

Cameroonian NTFPs: Selecting Species/Products for International Market Development Proposed Next Steps for CARPE/IR1

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One of the objectives of CARPE IR1 is to expand understanding of how communities in the Congo Basin it is working in can generate income sustainably while not exacerbating forest degradation in the Basin. Experience elsewhere has demonstrated (BCN, 1999) that the commercialization of Non-Timber Forest Products (NTFPs) in order to serve conservation and development objectives is neither simple, nor does it always accomplish the intended objectives. Increased exposure to markets might increase per capita income, for example, but lead ultimately to unintended and potentially destructive; collection of NTFPs for markets might primarily benefit outside collectors and only minimally improve the livelihoods of communities living around the forest. Where producers abandon other activities for NTFP trade, should the latter collapse they might be left worse off than before (Browder, 1992). In view of the poorly understood ecology of most tropical forest species, it is also common for marketing strategies to create pressure on wild populations, or even alter the composition of forests (Peters, 1996).

On the other hand, recent research in Cameroon highlights that some NTFPs can promote biodiversity objectives to a greater extent than other income-generating activities. Cocoa cultivation, for example, not only minimizes damage to soil resources but "in terms of carbon sequestration and below- and above-ground bio-diversity, the cocoa agroforest is superior to the competing food crop production land use based on the practice of slash-and-burn" (B. Duguma, 1999).

NTFPs are managed, consumed, and traded within a range of ecological, cultural, socioeconomic, and marketing contexts, and selection of species to serve the communities best for conservation and development purposes poses a number of dilemmas. First, it must be determined which species within IR1 zones have both sustainable economic development and harvesting potential. Secondly, once species are identified, how can a determination be made on whether harvesting can be ecologically sustainable?¹ Third, which market outlets exist for these species that at the same time encourage, or at least facilitate these sustainability goals in IR1 zones?

In the case of CARPE, the Limbe Workshop Species list provides the starting point for potential selection of NTFPs for IR1 (see Wilkie 1999, in Sunderland et al 1999). The challenge for IR1 is to develop a methodology for narrowing down species, or products, to work with that both build on the Limbe workshop results, and are "operationalizable" given CARPE budget constraints. The latter involves creating the "infrastructural" conditions for successful chain of value addition from harvesters to consumers (this issue will be touched upon here and will require further work in the future). CARPE can contribute to NTFP development in the Congo basin by building upon the results of its recently conducted mapping exercises (see recommendations below).

¹ These questions are consistent with the model presented by Cunningham at the Limbe Workshop (May, 1998) reported on by Wilkie in "Non Wood Forest Products of Central Africa: Current Research Issues and Prospects for Conservation and Development". Sunderland, Terry, Laurie Clark, and Paul Vantomme, FAO , Rome, 1999

CARPE IR1 enlisted a team of consultants to consider ecological, marketing and socioeconomic aspects of the CARPE IR1 program, and develop selection criteria for ranking the species/products that merit further investigation in terms of international market reconnaissance (local and regional markets while not less important were not included due to ongoing work other CARPE partners are doing). As a result of this complex array of factors, rough selection criteria were drafted – based on the experience of a range of groups and individuals working with NTFP trade and marketing – according to which products might be selected for further attention from CARPE IR1.

The identified priorities of local communities and collaborating projects within Cameroon are clearly the starting point for selection of products. Local priorities must then be twinned with CARPE's objectives to mitigate threats to species and ecosystems, and improve livelihoods through the generation of alternative income.² The team considered a list of 25 species/products that included both NTFPs and a few agricultural products (more specifically, organic cocoa and coffee). Then, the team scored each species based on the selection criteria, starting out with "cross-cutting" criteria such as:

- importance of species/products to Cameroonian communities and on-going projects
- potential to contribute to conservation and sustainable development (livelihoods) by mitigating threats to species
- generating alternative income sources, providing communities with improved livelihoods.

A full set of marketing, ecological, and sociological criteria were applied to species and the team came up with 12 products to look at in terms of potential and for which international marketing data might be readily available or particularly useful to partners within Cameroon. Product sheets were prepared for 7 of these:

Aframomum spp.*

Cola spp.

Eremospatha macrocarpa, *Laccosperma secundiflorum* - rattan*

Garcinia kola

*Pausinystalia johimbe**

*Physostigma venenosum**

Picalima nitida

Piper guineensis

*Prunus africana**

Ricinodendron heudelotii

*Strophanthus gratus**

Sustainable Cocoa*

* product sheet prepared; see annex

This product-specific research provides an informational base from which decisions to proceed can be made and a baseline that can be updated as new information is gathered. For example, the market for sustainable or organic cocoa from Cameroon in the U.S. and Europe is increasing as food manufacturers are looking to introduce more organic food products in response to demand from consumers. The medicinal plant species have great potential in an expanding herbal medicine market, which globally is

² There has been, and still is, considerable theoretical debate as to whether enhance livelihood exacerbates or reduces local resource user pressure on biodiversity. IR1's position is that if livelihood enhancement activities (such as NTFP development, for example) are "properly" designed (see Brown and Wycoff-Baird, 1992), then increased offtake and unsustainable consumption of high value forest products need not automatically result.

close to \$22 billion³. The green and fair trade marketing trend continues to grow, creating more opportunities for NTFPs and environmentally-friendly agricultural crops. But much more work on methodology and basic information gathering needs to be done. The progress made here will help in gaining a better understanding of how to analyze the opportunities for developing markets for key NTFPs coming from the region. Next steps for CARPE IR1 or the overall CARPE could include the following:

- further and more intensive marketing research on selected species in conjunction with CARPE "state of knowledge" (SOK) studies, resulting in "product packets" with comprehensive data on companies, prices, markets, so that comparative (and competitive analysis) can be conducted for selected species/products and allow decisions based cost/benefit analysis ;
- research on local trade networks and socioeconomic, ecological, and cultural features of product use and trade – to be combined with the above "product packets" to form a comprehensive informational and technical basis from which projects and communities can make informed decisions, given local considerations, on how to proceed with marketing (or, based on this information, to avoid it altogether) ;
- facilitation of links between projects and environmentally or socially responsible companies;
- facilitation of links between projects and certifiers and accrediting organizations, in order to develop "green", "fair trade", or "organic" labeled products with significant and appropriate markets overseas;
- support for domestication efforts where marketing appears likely to stress wild populations;
- support for efforts to produce local training manuals, workshops, and other forms of capacity building to assist in more effective participation in trade, and sustainable harvest techniques in the wild.

³ This is based on a forecast made by Givernwald (see *Nutraceutical World*, January-February 1999), who estimated the market for herbal medicinals in Europe at \$7.2 billion in 1997.

Step-by-Step Guide for NTFP International Market Research

I. First, select products for market research based on the following cross-cutting criteria:

- A. The importance of species/products to Cameroonian communities and on-going projects**
- B. The potential to contribute to conservation and sustainable development (livelihoods) by**
 - Mitigating threats to species;
 - Mitigating damage to ecosystems;
 - Generating alternative income sources, providing communities with improved livelihoods;

II. The second step is to narrow down products according to specific *marketing* criteria

- A. Identify the existing markets? Are they local, regional, or international?**
 - local (within Cameroon)
 - regional (West-Central African markets)
 - international (U.S., European, and other commercial/industrial markets)
- B. Categorize the range of sectors in products selected:**
 - pharmaceutical
 - botanical medicine
 - cosmetic
 - food and beverage
 - agricultural commodity, etc.
- C. Rank marketing opportunities: LOW/MEDIUM/HIGH**
 - international demand significant;
 - can make significant changes in sustainability and equity with small modifications in marketing chain;
 - processing and value-added;
 - marketing by-products;
 - marketing information;
- D. Rank marketing difficulties – LOW/MEDIUM/HIGH**
 - availability of substitutes;
 - alternative and competing sources of raw material
 - complexity of marketing chain
 - negative impact on subsistence use and local markets
 - consumer acceptance

III. The third step is to analyze products based on *ecological* criteria

A. Represent a range in the products selected and gather information on

- habitat
- plant part
- plant form
- conservation status
- conservation services
- Extent of domestication
- Extent of ecological knowledge on the species
- History of traditional use and management
- Harvesting techniques

B. Rank ecological opportunities: LOW/MEDIUM/HIGH

- surplus or widely available material is produced through domestication;
- sustainable harvesting techniques exist and can be promoted;
- traditional knowledge on species ecology and management exists;
- ecological and scientific data on species exists;
- species is common and widespread (vs. a rare endemic, for example);

C. Rank ecological difficulties: LOW/MEDIUM/HIGH

- lack of ecological data on species
- limited traditional management or knowledge base upon which to build larger-scale commercial management
- low volumes of material available from forest or domestication
- threat to species from increased demand
- damage to ecosystems (e.g. wildlife populations) from increased harvesting;

IV. The fourth step is to check against *socioeconomic* criteria

A. What is the social context? How are the livelihoods of members of the community affected?

- Harvesters/producers
- Training/skills
- Institutional infrastructure
- Important uses by local communities that marketing initiatives might disrupt
- Relationship to other land uses
- Legal access to a resource

B. Rank social opportunities: LOW/MEDIUM/HIGH

- marketing products will compliment other economic and land use activities, filling a useful niche and promoting diversification;
- marketing products will make available for local communities larger supplies of locally-important species not widely available (e.g. through domestication programs);
- a wide range of community members will benefit from marketing, and it will not reinforce inequitable relationships;
- institutional capacity exists within communities, or could be built from existing structures, in order to facilitate marketing arrangements;
- communities hold land and resource rights;

C. Rank social difficulties: LOW/MEDIUM/HIGH

- marketing the product will compete with local subsistence use and local markets for a species;
- supplying markets will take time away from other important activities;
- the product will not contribute significantly to livelihoods;
- marketing will benefit only a small segment of the community;
- institutional capacity does not exist to equitably manage marketing of the product, and community members do not have the training or skills necessary;
- marketing of the product will negatively impact local medicinal, cultural, and other “invisible” non-economic uses of species or forest areas;
- the legal and policy environment is not conducive to guaranteeing community rights over resources and land, and marketing is likely to enhance existing inequitable relationships;

V. Develop a short list of products based on the above four steps and conduct a commercial market reconnaissance

Using the Limbe Workshop Species list as a starting point, and then adding sustainable, or organic, cocoa and coffee because of their prominence as marketable agro-forstry crop, 7 products were selected

1. Baillonella toxisperma
2. Cola spp.
3. Dacryodes edulis
4. Dioscorea spp.

5. Eremospatha macrocarpa, Laccosperma secundiflorum – rattan

6. Garcinia kola
7. Gnetum africanum
8. Irvingia gabonensis
9. Marantacea

10. Pausinystalia johimbe

11. Physostigma venenosum

12. Picralima nitida
13. Piper guineensis

14. Prunus africana

15. Ricinodendron heudelotii

16. Strophanthus gratus

17. Tabernanthe iboga
18. Voacanga africana

19. Aframomum spp.

20. Citrullus lanatus
21. Monodora myristica
22. Tetrapleura tetraptera
23. Xylopia aethiopica

24. Organic Cocoa

25. Organic Coffee

VI. Highlights from Preliminary Market Reconnaissance

A. Cola (Kola Nut)

- The leading soft drink beverages are Coca Cola, Pepsi Cola, then Diet Coke which include cola as an ingredient, which while in low proportions, are in beverages whose sales are in the billions of dollars.
- New cosmetic applications for cola include the extract of the ***kola nut***, which has good properties but color and odor problems. Estee Lauder analyzed and separated its constituents, and identified the individual components with anti-irritant properties.

B. *Garcinia kola*

- U.S. imports *Garcinia kola* exceed \$10.0 million worth, most of which is used in over the counter herbal weight loss remedies.
- A scientist reported at the International Botanical Conference in St. Louis this year that compounds found in the *Garcinia kola* stopped the spread of the deadly Ebola virus in lab tests and may be effective against the flu.

C. Organic or Shade Grown Cocoa

- Cameroon is a major exporter of cocoa, of a quality highly desired in the market.
- While the organic cocoa market is in its infancy, with less than one percent of the overall \$13 billion U.S. **chocolate** retail market, the growth rate parallels the organic food industry as a whole (over 20% annual increases throughout the 1990s).
- International Wildlife reports that the **Chocolate** Manufacturers Association has launched a long-term program to develop environmentally sound growing techniques and to improve the livelihoods of the small farmers that supply most of their raw material. The industry's growing support for shade-grown beans holds out hope that most **chocolate**, not just ***organic chocolate***, will be grown in a way that preserves natural habitat."

D. *Eremospatha macrocarpa*, *Laccosperma secundiflorum* - Rattans

- The total world market trade in cane was up to \$100 million, while rattan furniture is 100 times larger, in excess of \$10 billion.
- Raw cane exports are now banned from all the main producers, including the world's largest producer (80%), Indonesia.
- Smallholder cultivation of *Calamus* spp. has been underway for over a hundred years in Asia (Kalimantan).
- There is a clear synergy between rattan harvesting and other activities such as bush meat collection.
- There is a wealth of knowledge and experience available in Asia on rattan and INBAR is expanding to Africa.
- Producing rattan furniture can be a village level cottage industry, with low capital investments and many beneficiaries.
- The current regional experience in wooden furniture production can be extended to rattan.

E. Aframomum spp.

- In 1997, the total European market for flavor products was \$1,225 mill., and the US imported \$166 mill. of flavor oils.
- The majority of this usage is for beverages, and this is a growing market in the US and Europe.
- There was previously an important historic trade in Aframomum (grains of paradise) starting from the 15th century.
- Aframomum is currently being used as a flavoring in Sam Adams Summer Ale, and probably also in Hoegaarden.
- An essential oil with interesting properties can be extracted from Aframomum spp. seeds and leaves.
- This oil appears to have anti-oxidant, anti-microbial and cyto-protective properties.

Annex: Product Information Sheets

SUMMARY:

Aframomum spp.

- In 1997, the total European market for flavor products was \$1,225 million, and the US imported \$166 million worth of flavor oils.
- The majority of this usage is for beverages, and this sector is a growing market in both the US and Europe.
- There was previously an important historic trade in Aframomum (grains of paradise) from West Africa to Europe, starting from the 15th century.
- Aframomum is currently being used as a flavoring in Sam Adams Summer Ale, and probably also in Hooegarden.
- An essential oil with interesting properties can be extracted from Aframomum spp. seeds and leaves.
- This oil appears to have anti-oxidant, anti-microbial and cyto-protective properties.
- The current use of *Aframomum* as a spice, flavoring and source of essential oils is limited.

NAMES:

Aframomum Melegueta. (Roscoe) K.Schum. Known in English as Grains of Paradise, Paradise Seeds, Guinea Pepper, or Melegueta pepper, the latter name is apparently a local name for pepper. It has also been called black cardamom.

In Amharic it is Kewrerima, Estonian; Melegeti aframon, French; Graines de paradis, Malaguette, Poivre de Guinée, Maniguette, German; Paradieskorner, Guineapfeffer, Melguetapfeffer, Malagettapfeffer, Italian; Grani de Meleguetta, Grani paradisi, Mani guetta, Russian; Rajskiye zyorna, Malagvet, Spanish; Malaqueta.

INTRODUCTION:

Mentioned by Chaucer in 1366, guinea grains or melegueta pepper are the seeds of *Aframomum spp.* The genus originated in Africa and is related to cardamom (of Asian origin), with which it is sometimes confused in the literature. Both are in the ginger family, *Zingiberaceae*. The seeds were used as a cheaper substitute for black pepper in the fifteenth century before the East Indies trade dominated the market. The high price at that time may have led to them being called grains of paradise. Alternatively, the reputed aphrodisiac qualities of the seeds may have led to this name.

In the past *Aframomum* has been cultivated as a crop in Ghana (Lock, 1977) and also in South America. Before WW1 disrupted the trade, Cameroon used to export to the United Kingdom and Europe. The plant was probably taken to the West Indies by slaves.

Although it is still an important commodity on the local and regional markets, the international trade in *Aframomum* has diminished significantly. One hundred years ago it was widely used as a flavoring in a variety of products. Nowadays it has a limited use in veterinary practice and to flavor spirits, wine, beer and vinegar. Ghana is probably still currently the main source of much of the internationally traded *Aframomum*.

The seeds are red/brown, turning grey when powdered. The taste is strong, spicy, hot and warm, a little bitter/acid at the close. It is probably closer to the cardamom seed in taste than it is to pepper, but not as aromatic. One description is as follows, "I would have to say it is "earthy" like when you go hiking in a

pine forest and you smell the wet earth with a pine note. It is not entirely unlike Szechuan peppercorns, spicy, peppery, and herb/floral aromatic. It has an aromatic, peppery aroma."

ACTIVE INGREDIENTS:

Aframomum seeds contain the hydroxyphenylalkanones, gingerole, paradole and shoagole, the same active ingredients found in ginger. An acetone extract of Ghanaian seeds had approximately equal parts of (6) and (7)-paradole, and (6)-shoagole present. Other species have flavenoids, diterpenoids, etc. present.

Essential oils can be extracted from the seeds, leaves and rhizomes of *Aframomum*

Although the pale yellow to brownish oil from *A.melegueta* is not a regularly produced item, its spicy, woody sweet odor make it a possible substitute for other essential oils such as *Hedychium* in spice blends and balsam.⁴

MAIN USES

The seeds are still used extensively in the region, eg. for flavoring "pepe" in Cameroon. In Morocco and Tunisia it is used mixed with black pepper, cloves, cinnamon and nutmeg to make *gâlat dagga* which is a spice mixture used in cooking. In the United States there is a limited demand for it by traditional spice users, who use it in cordials and sausage. The Boston Beer Company uses them in their Sam Adams Summer Ale. The plant has found its way into some specialty Belgian beers and even ginger ale. It is not well known nor even widely used. It is used by some select brewers in Belgium to achieve unique flavors for their beers, but no one will divulge who uses it where.

