Beecham, NCI and Yakult Honsha Co. Ltd. currently obtain natural camptothecin from Chinese and Indian pharmaceutical concerns. Although total syntheses for camptothecin exist, and yields for synthetic materials are constantly improving, they are still not competitive with semi-synthetic production from the natural product.

The delay between plant collection of *Camptotheca acuminata* (1950's) and product development (1980's) clearly argues the case for strong agreements between companies or the NCI, and source countries. The commercial potential of a species long outlives the professional relationships on which collections are based, and agreements are needed to protect the interests of source countries and local communities. Whether research into *Ancistrocladus* comes to anything in the near future, or not, the government of Cameroon should ensure that an effective agreement is in place to guarantee returns from any future work on this species, as well as others collected as part of the NCI program in the 1980's.

4. Content and implementation of arrangements
Benefit-sharing in the case of *Ancistrocladus korupensis* can be divided into three areas:

- The NCI Letter of Collection
- The 1994 Forestry Law (94/01) and 1996 Framework Law (96/12)
- R&D “Process” benefits for local stakeholders

The NCI Letter of Collection, and the 1994 Forestry Law (94/01) and 1996 Framework Law (96/12), can provide a rough guide to possible benefit sharing arrangements should the NCI LOC be signed by both parties, and the ABS measures in Cameroon be implemented. The benefits resulting from the R&D “process” are those that have already accrued to stakeholders in this case.

4.1 Benefits under the NCI LOC

"The LOC can't be more specific in guaranteeing recompensation to the host country, since by U.S. law the NCI, as a U.S. government agency, is not authorized to promise or encumber future intellectual property or patent rights... the LOC is, nevertheless, a firm commitment to ensure that royalties and other forms of compensation shall be provided to the host country. We assure the world community that this commitment shall be honored." - Dwight Kaufman, Deputy Director, Division of Cancer Treatment, NCI, 1993.

Benefits provided for under the NCI LOC, and corresponding provisions in the Convention on Biological Diversity, include:

- Provision of test results (Articles 15.7, 19.2)
- Research exchanges - a country of origin researcher collaborates with staff at NCI on research into species collected in their country (Articles 15.6, 19.1)
- “Royalties and other forms of compensation” (Articles 15.7)
- Seek as first source of raw materials the country of origin
- Provision of equipment, infrastructure support, technologies (Article 16.3)

Research necessary to develop a sustainable supply of *A. korupensis* leaves has provided the most significant benefits to date. Michellamine B has been synthesized, but synthesis is still not economical and a licensee might need to work with the Government of Cameroon and the Korup Project to source raw materials affordably in the future. To this end, the NCI LOC states that:

> “10) In obtaining licensees, the DTP/NCI will require the applicant for license to seek as its first source of supply the natural products available from “country”. If no appropriate licensee is found who will use natural products available from “country” or if “country organization” or its suppliers cannot provide adequate amounts of raw materials at a mutually agreeable price, the licensee will be required to pay to “country organization” an amount of money (to be negotiated) to be used for expenses associated with cultivation of medicinal plant species that are endangered by deforestation, or for other appropriate conservation measures”, a company is not required to source from the country of origin.”

The NCI invested more heavily in the sourcing of *Ancistrocladus korupensis* than it has in any other species of promise to date. Although the bulk of the expenditure was likely on US-based institutions, there existed spin-off benefits within Cameroon such as training, capacity building, infrastructure, equipment and supplies, and the supply of research results.

4.2 GoC: The 1994 Forestry Law (94/01) and Framework Law (96/12)

The 1994 Forestry Law language relating to benefit-sharing elaborates only on the requirement that royalties be paid to the GoC. The Law relating to environmental management No. 96/12, calls for the establishment of a system of access control for genetic resources, and in reference to benefit sharing refers only to the need for scientific research and collecting to benefit Cameroon, as stipulated in relevant international conventions, in particular the Convention on Biodiversity, and for foreign researchers to work closely with Cameroon institutions and local communities (Articles 64 and 65 of Law 96/12; CBD Articles 15.6, 15.7, 19.1).

During negotiations with NCI, the GoC (MINEF) issued a letter requesting a range of specific benefits, which could provide some insight into more detailed benefit-sharing priorities for the GoC:

- Immediate return of research results on any Cameroon species (CBD, Articles 15.7 and 19.2);
- Requirement that any propagation and cultivation research take place mainly at Korup, where the species was collected, and only in Cameroon (Article 15.6);
- Provision of a field herbarium for Korup (Article 16.3);
- Provision of a training course in plant taxonomy (Article 16.3);
- Assistance with the development of appropriate capacity within Cameroon for the evaluation of new natural products and authentication of traditional medicines (Article 16.3).

4.3 R&D "process" benefits

4.3.1 The Korup Project

Process benefits which have resulted for the Korup Project to date include:

- Training in collection and agronomic techniques (CBD, Article 16.3)
- Provision of infrastructure in the form of nurseries and equipment. (Article 16.3)
- Research results (Articles 15.7, 19.2)
- Investment in potential income-generating scheme (Articles 16.3, 19.1)
- Building of capacity within the Project to address ABS issues

In the long term, should royalties result from the development of a commercial product, the Korup project would likely receive a portion of the funds. The objectives and activities to which these funds would be applied will no doubt mirror contemporary concepts of biodiversity conservation at the time of receipt. These might include: general operating costs for the park; inventories; taxonomic research; research into forest management and sustainable management systems for locally-important forest products; and community development efforts, including alternative income generating schemes, and provision of schools, roads, and healthcare, to provide incentives for conservation.

4.3.2 Local communities

Local community involvement in access and benefit sharing has been mediated by The Korup Project. For the most part, expertise brought in as part of the *A. korupensis* research phase has not been applied directly to what might be considered the priority needs of local communities. However, during the research phase local communities have benefited from the employment of approximately a dozen staff in leaf collection, cultivation, and research efforts. It is also thought that the supply of *A. korupensis* to industry might make for an alternative agricultural crop (although one part of a market even less reliable and under the control of local farmers than cocoa, their main cash crop).

A variety of methods for *A. korupensis* cultivation were researched, in order to promote local community participation in industrial supply: inter-planting with oil palms; cultivation in traditional fields and fallows; and planting out in primary and secondary forest. Some individuals and community groups have supplied land in exchange for oil palms or cash, and should *A. korupensis* prove a valuable crop will have

ownership over the plants on their land. Should it fail, crops such as oil palm supplied by the Project will continue to produce income (P. Symonds, 1994, pers. comm.; A. Thomas, 1993).

In summary, then, benefits for local communities resulting directly from the R&D process, include:

- Training, in nursery and agronomic techniques associated with propagation and cultivation of *Ancistrocladus korupensis*;
- Employment, in research and development of sustainable sourcing strategies;
- Development of potential alternative income generating schemes, involving the supply of raw material to the pharmaceutical industry.

In the long term, should royalties result from a commercial product developed from *A. korupensis*, the Korup Project might supply financial benefits to Village Development Funds, or directly to the identified needs of local communities, such as: roads, health clinics, schools, water, electricity, and training and support for income-generating activities. The mechanism by which this would occur, and the role of communities in determining the nature and distribution of benefits, remains undefined to date.

4.3.3 University of Yaounde

The University of Yaounde has been involved in various stages of the R&D process, with resulting benefits including:

- Training (Article 19.1, 15.6)
- Equipment and infrastructure which can be applied to other uses (Article 16.3)
- Scientific exchanges (Articles 15.6, 19.1)
- Provision of research results (Articles 15.6, 19.1)

5. Policy, legislative, and administrative context

When collections of *Ancistrocladus korupensis* took place in 1987, an ABS framework was not in place within Cameroon, nor was there significant awareness within the country of the implications of these collections. The UNCED was still five years off, and researchers and governments operated under the “common heritage of mankind” principle for genetic resources.

Outside of Cameroon, 1987 was still very early-on in the biodiversity prospecting policy dialogue, but it was not until 1990 that NCI found compounds of interest in *A. korupensis*, a year after NCI staff, in conjunction with their contracted collectors (The New York Botanical Garden, Missouri Botanical Garden, and the University of Illinois at Chicago) had developed a draft Letter of Intent (the LOI was subsequently renamed a Letter of Collection). By the time the Letter of Collection was signed by parties representing the NCI and Cameroon in 1993, the InBio-Merck case had been publicized, the Convention on Biological Diversity had been signed in Rio, and awareness of these issues was increasing rapidly. The development of thinking on biodiversity prospecting issues in Cameroon therefore grew from, and had the benefit of, a rapidly expanding international policy discussion, and the specific experiences of a number of groups in tropical countries. These groups not only included InBio, but other countries and institutions negotiating with the NCI, such as the Department of Conservation and Land Management in Western Australia, which provided assistance in the early stages of this case. The Manila Declaration (1992) was also consulted by parties within Cameroon, actively in search of general guidelines for a relationship of the type that had been established with NCI.

The Forestry Law No. 94/01 and Implementing Decrees
As a result of these influences, the 1994 Forestry Law included very general language in reference to these issues:

> The genetic resources of the national heritage shall belong to the State of Cameroon. No person may use them for scientific, commercial or cultural purposes without prior authorization (Article 11).
>
> The economic and financial spin-off resulting from their use shall be subject to the payment to the State of royalties the rate and conditions of which shall be laid down, to the prorata of their value, by an order of the minister in charge of finance upon the proposal of the competent ministers (Article 12.)

The National Assembly passed the Forestry Law in December 1993 (No. 94/01 Concerning forests, wildlife, and fisheries as of January 20, 1994). Its Implementing Decrees are Decree No.95/531/PM of 23 August 1995 and Decree No.95/466/PM of 20 July 1995 - relating to forestry and wildlife respectively. The Law and its implementing decrees are the main legal instruments for implementing the Forest Policy. They outline the administrative procedures and norms relevant to the attribution and management forests.

Article 12 of the Forestry Law establishes national sovereignty over all genetic and biological resources, and requires prior informed consent from the GoC for any scientific, commercial, or cultural exploitation. A permitting process for exploitation of forest products, guidelines for the collection of genetic resources, and requirements for the equitable sharing of benefits, are also included. Article 12 also channels all benefits in the form of royalties to the GoC. Other Articles relating to benefit-sharing with local communities include Articles 51, 68, and 85, but these address timber exploitation, and do not mention genetic resources.

More recently, a framework law relating to environmental management - Law No. 96/12 of 5 August 1996 - was adopted. Articles 64(1) (c) and 65 (1) and (2) recognize the need for a system of access control for genetic resources. They further state that scientific exploration of genetic resources should benefit Cameroon, and be done under conditions of transparency and in close collaboration with national research institutions and local communities, as stipulated in relevant international conventions signed by the GoC, in particular the Convention on Biological Diversity. The Law further calls for an enabling decree to define the contractual relationship that should exist between foreign and Cameroonian research institutions and local communities. The provisions cited establish a sufficient legal base on which subsequent access control agreements and benefit-sharing mechanisms can be developed.

While the Forestry Law and Decree of application are silent on Article 8j of the Convention on Biodiversity, by stipulating in Article 65(1) that the exploration and exploitation of genetic resources should be in accordance with the provisions of the CBD, the Framework Law (96/12) implicitly incorporates the relevant provisions of Article 8j.

A significant institutional obstacle to implementing the genetic resources provisions of the Forestry Law, as well as addressing issues raised by the case of *Ancistrocladus korupensis*, has been the lack of a clearly defined national authority to oversee access and benefit sharing issues. As a result, rather than a strategic approach to negotiations with the NCI, and

access and benefit sharing issues in general, the GoC has had a more reactive response to events.

BOX 3: Legislation and documents relevant to the implementation of access and benefit sharing in Cameroon

- Government of Cameroon. 1994. Law No. 94/01 of 20 January 1994 concerning Forests, Wildlife and Fisheries.
- Government of Cameroon. 1994. Arrete no. 080/CAD/PM of 1 September, 1994 concerning formation of Prime Minister's Follow-Up Commission on the Exploitation and Conservation of *Ancistrocladus korupensis*.
- Government of Cameroon. Decree No. 95/531 PM of 23 August 1995 relating to Forestry.
- Government of Cameroon. Decree No. 95/466 PM of July 1995 relating to Wildlife.
- Government of Cameroon. Law No. 96/12 of 5 August 1996 relating to environmental management.
- Government of Cameroon. Cameroon National Environmental Management Plan - Synthesis of the Donors Conference, August 1996.
- Government of Cameroon, MINEF. Manual of the Procedures and Norms for Attribution and Management of Community Forests, draft June 1997.

6. Impact on conservation

The case of *Ancistrocladus korupensis* helped to catalyze a process within Cameroon which resulted in preliminary steps towards the development of a national access and benefit sharing policy. In this regard, benefits derived from the commercial use of genetic resources within Cameroon should in future stand a greater chance of being captured by the national government (Law 94/01, Article 12) and by local communities (Law 96/12, Articles 64. and 65.). These benefits should, in turn, create economic incentives for the conservation of biodiversity at a policy, and perhaps local, level.

In a more immediate sense, the benefits that resulted from the R&D process include training and capacity-building in areas of propagation and cultivation of species, as well as laboratory-based research at the universities. These forms of capacity building will contribute to Cameroon's ability to conduct research and develop commercial applications for domestic genetic and biochemical resources. In turn, capacity-building will allow for greater scope in the kinds of academic and commercial partnerships into which Cameroon can enter.

The Korup Project, which is committed to the conservation of biodiversity in the Korup National Park, received some minor support and infrastructure development which can be employed to address other conservation priorities, such as using nurseries to domesticate locally-valuable forest species. If *Ancistrocladus korupensis* proves of economic value, the supply of sustainable raw material to industry might act as an alternative economic activity to practices more destructive to

the forest, such as clearing for agriculture and hunting.[5] In the long term, a portion of royalties might also contribute to the management and administration of the National Park, or "conservation overhead" as it is known in the InBio case in Costa Rica, and to sustainable development objectives set by local communities.

7. Policy conclusions

7.1 Distribution of species across international borders

As a species new to science, the distribution of *A. korupensis* was not known in 1987, at the time of collection, nor during the following few years. At one time it was suggested that *A. korupensis* was a common species, however this was then revised and some considered it locally endemic to the Korup area. Although narrowly endemic, it has been found in the forest on both sides of the border between Cameroon and Nigeria. Had *A. korupensis* proved to exist only in the area around Korup, where the plant was originally collected, few questions would be raised regarding sovereignty and benefit-sharing from commercialization of the compound michellamine B. However, *A. korupensis* is found in forest type shared by Cameroon and Nigeria, spanning a border which, similarly, separates people of similar ethnic heritage.

There are, therefore, no defining ethnic or geographic limits for *A. korupensis* that fall within national political boundaries. This raises a number of questions with regards to who should benefit from the commercialization of *A. korupensis*, which can be addressed by one of a range of approaches, including: 1) *point of collection* - benefits should be negotiated by and returned to communities, institutions, and governments in areas where a species or knowledge of that species is collected; 2) *bioregional approach* - benefits should be returned to a bioregion, that is the area to which a species is native; and 3) *global funds* - benefits should be fed into a global fund which will return benefits to communities, institutions, and governments throughout the developing world (see discussion in Laird, Cunningham, and Lisinge, in press). This case argues strongly in favour of the effective implementation of national ABS measures, and some form of regional cooperation, to ensure that neighbouring countries support each other's regimes.

7.2 R&D Process Benefits

The development of *A. korupensis* into a commercial drug could yield a range of benefits for Cameroon, the conservation of local biodiversity, and communities in the Korup area. These benefits might include: advance, milestone, and royalty payments which could contribute to technology transfer, training, conservation "overhead", and local community development programs, a license to manufacture a commercial product for in-country or regional consumption, the development of supply industries for raw materials or extracts, commercial drugs at cost, assistance with the development of screening capabilities for tropical diseases, and so on (for a list and discussion of benefits see, for example, Laird and Wynberg, 1996; Laird, 1995; UNEP/CBD/COP/3/Inf.53)

[5] Although this has proved a complex benefit to link to conservation in practice. See, for example, S.A. Laird, 1994. *Sustainable Sourcing of Raw Materials for Natural Products: Weighing the Benefits*. WWF-I; and Sheldon, Balick, and Laird, 1997.

To date, and possibly in total, however, the actual benefits resulting from *A. korupensis* stem not from commercialization - since no commercial product is yet developed - but from the research and development (R&D) process. In fact, these R&D benefits are often the most significant, since even compounds of great interest like michellamine B might never make it into commercial product development. For biodiversity prospecting to maximize its contributions to both conservation and development, a wide spectrum of individuals and groups must benefit, often in distinctly different ways, and this must occur in the short, medium and long term. Royalty payments into a global fund 10 years down the road, no matter the magnitude, will never have as great an impact as benefits scattered both spatially and temporally. It is in the wide and creative disbursal of benefits throughout the research and development, as well as the commercialization, phase that biodiversity prospecting will have the most lasting effect. One must look at the *process* by which samples are collected, R&D conducted, and sources of raw materials developed, in order for the many spin-off benefits for biodiversity science, medicinal plant research, conservation, and overall development to become fully apparent.

7.4 Setting the Stage: Research Agreements and National Legislation

Much of the confusion surrounding negotiations and the assignment of responsibility within Cameroon for the *A. korupensis* case could have been avoided had research agreements with original collectors (based on the prior informed consent of the Korup Project, local communities, the University of Yaounde, and the GoC), and national legislation guiding these collections, been in place. Instead, terms were not set for the potentially commercial NCI collections conducted in 1987 and, once interesting compounds had been identified, no framework to guide the activities of local organizations, research institutions, and the government existed. Additionally, it was unclear to which body in government the responsibility for administering the case fell. At that time this was not unusual, but much has changed since then, and awareness has been raised on the importance of having good access and benefit sharing frameworks in place.

The drafting and development of national access and benefit sharing legislation is receiving a great deal of attention, as countries work to implement the Convention on Biological Diversity (see, for example, Glowka, in press; UNEP/CBD/COP/3/20; UNEP/CBD/COP/4/23; The Philippines, 1995,1996; Andean Pact, 1996; Barber and LaVina, 1997; ten Kate, 1997; Laird, 1995; Mugabe et al (eds.), 1997; Gollin and Laird, 1996). Research agreements have received less attention, but are extremely important as a complement to national legislation (see Laird, in press). In order for many countries to effectively draft a national ABS strategy, and implement both legislative and non-legislative approaches to access and benefit sharing, however, financial and technical support will be necessary. The COP may wish to request the Global Environment Facility to concentrate upon these areas, as recommended in the UNEP/CBD/COP/4/22 document on options for assistance to developing countries.