Only small amounts are used in beer, home brewers use 1.5 gm/5 gallons or 3gm/7.5 gallons ground seed. Whereas in cooking comparatively large quantities of the ground spice are needed, and they are added just before serving.

Insecticidal and anti-feedant properties have been reported.

SOURCES AND PRICES:

Trade data on current yields, production, value is not available. The international markets are narrow, with few buyers and sellers. They are also often informal, and outside of government control. Volumes traded internationally are comparatively low by all accounts. Although a current web site advertising Ghanaian NTFP's included *Aframomum* as one of the products it was able to source, it did not respond to e-mail inquiries,

Some retail suppliers of *Aframomum* in the United States include:

- Penn Herb, 603 N.2nd St, Philadelphia, PA 19123-3098, Tel. 1-800-523-9971, www.pennherb.com.
- The Peppers Guild, dchesty@ix.netcom.co
- Aphrodisia, 282 Bleeker St., NY N 10014, Tel. 212 989-6440,
- Penzeys Ltd., P.O. Box 1448, Waukesha, WI 53187, Tel. 414 574-0278
- DragonMarsh, Riverside, CA., www.dragonmarsh.com

Current retail prices range around \$2.2 for an ounce (\$1.75/25g), down from \$2.5/oz. five years ago.

⁴ . *Hedychium* oil is extracted from the rhizomes of *Hedychium spicatum*, another member of the Zingiberaceae, grown in India and Malaysia.

There are apparently two types available on the international markets, one larger than the other.

OPPORTUNITIES:

In the early 1990's over 87% of the aromas used by Nestle's, one of the largest food companies in the world came from natural origins. The market for flavours is large and growing by 5-7% per year. In the mature markets of Europe in 1997 over \$1,200 million was spent on flavoring materials. United Kingdom (\$270 m.), Germany (\$250 m.), France (\$190 m.), Italy (\$125 m.), Spain (\$105 m.), the Nordic countries (\$70 m.), Netherlands (\$60 m.), Belgium (\$45 m.) and the others (\$110 m.)

The growth markets for flavours, used primarily in the beverage and snack sectors are in Eastern Europe, Asia and the former Soviet Union.

There is an increasing interest in ethnic cooking, aromatherapy and natural products.

There may be a slight opportunity of new demand developing from some of the novel pharmacological characteristics of the seed oil being described now.

CONSTRAINTS:

The genus is a confusing one with many overlapping species and frequent synonymy. It is often unclear which species is being referred to in any particular piece of research. For example in the wetter forest, *A.danielli* forms a confusing species complex with *A.angustifolium*. In Madagascar, the Seychelles, Mauritius, and E. Africa *A. angustifolium* is cultivated as Madagascar cardamom and the seeds used as a condiment. While *A. melegueta* is found and cultivated (or at least encouraged) from Sierra Leone to Gabon, there is also *A. flavum* Cameroon cardamon.

The various *Aframomum* species are found from the wetter forests, through the gallery forests, the seasonally dry forests near the savannah, to the savannah. They cross the Dahomey gap and occur in East as well as West Africa. The mixture of species found, their abundance, productivity, yields of particular chemicals etc are likely to be quite different between the three study areas. For example, Lamaty et al (1993) found quite different compounds in the essential oil extracted from collections made in the CAR as compared to Cameroon. The species, clone, climate, season, soils, stage of development at harvest all effect the essential oil content in other plant species.

The seasonality of production in the forest is also not clear. A species *A. alboviolaceum* found in the tall grass/low tree savannah, often in the fire complex associated with *Borassus aethiopicum*, appears to fruit only late on in the wet season. All of these factors increase the likely variability of the sourced and the difficulty of obtaining a niche market, without competition from other countries/regions.

The market for essential oils is dominated by a small number of purchasing houses, often family owned, and increasingly consolidating. Prices for essential oils, fragrances and flavours are generally falling, and because of the increasing demands for quality and consistency the barriers to market entry are getting higher. Any attempt to add value by extracting essential oils in country will require a far degree of sophistication and management, with analytical facilities and producer inspection and possibly certification. In Europe for example, the trade is primarily in quality oils, with chemical and physical specifications within clear limits allowing the user to use them consistently. The oils (and the seeds) also need to be free from contamination and have to comply with health and food regulations.

The yields of essential oils are low, the seeds contain c. 0.3%, the leaves 0.14%. The plants appear to be locally abundant, but scattered, so the yields per unit area are likely to be low. Anytime that the price for the essential oil rises significantly, it is likely to provoke either a shift to substitutes, or laboratory synthesis.

RECOMMENDATIONS:

RECIPIES

One very old recipe for grains of paradise comes from a Belgian herb supplier to breweries who found it in an old brewing book: adjusted for a 5 gal batch.

8 lbs pale extract

2 lbs amber extract

1.5 oz hops

1/4 oz licorice root

2 oz molasses

1.5 gram (.06 oz) paradise seeds

It can also be used sparingly (3 grams in 7-1/2 gallons) in ginger wit to which it gives a bit of additional complexity. This is a traditional witbier recipe with the substitution of fresh ginger for orange peel and lactic acid. It gives a bit of the bite that the lactic acid

might, and the ginger is very refreshing. It is popular with beer drinkers who prefer a cooler-type drink.

The spices for 7.5 gallons are:

3.2 oz peeled fresh ginger, pureed

1 oz. freshly ground coriander

5 g. freshly ground cardamom

3 g. freshly ground grain of paradise

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SUMMARY

CALABAR BEAN

Physostigma venenosum Balfour

Leguminosae - Papilionaceae

Known as the Calabar, or Ordeal, Bean, *Physostigma venenosum* is a woody climber found growing in forests from Senegal through Cameroon and to the Congo. It has also been introduced to South America

(Brazil) and India. The Calabar Bean flowers in March - long clusters of curved purple or pink flowers - which are replaced by dark brown pods around 6 inches long, oval shaped, containing a few extremely hard dark brown seeds. The seeds ripen in all seasons, but are best and most abundant during the rainy season – March to October [June to September]. Vines climb 50-60 feet into the trees. Botanical collections of the Calabar Bean were made as early as 1846, when it was planted in the Edinburgh Botanical Gardens.

Traditional Use

The Calabar Bean was used traditionally as an ordeal poison, to test guilt or innocence. The seeds from the bean are ground and placed in water, or are given whole to the accused to eat – if they vomit within half an hour they are considered innocent, but if they die, are guilty. The British banned the use of Calabar Bean in Nigeria – along with other ordeal poisons - in the 1940s (Iwu, 1994). In Ghana, the beans are mixed with water to treat oedemas, rheumatism, and topically for ringworm, and parasitic skin diseases. Crushed beans are used as an external pain killer and in acute cases of tetanus (Abbiw, 1990). Seeds are also used as fish poisoning, and to poison rats and mice. Traditional names include: Eseré (Efik), Akpi (Igbo), Iso (Yoruba), and Mukase or Mbingo (Douala).

Commercial Use

The Calabar bean yields the alkaloid physostigmine, an anticholinesterase used in ophthalmology to treat glaucoma. Physostigmine promotes drainage of fluid build-up in the eye, which would otherwise lead to the optic nerve damage and loss of vision that characterizes glaucoma. Derivatives of physostigmine (eserine) also show therapeutic promise for treating Alzheimer's disease and combating the effects of chemical weapons (American Chemical Society, 1999). Studies of the Calabar Bean also led researchers to the development of methyl carbamate insecticides (Plotkin, 1988). Other active constituents found in the Calabar bean are eseranine, eseridine, calabarine, and physovenine (Abbiw, 1990).

Physostigmine was first produced synthetically by an African American scientist, Percy Lavon Julian, following three years of intensive research completed in 1935, and called the most challenging total synthesis of its time. Prior to this, physostigmine could only be isolated from the Calabar Bean (ACS, 1999).

The Calabar Bean is a powerful poison, and does not have a role in botanical medicine, nutraceutical, or other markets which might absorb some of the medicinal plants also used in the pharmaceutical industry (e.g. yohimbe). Physostigmine is sold as an ethical pharmaceutical product as physostigmine salicylate – sold in the US as Isopto-Eserine – and physostigmine sulphate – sold as Eserine sulphate. Synthetic derivatives include neostigmine bromide and neostigmine methylsulfate (Prostigmin), currently used to treat myasthenia gravis.

Raw Material Trade

Calabar Bean is exported from Nigeria, Ghana, and Cote d'Ivoire, largely from wild sources (Cunningham, 1999; Laird et al 1996). Plantecam exports Calabar Bean from Cameroon for use in the pharmaceutical industry. In 1987, for example, MINEF approved the export by Plantecam of 100 tonnes of "Feve de calabar" collected in the southeast and southwest. The Nigerian company Noga-Wills (Nig) Ltd, based in Calabar, sells dried and extracted *Physostigma venenosum* under "special harvesting arrangements" with the Corporate Affairs commission of Nigeria (RC No. 200724). Prices for products sold are not listed; the company sends samples upon specific demand and price offers from potential customers.

Sustainable Sources

There are few examples of *Physostigma* cultivated for the market, although Plantecam has begun work on domestication of the vine. In Nigeria, and NGO, BDCP, has taken up cultivation of *Physostigma* as a

conservation and development activity. Bioresources Development and Conservation Program (BDCP) is a platform of natural products scientists, environmentalists, policy experts, and company staff working to conserve biodiversity through sustainable development. One of the projects run by BDCP in Nigeria includes a trial “deep forest farm” in the Akwanga District of Cross River State to experiment with the cultivation of *Physostigma venenosum* as an alternative use of the habitat, and production of raw material for industrial production. Vines are planted within the forest, and as part of traditional forest management systems that require retention of the forest canopy (Iwu, 1996). According to local people, germination of the very hard seeds requires splitting open by the African porcupine – so availability of the species is dependent upon forest (Iwu, 1994).

Market Opportunities

- There exists a significant market for physostigmine pharmaceutical products, and for other alkaloids found in the Calabar Bean.
- Marketing and trade networks exist for the raw materials;
- Calabar Bean does not appear threatened by existing demand;

Market Constraints

- It is unlikely that pharmaceutical medicines (in contrast, for example, to botanical medicines, foods, beverages, and cosmetics) will be strong candidates for “green” or “fair trade” marketing schemes;
- The existing and potential relationship between *Physostigma* raw material sourcing, conservation, and development remain unclear;
- Pharmaceutical markets are large, multi-national, and sophisticated; determination of sourcing strategies is based on cost and quality, and decisions are usually made far from the countries in which species grow; a relatively unresponsive and powerful market such as this is not ideal for small-scale or community based marketing projects.

Next steps

- Prior to initiating any marketing project, research should be undertaken to determine the nature and scope of existing raw material sourcing strategies – ecological impacts, management practices, trade networks, key players, value chain, etc.;
- CARPE might assist in efforts to domesticate the product, if it is decided to be a priority species.

Cocoa

Highlights

T. cacao

- World production of cocoa is rising faster than demand causing prices to fall to a level just over \$800 per ton. At the same time, some countries in West Africa face production problems because of black pod disease while Brazil is encountering witches broom fungus. These problems have been attributed to the agricultural practices that are not sustainable.
- Cameroon is a significant source of cocoa for world markets, producing 5 percent of world production, of a quality highly desired in the market. Cameroon cocoa is largely the Trinitario variety, producing beans with high fat and a reddish color. This cocoa is in demand, especially in the Netherlands or Germany where manufacturers produce cocoa products -- cakes, biscuits and confections -- sold at premium prices.

- While the organic cocoa market is in its infancy, with less than one percent of the overall \$13 billion U.S. chocolate retail market, the growth rate parallels the organic food industry as a whole (over 20% annual increases throughout the 1990s).
- The American Chocolate Research Institute has launched a long-term program to develop environmentally sound growing techniques and to improve the livelihoods of the small farmers that supply most of their raw material. The industry's growing support for shade-grown cocoa is intended to promote cocoa grown in a way that preserves natural habitat."
- One trader of organic cocoa in the Netherlands indicated they would buy up to 500 tons of Cameroonian cocoa at \$125 over the existing fob price for non-organic. While this is still a niche market, there are some successful initiatives in Latin America and Africa that capitalize on increased consumer demand for organic or "fair trade" products.

Names and varieties:

The cocoa tree is of the genus *Theobroma*, a group of about 20 species originating in the Amazon basin and other tropical areas of Central and South America. *Theobroma cacao* is the only one extensively cultivated, although there is some recent interest in *T. grandiflorum* (Cupusassu) as a flavoring. There are three cocoa varieties, Criollo, Forastero and Trinitario, the latter of which is a cross between the first two.

Production:

World cocoa bean production for the 1998/99 season is estimated at 2.78 million tons, down 5 percent from the record 2.94 million-ton output of 1995/96. As far as recent trends, strong production figures from Cote d'Ivoire, Ghana, Indonesia, Cameroon and Nigeria, offsetting decreases in Brazil and Ecuador. The 1998/99 production figures for cocoa in Cameroon are over 125,000 metric tons, matching the level achieved in the 1997/98 crop season when Cameroon produced 126,804 tons of cocoa beans. Estimates of the 1999/2000 crop indicate that it is expected to be roughly the same size, 120,000 tons or slightly more.

Production in 1998/99 in Cote d'Ivoire, the world's largest cocoa bean producer, is forecast at 1.18 million tons, while Ghana's 1998/99 production forecast has been revised upward 8 percent to 390,000 tons. This increase is based on improved rainfall patterns in the major cocoa growing areas. Brazil, however, show a lower 1998/99 production level at about 164,500 tons, up slightly from 1997/98. Decrease were attributed to high rates of tree infection, "witches broom", as well as the effects of the drought on flowering during early 1998. Indonesia's 1998/99 cocoa bean production is 330,000 tons, 4 percent above last season, exceeding production records set in the previous three seasons. The 1997/98 estimate was increased to 318,000 tons, 4 percent above the previous estimate. Nigeria also registered increased production for 1998/99, forecast at 165,000 tons, up 6 percent from the previous season. Malaysia's 1998/99 cocoa bean crop of 100,000 tons is up 2 percent from last season. However, this level is 17 percent below 1996/97 and much below the record 1989/90 harvest of 240,000 tons.

There is concern over the effect of pests and disease on the production and price levels of cocoa as black pod and witches broom threaten production in West Africa and Brazil respectively. Some attribute these problems to the adoption of plantation input-intensive varieties and the abandonment of small-scale shade tree production, trading off natural protection for higher yields. This concern has been translated into actions now undertaken by chocolate manufacturers, the American Cocoa Research Institute (ACRI) and the International Cocoa Organization (ICO). Mars is taking a lead role within the international chocolate industry in supporting initiatives to "foster a new understanding and appreciation of cocoa's beneficial, multi-dimensional role in tropical forest ecosystems and to encourage the cultivation of cocoa in

traditional areas as well as new regions using sustainable agriculture methodologies." Other smaller chocolate companies are providing incentives to producers through marketing outlets for sustainably produced cocoa and certified organic cocoa.

Marketing and Processing

The major buyers of West African cocoa are European, while the United States is the major buyer of South American and Asian cocoas. The purchasing of raw cocoa is dominated a few international traders who either sell beans to chocolate manufacturers, or process the cocoa and sell the by-products (liquor, butter or powder). Chocolate manufacturers prefer to purchase through traders because they limit their risk with respect to shipment and quality problems. While the manufacturers are concerned about supply problems in the future -- which has prompted their support for promoting sustainable production -- they are not trying to change production and marketing channels to meet specific social and environmental goals. Instead, there are a number of firms and organizations that have taken up the banner of fair-trade and organic to advance these objectives. For example, the UK firm of Green & Blacks produces a Maya Gold chocolate bar, which has both organic and fair trade labels. Working with small family cocoa growers in Belize, Green and Blacks offered them assistance to convert to organic production, including price and financing guarantees. The provision of premiums, and arrangements for direct purchasing through long-term contracts has given producers enough security to diversify. Green and Blacks is also working on an organic cocoa program in Togo. The Organic Commodity Project (OCP), based in Cambridge, Massachusetts, is implementing a successful commercial program for supplying niche chocolate manufacturers with organic "sustainable cocoa" that benefits the community in diverse ways. Joe Whinney, director of OCP, reports that "Any system developed for sustainable cocoa must be one which allows for high biodiversity while providing for farmers' subsistence and cash needs. Our experience has shown us that cocoa can be produced commercially in a biologically rich and diverse "forest" environment in the humid tropics... An assessment of the current environmental impact of cocoa production in key cocoa growing regions is an important step to identify long term restorative strategies. This work will also be vital in determining what positive production schemes already exist. Furthermore, understanding the cocoa economies in the same regions will help identify what socioeconomic needs must be met. Continued and rigorous research is required to support and identify sustainable cultivation techniques specific to each cocoa growing region will be a necessary and important ingredient in developing cross trade support for sustainable production

A recent report on the African news wires described the start-up of a pilot organic cocoa project in Uganda, promoted by a local company, Cofftea and a multi-million international company, Export Promotion of Organic Products from Africa (EPOPA). working with 1000 cocoa farmers.