Bibliography

Adams, J. 1993. AIDS: Garden Botanists Discover a Plant That May Lead to Treatment. **Missouri Botanical Garden Bulletin**, July/August 1993.

Andean Pact. 1996. The Common System on Access to Genetic Resources, the Commission of the Cartagena Accord.

Baker, J.T., R.P. Borris, B. Carte, C.A. Cordell, D.D. Soejarto, G.M. Cragg, M.P. Gupta, M.M. Iwu, D.R. Madulid, and V.E. Tyler. 1995. Natural Product Discovery and Development: New Perspectives on International Collaboration. **Journal of Natural Products.** Vol. 58, No. 9, pp. 1325-1357.

Barber, C.V. and La Vina, A. 1997. Regulating Access to Genetic Resources: The Philippine Experience. *in* J. Mugabe, C. Barber, G. Henne, L. Glowka, and A. La Vina (eds). **Managing Access to Genetic Resources: Towards Sustainable Strategies for Benefit-Sharing**. African Centre for Technology Studies, Nairobi and World Resources Institute, Washington D.C.

Bringmann, G., C. Kehr, U. Dauer, K. P. Gulden, R. D. Haller, M. A. Isahakla, S.A. Robertson and K. Peters. In press. **Ancistrocladus robertsoniorum** "produces" pure crystalline droserone when wounded. **Planta Medica**.

Bringmann, G. 1986. Naphthylisoquinoline Alkaloids. in: A Brossi (ed) **The Alkaloids**. New York: Academic Press, pp. 141-184.

Burnham, P. 1993. **The Cultural Context of Rainforest Conservation in Cameroon**. Paper presented at the Thirty-Sixth Annual meeting of the African Studies Association, Boston, December 1993.

Carte, B. and R.K. Johnson.1996. Topotecan development: an example of the evolution of natural product drug discovery research. in : M. Balick, E. Elisabetsky, and S. Laird (eds). **Medicinal Resources of the Tropical Forests: Biodiversity and Its Importance to Human Health**. New York: Columbia University Press.

Cragg, G.M., D.J. Newman, and K.M. Snader. 1997. National Products in Drug Discovery and Development. **Journal of Natural Products**. Vol. 60, No.1, pp. 52-60.

Cragg, G.M., M.R. Boyd, M.R. Grever, and S.A. Schepartz. 1994. Policies for International Collaboration and Compensation in Drug Discovery and Development at the United States National Cancer Institute, The NCI Letter of Collection. in: T. Greaves (ed). 1994. **Intellectual Property Rights for Indigenous Peoples: A Source Book**. Oklahoma City: Society for Applied Anthropology.

Devitt, P. 1988. The people of the Korup Project Area. Report 1 of the socio-economic survey. WWF and Government of Cameroon - #3206/A9.7

Gartlan, J.S. 1989. **La conservation des ecosystemes forestiers du Cameroun**, IUCN, Switzerland.

Gereau, R.E. 1997. Typification of Names in Ancistrocladus Wallich (Ancistrocladaceae). **Novon** 7: 242-245

Glowka, L. in press. **A Legislative Guide for States Providing Genetic Resources**. IUCN, Gland and Cambridge.

Gollin, M. and S.A. Laird. 1996. Global Policies, Local Actions: The Role of National Legislation in Sustainable Biodiversity Prospecting. **Boston University Journal of Science and Technology Law**, 2, L.16.

Government of Cameroon. 1994. Law No. 94/01 of 20 January 1994 concerning Forests, Wildlife and Fisheries.

Government of Cameroon. Decree No. 95/531 PM of 23 August 1995 relating to Forestry.

Government of Cameroon. Decree No. 95/466 PM of July 1995 relating to Wildlife.

Government of Cameroon. Law No. 96/12 of 5 August 1996 relating to environmental management.

Government of Cameroon. Cameroon National Environmental Management Plan - Synthesis of the Donors Conference, August 1996.

Government of Cameroon, MINEF. Manual of the Procedures and Norms for Attribution and Management of Community Forests, draft June 1997.

Government of Cameroon, MINEF. 1995. Forest Policy Document, November 1995.

Gustafson, A. 1993. Botanical hunt finds a vine that fights AIDS. **The Statesman Journal**, December 1993.

Hallock, Y.F., K.P. Manfredi, J.W. Blunt, J.H. Cardellina II, M. Schaffer, K.P. Gulden, G. Bringmann, A.Y. Lee, J. Clardy, G. Francois, and M.R. Boyd. 1994. Korpensamines A-D, Novel Antimalarial Alkaloids from *Ancistrocladus korupensis*. **The Journal of Organic Chemistry**, 59, pp. 6349-6355.

Irvine, F.R. 1961. **Woody Plants of Ghana**. London: Oxford University Press.

Iwu, M.M. 1993. **Handbook of African Medicinal Plants**. CRC Press, London.

Jato, J. and D. Thomas, 1993. Ancistrocladus korupensis and michellamine-B in Cameroon, March 1993.

ten Kate, K. 1997. The common regime on access to genetic resources in the Andean Pact. **Biopolicy**, vol 2, paper 6.

Katz-Miller, S. 1993. High hopes hanging on a "useless" vine. **New Scientist**, January 16, 1993.

Kaufman, D. 1993. Published letter. **Botany 2000 Asia Newsletter**. October, 1993.

Kofele-Kale, N. 1981. **Tribesmen and patriots: political culture in a polyethnic African state**. University Press of America.

Laird, S.A. 1995. **Access Controls for Genetic Resources**. A WWF-International Discussion Paper, prepared for the WWF Support for the Implementation of the Biodiversity Convention Project, Switzerland.

Laird, S.A. and R. Wynberg. 1996. Biodiversity Prospecting in South Africa: Towards the Development of Equitable Partnerships. *in*. J. Mugabe, C. Barber, G. Henne, L. Glowka, and A. La Vina (eds). **Managing**

Access to Genetic Resources: Towards Sustainable Strategies for Benefit-Sharing. African Centre for Technology Studies, Nairobi and World Resources Institute, Washington D.C.

Laird, S.A. and T.C.H. Sunderland. 1996. **The Over-lapping Uses of "Medicinal" Species in South West Province, Cameroon: Implications for Forest Management.** Paper presented at the annual meeting of the Society of Economic Botany, June 1996. London.

Laird, S.A. in press. **Tools of the Trade in Biodiversity and Traditional Knowledge: Equitable Partnerships in Practice.** A People and Plants Conservation Manual. Chapman and Hall, London.

Larsen, T. 1997. **Butterfly Inventory in Korup National Park, Rumpi Hills Forest Reserve and Surrounding Areas.** Interim report to the Korup Project, Mundemba, Ndian Division, Cameroon.

Malleson, R. 1993. **Harmony and Conflict Between NTFP Use and Conservation in Korup National Park**. Rural Development Forestry Network Paper 15 c. ODI, London.

Malleson, R. 1987. Food Survey of Mundemba Town and Ndian Estate. WWF Paper no. 1 of the Korup Project socio-economic survey - #3206/A9.

Manfredi, K.P., J.W. Blunt, J.H. Cardellina II, J.B. McMahon, L.L. Pannell, G.M. Cragg and M.R. Boyd. 1991. Novel Alkaloids from the Tropical Plant **Ancistrocladus abbreviatus** Inhibit Cell Killing by HIV-1 and HIV-2. **Journal of Medicinal Chemistry**, December 1991: 3402-3405.

Manila Declaration. 1992. Asian Symposium on Medicinal Plants, Spices and Other Natural Products (ASOMPS VII), February 1992. Manila, Philippines.

Mays, T.D., E.J. Asebey, M.R. Boyd and G. Cragg. 1993. Quid Pro Quo - A Reexamination of the Equities in the Search for New Medicines from Biodiversity. **Intellectual Property and Indigenous Rights: Alternatives for Equity and Conservation.** Lake Tahoe.

Le Messager. 1993. Korup forest gives fresh hopes for cure. Tuesday, March 16, 1993, Cameroon.
Morakinyo, A.B. 1994. Community Forestry in the Support Zone of Cross River National Park. **The Nigerian Field** 59: 95-104.

J. Mugabe, C. Barber, G. Henne, L. Glowka, and A. La Vina (eds). 1997. **Managing Access to Genetic Resources: Towards Sustainable Strategies for Benefit-Sharing**. African Centre for Technology Studies, Nairobi and World Resources Institute, Washington D.C.

La Nouvelle Expression. 1995. Guerre de controle entre Camerounais et Americains. No. 240 du 17 au 20 mars, 1995, Cameroon.

Okafor, J.C. 1992. The Korup Project Agroforestry Programme. A Report on Consultancy Work Carried out for the GTZ. 6 January - 1 February, 1992.

The Philippines Executive Order No. 247, 1995. *Prescribing Guidelines and Establishing a Regulatory Framework for the Prospecting of Biological and Genetic Resources, their By-Products and Derivatives, for Scientific and Commercial Purposes*, May 1995; and the *Implementing Rules*

and Regulations on the Prospecting of Biological and Genetic Resources, June 1996.