Opportunities

Cameroon cocoa is largely the Trinitario variety, producing beans with high fat and a reddish color. This cocoa is in demand, especially in the Netherlands or Germany where manufacturers produce cocoa products -- cakes, biscuits and confections -- sold at premium prices. The cocoa farmers in Cameroon are now trying to deal with the changes wrought by liberalization and need to know how to take advantage of the new market-based system. Research on how farmers can adopt of improved and environmentally sound production techniques in a shade grown system that helps preserve the natural habitat is critical. Getting higher prices through organic certification could be a bonus in the future but will take time. While the organic cocoa market is in its infancy, with less than one percent of the overall \$13 billion U.S. chocolate retail market, the growth rate parallels the organic food industry as a whole (over 20% annual increases throughout the 1990s). One trader of organic cocoa in the Netherlands indicated they would buy up to 500 tons of Cameroonian cocoa at \$125 over the existing fob price for non-organic.

Constraints

Cocoa prices have slumped and are now between \$800-900/ton, compared with prices last year as high as \$1,800 per ton. The premiums for organic are now significant but it is still a niche market that can easily fall if a few suppliers come in the market at the same time with product. And Cameroon would likely depend on European consumers whose acceptance of organic is still vacillating, with Germany the only multi-billion dollar market (about \$2.5 billion) for all organic foods (France and the UK are both around \$600 million and Italy not even \$30 million). In comparison, the U.S. is almost \$10 billion market for organic. Another problem with organic is that quality is not easily achieved because of the use of alkalization in cocoa processing. One of the reasons some chocolate manufacturers doubt the potential of organic is because it precludes doing alkalization, the way in which they normally enhance the flavor and color of cocoa liquors and powders. The alkalization process consists of mixing selected cacao material with a solution of a specified alkaline compound at high temperatures and possibly increased pressures. The common alkaline compounds are potassium carbonate, calcium carbonate, and sodium hydroxide, which by virtue of their chemical origin cannot be used for organic chocolate

Smallholder cocoa (*Theobroma cacao* Linn.) cultivation in agroforestry systems of West and Central Africa: challenges and opportunities, B. Duguma

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Abstract

The cultural features, management practices, environmental sustainability, and economic profitability of smallholder cocoa production in West and Central Africa are reviewed. The aim is to highlight factors affecting the production and marketing sector and to propose appropriate strategies to ensure sustainable and profitable production in the region. The cocoa cultivation system causes minimum damage to soil resources. In terms of carbon sequestration and below- and above-ground bio-diversity, the cocoa agroforest is superior to the competing food crop production land use based on the practice of slash-and-burn. Cocoa is inter-cropped with several high value tree species that provide shade to the cocoa tree and additional income and products for the farmers. Economic profitability analysis of the system in Cameroon showed that even with no value assigned to the inter-cropped species, the sector could still be profitable at current prices. In the late 1980s, the distorted economic policy and unfavorable international trade governing the sector made the system less attractive to the farmers such that many of them abandoned their farms or in some cases cut the trees in order to grow food crops. Technically, the system is environmentally sustainable. The fundamental question is thus what should be the research and development strategy that would enhance profitability and environmental resilience of cocoa production system and minimize risk to the farmers in order to sustain their interest. Based on the current review and our knowledge of the region, there is an urgent need to: a) rationalize and optimize arrangement of the various components in cocoa agroforest, b) domesticate high-value indigenous species and integrate them

into the system in order to enhance the system's diversity and profitability; c) develop shade-tolerant and disease-resistant cocoa varieties d) integrate small-stock production into the system, and e) develop an enabling policy environment addressing cocoa marketing, plant protection, land tenure, and transformation of non-cocoa primary products from the cocoa agroforests.

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PYGEUM

Prunus africana (Hook. F.) Kalkman

Rosaceae

Prunus africana is a montane forest tree occurring from Ethiopia down through South Africa, and as far east as Nigeria and west as Madagascar. It is an evergreen mid to later successional species that can attain heights of 45 m and up to 130 cm diameter. The only *Prunus* species native to Africa, it is found above the 1000m altitude. In 1994, *P. africana* was listed on CITES Appendix II in response to concerns associated with unsustainable harvest of the species for international markets. Local uses of *Prunus africana* include use of the bark as a medicine, including around Mount Cameroon for "old man's disease"; and as timber (building poles, axe handles, fuelwood).

A great deal has been done to date to address the sustainable management and threats to the survival of *Prunus africana* populations. Groups such as MINEF, Mount Cameroon Project, WWF, ONADEF, the Kilim Project, ICRAF, University of Bangor, BDCP, CARPE and others have undertaken research on the ecology and management of the species; have initiated community development programs associated with domestication; have brokered more equitable arrangements between Plantecam and local communities; and have lobbied company and government officials to better regulate harvests and develop strategies for long-term sustainable management of the species. Pygeum is also one of more than 160 medicinal plants listed on the CITES Appendices, and one of about 20 of which are traded significantly.

As a result, there is a detailed and extremely useful literature on ecology, domestication, conservation, markets, and other aspects of *Prunus africana* use and management directly relevant to CARPE's work, which we will not seek to duplicate here. Key sources to consult include (see bibliography):

- Acworth and Ewusi, 1999
- Cunningham and Mbenkum, 1993
- Cunningham et al, 1997
- Cunningham, 1999
- Simons and Tchoundeu, 1998
- Sunderland and Nkefor, 1997

A short summary of market information which can act as the basis for building further, detailed background on this species and products follows.

Commercial Use

Prunus africana is used to treat benign prostatic hyperplasia (BPH), a condition that affects more than half of all men over the age of 60. BPH is a benign condition, and should not be confused with prostate cancer. BPH is simply an enlargement of the prostate gland, which rests at the base of the bladder and surrounds the urethra, and when enlarged puts pressure on the urethra, constricting the outlet for urine (Pharmaton, 1999). European interest in pygeum began as early as the 1700s when early settlers in the Natal province of South Africa related the effects of pygeum on bladder pains (Simons and Tchoundjeu,

1998). In 1966 Jacques Debat first patented a pygeum bark extract (Cunningham and Mbenkum, 1993). The use of saw palmetto and pygeum have been approved treatments for BPH since the early 1970s in Europe, and have contributed to reduced surgery rates and a safer, more cost-efficient management of the condition (Brown, 1996).

Prunus africana is commonly sold as a standardized extract – that is, an extract standardized against a group of market chemicals. The active substances are phytosterols (sitosterols), pentacyclic triterpenoids, and ferulic esters of long chain fatty acids. Extracts are standardized against the phytosterol content (beta-sitosterol; beta-sitosterone, and n-docosanol), usually at between 12-13% phytosterols.

100-200 mg of such extracts are recommended per day; individual capsules generally contain between 50-100mg of standardized extract. Saw palmetto and nettle are often combined with pygeum, and are seen as enhancing and providing synergistic effects.

The pharmacology of pygeum is not completely understood, but a few decades of pre-clinical and clinical trials have demonstrated its efficacy in managing frequent urination at night, promoting normal urinary patterns, and maintaining prostate health (Pharmaton, 1999).

Commercial Products and Companies

Retail sales of *Prunus africana* products is estimated by Cunningham et al (1997) as \$220 million per year. Companies selling products are based in Europe (primarily France, Italy, and Spain), South America (Argentina, Brazil, Venezuela), Australia, and the US. Twenty European companies produce and sell products containing *Prunus africana* extract (Cunningham, 1999).

Examples of companies marketing and distributing finished products containing pygeum include: Groupe Fournier (France); Inverni della Beffa (Indena Spa) (Italy); Solgar (USA); Boehringer-Ingelheim/Pharmaton (Germany); Prosynthese? (France); Nature's Way (USA); Jarrow Formula; HerbsNow; Vitamin Express; Nature's Sunshine Products; iHerb. (See Cunningham et al 1997).

Examples of companies supplying *Prunus* raw materials, or bulk ingredients (including standardized extracts), include: Indena (Italy, and its cosmetics division in France); Globex International (USA); Plantecam (Cameroon), a wholly owned subsidiary of Groupe Fournier (France); GCI Nutrients (USA); Schweizer Hall (Germany); Extractos Natra (Spain); and Triarco.

Prices for finished products vary:

Pigenil (Inverni della Beffa) – 25 mg and 50 mg capsules

Tadenan (Groupe Fournier) – 1996 (Europe): 50 mg extract – 30 capsules - \$20.70; 60 capsules \$39.17

Prostatonin (Pharmaton) – 1996 (Europe): 25 mg capsules – 30 capsules - \$25.30

Jarrow Formulas Saw Palmetto and Pygeum 202 mg. – 1999 (USA): 120 soft capsules (each containing 100mg of standardized pygeum extract) - \$39.95

Substitute products for pygeum include saw palmetto (*Serenoa repens*) and stinging nettle (*Urtica dioica*). However, pygeum and nettle have been shown to be more potent when used together, and to have a significantly stronger, synergistic effect (Brinker, 1997). Saw palmetto and pygeum, and saw palmetto and nettle, are also often combined into a single formula, or prescribed together (Alive, 1998). Other suggested substitutes include pumpkin seeds and pollen. Saw palmetto is the best-researched and most widely recommended botanical therapy for BPH, however. In 1998 it was the fifth top-selling botanical medicine in the US, and in 1995 was the ninth top-selling botanical in Germany (Laird, 1999). Saw palmetto is native to North America, and grows wild in the southeast. A tea made from saw palmetto berries was commonly recommended in the US during the early part of this century for prostate and urinary tract problems (Brown, 1996). Both saw palmetto and pygeum are taken for the long-term,

incorporated into daily regimes. The FDA in the United States has recently expressed problems with the way saw palmetto and pygeum are promoted to treat BPH, and they might face some regulatory obstacles in the future (Blumenthal, 1998).

Raw material trade

Annual pygeum export figures from Africa are between 3,200 – 4,900 metric tonnes of bark. All of this is taken from wild populations in Cameroon (which represents 70% of world trade) and Madagascar (18%), and to a lesser extent Congo, Equatorial Guinea, and Kenya. Bark or bark extract is exported to France, Italy, Belgium, and Spain. In the past few decades, a growing proportion of extract has been processed and exported from Cameroon and Madagascar (Cunningham, 1999). Prices paid for bark are roughly \$2,000 per tonne for bark and \$1,000 per kilo of extract (Archaya, 1998).

Export of raw bark from Plantecam's factory in Mutengene averaged 1,923 tonnes during the period 1986-1991, during which time Plantecam was the sole licensed exporter. Today, additional exporters are shipping out unknown quantities of bark. Bark harvesters are paid on average \$0.38 per kilogram of bark (Acworth and Ewusi, 1999).

Market Opportunities

- Existing international demand, and trade networks;
- Sold on the botanical medicine market, Prunus products are likely to be consumed by those with a potential interest in environmentally and socially sound raw materials – therefore potential consumers of “green” or “fair trade” labeled products;
- Efforts have been made to structure arrangements for sustainable management and better pay per kilo for local communities; although not successful over time to date, the experience is valuable for building future trade networks based on equity and sustainability;

Market Constraints

- A single company (Groupe Fournier) dominates the export of Prunus from Cameroon, and price or other constraints appear to be placed on the subsidiary company, Plantecam, to keep raw material cheap – this is standard for the industry;
- Existing demand exceeds supply; therefore, there will always be pressure to over-exploit raw material in the wild, and marketing efforts must be vigilant in ensuring that they manipulate the nature of existing demand, rather than increase demand;
- Substitute products exist – eg saw palmetto and nettle – to which consumers might turn; long-term demand for Prunus must be clear before embarking on additional marketing projects;

Next Steps

- Prunus is an excellent candidate for green and fair trade labeling – incorporated for a number of years into conservation and development projects in the area, attracting a great deal of research (relative to other medicinal species) its ecology and potential sustainable management are now better understood, and sustainable yields per year have been estimated. CARPE might assist in efforts to link projects and communities with certifiers and accrediting bodies; they might also build capacity to work within a certification system in Cameroon. Timber certification is receiving increasing interest, and the FSC is moving towards establishing a larger presence in the region. One element of growing interest to the FSC and timber certifiers is NTFP certification. Prunus is under consideration as a case study in the Rainforest Alliance/Smart Wood NTFP certification manual, due out early next year.
- CARPE could (already is?) assist in the wide range of efforts underway (MINEF, ICRAF, MCP, WWF, etc.) to effectively bring Prunus into cultivation. In Cameroon, sustainable systems of bark harvest were developed, involving removal of opposing quarters of bark, and allowing time for the growth of callous and bark regeneration (Cunningham and Mbenkum, 1993). These systems have not

been implemented in recent years, and cultivation is considered the most secure way to ensure survival of the species. Cultivation of *Prunus africana* is considered a viable proposition for farmers, because even if the market for the bark collapses, the tree has a number of other useful properties, as well, including timber, poles, and fuelwood (WWF ethnobotany and sustainable use of wild plant resources programme).

- The SOK studies undertaken by CARPE, and the monograph under preparation by the University of Bangor and others, will provide a great deal of information on the ecology, management, and markets for *Prunus*. [This part of] CARPE may wish to assist in building the technical, informational, and marketing base for this species, but should wait until early next year to identify any gaps remaining after the CARPE SOK and Bangor studies. CARPE may also assist in strategic ways the development of a “National *Prunus africana* management strategy”.

Examples of Commercial *Prunus africana* Products

Company	Name of Product	What they say about the product
Indena www.indena.it	PrunusSelect	Pygeum purified soft extract (cont. 13% total sterols calculated as B-sitosterol); the cosmetics division also promotes pygeum purified soft extract as a “botanical ingredient with cosmetic potential”; Indena Spa sells a product “Pigenil.”
HerbsNow www.herbsnow.com Nature’s Sunshine Products www.webcom.com/drweed/naturalherbs/products	Men’s Formula	A mixture of pygeum extract (54mg) standardized to 2.5% total sterols, calculated as B-sitosterol, 190 mg of saw palmetto extract standardized to 20% essential fatty acids; and 10 mg of stinging nettle extract, 150 mg of gotu kola, and 5 mg of zinc.
Vitamin Express http://vitaminexpress.com iHerb www.iherb.com Prime Vitality LLC www.primmmev.com	Jarrow Formulas – Ultra Saw Palmetto + Pygeum	Standardized extracts of saw palmetto (150 mg) and pygeum africanum (50mg – standardized to 13% sterols).
Solgar www.solgar.com	Saw palmetto pygeum complex with lycopene capsules	Each 2-piece capsule provides 50mg of saw palmetto extract (4.1% extract); 50 mg of standardized pygeum extract (2.5% total sterols); 50 mg of cactus flower; 4 mg tomato; 10 mg zinc; and 25 mg selenium.

Boehringer Ingelheim/Pharmaton www.pharmaton.com	Prostatonin	Prostatonin contains two clinically proven proprietary extracts: standardized Pygeum africanum [PY102] and Nettle [UR102] Extract. These extracts, both individually and in combination, have been proven to help manage frequent urination at night, promote normal urinary patterns and maintain prostate health. Details and citations for clinical studies are provided at: www.pharmaton.com/clinical_studies/clin_prost.html .

Rattans: *Eremospatha macrocarpa*, *Laccosperma secundiflorum*

The total world market trade in cane was up to \$100 million, while rattan furniture may be 50 times larger, certainly more than \$5 billion.

- Raw cane exports are now banned from all the main producers, including the world's largest producer, Indonesia.
- Smallholder cultivation of *Calamus* sp. has been underway for over a hundred years in Asia (Kalimantan).
- There is a clear synergy between rattan harvesting and other activities such as bush meat collection.
- There is a wealth of knowledge and experience available in Asia on rattan and INBAR is expanding to Africa.
- Producing rattan furniture can be a village level cottage industry, with low capital investments and many beneficiaries.
- The current regional experience in wooden furniture production can be extended to rattan.

Names

Eremospatha macrocarpa small rattan, rotin filet, asa-nlong (Fang) nloun (Bassa) molongo (Bayenge), cane rope (pidgin) ndo (Tikar) and *Laccosperma secundiflorum* large rattan, giant cane, gros rotin, makak (Bakossi/Bassa) boro (Fang), ku (Tikar) are the two commercially important species. Generic names for rattan include *melongos* (Spanish) *mokolo* (Bakossi), “forest police” (pidgin), malacca, mulonga.

Introduction

Rattan is used to make a wide range of different objects, traditionally for furniture, baskets, roofing, fishtraps etc. in Africa and Asia, and to produce commercial furniture in factories in Asia, Europe and America. It is the stem of various climbing species of the palm family. More than 650 species belonging to 22 genera are recognized, out of which 4 genera (three of which are endemic) and about 14 species are recorded in Africa. Worldwide some 50 rattan species are used commercially. In Africa only two species

are commonly used, *Eremospatha macrocarpa* for the decoration and binding, and *Laccosperma secundiflorum* for the framework.

Rattan stems combine strength and flexibility that make them suitable to produce cane furniture with intricate designs. Rattan is commercially the most important non-timber forest product in Southeast Asia, second only to timber. A large amount of research has been done on the Asian species used in trade, including their botany, ecology, cultivation, utilization, manufacturing, treatment, etc. while significantly less research has been done on the African species.

Traditional Use

Rattan is often collected while conducting other activities in the forest, such as hunting. Usually the base of the rattan stem is cut and then the plant is pulled down from the canopy. Often the prickly stems scratch the collector, or they may dislodge other branches, insects or their nests, or even snakes from the trees above. Frequently portions of the rattan are left behind suspended in the trees. Up to 50% of the stem may be left behind. In some cases, trees may be cut down to get a particularly large diameter stem. It is clear from the Asian experience that the different species of rattan have quite different characteristics in terms of regrowth, following harvest. Only preliminary work has been done on regrowth in the African species.

If the stem is left after cutting for 15 to 30 days, the side branches are more easily broken and larger portions of the stem can be harvested. Machines for pulling the stem down and for decorticating before transport have been developed, but they represent a further burden of wheels, pulleys and ropes to be carried deep into the forest. Moreover, leaving the cane in the forest after cutting increases the chances of it losing quality.

The cane is brought in from the forest, and the bush meat captured is often sold to provide the cash for the transport of the cane to the regional wholesale markets, where it is sold to the middlemen, who transport it in bulk to the towns. It was estimated by Defo that twenty forest villages served the wholesale market, which services more than 100 small workshops in Yaounde. Furniture makers in Cameroon are usually based in the urban centers and are selling mainly to the middleclass there. Occasionally, a container load of furniture will be purchased and exported to Europe.

According to Sunderland, in Cameroon, Nigeria and Equatorial Guinea, cane gatherers, basket weavers, traders and furniture artisans are almost exclusively male, with women playing a minor role in the trade

Commercial Use

In Asia, processing includes washing, cleaning, bleaching, drying, and surface finishing and grading. Cane is sold as rattan sticks, cane, (either in rolls or lengths) core and split cane. Rattan is thought to come from raut/rotan the Malaysian words meaning to pare/smooth. The thinner top of the cane is discarded, and the middle portion is used. The bases are sometimes used for walking sticks and canes. The cuticle, epidermis and outer bundles are used to make the splits used to bind and weave. The inner core is used to make the furniture frames and itself split sometimes.

The hardness, stiffness and elasticity of the pith all vary with species, age of stem and the thickness, as do the length and internodal length, the color, gloss and texture. The strength of the cane is related to the arrangement and the nature of the vascular bundles. The lignification and vascular bundle distribution determine the eventual quality of the cane. A preliminary anatomical survey of the African species suggests that they may lack some of the qualities of the better Asian species for furniture making (Weiner et al). However, there is a suggestion that the herbarium specimens on which some of this work was done may have been mis-identified, (Sunderland, per. comm.).

The rattan is either used whole, or as peel or core. Peel is the outer bark used for braiding, to cover or support joints and as a decorative wrap for the rattan or metal frames. Core is the central portion of the stem; it is split into smaller pieces and used to weave decorative or supportive trim.

The quality of the processed cane is linked to the diameter, length, color, hardness, and length of nodes, uniformity and absence of fungal stains, scars/bruises, checks, and discoloration.

Rattan furniture prices vary widely and are linked to the type of cane used, the quality of the workmanship and the designs, and the incorporation of other materials, such as leather, wood, bamboo and metal.

In Kalimantan, the commercial plantations of *Calamus caesius* take 8-12 years to reach harvestable maturity, producing 13-18 meter bright yellow, glossy canes. The palms are harvested by pulling down, stripped of their leaf sheathes, then cut to head lengths of 2-3 m, or 5-7 m then bent. The initial processing includes drying and fumigating. In the secondary processing, the stems may be washed with sodium hypochlorite or hydrogen peroxide, fumigated with sulfur, then sorted; machine cut to uniform lengths, the nodes may be scraped off at this point also. They are then graded into quality classes/lengths, for use as cores and peeled, or as splits. They are also graded as to hardness. They are finally soaked, sanded and dried. The 18-34 mm poles are used for furniture, the 12-18 mm are used for other decorative articles. Up to 3 tons per hectare of green cane may be harvested.

Sources and Prices

Malaysia, Indonesia, Vietnam and China, are major sources of rattan, with smaller quantities originating from Myanmar, Thailand, Philippines and Kampuchea. Commercial plantations of *Calamus spp.* have been established in Sarawak, Sabah, the Philippines, Indonesia and Papua New Guinea. Singapore, Hong Kong and to some degree Taiwan have been major value added processors in the past. The companies based there still dominate the world trade.

The main trade from Asia is with the USA, France, Italy, Spain, Egypt, the Netherlands, and with Japan, Taiwan, China and Korea. The USA imports rattan from the Philippines and Indonesia. In the past, much of this trade has been semi-processed cane for further processing, treatment and manufacture into furniture in the importing countries. For the last ten years, Indonesia has banned the export of raw or semi-processed cane to encourage processing internally. However, the Indonesian trade figures are extremely suspect, with import and export figures differing by large orders of magnitude. Whatever the volumes exported, it is clear that hundreds of thousands of tons of rattan are harvested annually in Indonesia alone. Probably less than 15% of these exports are being produced on the commercial plantations in Kalimantan and elsewhere.

The world trade in rattan is large, and in the past, much of this was raw or semi-processed rattan. It is estimated that the added value of raw (whole) or unprocessed rattan to finished rattan increases between 1-2,000%, whereas semi-processed or half-finished rattan (core) to finished rattan increases by 3-800%. This added value depends on the workmanship and creativity of the workers. The value of the world trade in rattan is at least \$100 million annually. The trade price of a ton of cane fluctuates around \$1-2,000, depending on quality and supply. The value of the furniture trade was put at \$6.5 billion by the ITTO in 1998.

For export, the stems are cut into 10-20 foot lengths; the diameter varies, but rarely exceeds 1.75 inch. Rattan (unpeeled) is sold retail in the US in 8-10 ft. lengths at \$9.50 for a 3/4" pole, to \$27.50 for a 1 7/8th-inch pole. Peeled rattan in 9-12 ft lengths costs from \$9.50 for a 7/8th-diameter pole to \$18.50 for a

1 3/4-inch pole. The smaller diameter canes, (red pullet, Palembang and koboo are sold by the pound. The 1/8" has 250-300 ft per pound and the 1/2" diameter has 10-15' per pound. They both cost \$7.50. Prices vary seasonally and from supplier to supplier. On the internet for example, rattan poles of 9 foot long where being quoted in NJ at \$17.95, with a discount of 25% being given on bales of 40 canes of up to 2" in diameter.

Chair cane is the outer bark of rattans, which is stripped from the core, and cut into various diameters and thickness' for use in weaving, or for wrapping and binding. Depending on its diameter, the amount of chair cane needed to weave four chairs, a 1000 ft. hank, sells for between \$34-\$49.00 retail. The finer diameters, 1.5-mm etc. are cheaper than the larger diameter 3.5 mm. The strands in the hanks are c. 8 foot long.

The binding cane, which is used to lash woven pieces to the chair frame, costs \$9.00 per 40-ft length. This ranges from 4 - 6 mm in diameter. A coarser split 8-9 mm cane is used to wrap wooden and rustic furniture. This costs between \$15 - \$21.00 for 300 ft., depending on the strand length.

The color variation, the degree of staining and damage and the joint scars influence the quality of the chair and binding canes.

Reed is the split core. It varies in diameter and cross section from 5/8th-split oval to 1/4 inch flat. It costs between \$12.00 to \$15.50 a hank, with hanks containing 90-370 ft of reed depending on the diameter. It is also used to produce pre-woven cane webbing for chair seats and backs, and comes in a variety of patterns and designs. The price varies from \$142 - \$427 for a fifty-foot roll, depending on the width, from 12" to 36".

Opportunities

In Asia rattan, furniture manufacture has been a labor-intensive, comparatively low capital investment; rural based industry, which earns foreign exchange. There is an opportunity to build on the furniture making expertise of the local workshops in Cameroon, but design and marketing help is critical to their eventual success. New machinery is needed, steaming equipment, moulds for forming, better or improved ways to sand/scrape, concave cut, drill, dowel, groove, glue, staple, bind joints, stain, add upholstery are all needed. Carbide tipped tools and other stripping and splitting devices are likely to be needed. Training will be needed in processing, cleaning, treating for insects, scraping, straightening, binding, framing, finishing etc.

The trade in rattan furniture is becoming increasingly sophisticated. If the African rattans are found to have the mechanical and other properties of their Asian competitors, there is a possible market for high quality furniture. Attention will have to be paid to the quality of the raw cane, and the attention to detail, especially the jointing and binding. Knock down components are one way of reducing shipping costs, but need good design and engineering to work well. The coloring and finishing of the cane is also crucial. Different designs and finishes are needed for the various markets, with Italy, German, the US etc all having different demands.

There has apparently been some interest shown by the Southeast Asian processors in sourcing rattan in West Africa. The International Network for Bamboo and Rattan INBAR is currently extending its activities into Africa. There is a body of research already done in Asia that can be readily adapted, and Information centers at the Forestry Research Institute, Malaysia and also in India at Dehra Dun. ICRAF, Limbe and Kew are looking at rattan techniques aimed at conservation through cultivation. ECOFAC is doing research into ecology and local marketing. The African Rattan Research Programme is preparing a report on regional and international trade.

Constraints

The collection of rattan cane is dirty, heavy, hard work. It is usually a marginal activity, done occasionally, depending on the weather, farming activities, hunting, prices for alternative employment, etc. It is a hardship income source, rather than a regular activity. The supply is therefore erratic, depending on the prices and the timing of other activities. There is high wastage, both in the forest, with long lengths left unharvested and at the factory with 30% plus of the cane being rejected or wasted.

The demand is for quality, not quantity, so there is also the need to compete with the quality being produced by the Asian nations after many years of research and experimentation. For example, rapid drying of the harvested cane is one key to reducing the amount of stain fungi and thus keeping the quality of the cane high. More than 20% of the harvested canes may be lost to starchy rots and stains. There appears to be little value in exporting raw cane, splits or binding cane.

There is some uncertainty about the quality of the African species for furniture. In the Asian genera for instance, the leaf sheathes erode with age, but they persist in *Eremosphata* and *Laccosperma*. The stem of *Eremosphata* spp. may tend to be more triangular in cross section than round. The mechanical qualities of the African stems have been questioned. Commercial canes in Asia have thick walled fibers, large diameter metaxylem vessels and a mean fiber content of between 26-39%.

The availability, ease of extraction, density of the wild plants etc will determine the supply of raw cane. The investment into quality, processing equipment, machinery and training will determine the supply of saleable furniture. A regular supply of suitable cane, with clear standards and grading, followed by value added processing, and marketing/export is needed to expand the market beyond the small numbers of affluent local and regional customers.

The volumes needed to serve the furniture manufacturers may simply not be available. Three people can process 500 plus canes 15 ft long per month. A small manufacturer may use between 10,000 - 240,000 canes per year. One chair can take 2 days to make, a sofa 6 days. Even if the volumes are available, the prices paid, the efficiencies and the costs of transport to the markets may keep the return to the producers and harvesters low.

The natural tendency will be for the primary market to be for raw/ minimally processed cane for use in the existing factories around the world. The possibility of working to ban the export of raw cane from the CARPE countries should be considered. For instance, it wasn't until the bans on raw cane by the Philippines and Indonesia that Japan invested heavily in the carpeting and matting factories of S. Kalimantan.

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TWISTED FLOWER

***Strophanthus gratus* (Hook.) Franch.**

Apocynaceae

Strophanthus gratus is fairly common to deciduous forest and secondary growth from Sierra Leone to Cameroon, and extending to Congo. It is a woody climber, or shrub, growing to 25 metres, with large bell-shaped white or purple flowers. The name “*Strophanthus*” is derived from the Greek word *strophos* – a twisted cord or rope – and *anthos* (flower). The seed is from 7 to 20 mm in length, light brown, with a greenish tinge.

Traditional Use

In Ghana, the leaves are used in a rub to treat fever and are an antidote for back-necked cobra bite. Mashed and pounded leaves are applied to guinea worm sores, and the leaf juice is used to treat ulcers. The root is used to treat venereal diseases. The seeds and wood are used in arrow and fish poisons (Abbiw, 1990). In many parts of West-Central Africa, *S. gratus* has important cultural and ceremonial uses, including as protection and to bring luck. Traditional names within Cameroon include Kerim (Korup) and Ejoku ja mfa (Oroko). A number of *Strophanthus* species are used to make arrow poisons.

Commercial Use

S. gratus seed yields the cardiotoxic compound ouabain. Many *Strophanthus* species yield the cardenolides strophanthins K, g, etc., which act as heart tonics. The strophanthins from different species vary somewhat in chemical composition. The Apocynaceae family contains a number of plants yielding cardenolides and some of the most important cardiotoxics. The seeds of *S. gratus* yield 3-7% of g-strophanthin – or ouabain. Ouabain was first isolated in crystallized form in 1877. It is used in preference to digitalis when more rapid action is required (Olivier-Bever, 1986). In addition to strophanthine (a glycoside), *S. gratus* contains the alkaloid inoiene, and the steroidal glycoside k-strophanthoside.

Raw Material Trade

In 1989/90 and 90/91 around 2,700 tonnes of *Strophanthus* were licensed for export each year from Cameroon (Besong, 1992). Plantecam currently exports fairly large quantities of *Strophanthus*, which has featured as one of its main species for the export market for decades. For example, between 1985/86 and 1990/91, 6.7 tons of seed were delivered to the Plantecam factory in Mutengene. Plantecam staff are working on the domestication of *S. gratus* within their compound in Mutengene.

Europe is the main destination of *Strophanthus gratus* fruit – Luxembourg and Belgium account for 38% of market (Cunningham, 1999). Other countries importing significant quantities of *S. gratus* seeds include Britain, France, Swiss, Germany, and US.

There are 28 species of *Strophanthus* in Africa and Asia, and the commercial drug is often comprised of a mix of the species. Primary commercial species include *S. kombe*, which grows in East Africa; *S. hispidus* (preferred by the German market “because of their guaranteed purity”), *S. glabra*, *S. emini*, *S. courmontii*, *S. thallone*, and *S. Nicholsoni*. *S. gratus* is preferred by some because they are easily identified and yield strophanthin readily in crystalline form (Grieve, 1999).

Market Opportunities

- There exists a significant market for ouabain pharmaceutical products;
- Marketing and trade networks exist for the raw materials;

Market Constraints

- It is unlikely that pharmaceutical medicines (in contrast, for example, to botanical medicines, foods, beverages, and cosmetics) will be strong candidates for “green” or “fair trade” marketing schemes;
- The existing and potential relationship between *Strophanthus* raw material sourcing, conservation, and development remain unclear; it is likely that local communities benefit little from existing trade patterns and the exploitation of this species within Cameroon;
- Pharmaceutical markets are large, multi-national, and sophisticated; determination of sourcing strategies is based on cost and quality, and decisions are usually made far from the countries in which species grow; a relatively unresponsive and powerful market such as this is not ideal for small-scale or community based marketing projects.

Next steps

- Prior to initiating any marketing project, research should be undertaken to determine the nature and scope of existing raw material sourcing strategies – ecological impacts, management practices, trade networks, key players, value chain, etc.;

YOHIMBE

Pausinystalia johimbe

Rubiaceae

Pausinystalia johimbe, yohimbe, is a tree found in the forests extending from SE Nigeria, through Cameroon, Gabon, Equatorial Guinea, and Congo Brazzaville. Previously found in Nigeria, it is now all but extinct there due to over-exploitation. *P. johimbe* occurs mainly in closed-canopy forest, which it appears to require for healthy recruitment (Sunderland et al, 1997; 1999). Both *P. johimbe* and *P. macroceras* are known as “yohimbe”. Both are fast-growing species, but neither reaches a diameter of more than 50 cm dbh. They do not occur together in the same place (Sunderland et al, 1997; 1999).

P. johimbe contains a mixture of alkaloids, the principle one being yohimbine. The presence of yohimbine in bark is highly variable, with optimum quality and concentration of alkaloids found in the bark of the main stem; yohimbine content was found to be as high as 3.42% in the rainy season and as low as 2.52 % in the dry season (Paris and Letouzey, 1960). Alkaloids are not present in significant quantities until the tree is 15-20 years of age, at which time it can contain between 2-15% yohimbine (BPC, 1947; Sunderland et al, 1997).

P. johimbe bark collections take place almost exclusively in Cameroon, although increasing interest in sources in other countries exists. Yohimbe bark harvest is often linked to logging operations, which open forest area, and following which employees fell trees and strip yohimbe bark (Sunderland et al, 1999).

Traditional Use

Yohimbe is used traditionally to restore erections in impotent men, has been smoked as a hallucinogen, and used to treat angina and hypertension. Yohimbe is used as a performance enhancer for athletes and to increase the clarity of the voices of singers during long festivals. Yohimbe is also used as fuelwood, fish poison, and the inner bark as straps for hunting panniers. Yohimbe is consumed as powdered/ground bark, and is drunk as liquid, after bark is boiled in water with accompanying herbs. Both *P. johimbe* and *P. macroceras* are used traditionally, and in many cases the use of these species is not differentiated, although *P. johimbe* is considered superior by healers. Yohimbe is primarily consumed at a subsistence

level, but bark is also traded within the region. Local consumption of yohimbe is on the rise, and is now widespread and common. Healers and traders have noted the scarcity of *P. johimbe*, which is rare, unreliable, and much more expensive (see review of ethnobotanical literature and reports from field research in Sunderland et al, 1997; 1999).

Pharmacology

Most medical research on yohimbe has been on the indole alkaloid yohimbine, rather than the whole extract (as it is used traditionally). Yohimbine inhibits contraction of blood vessels caused by adrenaline-mediated stimulation of the sympathetic nervous system (i.e. the flight or fight response). Specifically, yohimbine selectively blocks pre-synaptic alpha-2-adrenergic receptors, and blocks peripheral 5-HT receptors. Administration of 15-20mg per day has been shown to result in increased muscle tone and stimulation of sacral region of the spinal cord, as well as genital tissue. Yohimbine has shown benefit in cases of psychogenic impotence and vascular insufficiency. Adverse effects can include increased heart rate and blood pressure, dizziness, hallucinations (at very high doses), nausea, salivation, irritability, headache, and skin flushing (Pure World, 1999).