Posey, D.P. 1996. **Traditional Resource Rights: International Instruments for Protection and Compensation for Indigenous Peoples and Local Communities**. IUCN, Switzerland.

Reid, W.V., Laird, S.A., Meyer, C.A., Gamez, R., Sittenfeld, A., Janzen, D.H., Gollin, M.A., and Juma, C. (eds). 1993. **Biodiversity Prospecting: Using Genetic Resources for Sustainable Development**. Washington, D.C.: World Resources Institute.

Richards, P. 1996. Culture and Community Values in the Selection and Maintenance of African Rice. in. Brush, S. and D. Stabinsky (eds). **Valuing Local Knowledge: Indigenous People and Intellectual Property Rights.** Washington, D.C.: Island Press.

Richards, P. 1993. **"Indigenous Peoples"**. in: Thematic Issue of the Proceedings of the Royal Society of Edinburgh on the Lowland Rain Forest of the Guinea-Congo Domain.

Sharpe, B. 1994. Work in Progress - study of cultural perceptions of conservation in Southwest province, Cameroon.

Sharpe, B. 1997. Forest People and Conservation Initiatives: the cultural context of rainforest conservation in West Africa.

Sheldon, J.W., M.B. Balick, and S.A. Laird. 1997. Medicinal Plants: Can Utlization and Conservation Coexist? **Advances in Economic Botany,** volume 12. The New York Botanical Garden.

Sikod, Fondo. 1996. **The Structure of the Logging Industry and Sustainable Forest Management in Cameroon.** WWF-Cameroon, Yaounde.

Sunderland, T.C.H. 1997. **The Ethnobotany, Ecology, and Natural Distribution of Yohimbe (Pausinystalia johimbe (K. Schum.) Pierre ex Bielle), an Evaluation of the Sustainability of Current Bark Harvesting Practices, and Recommendations for Domestication and Management.** A report prepared for ICRAF, Cameroon.

Tchounkoue, P. and Jenkin, R.N. for Ministry of Planning and Territorial Development. 1989. **Draft Korup Project Master Plan**. Government of Cameroon, Yaounde.

Thomas, A. 1993. Report and workplan for **Ancistrocladus** cultivation, Cameroon, 1993. Missouri Botanical Garden.

Thomas, D. et al. 1994. Sustainable harvest of **Ancistrocladus korupensis** (Ancistrocladaceae) leaf litter for research on HIV. **Economic Botany** 48(4): 413-414.

Thomas, D.W. and Gereau, R.E. 1993. **Ancistrocladus korupensis** (Ancistrocladaceae): a new species of liana from Cameroon. **Novon** 3 (4): 494-498.

Thomas, D. 1992. *Ancistrocladus* in Cameroon: Taxonomy, Collection and Cultivation. Report to the National Cancer Institute.

Thomas, D., J. Thomas, W. Bromley, and F.T. Mbenkum. 1989. Korup Ethnobotany Survey. WWF.

WCMC. 1994. **Cameroon: Conservation Status Listing of Plants**. Compiled from the WCMC Plants Database, Cambridge, UK.

Wicks, C.M., J.D. Dalton and H. Macleod. 1986. Report on preliminary agricultural survey of the area around the Korup National Park in Cameroon. Bioresources, London.

Wood, C.B. 1993. **Managing the Forest Boundary: Case Study 1: Cameroon**. Overseas Development Association.

World Bank, IUCN, et al. 1990. **Conserving the World's Biodiversity**. IUCN, Gland.

Case Study 2: Sustainable Harvesting of *Prunus africana* on Mount Cameroon: Benefit Sharing between Plantecam Company and the Village of Mapanja[6]

1. Overview

Prunus africana (Pygeum) is a hardwood species native to montane forests in Africa with a range extending from Cameroon across mainland Africa to Kenya and Madagascar, and as far south as the Cape. In Cameroon, Pygeum occurs in the montane forests of the North West and South West Provinces. Pygeum has been used traditionally for carving, and to a limited extent in medicine. Over the past 20 years, the bark has been sold on the phytomedical market in Europe as a treatment for benign prostatic hyperplasia, with total sales estimated at $150 million per year. The bark of this species continues to be over-harvested for export markets due to a variety of social, political, and economic disincentives for the development of long-term sustainable sourcing strategies. At the ninth CITES Conference of the Parties in 1994, *Prunus africana* was included on Appendix II as a "vulnerable species requiring monitoring."[7]

Collections in the wild continue across Africa. In Cameroon, collections take place around Mount Cameroon, Mount Kupe, and in the Bamenda highlands, including Mount Oku and Nso. Because of unsustainable exploitation and exhaustion of supplies in North West Province, the area around Mount Cameroon has become an increasingly important source of Pygeum bark in recent years. For the most part, this exploitation has been unsustainable, with trees being felled, rather than harvested according to established sustainable techniques.

In an effort to correct this process, and generate greater benefits for local communities from the commercial use of Pygeum bark, in 1997 an agreement - "*The Agreement for Sustainable Management of the Species and Production of P.africana at Mapanja Village*" - was signed between the main purchasing company, Plantecam Medicam, and the village of Mapanja, located in an area of Mount Cameroon forest with significant remaining Pygeum populations. This agreement outlines general benefits for the village (e.g. increased revenues from higher payments per ton collected; training in sustainable management techniques) and serves the wider conservation objective of managing this species sustainably.

The main actors involved in this case are:

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[6] Research for this case study included interviews with a number of individuals whom we would like to thank. They include: Joseph Besong, Director, MCP Limbe; Del Vecchio , Director, Plantecam Mutengene; Tabi Philip, D/Director of Forestry, MINEF, Yaounde; Ngatoum Donald, DDEF/Fako, Limbe; Nkefor Joseph, MCP Limbe; Bruno Njombe Ewusi, MCP Limbe; Nkuinkeu Robert, Plantecam, Mutengene; Ekati Etoma, President, Prunus Harvesters Union, Mapanja; William Mbanda, Financial Secretary, PHUM; Elio Collins Ngoisa, Chairman, Matango Union, Bokwongo; Lifanje Moaika, Secretary, MUB; Ngale Njie Daniel, Bokwongo village; Nyime Bernard Bille, President, Likoko Membea; Ngomba John, Ekonjo village; Amalanga Sylvestre, Coordinator for Exploitation, Plantecam; Ndgemba Jean-Louis, Head of Wildlife and PA's. We would also like to thank Steve Gartlan for all of his help with this project.

[7] A.B. Cunningham and F.T. Mbenkum. 1993. *Sustainability of harvesting Prunus africana bark in Cameroon: A medicinal plant in international trade.* People and Plants Working Papers no.2. Paris: UNESCO/WWF/RBG, Kew

J. W. Sheldon, M.J. Balick, and S.A. Laird. 1997. *Medicinal Plants: Can Utilization and Conservation Coexist*? Advances in Economic Botany, volume 12. Bronx, NY: The New York Botanical Garden.

S.A. Laird. 1995. *The Natural Management of Tropical Forests for Timber and Non-Timber Products*. Oxford Forestry Institute, Occasional Papers no. 49.

- The Bakweri villages of Mapanja and Bokwongo, located in the Mount Cameroon region of South West Province, Cameroon.
- The French-owned company Plantecam-Medicam, the main purchaser of Pygeum bark within Cameroon; the company also processes bark into extracts for export;
- The Ministry of Forests and Environment (MINEF) and the Mount Cameroon Project (MCP), a local conservation and sustainable development project, which facilitated the signing of this agreement.

This case study illustrates incentive measures and benefit-sharing issues addressed in the following articles of the Convention on Biological Diversity:

- Article 1
- Article 7 (identification and monitoring)
- Article 8 (in-situ conservation)
- Article 8j (sharing of benefits arising out of the use of knowledge, innovations, and practices of indigenous and local communities)
- Article 10 (sustainable use of components of biological diversity)
- Article 11 (incentive measures)
- Article 12 (research and training)
- Article 15 (access and prior informed consent; mutually agreed terms; equitable sharing of benefits from commercial and other use)

It responds to the call for case studies in preparation of the fourth meeting of the Conference of the Parties to the Convention on Biological Diversity. In particular, it addresses:

- Decision III/18, paragraph 7: “experiences on incentive measures”;
- Decision III/14, paragraph 3:“interactions between traditional and other forms of knowledge relating to conservation and sustainable use of biological diversity; the influence of current laws and policies on knowledge, innovations, and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity; and incentive measures”; and, to a lesser extent,
- Decision III/15, paragraph 2, on access to and benefit sharing from genetic resources;

2. Description of the context

2.1 *Prunus africana* - current status and trade

At the Eight Meeting of the Plants Committee of CITES in November 1997, a summary of a report on Pygeum[8] was circulated which included the following information on current trade: between 3,200-4,900 tons of Pygeum bark are exploited annually from wild populations for export, primarily to France, Italy, and Spain, but also including the U.S.A., Argentina, Brazil, Venezuela, and Japan. Pygeum products are traded in five forms:

- unprocessed dried bark (570-580 tons/year) from Democratic Republic of Congo, Cameroon, Tanzania, Kenya, and Madagascar;
- bark extract (estimated at 14.6 tons/year extracted from 3,000 tons of bark) from Cameroon and Madagascar;

[8] Cunningham, M., Cunningham, AB and Schippmann, U. 1997. Trade in *Prunus africana* and the implementation of CITES. Summary contained in CITES document PC8 (9.1.3;9.1.4; 12; 17.2).