Trade in Raw Material

The trade in yohimbe bark is complex and varied. In their 1997 study, Sunderland et al found that the Yaounde market, for example, is fed by sources from the East of Cameroon. The majority of this bark is from *P. macroceras*, due to the poor representation of *P. johimbe* in this area. The highest population density of *P. johimbe* is found in the South Province which supplies Yaounde, Edea, and Douala with bark (50% of which is *P. johimbe*). The NW Province is primarily supplied by bark sourced from the Mamfe area, from which bark also goes to Douala.

Plantecam, a subsidiary of the French company Fournier Laboratories, is the sole supplier for yohimbe to the pharmaceutical company Boehringer Ingelheim (to which it supplied around 100 tonnes in 1997), as well as other companies overseas. Boehringer Ingelheim of Germany imports significant quantities of yohimbe from Cameroon. In 1997 they commissioned ICRAF (International Council for Research in Agroforestry) to undertake a pilot study of the ethnobotany, ecology, and natural distribution of yohimbe, and to assess the effects of harvesting practices on populations (Sunderland et al, 1997).

Plantecam operations in Cameroon were commissioned as a Free Trade Zone in April 1995, which means that the company is not liable for national taxes or customs duty. Plantecam/Fournier Laboratories is wholly French-owned, and does not have Cameroonian shareholders. Annual turnover in 1997 was 1.5 – 2 billion CFA (Sunderland et al, 1997). Plantecam was investing in extraction capacity, in order to ship smaller quantities of raw material overseas (1 tonne bark = 1 kg yohimbine). Depending upon moisture content and quality, Plantecam pays suppliers between 125-280 CFA/kilo. Roadside prices paid to collectors are generally between 50 – 150 CFA. Prices paid to local collectors are often a third or half of the prices Plantecam pays per kilogram (Sunderland et al, 1999).

Yohimbe is collected by outside contractors, who supply material to Plantecam and others for sale overseas. Collections are made under licenses provided by the Forestry Department, with most contractors registered in Littoral, SW and South Provinces. In fact, however, the majority of collections are undertaken without licenses by independent contractors and local communities who are paid at the roadside for the delivery of bark. Suppliers to Plantecam between 1992-94 included: Ngah Dima, ITTC, ECIC, Ngako, Jahoung, KAMDEM, and Mme Lea (Sunderland et al, 1997).

Sourcing methods

Yohimbe bark harvests are undertaken in the rainy season (May-September). Bark is collected only from the main stem, and trees are often felled to speed harvests. It is estimated that 98% of the trees exploited are felled. Although larger individuals provide more bark, they are difficult to come by, and trees as small

as 10cm dbh are harvested. Both *P. johimbe* and *P. macroceras* are harvested, and are difficult for many to distinguish in the forest. *P. macroceras* has substantially lower yohimbine content than *P. johimbe*. Current harvesting strategies for yohimbe are considered unsustainable (Sunderland et al, 1997). With 98% of trees destroyed in the harvesting process, the genus can regenerate and recruit well, but persistent exploitation will compromise long term health of populations. Sunderland et al recommend sustainable harvesting methods in the wild (stripping bark and allowing callus or re-growth bark), and cultivation (prolific quantities of seed; coppices well, ideal candidate for clonal propagation). ICRAF (International Centre for Research in Agroforestry), in collaboration with IRAD (Institute of Agricultural Research and development) are investigating the potential to domesticate the species – this includes improving understanding of the germination process, improving the genetic base of the species, and to develop techniques for the large-scale cultivation of the species using appropriate vegetative propagation techniques (Tchoundjeu et al, 1999).

Commercial Use

Interest in yohimbe outside of Africa was first recorded in Germany, where it was used as an aphrodisiac, as well as for treating painful menstruation and prostate inflammation with bladder complaints, and serving as a local anesthesia for eye, ear, and nose operations. Growth in the US herbal medicine market use of yohimbe came about in the 1970s (Foster, 1999). Prior to Viagra, yohimbe was the medicine of choice for impotency for millions of men around the world. Markets for products treating erectile dysfunction are substantial – it is estimated that 50% of men between the ages of 40 and 70 suffer from some degree of erectile dysfunction (Massachusetts Male Health Study).

Under US law, yohimbe is regulated as a dietary supplement, and yohimbine hydrochloride is an FDA-approved pharmaceutical drug for impotence. The American Urological Association's Clinical Guidelines Panel on erectile dysfunction classifies yohimbine as a second line treatment for organic erectile dysfunction (Pure World Botanicals, 1999). Germany's Commission E monograph does not recommend yohimbe for impotence, citing mixed clinical evidence and the potential for adverse side effects, such as tremors, sleeplessness, high blood pressure, and rapid heartbeat (Tyler, 1999).

Yohimbe bark contains up to 6% of a mixture of alkaloids, the principal one being yohimbine (Tyler, 1993). Yohimbine was first isolated from yohimbe in 1896. The US FDA approved the use of yohimbine as a treatment for impotence, and the compound is now available in eleven prescription drugs including Aphrodyne, Erex, Yocon, Yohimex, and Yovital. A synthesized yohimbe pharmaceutical drug containing yohimbine hydrochloride has been available for decades. Yohimbine affects the autonomic nervous system and helps with male erection by increasing blood flow to the penis (Foster, 1999). Yohimbe tree bark has also been reported to increase energy and endurance, while building both strength and muscle mass by raising testosterone production. It is also used for weight loss. There is not sufficient medical evidence to prove these claims.

In 1995, the US FDA sponsored a study of 26 OTC (over-the-counter) yohimbe products and found only trace amounts of yohimbine in the products tested, ranging from 0.1 to 489 parts per million (PPM), probably not enough to have much effect, and much less than the average yohimbe content of yohimbe bark (7,089 ppm). As Varro Tyler reports, "There is almost a 100% chance that the yohimbe product you purchase over the counter will be worthless" (Milman, 1999).

More seriously, yohimbe has been linked to serious health problems, and steps are being taken in the US to better regulate yohimbe products. Included in the FDA "Unsafe List", it can cause anxiety, sleeplessness, and may react dangerously with a substance found in wine and cheeses, causing high blood pressure, nausea, and vomiting (Milman, 1999). The 1997 FDA safety rules for ephedra –containing products included advising against the use of ephedra products mixed with caffeine or yohimbe (Nutrition

Science, 1997). Health Canada and the Health Protection Branch of the federal government banned the sale of yohimbe, along with dozens of other botanical products, due to safety concerns (Lake, 1998).

As a result, although the media attention on Viagra helped to create interest in botanical impotence drugs, concerns associated with yohimbe's safety have had a dampening effect on its widespread acceptance. Although yohimbe is the only botanical sex aid to be listed in the Physicians Desk Reference, and has been scientifically proven to improve sexual function, its side effects are considered as serious, if not more so, than those associated with Viagra. Those with hypertension, prostate problems, or heart disease - in effect those most likely to consume it - are warned against using yohimbe (EN, 1999). Ginkgo, garlic, ginseng, oatstraw (*Avena sativa*), muira puama, damiana and other botanicals tend to be promoted in the botanical medicine literature for wide spread use over yohimbe, although for specialists, yohimbe appears to be holding its own. (e.g. Haynes, 1998; Brody, 1998; Natural Way, 1998). In sum, yohimbe is considered a useful medicine, but one to be taken seriously and under the advice of a specialist, and not consumed through the wide-spread self-medicating botanicals market.

Yohimbe Products

Yohimbe is sold as both a pharmaceutical drug containing synthesized yohimbine hydrochloride, and as botanical medicine (as bark extracts or ground up bark). Yohimbe dietary supplement products are usually sold as capsules or tablets, but liquid extracts are also available. Yohimbe products are sold both for impotency, and as a fat-burner/muscle builder for men. Prescription drugs (today usually 5.4 mg per tablet) include Aphrodyne, Erex, Yocon (Palisades Pharmaceuticals), Yohimex, and Yovital, and over-the-counter botanical preparations like Yohimbe Power, Vigor Fit for Men, Inca Warrior Potent Male Formula, Yohimbe Backdraft, Men's X-Action Male-Performance Supplement, Super Man, Hot Stuff, and Yohimbe Concentrate. In addition to the botanicals and pharmaceutical industries, yohimbe is also featured increasingly in nutraceutical products designed to boost energy. For example, SoBe Beverages recently launched the Energy Drink, with Guarana, Yohimbe, and Agimime. In one advertising spot launched in 1999 by Sobe (South Beach Beverage, Norwalk, CT), the benefits of herbal ingredients, or "functional beverages" is made explicit, including the sustained energy contribution of yohimbe to the SoBe energy drink (guarana provides instant energy, arginine enhances physical performance)(Khermouch, 1999).

Botanicals are playing an increasing role in nutraceuticals, particularly sports nutrition. Key botanicals used to increase endurance and energy include yohimbe ephedra, ma huang, guarana, kola nut and ginseng. Nutraceutical, or functional foods, include added ingredients that impart health benefits, and are growing rapidly in the mass market (Shugarman, 1999).

Companies marketing yohimbe products include: Univeral Labs, Twinlab, Ultimate Nutrition, Only Natural, Vitol, Solaray, and HerbPharm. It is difficult to compare prices between brands since the quality of capsulated powder and the concentration of liquid extracts varies greatly (www.yohimbe.org). An example of products and prices are those of Gaines Nutrition (Madaus):

Yohimbe Extracts, 1500 mg – 110T - \$39.99

Yohimbe Alcohol free extract – 1 fl oz. – \$9.95

Yohimbe extracts, 1000 mg – 50C – \$18.99

Yohimbe Bark powder (use with caution – *Corynanthe yohimbe*) – 1 lb – \$23.50

Yohimbe extract, 1000 mg (10 capsules free) – 110C – \$35.99

Suppliers of yohimbe raw materials to manufacturers include: AIDP, ATZ, Pure World Botanicals, and Stryka Botanics Co (USA); Nuova Linnea (Switzerland), Extractos Natra (Spain), and Schweizer Hall. A Nigerian company – Noga-Wills (Nig.) Ltd. specializes in the "supply of tropical rain forest products used in pharmaceutical and cosmetic industries internationally". Advertised on the internet as available is a large consignment of *Corynanthe yohimbe* bark. The company also claims to have their "own large Tropical Rainforest reserves and a team of Traditional Medicine Practitioners, whose botanical

knowledge of plant species are invaluable...We have special harvesting arrangements for our herbs, as well as...a valid registration certificate with the Corporate Affairs commission of Nigeria (RC No. 200724).

Substitute Products

A range of botanicals sold primarily for other purposes – like ginkgo, ginseng, garlic, and oat straw – are also sold as part of formulations intended to boost sexual performance. Damiana, muira puama, and ginkgo are widely recommended and sold as aphrodisiacs today.

Damiana (*Turnera diffusa*, *T. aphrodisiaca*) is a shrub with aromatic leaves found throughout Mexico, Central and South America, and the West Indies. Mayan Indians used Damiana for “giddiness and loss of balance” and as an aphrodisiac. It is also used traditionally to treat colds, catarrh, and nervous disorders. In addition to its use in medicine as an aphrodisiac, Damiana is used as a flavouring in food products, including alcoholic and non-alcoholic beverages, baked goods, and deserts. Damiana was introduced into American medicine (as an aphrodisiac) in 1874 by a Washington DC druggist who sold 8-ounce bottles of the tincture. Between 1888-1947, Damiana leaf and elixir was listed in the US National Formulary, and for more than 100 years in Europe and North America has been associated with improving both male and female sexual dysfunction (www.rain-tree.com). No constituent responsible for claims of damiana as an aphrodisiac has ever been identified, and some feel that because it lacks significant physiological activity, it is nothing more than an ‘herbal hoax’” (Tyler, 1993).

Damiana leaves are sold in a variety of forms, and by a number of companies including Botanicals International (www.botanicalsintl.com), and as Damiana Liquer, sold by Damiana Importing Inc. In Houston Tx. Damiana is also considered a treatment for depression, accompanied by a loss in libido. Damiana is also mentioned as a useful herb in preventing prostate cancer, hot flashes

Ginkgo (*Ginkgo biloba*) is a multi-faceted herb, which has been suggested by Varro Tyler (1999) as a possible treatment for impotence (“put the zing back in the sex lives of men whose erections are affected by taking antidepressants”). Popularly used as a memory-enhancer, ginkgo increases blood flow throughout the body. In a 1989 study conducted by the Urology Clinic in Aachen, Germany, and published in the Journal of Urology, ginkgo was found to produce better results than the anti-impotence drug papaverine hydrochloride (Haynes, 1998).

Market opportunities:

- Demand is significant, and is outstripping supplies; demand is projected to grow in the coming years;
- Viagra has drawn attention to botanical aphrodisiacs and treatments for impotence;
- Existing trade networks exist for the bark;
- Improved and increased processing of material within Cameroon is underway;
- A few international companies have demonstrated concern over the long-term sustainability of yohimbe raw material sources;
- Research is underway to domesticate the species, and thereby supplement supply of raw material; research on ecology and sustainable management in the wild has also been initiated;
- Yohimbe is sold over-the-counter in markets that respond well to labeling of products according to environmental and social standards;

Market constraints

- Demand will be tempered by increasing concern associated with the side-effects associated with yohimbine;
- Existing trade networks, processing, and commercialization activities do not appear to significantly benefit local communities and those living in proximity to wild yohimbe;
- Although research is underway, the nature and extent of subsistence use, trade networks, and ecology are not well understood;

- Strategies for the sustainable management and sourcing of bark *in situ* are not yet in place, and more research is needed;
- It is not clear that the legal and policy context supports the sustainable management of yohimbe on a local or national level.

Next Steps

Yohimbe is a good candidate for a certification and labeling program – an area likely to play an increasing role in the botanical medicine market (plagued as it is by sustainability problems associated with many of its raw materials). Although tracking and chain of custody issues would prove challenging within Cameroon, yohimbe appears a good candidate for this approach, given its relatively high value, consistent international demand, concerns associated with quality and species identification (which can be addressed alongside sustainability issues), and relative ease with which it might be sustainably managed.

The ICRAF study (Sunderland et al 1997) concluded with recommendations that might also be considered by CARPE, including:

- identification manuals to distinguish between species;
- development of sustainable harvesting methods in the wild (bark regeneration; yohimbine content in callus bark, etc.);
- further inventories to provide greater insight into stocking levels;
- domestication programs (including assessment of farmer interest);
- market analysis;

An extensive “state of the knowledge” study of yohimbe ecology, management, and markets is underway within CARPE, which will help provide some of the extensive background information needed to pursue marketing and sustainable sourcing strategies for yohimbe (Sunderland, Cunningham, et al).

Examples of Yohimbe Products

Company	Product	What they say about the product
Nature’s Herbs	Yohimbe Power	Certified Potency Yohimbe-Power contains 400 mg Yohimbe Extracts, standardized for 8mg Yohimbine per capsule. It offers all the naturally-balanced active principles while retaining and enhancing all the whole-plant synergistic benefits.
SoBe Beverages www.sobebev.com	Energy Drink (guarana, yohimbe, and argimime)	All SoBe beverages are specially formulated to uplift the mind, body, and spirit, with exotic teas and juice blends whose health benefits have been enhanced by the addition of herbs, nutrients, and other natural supplements.
Team Bodybuilding www.teambodybuilding.com/yohback.html	Yohimbe Backdraft	A team body building formula... contains Yohimbe Bark extract 10 x 25 mg Dioscorea, 20 mg Niacin, and 10 mg Boron. Enhances and maintains elevated testosterone levels, provides all the critical sapogens necessary for muscle growth, and expands capillaries for maximum muscle nutrient feed.

Advanced Labs (offered by Reach4Life Quality Products) www.reach4life.com/1617.html	Yohimbe Gold	Yohimbe Sublingual Extract “is the extract of the bark of the Corynanthe Yohimbe Schum., a rubiaceous tree growing in the southern Cameroon’s district in Africa.” It is an aphrodisiac and athletes report increases strength and muscularity. Each dropper full of Yohimbe Sublingual Extract formula (1cc) contains 850 mg of pure extract, which is equal to 12,000mg of raw herb bark.
Madis (Pure World) Botanicals South Hackensack, NJ 07606	Yohimbe PE 4% (4% total yohimbines)	Yohimbe PE 4% is an extract standardized to 4% total yohimbines (yohimbine \geq 2.5%), sold as a red-brown powder with characteristic odor and taste. The assay method employed is HPLC (with yohimbine standard), maltodextrin as an excipient, and moisture content at not more than 5%.
Nature’s Sunshine Products/Back to Health www.bth.4the.net/NSP/Xaction.html	Men’s X-Action Male-Performance Supplement	Contains a synergistic herbal combination that enhances male performance energy, featuring muira puama stem concentrate (<i>Ptychopetalum olacoides</i>) and yohimbe bark, in a unique herbal base that includes arginine, damiana leaves, oat straw, saw palmetto. Muira puama and yohimbe have long been valued for supporting and stimulating the nervous system.
Ashaninka http://ashaninka.com	Inca Warrior Potent Male Formula	“Ancient Weapon, New Battle” – Inca Warrior Potent Formula is a combination of tropical plants traditionally used by sexually active men of all ages, including: Damiana, Guarana, Maca, Marapuama, Suma, Chuchuhuasi, Yohimbe, and Catuaba.
Cyberseeds Cyberseeds.com	Yohimbe seeds	“Herbs for Impotence – Alternatives to Viagra”. Include Damiana, Gingko biloba, Ginseng, and Yohimbe. They do not have a source for yohimbe seed, although the others are available online.
Milagro www.tfg-marketing.com/viagra/impotency.htm	Mialgro for Men	Milagro is a natural male potency pill that provides total systemic support for men who wish to stay healthy, strong, and virile for decades to come. The balanced formula nutritionally supports increased desire, erectile dysfunction, ejaculatory control, and improved fertility. Includes a specially engineered combination of Zinc (30 mg), L-Arginine hydrochloride (2,800 mg), Yohimbe bark extract (800 mg), DHEA (50 mg) and a comprehensive herbal blend (includes damiana, muira puama, ginseng, oat straw).
Fit America/Vigor Fit www.vigor-fit.com	Vigor Fit for Men	Each capsule contains 480 mg of a proprietary blend of: Ginseng root, Damiana leaf, Saw palmetto berries, Muira-puama root, Gjuta kola herb, Fo ti root, Saraparilla root, and yohimbe.

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VI. Highlights from Preliminary Market Reconnaissance

A. Cola (Kola Nut)

- The leading soft drink beverages are Coca Cola, Pepsi Cola, then Diet Coke which include cola as an ingredient, which while in low proportions, are in beverages whose sales are in the billions of dollars.
- New cosmetic applications for cola include the extract of the ***kola nut***, which has good properties but color and odor problems. Estee Lauder analyzed and separated its constituents, and identified the individual components with anti-irritant properties.

F. Garcinia kola

- U.S. imports garcinia kola exceed \$10.0 million worth, most of which is used in over the counter herbal weight loss remedies.
- A scientist reported at the International Botanical Conference in St. Louis this year that compounds found in the garcinia kola stopped the spread of the deadly Ebola virus in lab tests and may be effective against the flu.

G. Organic or Shade Grown Cocoa

- Cameroon is a major exporter of cocoa, of a quality highly desired in the market.
- While the organic cocoa market is in its infancy, with less than one percent of the overall \$13 billion U.S. **chocolate** retail market, the growth rate parallels the organic food industry as a whole (over 20% annual increases throughout the 1990s).
- International Wildlife reports that the **Chocolate** Manufacturers Association has launched a long-term program to develop environmentally sound growing techniques and to improve the livelihoods of the small farmers that supply most of their raw material. The industry's growing support for shade-grown beans holds out hope that most **chocolate**, not just ***organic chocolate***, will be grown in a way that preserves natural habitat."

H. Eremospatha macrocarpa, Laccosperma secundiflorum - Rattans

- The total world market trade in cane was up to \$100 million, while rattan furniture is 100 times larger, in excess of \$10 billion.
- Raw cane exports are now banned from all the main producers, including the world's largest producer (80%), Indonesia.
- Smallholder cultivation of Calamus spp. has been underway for over a hundred years in Asia (Kalimantan).
- There is a clear synergy between rattan harvesting and other activities such as bush meat collection.

- There is a wealth of knowledge and experience available in Asia on rattan and INBAR is expanding to Africa.
- Producing rattan furniture can be a village level cottage industry, with low capital investments and many beneficiaries.
- The current regional experience in wooden furniture production can be extended to rattan.

I. **Aframomum spp.**

- In 1997, the total European market for flavor products was \$1,225 mill., and the US imported \$166 mill. of flavor oils.
- The majority of this usage is for beverages, and this is a growing market in the US and Europe.
- There was previously an important historic trade in Aframomum (grains of paradise) starting from the 15th century.
- Aframomum is currently being used as a flavoring in Sam Adams Summer Ale, and probably also in Hoegaarden.
- An essential oil with interesting properties can be extracted from Aframomum spp. seeds and leaves.
- This oil appears to have anti-oxidant, anti-microbial and cyto-protective properties.

Annex: Product Information Sheets

SUMMARY:

Aframomum spp.

- In 1997, the total European market for flavor products was \$1,225 million, and the US imported \$166 million worth of flavor oils.
- The majority of this usage is for beverages, and this sector is a growing market in both the US and Europe.
- There was previously an important historic trade in Aframomum (grains of paradise) from West Africa to Europe, starting from the 15th century.
- Aframomum is currently being used as a flavoring in Sam Adams Summer Ale, and probably also in Hoegaarden.
- An essential oil with interesting properties can be extracted from Aframomum spp. seeds and leaves.
- This oil appears to have anti-oxidant, anti-microbial and cyto-protective properties.
- The current use of *Aframomum* as a spice, flavoring and source of essential oils is limited.

NAMES:

Aframomum Melegueta. (Roscoe) K.Schum. Known in English as Grains of Paradise, Paradise Seeds, Guinea Pepper, or Melegueta pepper, the latter name is apparently a local name for pepper. It has also been called black cardamom.

In Amharic it is Kewrerima, Estonian; Melegeti aframon, French; Graines de paradis, Malaguettes, Poivre de Guinée, Maniguette, German; Paradieskorner, Guineapfeffer, Melguetapfeffer, Malagettapfeffer, Italian; Grani de Meleguetta, Grani paradisi, Mani guetta, Russian; Rajskiye zyorna, Malagvet, Spanish; Malaqueta.

INTRODUCTION:

Mentioned by Chaucer in 1366, guinea grains or melegueta pepper are the seeds of *Aframomum* spp. The genus originated in Africa and is related to cardamom (of Asian origin), with which it is sometimes confused in the literature. Both are in the ginger family, *Zingiberaceae*. The seeds were used as a cheaper substitute for black pepper in the fifteenth century before the East Indies trade dominated the market. The high price at that time may have led to them being called grains of paradise. Alternatively, the reputed aphrodisiac qualities of the seeds may have led to this name.

In the past *Aframomum* has been cultivated as a crop in Ghana (Lock, 1977) and also in South America. Before WWI disrupted the trade, Cameroon used to export to the United Kingdom and Europe. The plant was probably taken to the West Indies by slaves.

Although it is still an important commodity on the local and regional markets, the international trade in *Aframomum* has diminished significantly. One hundred years ago it was widely used as a flavoring in a variety of products. Nowadays it has a limited use in veterinary practice and to flavor spirits, wine, beer and vinegar. Ghana is probably still currently the main source of much of the internationally traded *Aframomum*.

The seeds are red/brown, turning grey when powdered. The taste is strong, spicy, hot and warm, a little bitter/acid at the close. It is probably closer to the cardamom seed in taste than it is to pepper, but not as aromatic. One description is as follows, "I would have to say it is "earthy" like when you go hiking in a pine forest and you smell the wet earth with a pine note. It is not entirely unlike Szechuan peppercorns, spicy, peppery, and herb/floral aromatic. It has an aromatic, peppery aroma."

ACTIVE INGREDIENTS:

Aframomum seeds contain the hydroxyphenylalkanones, gingerole, paradole and shoagole, the same active ingredients found in ginger. An acetone extract of Ghanaian seeds had approximately equal parts of (6) and (7)-paradole, and (6)-shoagole present. Other species have flavenoids, diterpenoids, etc. present.

Essential oils can be extracted from the seeds, leaves and rhizomes of *Aframomum*

Although the pale yellow to brownish oil from *A.melegueta* is not a regularly produced item, its spicy, woody sweet odor make it a possible substitute for other essential oils such as *Hedychium* in spice blends and balsam.⁵

MAIN USES

The seeds are still used extensively in the region, eg. for flavoring "pepe" in Cameroon. In Morocco and Tunisia it is used mixed with black pepper, cloves, cinnamon and nutmeg to make gâlat dagga which is a spice mixture used in cooking. In the United States there is a limited demand for it by traditional spice users, who use it in cordials and sausage. The Boston Beer Company uses them in their Sam Adams Summer Ale. The plant has found its way into some specialty Belgian beers and even ginger ale. It is not well known nor even widely used. It is used by some select brewers in Belgium to achieve unique flavors for their beers, but no one will divulge who uses it where.

Only small amounts are used in beer, home brewers use 1.5 gm/5 gallons or 3gm/7.5 gallons ground seed. Whereas in cooking comparatively large quantities of the ground spice are needed, and they are added just before serving.

⁵ . *Hedychium* oil is extracted from the rhizomes of *Hedychium spicatum*, another member of the *Zingiberaceae*, grown in India and Malaysia.

Insecticidal and anti-feedant properties have been reported.

SOURCES AND PRICES:

Trade data on current yields, production, value is not available. The international markets are narrow, with few buyers and sellers. They are also often informal, and outside of government control. Volumes traded internationally are comparatively low by all accounts. Although a current web site advertising Ghanaian NTFP's included *Aframomum* as one of the products it was able to source, it did not respond to e-mail inquiries,

Some retail suppliers of *Aframomum* in the United States include:

- Penn Herb, 603 N.2nd St, Philadelphia, PA 19123-3098, Tel. 1-800-523-9971, www.pennherb.com.
- The Peppers Guild, dchesty@ix.netcom.co
- Aphrodisia, 282 Bleeker St., NY N 10014, Tel. 212 989-6440,
- Penzeys Ltd., P.O. Box 1448, Waukesha, WI 53187, Tel. 414 574-0278
- DragonMarsh, Riverside, CA., www.dragonmarsh.com

Current retail prices range around \$2.2 for an ounce (\$1.75/25g), down from \$2.5/oz. five years ago.

There are apparently two types available on the international markets, one larger than the other.

OPPORTUNITIES:

In the early 1990's over 87% of the aromas used by Nestle's, one of the largest food companies in the world came from natural origins. The market for flavours is large and growing by 5-7% per year. In the mature markets of Europe in 1997 over \$1,200 million was spent on flavoring materials. United Kingdom (\$270 m.), Germany (\$250 m.), France (\$190 m.), Italy (\$125 m.), Spain (\$105 m.), the Nordic countries (\$70 m.), Netherlands (\$60 m.), Belgium (\$45 m.) and the others (\$110 m.)

The growth markets for flavours, used primarily in the beverage and snack sectors are in Eastern Europe, Asia and the former Soviet Union.

There is an increasing interest in ethnic cooking, aromatherapy and natural products.

There may be a slight opportunity of new demand developing from some of the novel pharmacological characteristics of the seed oil being described now.

CONSTRAINTS:

The genus is a confusing one with many overlapping species and frequent synonyms. It is often unclear which species is being referred to in any particular piece of research. For example in the wetter forest, *A.danielli* forms a confusing species complex with *A.angustifolium*. In Madagascar, the Seychelles, Mauritius, and E. Africa *A. angustifolium* is cultivated as Madagascar cardomom and the seeds used as a condiment. While *A. melegueta* is found and cultivated (or at least encouraged) from Sierra Leone to Gabon, there is also *A. flavum* Cameroon cardamon.

The various *Aframomum* species are found from the wetter forests, through the gallery forests, the seasonally dry forests near the savannah, to the savannah. They cross the Dahomey gap and occur in East as well as West Africa. The mixture of species found, their abundance, productivity, yields of particular

chemicals etc are likely to be quite different between the three study areas. For example, Lamaty et al (1993) found quite different compounds in the essential oil extracted from collections made in the CAR as compared to Cameroon. The species, clone, climate, season, soils, stage of development at harvest all effect the essential oil content in other plant species.

The seasonality of production in the forest is also not clear. A species *A. alboviolaceum* found in the tall grass/low tree savannah, often in the fire complex associated with *Borassus aethiopium*, appears to fruit only late on in the wet season. All of these factors increase the likely variability of the sourced and the difficulty of obtaining a niche market, without competition from other countries/regions.

The market for essential oils is dominated by a small number of purchasing houses, often family owned, and increasingly consolidating. Prices for essential oils, fragrances and flavours are generally falling, and because of the increasing demands for quality and consistency the barriers to market entry are getting higher. Any attempt to add value by extracting essential oils in country will require a far degree of sophistication and management, with analytical facilities and producer inspection and possibly certification. In Europe for example, the trade is primarily in quality oils, with chemical and physical specifications within clear limits allowing the user to use them consistently. The oils (and the seeds) also need to be free from contamination and have to comply with health and food regulations.

The yields of essential oils are low, the seeds contain c. 0.3%, the leaves 0.14%. The plants appear to be locally abundant, but scattered, so the yields per unit area are likely to be low. Anytime that the price for the essential oil rises significantly, it is likely to provoke either a shift to substitutes, or laboratory synthesis.

RECOMMENDATIONS:

RECIPIES

One very old recipe for grains of paradise comes from a Belgian herb supplier to breweries who found it in an old brewing book: adjusted for a 5 gal batch.

8 lbs pale extract
2 lbs amber extract
1.5 oz hops
1/4 oz licorice root
2 oz molasses
1.5 gram (.06 oz) paradise seeds

It can also be used sparingly (3 grams in 7-1/2 gallons) in ginger wit to which it gives a bit of additional complexity. This is a traditional witbier recipe with the substitution of fresh ginger for orange peel and lactic acid. It gives a bit of the bite that the lactic acid might, and the ginger is very refreshing. It is popular with beer drinkers who prefer a cooler-type drink. The spices for 7.5 gallons are:

3.2 oz peeled fresh ginger, pureed
1 oz. freshly ground coriander
5 g. freshly ground cardamom
3 g. freshly ground grain of paradise

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SUMMARY

CALABAR BEAN

Physostigma venenosum Balfour

Leguminosae - Papilionaceae

Known as the Calabar, or Ordeal, Bean, *Physostigma venenosum* is a woody climber found growing in forests from Senegal through Cameroon and to the Congo. It has also been introduced to South America (Brazil) and India. The Calabar Bean flowers in March - long clusters of curved purple or pink flowers - which are replaced by dark brown pods around 6 inches long, oval shaped, containing a few extremely hard dark brown seeds. The seeds ripen in all seasons, but are best and most abundant during the rainy season – March to October [June to September]. Vines climb 50-60 feet into the trees. Botanical collections of the Calabar Bean were made as early as 1846, when it was planted in the Edinburgh Botanical Gardens.

Traditional Use

The Calabar Bean was used traditionally as an ordeal poison, to test guilt or innocence. The seeds from the bean are ground and placed in water, or are given whole to the accused to eat – if they vomit within half an hour they are considered innocent, but if they die, are guilty. The British banned the use of Calabar Bean in Nigeria – along with other ordeal poisons - in the 1940s (Iwu, 1994). In Ghana, the beans are mixed with water to treat oedemas, rheumatism, and topically for ringworm, and parasitic skin diseases. Crushed beans are used as an external pain killer and in acute cases of tetanus (Abbiw, 1990). Seeds are also used as fish poisoning, and to poison rats and mice. Traditional names include: Esere (Efik), Akpi (Igbo), Iso (Yoruba), and Mukase or Mbingo (Douala).

Commercial Use

The Calabar bean yields the alkaloid physostigmine, an anticholinesterase used in ophthalmology to treat glaucoma. Physostigmine promotes drainage of fluid build-up in the eye, which would otherwise lead to the optic nerve damage and loss of vision that characterizes glaucoma. Derivatives of physostigmine (eserine) also show therapeutic promise for treating Alzheimer's disease and combating the effects of chemical weapons (American Chemical Society, 1999). Studies of the Calabar Bean also led researchers to the development of methyl carbamate insecticides (Plotkin, 1988). Other active constituents found in the Calabar bean are eseranine, eseridine, calabarine, and physovenine (Abbiw, 1990).

Physostigmine was first produced synthetically by an African American scientist, Percy Lavon Julian, following three years of intensive research completed in 1935, and called the most challenging total synthesis of its time. Prior to this, physostigmine could only be isolated from the Calabar Bean (ACS, 1999).

The Calabar Bean is a powerful poison, and does not have a role in botanical medicine, nutraceutical, or other markets which might absorb some of the medicinal plants also used in the pharmaceutical industry (e.g. yohimbe). Physostigmine is sold as an ethical pharmaceutical product as physostigmine salicylate – sold in the US as Isopto-Eserine – and physostigmine sulphate – sold as Eserine sulphate. Synthetic derivatives include neostigmine bromide and neostigmine methylsulfate (Prostigmin), currently used to treat myasthenia gravis.

Raw Material Trade

Calabar Bean is exported from Nigeria, Ghana, and Cote d'Ivoire, largely from wild sources (Cunningham, 1999; Laird et al 1996). Plantecam exports Calabar Bean from Cameroon for use in the pharmaceutical industry. In 1987, for example, MINEF approved the export by Plantecam of 100 tonnes of "Feve de calabar" collected in the southeast and southwest. The Nigerian company Noga-Wills (Nig) Ltd, based in Calabar, sells dried and extracted *Physostigma venenosum* under "special harvesting arrangements" with the Corporate Affairs commission of Nigeria (RC No. 200724). Prices for products sold are not listed; the company sends samples upon specific demand and price offers from potential customers.

Sustainable Sources

There are few examples of *Physostigma* cultivated for the market, although Plantecam has begun work on domestication of the vine. In Nigeria, and NGO, BDCP, has taken up cultivation of *Physostigma* as a conservation and development activity. Bioresources Development and Conservation Program (BDCP) is a platform of natural products scientists, environmentalists, policy experts, and company staff working to conserve biodiversity through sustainable development. One of the projects run by BDCP in Nigeria includes a trial "deep forest farm" in the Akwanga District of Cross River State to experiment with the cultivation of *Physostigma venenosum* as an alternative use of the habitat, and production of raw material for industrial production. Vines are planted within the forest, and as part of traditional forest management systems that require retention of the forest canopy (Iwu, 1996). According to local people, germination of the very hard seeds requires splitting open by the African porcupine – so availability of the species is dependent upon forest (Iwu, 1994).