- herbal preparations sold as brand-name capsules in Europe, South America, USA, Australia, and other countries and regions;
- as a component in hair tonic sold in Japan;
- as sawn timber and furniture within Africa (Cunningham, Cunningham, and Schippmann, 1997).

Cameroon is the most important source of Pygeum. Exporters are SODIP and Plantecam, with the primary importers being Labatoire Debat/Groupe Fournier, France and Idena Spa, Italy. Between 1985/86 - 1990/91, Pygeum made up approximately 88% of the medicinal plant material handled by the Plantecam Medicam factory in Mutengene, South West Province Cameroon.[9]

The exploitation of Pygeum on Mount Cameroon began in 1972. The files of the Provincial Service of Forestry for the South West (now Provincial Delegation for Environment and Forestry) indicate that exploitation of medicinal plants was regulated only by Decree No. 74/1357 of 17 April 1974, which suggests a two year period of exploitation without a policy framework.

Following negotiations with the government in January 1975, Plantecam began official exploitation of Prunus in 1976, soon after it was issued a Special Permit - No.536/MINAGRI/DEFC of October 8, 1976. This Special Permit covered exploitation of 500 tons of Pygeum from both the North West and South West Provinces

TABLE 1: QUANTITY OF SOME MEDICINAL SPECIES EXPORTED IN RAW OR SEMI-TRANSFORMED STATE FROM CAMEROON 1995-97[10]

COMPANY	MEDICINAL SPECIES	TONNES 1995-96	TONNES 1996-97
AFRIMED			
	Voacanga		75,480
	Pygeum		53,900
	Yohimbe		36,648
PLANTECAM			
	Voacanga	24,371	40,414
	Pygeum	1,911,560	2,194,269
	Yohimbe	673,978	344,440
ETS ERIMON			
	Yohimbe	8,000	
Mme TCHOUKEM			
	Yohimbe	10,000	
SACO			
	Voacanga	31,000	
I.K. NDI & BROS. ENTERPRISE			
	Yohimbe		16,400 (1997)

[9] Cunningham and Mbenkum, 1993.

[10] SOURCE: Annual Reports 95/96 - 96/97: PLANTECAM; AFRIMED; P.F. Douala PORT; PDEF/South-West; D.F/Yaounde

* Quantity of raw material before extraction of active substance.

TOTAL		2,658,909	2,745,151

2.2 The Phytomedical Industry[11]

The phytomedical industry is experiencing growth of between 13.5 - 15% per year.[12] One estimate for the U.S. Herbal Medicine Industry's retail sales in 1994 came to $1,602, 790, 726. Estimates of markets in the EU are $6 billion, $500 million for the rest of Europe, $2.3 billion for Asia, and $2.1 billion for Japan.[13] Sales of herbal medicine products in China alone accounted for $5 billion in 1995.[14]

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The phytomedical industry employs conservative R&D research strategies, largely focused on temperate species with long histories of use (see, for example, Table 2.). R&D activities are limited by regulatory requirements, and a dependence upon raw materials of consistent quality for manufacturing - synthesis is not an option, as it is in the pharmaceutical industry. For the most part, therefore, access to new biochemicals and traditional knowledge in high biodiversity countries like Cameroon is not a priority for phytomedical companies.

Table 2. Top Selling Herbs in the United States, and geographic provenance[15]

Latin name	***Common name***	***Origin***
Echinacea spp.	Coneflower	North America
Allium sativum	Garlic	Central Asia/Europe
Hydrastis canadensis	Goldenseal	North America/Japan
Panax spp.	Ginseng	North America/East Asia
Ginkgo bilboa	Ginkgo	China
Serenoa repens	Saw Palmetto	North America
Aloe vera	Aloe	South Africa, Madagascar, Arabia
Ephedra spp.	Ma Huang	Warm America, Mediterranean, China
Eleutherococcus senticosus	Siberian ginseng	NE Asia
Vaccinium spp.	Cranberry	North America

[11] Many of the points made here also apply to nutraceutical, natural personal care, and cosmetic industries. A more detailed discussion can be found in ten Kate, K. and S.A. Laird. in press. *Placing Access and Benefit-Sharing in the Commercial Context: A Study of Private Sector Practices and Perspectives*. World Resources Institute and the Royal Botanic Gardens, Kew.

[12] P. Landes, 1996, Herbalgram 37, p56; Brevoort, P. 1995.

[13] IMS 1994 and Herbal Medicine Database 1993.

[14] Iwu, M. 1996. *Production of Phytomedicines and Cosmetics from Indigenous Genetic Resources: From Lab to Market.* BDCP workshop on "Commercial Production of Indigenous Plants as Phytomedicines and Cosmetics" proceedings in press. Iwu, M.M., Sokomba, E. and Akubue, P.I. (eds).

[15] Compiled from: Brevoort, 1996; A. Richman and J.P. Witkowski, 1995; D.J. Mabberley, 1987. *The Plant Book*, Cambridge University Press.

Rhamnus purshiana	Cascara sagrada	
Plantago spp.	Psyllium	
Valeriana officinalis	Valerian	Europe/Asia

However, there are a number of trends which suggest that this situation is changing. These industries are growing rapidly, as consumers become disillusioned with expensive modern health care for many disease categories, particularly chronic or poorly understood illnesses. A number of large pharmaceutical companies have bought out smaller phytomedical companies, which suggests that greater funds will be available for R&D. In addition, the regulatory environment is growing more favourable to natural products in many countries, and this is likely to make it more acceptable to incorporate new species from high biodiversity regions. All in all, it is likely that demand for access to species new to industry, and traditional knowledge as a guide to this process, will increase in the coming years.

Benefit sharing

The phytomedical industry potentially generates a range of benefits, including monetary benefits like fees, advance payments, and royalties (although not common practice to date) and non-monetary benefits such as: the development of sustainable sourcing industries in countries of origin; training in agronomic and laboratory science and technologies; improved capacity to launch and manage domestic phytomedical businesses based on local species and traditional knowledge; technology transfer in the form of extraction facilities, and laboratory technologies useful in the standardization of traditional medicine; infrastructure such as nurseries, laboratories, and equipment; and in-kind benefits such as the provision of healthcare for communities and small-scale income generating projects.[16]

Traditional knowledge, of more direct applicability to phytomedicines than to pharmaceuticals, is commonly consulted as a lead to new product development, but largely through databases and literature. To date, therefore, the link between access to traditional knowledge and benefit sharing has been severed, and indigenous peoples and local communities are rarely in direct contact with companies, and have rarely benefited from commercial products based on their knowledge.

It is likely that - given greater awareness of ABS issues, changes in regulatory environments, and in technology - this situation will change in the future, and access will more commonly be tied to benefit-sharing. Although “fair and equitable sharing of benefits” has not featured prominently in most company’s approaches to date, there are in fact numerous ways in which this industry can contribute benefits to countries from which species originate, and local communities and indigenous peoples whose knowledge guided researchers.

Perhaps the most significant benefit in the long term is technology transfer and the building of domestic capacity in high biodiversity

[16] It is important to be cautious in assessing the benefits that might result from this industry, however. Benefits for high biological and cultural diversity countries cannot be extrapolated from the size and growth projected for these industries, since a large proportion of this growth - as discussed above - will be based upon common and widespread species, most of them temperate. Also see warnings in the Conclusion on the need to design ABS measures which take note of the differences between industries, such as the pharmaceutical and phytomedical.

countries, through partnerships with the private sector. The World Health Organization estimates that 80% of the world's population relies on traditional medicine and 85% of traditional medicine is based on plants. In many high-biodiversity countries, efforts are underway to study and standardize traditional medicines in order to provide affordable, effective, and culturally-appropriate local healthcare[17] This is particularly important in areas where traditional knowledge is under threat.

In South Africa, for example, a domestic phytomedical company - South African Druggists - has established a subsidiary to develop phytomedicines based on traditional knowledge[18]. In Nigeria, a joint venture between BDCP and the Healers' Collective have launched Axxon Biopharm. It is an independent commercial project which will offer standardized and highly purified extracts and botanicals to the international phytomedicines, nutraceuticals and personal care markets. On the home market it will produce high quality phytomedicines based on the original formulations of the healers but with state-of-the art quality control[19].

The bulk of commercial companies operating in the phytomedical, nutraceutical, natural personal care and cosmetic industries are located in northern countries. Through partnerships and collaborations with high biodiversity countries, these companies can contribute significant benefits in the form of capacity building, technology transfer, and training for business development that can assist in the development of domestic industry.[20] Access to genetic resources for screening in the pharmaceutical industry can also be linked to benefit-sharing that contributes to capacity building in the domestic phytomedicine sector.

2.3 The Villages

The village of Mapanja signed its agreement with Plantecam in July 1997; Bokwongo village signed in September 1997. Both of these villages, and the others in the area around Mount Cameroon where Pygeum exploitation is taking place, are primarily Bakweri, with less than 500 people. The population is principally farmers of crops - including coco yams, yams, plantains, and huckleberry - for subsistence use and sale in local markets.