Market Opportunities

- There exists a significant market for physostigmine pharmaceutical products, and for other alkaloids found in the Calabar Bean.
- Marketing and trade networks exist for the raw materials;
- Calabar Bean does not appear threatened by existing demand;

Market Constraints

- It is unlikely that pharmaceutical medicines (in contrast, for example, to botanical medicines, foods, beverages, and cosmetics) will be strong candidates for "green" or "fair trade" marketing schemes;
- The existing and potential relationship between *Physostigma* raw material sourcing, conservation, and development remain unclear;
- Pharmaceutical markets are large, multi-national, and sophisticated; determination of sourcing strategies is based on cost and quality, and decisions are usually made far from the countries in which species grow; a relatively unresponsive and powerful market such as this is not ideal for small-scale or community based marketing projects.

Next steps

- Prior to initiating any marketing project, research should be undertaken to determine the nature and scope of existing raw material sourcing strategies – ecological impacts, management practices, trade networks, key players, value chain, etc.;
- CARPE might assist in efforts to domesticate the product, if it is decided to be a priority species.

Cocoa

Highlights

T. cacao

- World production of cocoa is rising faster than demand causing prices to fall to a level just over \$800 per ton. At the same time, some countries in West Africa face production problems because of black pod disease while Brazil is encountering witches broom fungus. These problems have been attributed to the agricultural practices that are not sustainable.
- Cameroon is a significant source of cocoa for world markets, producing 5 percent of world production, of a quality highly desired in the market. Cameroon cocoa is largely the Trinitario variety, producing beans with high fat and a reddish color. This cocoa is in demand, especially in the Netherlands or Germany where manufacturers produce cocoa products -- cakes, biscuits and confections -- sold at premium prices.
- While the organic cocoa market is in its infancy, with less than one percent of the overall \$13 billion U.S. chocolate retail market, the growth rate parallels the organic food industry as a whole (over 20% annual increases throughout the 1990s).
- The American Chocolate Research Institute has launched a long-term program to develop environmentally sound growing techniques and to improve the livelihoods of the small farmers that supply most of their raw material. The industry's growing support for shade-grown cocoa is intended to promote cocoa grown in a way that preserves natural habitat."
- One trader of organic cocoa in the Netherlands indicated they would buy up to 500 tons of Cameroonian cocoa at \$125 over the existing fob price for non-organic. While this is still a niche market, there are some successful initiatives in Latin America and Africa that capitalize on increased consumer demand for organic or "fair trade" products.

Names and varieties:

The cocoa tree is of the genus *Theobroma*, a group of about 20 species originating in the Amazon basin and other tropical areas of Central and South America. *Theobroma cacao* is the only one extensively cultivated, although there is some recent interest in *T. grandiflorum* (Cupusassu) as a flavoring. There are three cocoa varieties, Criollo, Forastero and Trinitario, the latter of which is a cross between the first two.

Production:

World cocoa bean production for the 1998/99 season is estimated at 2.78 million tons, down 5 percent from the record 2.94 million-ton output of 1995/96. As far as recent trends, strong production figures from Cote d'Ivoire, Ghana, Indonesia, Cameroon and Nigeria, offsetting decreases in Brazil and Ecuador. The 1998/99 production figures for cocoa in Cameroon are over 125,000 metric tons, matching the level achieved in the 1997/98 crop season when Cameroon produced 126,804 tons of cocoa beans. Estimates of the 1999/2000 crop indicate that it is expected to be roughly the same size, 120,000 tons or slightly more.

Production in 1998/99 in Cote d'Ivoire, the world's largest cocoa bean producer, is forecast at 1.18 million tons, while Ghana's 1998/99 production forecast has been revised upward 8 percent to 390,000 tons. This increase is based on improved rainfall patterns in the major cocoa growing areas. Brazil, however, show a lower 1998/99 production level at about 164,500 tons, up slightly from 1997/98. Decrease were attributed to high rates of tree infection, "witches broom", as well as the effects of the drought on flowering during early 1998. Indonesia's 1998/99 cocoa bean production is 330,000 tons, 4 percent above last season, exceeding production records set in the previous three seasons. The 1997/98 estimate was increased to 318,000 tons, 4 percent above the previous estimate. Nigeria also registered increased production for 1998/99, forecast at 165,000 tons, up 6 percent from the previous season. Malaysia's 1998/99 cocoa bean crop of 100,000 tons is up 2 percent from last season. However, this level is 17 percent below 1996/97 and much below the record 1989/90 harvest of 240,000 tons.

There is concern over the effect of pests and disease on the production and price levels of cocoa as black pod and witches broom threaten production in West Africa and Brazil respectively. Some attribute these problems to the adoption of plantation input-intensive varieties and the abandonment of small-scale shade tree production, trading off natural protection for higher yields. This concern has been translated into actions now undertaken by chocolate manufacturers, the American Cocoa Research Institute (ACRI) and the International Cocoa Organization (ICO). Mars is taking a lead role within the international chocolate industry in supporting initiatives to "foster a new understanding and appreciation of cocoa's beneficial, multi-dimensional role in tropical forest ecosystems and to encourage the cultivation of cocoa in traditional areas as well as new regions using sustainable agriculture methodologies." Other smaller chocolate companies are providing incentives to producers through marketing outlets for sustainably produced cocoa and certified organic cocoa.

Marketing and Processing

The major buyers of West African cocoa are European, while the United States is the major buyer of South American and Asian cocoas. The purchasing of raw cocoa is dominated a few international traders who either sell beans to chocolate manufacturers, or process the cocoa and sell the by-products (liquor, butter or powder). Chocolate manufacturers prefer to purchase through traders because they limit their risk with respect to shipment and quality problems. While the manufacturers are concerned about supply problems in the future -- which has prompted their support for promoting sustainable production -- they are not trying to change production and marketing channels to meet specific social and environmental goals. Instead, there are a number of firms and organizations that have taken up the banner of fair-trade and organic to advance these objectives. For example, the UK firm of Green & Blacks produces a Maya Gold chocolate bar, which has both organic and fair trade labels. Working with small family cocoa growers in Belize, Green and Blacks offered them assistance to convert to organic production, including price and financing guarantees. The provision of premiums, and arrangements for direct purchasing through long-term contracts has given producers enough security to diversify. Green and Blacks is also working on an organic cocoa program in Togo. The Organic Commodity Project (OCP), based in Cambridge, Massachusetts, is implementing a successful commercial program for supplying niche chocolate manufacturers with organic "sustainable cocoa" that benefits the community in diverse ways. Joe Whinney, director of OCP, reports that "Any system developed for sustainable cocoa must be one which allows for high biodiversity while providing for farmers' subsistence and cash needs. Our experience has shown us that cocoa can be produced commercially in a biologically rich and diverse "forest" environment in the humid tropics... An assessment of the current environmental impact of cocoa production in key cocoa growing regions is an important step to identify long term restorative strategies. This work will also be vital in determining what positive production schemes already exist. Furthermore, understanding the cocoa economies in the same regions will help identify what socioeconomic needs must be meet. Continued and rigorous research is required to support and identify sustainable cultivation

techniques specific to each cocoa growing region will be a necessary and important ingredient in developing cross trade support for sustainable production

A recent report on the African news wires described the start-up of a pilot organic cocoa project in Uganda, promoted by a local company, Cofftea and a multi-million international company, Export Promotion of Organic Products from Africa (EPOPA). working with 1000 cocoa farmers.

Opportunities

Cameroon cocoa is largely the Trinitario variety, producing beans with high fat and a reddish color. This cocoa is in demand, especially in the Netherlands or Germany where manufacturers produce cocoa products -- cakes, biscuits and confections -- sold at premium prices. The cocoa farmers in Cameroon are now trying to deal with the changes wrought by liberalization and need to know how to take advantage of the new market-based system. Research on how farmers can adopt of improved and environmentally sound production techniques in a shade grown system that helps preserve the natural habitat is critical. Getting higher prices through organic certification could be a bonus in the future but will take time. While the organic cocoa market is in its infancy, with less than one percent of the overall \$13 billion U.S. chocolate retail market, the growth rate parallels the organic food industry as a whole (over 20% annual increases throughout the 1990s). One trader of organic cocoa in the Netherlands indicated they would buy up to 500 tons of Cameroonian cocoa at \$125 over the existing fob price for non-organic.

Constraints

Cocoa prices have slumped and are now between \$800-900/ton, compared with prices last year as high as \$1,800 per ton. The premiums for organic are now significant but it is still a niche market that can easily fall if a few suppliers come in the market at the same time with product. And Cameroon would likely depend on European consumers whose acceptance of organic is still vacillating, with Germany the only multi-billion dollar market (about \$2.5 billion) for all organic foods (France and the UK are both around \$600 million and Italy not even \$30 million). In comparison, the U.S. is almost \$10 billion market for organic. Another problem with organic is that quality is not easily achieved because of the use of alkalization in cocoa processing. One of the reasons some chocolate manufacturers doubt the potential of organic is because it precludes doing alkalization, the way in which they normally enhance the flavor and color of cocoa liquors and powders. The alkalization process consists of mixing selected cacao material with a solution of a specified alkaline compound at high temperatures and possibly increased pressures. The common alkaline compounds are potassium carbonate, calcium carbonate, and sodium hydroxide, which by virtue of their chemical origin cannot be used for organic chocolate

Smallholder cocoa (*Theobroma cacao* Linn.) cultivation in agroforestry systems of West and Central Africa: challenges and opportunities, B. Duguma

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Abstract

The cultural features, management practices, environmental sustainability, and economic profitability of smallholder cocoa production in West and Central Africa are reviewed. The aim is to highlight factors affecting the production and marketing sector and to propose appropriate strategies to ensure sustainable and profitable production in the region. The cocoa cultivation system causes minimum damage to soil resources. In terms of carbon sequestration and below- and above-ground bio-diversity, the cocoa agroforest is superior to the competing food crop production land use based on the practice of slash-and-burn. Cocoa is inter-cropped with several high value tree species that provide shade to the cocoa tree and additional income and products for the farmers. Economic profitability analysis of the system in Cameroon showed that even with no value assigned to the inter-cropped species, the sector could still be profitable at current prices. In the late 1980s, the distorted economic policy and unfavorable international trade governing the sector made the system less attractive to the farmers such that many of them abandoned their farms or in some cases cut the trees in order to grow food crops. Technically, the system is environmentally sustainable. The fundamental question is thus what should be the research and development strategy that would enhance profitability and environmental resilience of cocoa production system and minimize risk to the farmers in order to sustain their interest. Based on the current review and our knowledge of the region, there is an urgent need to: a) rationalize and optimize arrangement of the various components in cocoa agroforest, b) domesticate high-value indigenous species and integrate them into the system in order to enhance the system's diversity and profitability; c) develop shade-tolerant and disease-resistant cocoa varieties d) integrate small-stock production into the system, and e) develop an enabling policy environment addressing cocoa marketing, plant protection, land tenure, and transformation of non-cocoa primary products from the cocoa agroforests.

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PYGEUM

Prunus africana (Hook. F.) Kalkman

Rosaceae

Prunus africana is a montane forest tree occurring from Ethiopia down through South Africa, and as far east as Nigeria and west as Madagascar. It is an evergreen mid to later successional species that can attain heights of 45 m and up to 130 cm diameter. The only *Prunus* species native to Africa, it is found above the 1000m altitude. In 1994, *P. africana* was listed on CITES Appendix II in response to concerns associated with unsustainable harvest of the species for international markets. Local uses of *Prunus africana* include use of the bark as a medicine, including around Mount Cameroon for "old man's disease"; and as timber (building poles, axe handles, fuelwood).

A great deal has been done to date to address the sustainable management and threats to the survival of *Prunus africana* populations. Groups such as MINEF, Mount Cameroon Project, WWF, ONADEF, the Kilim Project, ICRAF, University of Bangor, BDCP, CARPE and others have undertaken research on the ecology and management of the species; have initiated community development programs associated with domestication; have brokered more equitable arrangements between Plantecam and local communities; and have lobbied company and government officials to better regulate harvests and develop strategies for long-term sustainable management of the species. Pygeum is also one of more than 160 medicinal plants listed on the CITES Appendices, and one of about 20 of which are traded significantly.

As a result, there is a detailed and extremely useful literature on ecology, domestication, conservation, markets, and other aspects of *Prunus africana* use and management directly relevant to CARPE's work, which we will not seek to duplicate here. Key sources to consult include (see bibliography):

- Acworth and Ewusi, 1999
- Cunningham and Mbenkum, 1993
- Cunningham et al, 1997
- Cunningham, 1999
- Simons and Tchoundeu, 1998
- Sunderland and Nkefor, 1997

A short summary of market information which can act as the basis for building further, detailed background on this species and products follows.

Commercial Use

Prunus africana is used to treat benign prostatic hyperplasia (BPH), a condition that affects more than half of all men over the age of 60. BPH is a benign condition, and should not be confused with prostate cancer. BPH is simply an enlargement of the prostate gland, which rests at the base of the bladder and surrounds the urethra, and when enlarged puts pressure on the urethra, constricting the outlet for urine (Pharmaton, 1999). European interest in pygeum began as early as the 1700s when early settlers in the Natal province of South Africa related the effects of pygeum on bladder pains (Simons and Tchoundeu, 1998). In 1966 Jacques Debat first patented a pygeum bark extract (Cunningham and Mbenkum, 1993). The use of saw palmetto and pygeum have been approved treatments for BPH since the early 1970s in Europe, and have contributed to reduced surgery rates and a safer, more cost-efficient management of the condition (Brown, 1996).

Prunus africana is commonly sold as a standardized extract – that is, an extract standardized against a group of market chemicals. The active substances are phytosterols (sitosterols), pentacyclic triterpenoids, and ferulic esters of long chain fatty acids. Extracts are standardized against the phytosterol content (beta-sitosterol; beta-sitosterone, and n-docosanol), usually at between 12-13% phytosterols.

100-200 mg of such extracts are recommended per day; individual capsules generally contain between 50-100mg of standardized extract. Saw palmetto and nettle are often combined with pygeum, and are seen as enhancing and providing synergistic effects.

The pharmacology of pygeum is not completely understood, but a few decades of pre-clinical and clinical trials have demonstrated its efficacy in managing frequent urination at night, promoting normal urinary patterns, and maintaining prostate health (Pharmaton, 1999).

Commercial Products and Companies

Retail sales of *Prunus africana* products is estimated by Cunningham et al (1997) as \$220 million per year. Companies selling products are based in Europe (primarily France, Italy, and Spain), South America (Argentina, Brazil, Venezuela), Australia, and the US. Twenty European companies produce and sell products containing *Prunus africana* extract (Cunningham, 1999).

Examples of companies marketing and distributing finished products containing pygeum include: Groupe Fournier (France); Inverni della Beffa (Indena Spa) (Italy); Solgar (USA); Boehringer-Ingelheim/Pharmaton (Germany); Prosynthese? (France); Nature's Way (USA); Jarrow Formula; HerbsNow; Vitamin Express; Nature's Sunshine Products; iHerb. (See Cunningham et al 1997).

Examples of companies supplying *Prunus* raw materials, or bulk ingredients (including standardized extracts), include: Indena (Italy, and its cosmetics division in France); Globex International (USA); Plantecam (Cameroon), a wholly owned subsidiary of Groupe Fournier (France); GCI Nutrients (USA); Schweizer Hall (Germany); Extractos Natra (Spain); and Triarco.

Prices for finished products vary:

Pigenil (Inverni della Beffa) – 25 mg and 50 mg capsules

Tadenan (Groupe Fournier) – 1996 (Europe): 50 mg extract – 30 capsules - \$20.70; 60 capsules \$39.17

Prostatonin (Pharmaton) – 1996 (Europe): 25 mg capsules – 30 capsules - \$25.30

Jarrow Formulas Saw Palmetto and Pygeum 202 mg. – 1999 (USA): 120 soft capsules (each containing 100mg of standardized pygeum extract) - \$39.95

Substitute products for pygeum include saw palmetto (*Serenoa repens*) and stinging nettle (*Urtica dioica*). However, pygeum and nettle have been shown to be more potent when used together, and to have a significantly stronger, synergistic effect (Brinker, 1997). Saw palmetto and pygeum, and saw palmetto and nettle, are also often combined into a single formula, or prescribed together (Alive, 1998). Other suggested substitutes include pumpkin seeds and pollen. Saw palmetto is the best-researched and most widely recommended botanical therapy for BPH, however. In 1998 it was the fifth top-selling botanical medicine in the US, and in 1995 was the ninth top-selling botanical in Germany (Laird, 1999). Saw palmetto is native to North America, and grows wild in the southeast. A tea made from saw palmetto berries was commonly recommended in the US during the early part of this century for prostate and urinary tract problems (Brown, 1996). Both saw palmetto and pygeum are taken for the long-term, incorporated into daily regimes. The FDA in the United States has recently expressed problems with the way saw palmetto and pygeum are promoted to treat BPH, and they might face some regulatory obstacles in the future (Blumenthal, 1998).

Raw material trade

Annual pygeum export figures from Africa are between 3,200 – 4,900 metric tonnes of bark. All of this is taken from wild populations in Cameroon (which represents 70% of world trade) and Madagascar (18%), and to a lesser extent Congo, Equatorial Guinea, and Kenya. Bark or bark extract is exported to France, Italy, Belgium, and Spain. In the past few decades, a growing proportion of extract has been processed and exported from Cameroon and Madagascar (Cunningham, 1999). Prices paid for bark are roughly \$2,000 per tonne for bark and \$1,000 per kilo of extract (Archaya, 1998).