The Village Traditional Council served as the main negotiating and administrative body for this agreement. Each village also has access to numerous professionals (lawyers, business people, etc.) with expertise in these areas; they may live away in towns and cities, but keep close ties with the village. In order to channel financial benefits resulting from this agreement, each village established a Village Development Fund. The process of developing these agreements also led to the formation of the Prunus Harvester's Union, made up of village bark collectors, and its Union Fund. A Monitoring Committee was also

[17] See examples discussed in M. Balick, E. Elisabetsky and S.A. Laird. 1996. *Medicinal Resources of the Tropical Forest: Biodiversity and its Importance to Human Health*. New York: Columbia University Press; Iwu, 1996.

[18] See Laird and Wynberg, 1996.

[19] Iwu, pers. comm., 1997

[20] In some countries, such as South Africa, the development of this kind of domestic industry has spurred a valuable discussion about domestic companies' ABS obligations under the CBD, and issues relating to sustainable supplies of raw material for product manufacture (Laird and Wynberg, 1997).

established. In order to negotiate and implement this agreement, therefore, a great deal of capacity and institutional-building was required. The process of fine-tuning these institutions to most effectively serve the long term needs of the community is on-going.

3. Purposes and objectives of the benefit sharing arrangements

Although the local population around Mt. Cameroon exploited Pygeum for traditional carving, construction, and medicine, large-scale collections began with Plantecam's commercial interest in the bark in the 1970's. Plantecam established a system of training collectors to sustainably harvest bark from opposing quarters of a tree, and enforced this while its monopoly on exports lasted. However, in an effort to generate greater benefits for Cameroonians, the government extended export licenses to three domestic companies in 1993. These companies often worked with contractors and buyers with little interest in long-term bark sustainability.

By 1994, massive illegal exploitation of Pygeum was taking place around Mt. Cameroon. This was due to the following factors:

- The 1993 extensive of export licenses to companies with little interest in the sustainable sourcing of Pygeum.
- A shortage of Pygeum trees in the North-West Province, the source of the bulk of bark to date, due to local over-exploitation of Pygeum and degradation of forests due to encroachment from agriculture. As a result, contractors with exploitation permits moved into the Mt. Cameroon region to meet their quotas.
- The granting of Special Permits to companies other than Plantecam for exploitation on Mt. Cameroon: Two Companies - SOCO and MEBA - were issued special permits to exploit Pygeum at Muyenge and Ekona-Muyuka respectively. The zone granted to SOCO fell within the Plantecam area, while Pygeum trees are not found around Ekona. This led to illegal exploitation.

Based on reports consulted at Plantecam and the Provincial Delegation of Environment and Forestry in Buea, there was a marked increase in Pygeum bark supplied by individual contractors to Plantecam from 1993 (2,575,176 kg) to 1994 (4,170,309 kg). Despite the fact that Pygeum was no longer exploited in the North West and Western Provinces, the quantity supplied by individual contractors continued to increase. This suggests a massive increase in harvesting in the Mt. Cameroon region.

In the villages around Mount Cameroon, there was limited concern at the level of exploitation, and some villagers actively collaborated with middlemen, supplying them bark. Because these activities were largely illegal, there was little or no control over the harvesting, and a resulting high level of felling of trees to collect the bark. Prior to 1994, villagers had not been actively involved with bark harvests, or with Plantecam, beyond the granting by Traditional Village Councils of permission for collections. In return, Plantecam supplied Village Councils with around 125,000 CFA for a period of two years. Therefore, with the new events, and villagers' active collaboration with middlemen, it made sense to link villages directly with Plantecam, and draw them into a system of sustainable and legal exploitation of Pygeum bark. In this way, communities might better control access to Pygeum trees, might receive benefits from commercial exploitation, and so incentives would exist for sustainable management of Pygeum populations.

4. Process for establishing the arrangements

The plan to bring local communities under Plantecam's license for bark collections developed in 1994, and was further investigated in a study sponsored by Plantecam to look into this possibility in 37 villages around Mt. Cameroon. The study was conducted by a team from Plantecam, Ministry of Environment and Forests (MINEF) and Mount Cameroon Project (MCP). One of the primary findings was that such a system would most likely succeed in villages on the Eastern slopes of the mountain, including Mapanja and Bokwongo villages.

The initiation of this system began in Mapanja village with the following steps: perception gathering; conflict mapping and identification of common ground; building on the common ground to set up a harvesting system; and putting in place a participatory monitoring and evaluation system. Perception gathering was done by meeting all stakeholders separately and having general feedback meetings. Setting up the harvesting system involved training of the villagers in proper harvesting techniques, organizing them into manageable groups, and agreeing with Plantecam on the modalities for exploitation, including quotas.

This process culminated in the signing of two contractual agreements between Plantecam and Mapanja village (July 1997) and Bokwongo village (September 1997) for the harvesting and supply of Pygeum bark under Plantecam's license, with a view to guarantee sustainable management of Pygeum, and generate greater long-term benefits from exploitation for the local communities. There remain conflicting opinions on the best strategy for incorporating other villages at this stage: does Plantecam sign a single agreement binding all villages, or continue to sign agreements separately with each village?

5. Content and implementation of the arrangements

The first agreement - *Agreement for the Sustainable Management of the Species and Production of African Prunus at Mapanja Village facilitated by Mount Cameroon Project (MCP) and Ministry of Environment and Forest (MINEF)* - was signed in July 1997 by Plantecam and The Prunus Harvesters of Mapanja village.

Under the terms of this agreement, the Prunus Harvesters' Union harvest bark in place of Plantecam's recruited workers, and sell the bark to Plantecam at the rate Plantecam buys from middlemen with special permits (209 CFA per kg). These middlemen used to buy bark from villagers at a much reduced price (100 CFA per kg). Therefore, the Union members (about 60)now receive a higher price for their produce.

Article 2(D) of the agreement provides for a maximum monthly tonnage of 10 tons to be supplied by the Mapanja Harvesters Union to Plantecam. Each villager can harvest a maximum of 30kg a day, and from this must contribute 2kg to the Village Development Fund and 1kg to the Union's Fund. Each member retains 27 kg, for which they are paid 209CFA/kg (weight measured at Plantecam). Bark harvesters must also pay 10CFA/ kg for transportation from their village to the company's factory at Mutengene, and 10% of total tonnage as exportation tax. After all deductions have been made, each bark harvester receives a wage of about 35.000CFA a month assuming that he supplied his 27kg.

As a result of 2kg per every 30kg bundle payments by each bark harvester to the Village Development Fund, the Fund had a sum of about one million CFA just 5 months after it was set up. The villagers intend to use this money for the realization of a long-awaited water project.

In addition to the monetary benefits accruing to the village in the form of higher payments per kg, and resulting magnification of these benefits in the form of a Village Development Fund, the following non-monetary benefits have resulted from this agreement:

- **Training**: Bark harvesters have been trained to harvest the bark sustainably, and monitoring is on-going to ensure these methods are adhered to. Monitoring is undertaken by a joint team made up of staff from Plantecam ,MINEF, MCP, as well as villagers. Training has also taken place in financial accounting and management of relationships with companies.

- **Capacity and institution-building**: Considerable institutional and capacity building has taken place to improve village structures. The Village Development Fund, Prunus Harvesters Union and its Fund, and the Monitoring Committee were established as part of this process. There exists greater awareness of the long term benefits of sustainable harvests of bark under this new agreement with Plantecam, and capacity to realize the benefits on a local level.

- **Infrastructure and equipment**: In some of the less accessible villages, such as Ekonjo, Plantecam has helped in upgrading the roads to improve accessibility. Assistance has also been provided in the building of community halls. Equipment supplied to communities includes cutlasses and climbing gear of use in collections.

TABLE 3. BENEFITS RESULTING FROM THE AGREEMENT

	MONETARY	
	SHORT TERM	**LONG TERM**
VILLAGES	increased income	Village Development Fund and the Union Fund
PLANTECAM		
GOVERNMENT OF CAMEROON	increased tax revenues	on-going tax revenues from a sustainable industry
	NON-MONETARY	
	SHORT TERM	**LONG TERM**
VILLAGES	training; capacity- and institution-building; infrastructure and equipment	increased capacity to share in benefits from Pygeum exploitation, and improved institutions; infrastructure improvements such as the water project
PLANTECAM		assured supply of Pygeum bark

GOVT. OF CAMEROON	reduced illegal exploitation	reduced illegal exploitation

6. Policy Context

Since 1974 the legal and policy framework for Pygeum has been in constant flux, with a number of different measures influencing the manner in which Pygeum is harvested and local communities benefit from this exploitation. These include the following:

TABLE 4. GoC MEASURES RELEVANT TO THE CASE OF PRUNUS AFRICANA

Decree No.74/357, 17 April, 1974 - Sections 74, 97 98 - Regulates the exploitation of medicinal plants.

Law No. 81-13 , 27 November 1981 - Lays down Forest, Wildlife and Fisheries Regulations

Decree No. 83-169, 12 April 1983 - Lays down Forestry Regulations

Arrete No.48/A/MINAGRI/DF, 28 February 1991 - Banned the exploitation of Prunus in Cameroon (exempting Plantecam)

Arrete No. 48/MINAGRI/DF ,14 February 1992 - Lifted the ban on Prunus exploitation

Decision No. 0045/MINEF/DF, 11 January 1993 - Banned felling in the exploitation of Prunus

Law No. 94/01, 20 January 1994 - Lays down Forestry, Wildlife and Fisheries Regulations

Decree No. 15/ 531/PM, 23 August 1995 - Lays down Forestry Regulations

Although some of the earlier Ministerial decisions still apply to the exploitation of Pygeum, such as the 1993 Decision No. 0045/D/MINEF/DF to ban felling in the exploitation of Pygeum bark, the main legal framework today is provided by Law No. 94/01 of 20 January 1994.

Cameroon became a Party to the Convention on Biological Diversity (CBD) at around the same time the World Bank was exerting pressure to reform the country's forest policy. As a result of these events, the government adopted a new Forestry Law No. 94/01 of 20 January 1994 on Forestry, Wildlife and Fisheries. The 1994 law is considered a major improvement on the previous 1981 Law, since it attempts to at least address the need to rationalize the forestry sector, conserve and sustain biological resources, increase the contribution of forest resources to development, and to improve the lives of local communities and forest dwellers. Despite these improvements, over-exploitation of forest resources continues since effective implementation of the law has not yet been achieved.

While the procedure for the exploitation of Pygeum remains basically the same as in the 1981 Forestry Law, the 1994 Law introduced two major changes for all special forest products: 1) The applicant must be granted approval first for forest exploitation activities(S.41 of the law) from the Prime Minister's office, and then seek permission from MINEF - this creates a two-tiered system of control; and 2) The

Provincial Chief of forest must attach a technical report which specifies the species to be exploited, their quantities, the area in which exploitation will take place, and the harvesting modalities (Art. 59(2b) of decree of application).

In addition to these provisions, the 1994 Law goes further in introducing articles on financial and fiscal measures for the benefit of local communities i.e S.67(2) and 68(2)and(3). These articles grant benefits to local councils, however, which means they will not always find their way to the local population.

Community-control over forest resources is generally in flux as a result of the 1994 Forestry law innovation of “Community Forests” (Article 37). The 1994 Forestry Law classifies the national forest estate into two categories of forest: permanent and non-permanent forest. The non-permanent forest includes: communal, community and private. The application of the provision relating to community forests is complicated by ambiguity in the definition of “community”. Both the Law and its decree of application see “community’ as an entity provided for under existing Cameroonian legislation (Article 28.2). A draft MINEF manual on procedures and norms for the attribution and management of community forests defines a community as “a legal entity duly registered under the existing legal text as either an association, co-operative, common initiative group, or economic interest group.”

In general, to date the policy framework has not created mechanisms for sharing benefit with local communities, and as a result little incentive exists for them to conserve or sustainably harvest populations of Pygeum or other medicinal plants.

7. Impact on Conservation

It is felt by people in the villages of Mapanja and Bokwongo that illegal and unsustainable harvesting of Pygeum bark in their area, including felling of trees, has greatly declined since these agreements were signed with Plantecam. In addition, it is felt that relations have improved between the elders and youth of the village, and the establishment of the Village Development Fund, and improved capacity in areas of sustainable management and Fund management, show prospects for long-term benefits for the Village from Pygeum bark collection. If the village can support itself from sustainable extractive activities, pressure to unsustainably hunt or harvest forest products from the forest might abate.

However, bark exploitation has caused serious damage to Pygeum, which has relatively low population densities, and is found in afromontane forest areas very limited in size. Although they are an important step in the move towards sustainable management of Pygeum populations, the conservation of wild populations of Pygeum will not be accomplished by the agreements between Mapanja and Bokwongo villages and Plantecam alone, nor agreements with all villages in the area. In addition, a few other specific measures must be undertaken:

Sustainable harvesting quotas must be established.

A baseline inventory of Pygeum stock has never been conducted, which means that quotas are set in ignorance. Inventories must be conducted to establish reasonable harvesting levels for Pygeum. In order to ensure sustainability, it is imperative that the competent authorities do an inventory of actual stock or refer to all available information on

quantity of Prunus and yield estimates so that appropriate exploitation quotas are set.

Increased cultivation to meet global demand.
Although other herbal medicines - such as saw palmetto, *Serenoa repens* - compete in the marketplace with Pygeum, demand does not show signs of lessening - although this should be confirmed by market studies. It is critical, therefore, that additional efforts to cultivate Pygeum with villages be initiated. Already, efforts to cultivate Pygeum have expanded in both North West and South West Province Cameroon, with estimates of numbers of small farmers cultivating this species at 3,500.[21] It will be important, however, as part of a wider market survey, to estimate volumes of cultivated bark coming onto the market from existing plantings of Pygeum.

The commercial exploitation of Pygeum can generate benefits for local communities in a manner which provides incentives for conservation of species and, in providing an alternative income based on sustainable use, for local forests and the biodiversity the contain. However, the most immediate connection between biodiversity conservation and Pygeum, is related to sourcing problems associated with an international demand which exceeds cultivated supplies, and likely wild sources in the not too distant future. Most pressing, then, is the need to develop ecological, commercial, and socio-economic strategies that promote and make possible the sustainable exploitation of this species.

The concerns outlined above, and illustrated through this case study, are addressed in recent recommendations for implementation of inclusion of Pygeum in Appendix II CITES, presented at the Eighth Meeting of the Plants Committee in November 1997:

i) the monitoring of the trade in Pygeum;
ii) assistance to forestry departments to establish sound management and cultivation of the species;
iii) raise awareness within important countries and companies on the impacts on forests and Pygeum populations of wild harvests;
iv) to achieve legal recognition of legitimate growers of Pygeum within exporting countries and internationally;
v) to obtain more information on the trade from Tanzania, Equatorial Guinea, and Democratic Republic of Congo.[22]

The recommendations to CITES also include that the CITES Scientific Authorities contact importing countries and all companies selling herbal preparations based on Pygeum to give them information on the impact of wild sourced bark, and the potential need for commercial cultivation in Africa as a sustained source of bark and revenue for the countries involved (III.2); it also recommended that the IUCN/SSC Medicinal Plant Specialist Group liaise with the European-American Phytotherapeutic Coalition (EAPC) to increase awareness about the conservation implications of bark exploitation from wild populations (III.3); industry should also be encouraged to assist in financing inventories and sustainability studies (III.4).

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[21] Sunderland, T. and J. Nkefor. 1997. *Conservation Through Cultivation. A Case Study: The Propagation of Pygeum - Prunus africana*. Paper presented at the Tropical Agriculture Association Biennial Seminar, Oxford, September 1997.
A Strategy for the Conservation of *Prunus africana* on Mount Cameroon-Technical papers and Workshop Proceedings' Mount Cameroon Project, February 1996.

[22] Cunningham et al, 1997.

Included in this dialogue with industry might be awareness-raising on benefit-sharing issues and the changing legal and policy frameworks in which these activities take place under the Convention on Biological Diversity. Companies should also be encouraged to participate and contribute private sector perspectives to the international dialogue striving to operationalize the concept of "fair and equitable sharing of benefits".

8. Policy recommendations/lessons learned

This case demonstrates problems associated with species brought into international phytomedical markets with high demands for raw materials. The incentive to over-harvest the species in the wild is created by social, economic, and political factors which are often complex to address, as persistent sustainability problems associated with Pygeum across Africa attest. The agreements between Plantecam and the villages of Mapanja and Bokwongo are a solid effort to tackle some of these issues. In order for these two-party agreements to be effective over time, however, they must be part of a wider national and international policy framework.

Land tenure is also an important factor in this case. The land tenure system in Cameroon provides for three legal categories of tenure: state property, private property, and national lands which can be communal holdings or open access. Pygeum is found in forests falling within all of these categories. In open access areas and common property areas, conflict and confusion might continue since it is not clear who holds exploitation rights. At present, villages can only engage in the commercial exploitation of Pygeum under Plantecam's permit, in areas where Plantecam has the right to operate. One way in which the GoC can minimize this problem is by specifying exploitation areas as well as the quantity to be harvested in each exploitation area, something it has not done to date.

Earlier efforts to address benefit-sharing by the GoC took the form of issuing larger numbers of exploitation permits to Cameroonians, with the idea that this would increase benefits accruing to local parties. This backfired, resulting in increased widespread and unsustainable exploitation. These agreements - by addressing the issue at the level of communities living in proximity to Pygeum populations - are more likely to generate lasting benefits for the conservation of biodiversity and sustainable development in this region.

Conclusion: The *Ancistrocladus korupensis* and *Prunus africana* Case Studies from Cameroon: Contrasting Benefit-Sharing in the Pharmaceutical and Phytomedical Industries

The cases of *Ancistrocladus korupensis* and *Prunus africana* illustrate some of the significant differences between benefit-sharing resulting from pharmaceutical R&D and commercial product development, and that associated with phytomedicines, including:

- *Links between access and benefit sharing.* Under the CBD and most national ABS measures, access to genetic resources on the part of the pharmaceutical industry is linked with benefit sharing; in the case of phytomedicines, this link is more likely to be severed, since companies do not usually seek access to large numbers of samples through field collections, and are guided primarily by traditional knowledge and

natural products research results acquired from databases and literature reviews.

- *National measures addressing access and benefit-sharing.* National ABS measures to date tend to orient benefit-sharing provisions towards those resulting from the pharmaceutical and biotech industries, although some of these are applicable to phytomedical companies, as well.
- *Size of financial revenues generated by the industry as a whole, and financial benefits deriving from any one product*. The pharmaceutical industry is magnitudes larger than the phytomedical, and financial revenues, and therefore potential benefits for countries of origin, generated from a single product are many times that of a single phytomedicine.
- *Chances of developing a commercial product*. The odds of developing a pharmaceutical product are slim, estimated at 1 in 10,000 samples screened. Therefore, R&D "process" benefits are of central importance in the case of pharmaceuticals. Phytomedical R&D does not involve large-scale random screening of compounds, and is directed towards species of known interest, often with long histories of traditional use, so chances of product development per species studied are greater. Long-term benefits are therefore more likely than in the case of pharmaceuticals.
- *Value of traditional knowledge to R&D*. Traditional knowledge serves as a direct lead for most new phytomedical product development, while in the pharmaceutical industry its role tends to be more peripheral and supplementary. Both industries consult literature and databases, which usually severe links between access and benefit sharing.
- *Process benefits*. Although they may vary in type, process benefits resulting from R&D collaborations can be built into both pharmaceutical and phytomedical partnerships.
- *Sourcing of raw material.* Phytomedical companies will continue to require affordable and reliable sources of raw material for manufacturing purposes, which is not always the case with pharmaceutical products. Benefit sharing packages should include long-term sustainable sourcing and value-added industries in countries of origin.

The primary benefits in the case of *A. korupensis* to date have been R&D "process" benefits which reflect the general approach outlined in the NCI's LOC (research collaborations, seeking in the country of origin the first source of raw material, etc.), and the need for NCI to ensure a sustainable supply of raw material for further testing. The latter resulted in larger investments in ecological, taxonomic, propagation, and cultivation studies than had previously been supplied by NCI. In this sense, benefit-sharing was linked to access, although the LOC had not been signed, the UNCED was five years in the future, and relevant ABS provisions were not to feature in Cameroonian law for another seven years. Benefits did accrue primarily to the area (Korup), and the country in which collections took place. NCI did not, for example, set up propagation and cultivation studies in neighbouring Nigeria at this time.

In the case of *Prunus africana,* however, commercialization of the bark took place more than 20 years ago. As a result, a framework did not exist which linked original access to benefit sharing. Although ABS measures have largely addressed pharmaceutical demand for access to genetic resources, it is possible that "prospecting" by phytomedical companies in the future will also be covered by these measures, and collectors will be required to

receive prior informed consent (PIC), and equitably share benefits. The phytomedical industry can also generate R&D "process" benefits for collaborators, such as the sharing of laboratory results, collaboration in the R&D process, and building of local capacity in this area.

Given the severing of the link between access and benefit sharing in the case of *Prunus africana,* concerns relating to the fair and equitable sharing of benefits, sustainable development, and the conservation of biodiversity (CBD, Article 1) today primarily revolve around the demands of a well-established market on a limited population of a desired species. The sourcing of raw material, therefore, must be made sustainable in order to allow both for the survival of *P. africana,* and in order to provide greater benefits for Cameroon and local communities in the form of capacity building, training, value-addition to materials, and larger tax revenues.

Long-term financial benefits in the form of royalties may or may not result from the *Ancistrocladus korupensis* case, given the continued commercial uncertainty of michellamine B. This case provides an example of the uncertain and small odds that a compound will develop into a commercial pharmaceutical product. Should financial benefits in the form of royalties result, however, they might prove far greater than revenues generated by the phytomedical industry within Cameroon. *Prunus africana* will not generate royalties for Cameroon or local communities, but in the future measures could require that development of phytomedical products lead to the sharing of financial benefits. While these will be a great deal smaller than any pharmaceutical royalty, the odds of developing a commercial product from collections undertaken within Cameroon are far greater. Given the importance of traditional knowledge in the phytomedical industry, it is also critical that benefit-sharing arrangements include local communities and indigenous peoples.

At the same time, governments must be cautious in regulating the phytomedical industry, and must manage expectations, because:

- R&D programs operate on a much smaller scale and with budgets a fraction of the size of those common to the pharmaceutical industry;
- The existing regulatory atmosphere and sourcing needs of companies discourages investment in research on new species from high biodiversity regions; and
- Smaller commercial revenues from products means that companies have less to share at the end of the day.

In the case of both pharmaceutical and phytomedical R&D and commercial product development, governments should seek as their primary objective the promotion of partnerships which build capacity within high biodiversity countries to work at a higher level in these industries (and not solely as raw material suppliers), and to improve and increase research on areas of domestic importance (e.g. standardizing traditional medicine; developing affordable plant-based phytomedicines for domestic markets; building industries which make use of biodiversity; conducting research on tropical diseases). In this way, benefit-sharing will more likely lead to the creation of incentives for biodiversity conservation and sustainable development over time.

Table 2. Benefit-sharing in the Cameroon Cases of Ancistrocladus korupensis (potential pharmaceutical) and Prunus africana (existing phytomedicine).

Benefits	**Articles in the Convention on Biological Diversity**	**The Philippines Executive Order no.247 and IRR's**	**The Andean Pact Common System on Access**	**The Cameroon Forestry Law No. 94/01 and Law No. 96/12** **and 1993 MINEF letter to NCI**	**The National Cancer Institute Letter of Collection (and "process" benefits from A. korupensis case not addressed in LOC)**	**Prunus africana: benefit-sharing under the 1997 agreement between Plantecam and the villages of Mapanja and Bokwongo**
MONETARY **Fees, royalties, and financial benefits**		Article 8.1.14; 8.2.2		Article 12, Law 94/01	Sections 8) and 12)	Higher payments/ton for bark; increased income for Village Development Fund; increased tax revenue for the GoC
NON-MONETARY **Participation of nationals in research**	Article 15.6, 19.1	Article 8.1.12	Article 17.a	Article 65, Law no. 96/12	Section 4) University of Yaounde, National Herbarium, the Korup Project	
Sharing of research results	Articles 15.7; 17; 19.2	Article 8.1.9	Article 17.d; 17.h	1993 MINEF letter to NCI	Section 1) GoC University of Yaounde	

Benefits	**Articles in the Convention on Biological Diversity**	**The Philippines Executive Order no.247 and IRR's**	**The Andean Pact Common System on Access**	**The Cameroon Forestry Law No. 94/01 and Law No. 96/12** **and 1993 MINEF letter to NCI**	**The National Cancer Institute Letter of Collection (and "process" benefits from A. korupensis case not addressed in LOC)**	**Prunus africana: benefit-sharing under the 1997 agreement between Plantecam and the villages of Mapanja and Bokwongo**
Voucher specimens left in national institutions		Article 8.1.2	Article 17.g		National Herbarium, Yaounde	
Support for research into conservation and sustainable use			Article 17.b	Article 64, Law 96/12 1993 MINEF letter to NCI: propagation and cultivation research	Research into *A. korupensis* sourcing 1992-1997	Development of quotas, limiting harvest of *P. africana*; research and training in sustainability issues
Technology transfer, including biotech-nology	Article 16		Article 17.c.9	1993 MINEF letter to NCI: development of natural products R&D capacity	Korup, and the University of Yaounde - nursery and laboratory	
Strengthen institutional capacity, including training	Article 18		Article 17.e	1993 MINEF letter to NCI: training	Some training in collection, ecology, cultivation research	The Village Development Fund was initiated by this process, as was

					- Korup Project and University of Yaounde	the Prunus Harvesters' Union, and the Union Fund.

Benefits	**Articles in the Convention on Biological Diversity**	**The Philippines Executive Order no.247 and IRR's**	**The Andean Pact Common System on Access**	**The Cameroon Forestry Law No. 94/01 and Law No. 96/12** **and 1993 MINEF letter to NCI**	**The National Cancer Institute Letter of Collection (and "process" benefits from A. korupensis case not addressed in LOC)**	**Prunus africana: benefit-sharing under the 1997 agreement between Plantecam and the villages of Mapanja and Bokwongo**
Strengthen the capacities of indigenous peoples and local communities			Article 17.f	Article 65, Law 96/12		Training of local communities in sustainable harvesting techniques
Access by nationals to all national specimens located in international *ex situ* collections		Article 8.1.4		1993 MINEF letter to NCI: requesting information on all live plant collections conducted in Cameroon		
Receipt by Providers of all technologies developed from endemic species		Article 8.1.13				
Equipment donation to		Article 8.1.3		1993 MINEF letter to	Korup and University of	

national institutions				NCI: field herbarium at Korup	Yaounde	

Benefits	**Articles in the Convention on Biological Diversity**	**The Philippines Executive Order no.247 and IRR's**	**The Andean Pact Common System on Access**	**The Cameroon Forestry Law No. 94/01 and Law No. 96/12** **and 1993 MINEF letter to NCI**	**The National Cancer Institute Letter of Collection (and "process" benefits from A. korupensis case not addressed in LOC)**	**Prunus africana: benefit-sharing under the 1997 agreement between Plantecam and the villages of Mapanja and Bokwongo**
Sharing of benefits arising out of the use of knowledge, innovations, and practices of indigenous and local communities	Article 8j			Article 65, Law 96/12 (implied)		General recognition of the need to benefit local communities which live in the area, and manage local forests
Seeking within the country of origin the first source to supply raw materials for R&D, and manufacture				1993 MINEF letter to NCI	Section 10)	The company will only purchase bark from the villages' Prunus Harvesters Unions
Development of local income-generating schemes;				Article 65, Law 96/12	Development of sustainable sourcing, agroforestry schemes	Increased income based on now sustainable system of resource

short-term employment					at Korup; some short-term employment	extraction