Export of raw bark from Plantecam's factory in Mutengene averaged 1,923 tonnes during the period 1986-1991, during which time Plantecam was the sole licensed exporter. Today, additional exporters are shipping out unknown quantities of bark. Bark harvesters are paid on average \$0.38 per kilogram of bark (Acworth and Ewusi, 1999).

Market Opportunities

- Existing international demand, and trade networks;
- Sold on the botanical medicine market, *Prunus* products are likely to be consumed by those with a potential interest in environmentally and socially sound raw materials – therefore potential consumers of “green” or “fair trade” labeled products;
- Efforts have been made to structure arrangements for sustainable management and better pay per kilo for local communities; although not successful over time to date, the experience is valuable for building future trade networks based on equity and sustainability;

Market Constraints

- A single company (Groupe Fournier) dominates the export of Prunus from Cameroon, and price or other constraints appear to be placed on the subsidiary company, Plantecam, to keep raw material cheap – this is standard for the industry;
- Existing demand exceeds supply; therefore, there will always be pressure to over-exploit raw material in the wild, and marketing efforts must be vigilant in ensuring that they manipulate the nature of existing demand, rather than increase demand;
- Substitute products exist – eg saw palmetto and nettle – to which consumers might turn; long-term demand for Prunus must be clear before embarking on additional marketing projects;

Next Steps

- Prunus is an excellent candidate for green and fair trade labeling – incorporated for a number of years into conservation and development projects in the area, attracting a great deal of research (relative to other medicinal species) its ecology and potential sustainable management are now better understood, and sustainable yields per year have been estimated. CARPE might assist in efforts to link projects and communities with certifiers and accrediting bodies; they might also build capacity to work within a certification system in Cameroon. Timber certification is receiving increasing interest, and the FSC is moving towards establishing a larger presence in the region. One element of growing interest to the FSC and timber certifiers is NTFP certification. Prunus is under consideration as a case study in the Rainforest Alliance/Smart Wood NTFP certification manual, due out early next year.
- CARPE could (already is?) assist in the wide range of efforts underway (MINEF, ICRAF, MCP, WWF, etc.) to effectively bring Prunus into cultivation. In Cameroon, sustainable systems of bark harvest were developed, involving removal of opposing quarters of bark, and allowing time for the growth of callous and bark regeneration (Cunningham and Mbenkum, 1993). These systems have not been implemented in recent years, and cultivation is considered the most secure way to ensure survival of the species. Cultivation of *Prunus africana* is considered a viable proposition for farmers, because even if the market for the bark collapses, the tree has a number of other useful properties, as well, including timber, poles, and fuelwood (WWF ethnobotany and sustainable use of wild plant resources programme).
- The SOK studies undertaken by CARPE, and the monograph under preparation by the University of Bangor and others, will provide a great deal of information on the ecology, management, and markets for Prunus. [This part of] CARPE may wish to assist in building the technical, informational, and marketing base for this species, but should wait until early next year to identify any gaps remaining after the CARPE SOK and Bangor studies. CARPE may also assist in strategic ways the development of a “National *Prunus africana* management strategy”.

Examples of Commercial *Prunus africana* Products

Company	Name of Product	What they say about the product
Indena www.indena.it	PrunusSelect	Pygeum purified soft extract (cont. 13% total sterols calculated as B-sitosterol); the cosmetics division also promotes pygeum purified soft extract as a “botanical ingredient with cosmetic potential”; Indena Spa sells a product “Pigenil.”
HerbsNow	Men’s Formula	A mixture of pygeum extract

<p>www.herbsnow.com</p> <p>Nature's Sunshine Products www.webcom.com/drweed/naturalherbs/products</p>		<p>(54mg) standardized to 2.5% total sterols, calculated as B-sitosterol, 190 mg of saw palmetto extract standardized to 20% essential fatty acids; and 10 mg of stinging nettle extract, 150 mg of gotu kola, and 5 mg of zinc.</p>
<p>Vitamin Express http://vitaminexpress.com iHerb www.iherb.com</p> <p>Prime Vitality LLC www.primmmev.com</p>	<p>Jarrow Formulas – Ultra Saw Palmetto + Pygeum</p>	<p>Standardized extracts of saw palmetto (150 mg) and pygeum africanum (50mg – standardized to 13% sterols).</p>
<p>Solgar www.solgar.com</p>	<p>Saw palmetto pygeum complex with lycopene capsules</p>	<p>Each 2-piece capsule provides 50mg of saw palmetto extract (4.1% extract); 50 mg of standardized pygeum extract (2.5% total sterols); 50 mg of cactus flower; 4 mg tomato; 10 mg zinc; and 25 mg selenium.</p>
<p>Boehringer Ingelheim/Pharmaton www.pharmaton.com</p>	<p>Prostatonin</p>	<p>Prostatonin contains two clinically proven proprietary extracts: standardized Pygeum africanum [PY102] and Nettle [UR102] Extract. These extracts, both individually and in combination, have been proven to help manage frequent urination at night, promote normal urinary patterns and maintain prostate health. Details and citations for clinical studies are provided at: www.pharmaton.com/clinical_studies/clin_prost.html.</p>

Rattans: Eremospatha macrocarpa, Laccosperma secundiflorum

- The total world market trade in cane was up to \$100 million, while rattan furniture may be 50 times larger, certainly more than \$5 billion.
- Raw cane exports are now banned from all the main producers, including the world's largest producer, Indonesia.

- Smallholder cultivation of *Calamus* sp. has been underway for over a hundred years in Asia (Kalimantan).
- There is a clear synergy between rattan harvesting and other activities such as bush meat collection.
There is a wealth of knowledge and experience available in Asia on rattan and INBAR is expanding to Africa.
- Producing rattan furniture can be a village level cottage industry, with low capital investments and many beneficiaries.
- The current regional experience in wooden furniture production can be extended to rattan.

Names

Eremospatha macrocarpa small rattan, rotin filet, asa-nlong (Fang) nloun (Bassa) molongo (Bayenge), cane rope (pidgin) ndo (Tikar) and *Laccosperma secundiflorum* large rattan, giant cane, gros rotin, makak (Bakossi/Bassa) boro (Fang), ku (Tikar) are the two commercially important species. Generic names for rattan include *melongos* (Spanish) *mokolo* (Bakossi), “forest police” (pidgin), malacca, mulonga.

Introduction

Rattan is used to make a wide range of different objects, traditionally for furniture, baskets, roofing, fishtraps etc. in Africa and Asia, and to produce commercial furniture in factories in Asia, Europe and America. It is the stem of various climbing species of the palm family. More than 650 species belonging to 22 genera are recognized, out of which 4 genera (three of which are endemic) and about 14 species are recorded in Africa. Worldwide some 50 rattan species are used commercially. In Africa only two species are commonly used, *Eremospatha macrocarpa* for the decoration and binding, and *Laccosperma secundiflorum* for the framework.

Rattan stems combine strength and flexibility that make them suitable to produce cane furniture with intricate designs. Rattan is commercially the most important non-timber forest product in Southeast Asia, second only to timber. A large amount of research has been done on the Asian species used in trade, including their botany, ecology, cultivation, utilization, manufacturing, treatment, etc. while significantly less research has been done on the African species.

Traditional Use

Rattan is often collected while conducting other activities in the forest, such as hunting. Usually the base of the rattan stem is cut and then the plant is pulled down from the canopy. Often the prickly stems scratch the collector, or they may dislodge other branches, insects or their nests, or even snakes from the trees above. Frequently portions of the rattan are left behind suspended in the trees. Up to 50% of the stem may be left behind. In some cases, trees may be cut down to get a particularly large diameter stem. It is clear from the Asian experience that the different species of rattan have quite different characteristics in terms of regrowth, following harvest. Only preliminary work has been done on regrowth in the African species.

If the stem is left after cutting for 15 to 30 days, the side branches are more easily broken and larger portions of the stem can be harvested. Machines for pulling the stem down and for decorticating before transport have been developed, but they represent a further burden of wheels, pulleys and ropes to be carried deep into the forest. Moreover, leaving the cane in the forest after cutting increases the chances of it losing quality.

The cane is brought in from the forest, and the bush meat captured is often sold to provide the cash for the transport of the cane to the regional wholesale markets, where it is sold to the middlemen, who transport it

in bulk to the towns. It was estimated by Defo that twenty forest villages served the wholesale market, which services more than 100 small workshops in Yaounde. Furniture makers in Cameroon are usually based in the urban centers and are selling mainly to the middleclass there. Occasionally, a container load of furniture will be purchased and exported to Europe.

According to Sunderland, in Cameroon, Nigeria and Equatorial Guinea, cane gatherers, basket weavers, traders and furniture artisans are almost exclusively male, with women playing a minor role in the trade

Commercial Use

In Asia, processing includes washing, cleaning, bleaching, drying, and surface finishing and grading. Cane is sold as rattan sticks, cane, (either in rolls or lengths) core and split cane. Rattan is thought to come from raut/rotan the Malaysian words meaning to pare/smooth. The thinner top of the cane is discarded, and the middle portion is used. The bases are sometimes used for walking sticks and canes. The cuticle, epidermis and outer bundles are used to make the splits used to bind and weave. The inner core is used to make the furniture frames and itself split sometimes.

The hardness, stiffness and elasticity of the pith all vary with species, age of stem and the thickness, as do the length and internodal length, the color, gloss and texture. The strength of the cane is related to the arrangement and the nature of the vascular bundles. The lignification and vascular bundle distribution determine the eventual quality of the cane. A preliminary anatomical survey of the African species suggests that they may lack some of the qualities of the better Asian species for furniture making (Weiner et al). However, there is a suggestion that the herbarium specimens on which some of this work was done may have been mis-identified, (Sunderland, per. comm.).

The rattan is either used whole, or as peel or core. Peel is the outer bark used for braiding, to cover or support joints and as a decorative wrap for the rattan or metal frames. Core is the central portion of the stem; it is split into smaller pieces and used to weave decorative or supportive trim.

The quality of the processed cane is linked to the diameter, length, color, hardness, and length of nodes, uniformity and absence of fungal stains, scars/bruises, checks, and discoloration.

Rattan furniture prices vary widely and are linked to the type of cane used, the quality of the workmanship and the designs, and the incorporation of other materials, such as leather, wood, bamboo and metal.

In Kalimantan, the commercial plantations of *Calamus caesius* take 8-12 years to reach harvestable maturity, producing 13-18 meter bright yellow, glossy canes. The palms are harvested by pulling down, stripped of their leaf sheathes, then cut to head lengths of 2-3 m, or 5-7 m then bent. The initial processing includes drying and fumigating. In the secondary processing, the stems may be washed with sodium hypochlorite or hydrogen peroxide, fumigated with sulfur, then sorted; machine cut to uniform lengths, the nodes may be scraped off at this point also. They are then graded into quality classes/lengths, for use as cores and peeled, or as splits. They are also graded as to hardness. They are finally soaked, sanded and dried. The 18-34 mm poles are used for furniture, the 12-18 mm are used for other decorative articles. Up to 3 tons per hectare of green cane may be harvested.

Sources and Prices

Malaysia, Indonesia, Vietnam and China, are major sources of rattan, with smaller quantities originating from Myanmar, Thailand, Philippines and Kampuchea. Commercial plantations of *Calamus spp.* have been established in Sarawak, Sabah, the Philippines, Indonesia and Papua New Guinea. Singapore, Hong

Kong and to some degree Taiwan have been major value added processors in the past. The companies based there still dominate the world trade.

The main trade from Asia is with the USA, France, Italy, Spain, Egypt, the Netherlands, and with Japan, Taiwan, China and Korea. The USA imports rattan from the Philippines and Indonesia. In the past, much of this trade has been semi-processed cane for further processing, treatment and manufacture into furniture in the importing countries. For the last ten years, Indonesia has banned the export of raw or semi-processed cane to encourage processing internally. However, the Indonesian trade figures are extremely suspect, with import and export figures differing by large orders of magnitude. Whatever the volumes exported, it is clear that hundreds of thousands of tons of rattan are harvested annually in Indonesia alone. Probably less than 15% of these exports are being produced on the commercial plantations in Kalimantan and elsewhere.

The world trade in rattan is large, and in the past, much of this was raw or semi-processed rattan. It is estimated that the added value of raw (whole) or unprocessed rattan to finished rattan increases to between 1-2,000%, whereas semi-processed or half-finished rattan (core) to finished rattan increases by 3-800%. This added value depends on the workmanship and creativity of the workers. The value of the world trade in rattan is at least \$100 million annually. The trade price of a ton of cane fluctuates around \$1-2,000, depending on quality and supply. The value of the furniture trade was put at \$6.5 billion by the ITTO in 1998.

For export, the stems are cut into 10-20 foot lengths; the diameter varies, but rarely exceeds 1.75 inch. Rattan (unpeeled) is sold retail in the US in 8-10 ft. lengths at \$9.50 for a 3/4" pole, to \$27.50 for a 1 7/8th-inch pole. Peeled rattan in 9-12 ft lengths costs from \$9.50 for a 7/8th-diameter pole to \$18.50 for a 1 3/4-inch pole. The smaller diameter canes, (red pullet, Palembang and kobo) are sold by the pound. The 1/8" has 250-300 ft per pound and the 1/2" diameter has 10-15' per pound. They both cost \$7.50. Prices vary seasonally and from supplier to supplier. On the internet for example, rattan poles of 9 foot long were being quoted in NJ at \$17.95, with a discount of 25% being given on bales of 40 canes of up to 2" in diameter.

Chair cane is the outer bark of rattans, which is stripped from the core, and cut into various diameters and thicknesses for use in weaving, or for wrapping and binding. Depending on its diameter, the amount of chair cane needed to weave four chairs, a 1000 ft. hank, sells for between \$34-\$49.00 retail. The finer diameters, 1.5-mm etc. are cheaper than the larger diameter 3.5 mm. The strands in the hanks are c. 8 foot long.

The binding cane, which is used to lash woven pieces to the chair frame, costs \$9.00 per 40-ft length. This ranges from 4 - 6 mm in diameter. A coarser split 8-9 mm cane is used to wrap wooden and rustic furniture. This costs between \$15 - \$21.00 for 300 ft., depending on the strand length.

The color variation, the degree of staining and damage and the joint scars influence the quality of the chair and binding canes.

Reed is the split core. It varies in diameter and cross section from 5/8th-split oval to 1/4 inch flat. It costs between \$12.00 to \$15.50 a hank, with hanks containing 90-370 ft of reed depending on the diameter. It is also used to produce pre-woven cane webbing for chair seats and backs, and comes in a variety of patterns and designs. The price varies from \$142 - \$427 for a fifty-foot roll, depending on the width, from 12" to 36".

Opportunities

In Asia rattan, furniture manufacture has been a labor-intensive, comparatively low capital investment; rural based industry, which earns foreign exchange. There is an opportunity to build on the furniture making expertise of the local workshops in Cameroon, but design and marketing help is critical to their eventual success. New machinery is needed, steaming equipment, moulds for forming, better or improved ways to sand/scrape, concave cut, drill, dowel, groove, glue, staple, bind joints, stain, add upholstery are all needed. Carbide tipped tools and other stripping and splitting devices are likely to be needed. Training will be needed in processing, cleaning, treating for insects, scraping, straightening, binding, framing, finishing etc.

The trade in rattan furniture is becoming increasingly sophisticated. If the African rattans are found to have the mechanical and other properties of their Asian competitors, there is a possible market for high quality furniture. Attention will have to be paid to the quality of the raw cane, and the attention to detail, especially the jointing and binding. Knock down components are one way of reducing shipping costs, but need good design and engineering to work well. The coloring and finishing of the cane is also crucial. Different designs and finishes are needed for the various markets, with Italy, German, the US etc all having different demands.

There has apparently been some interest shown by the Southeast Asian processors in sourcing rattan in West Africa. The International Network for Bamboo and Rattan INBAR is currently extending its activities into Africa. There is a body of research already done in Asia that can be readily adapted, and Information centers at the Forestry Research Institute, Malaysia and also in India at Dehra Dun. ICRAF, Limbe and Kew are looking at rattan techniques aimed at conservation through cultivation. ECOFAC is doing research into ecology and local marketing. The African Rattan Research Programme is preparing a report on regional and international trade.

Constraints

The collection of rattan cane is dirty, heavy, hard work. It is usually a marginal activity, done occasionally, depending on the weather, farming activities, hunting, prices for alternative employment, etc. It is a hardship income source, rather than a regular activity. The supply is therefore erratic, depending on the prices and the timing of other activities. There is high wastage, both in the forest, with long lengths left unharvested and at the factory with 30% plus of the cane being rejected or wasted.

The demand is for quality, not quantity, so there is also the need to compete with the quality being produced by the Asian nations after many years of research and experimentation. For example, rapid drying of the harvested cane is one key to reducing the amount of stain fungi and thus keeping the quality of the cane high. More than 20% of the harvested canes may be lost to starchy rots and stains. There appears to be little value in exporting raw cane, splits or binding cane.

There is some uncertainty about the quality of the African species for furniture. In the Asian genera for instance, the leaf sheathes erode with age, but they persist in *Eremosphata* and *Laccosperma*. The stem of *Eremosphata* spp. may tend to be more triangular in cross section than round. The mechanical qualities of the African stems have been questioned. Commercial canes in Asia have thick walled fibers, large diameter metaxylem vessels and a mean fiber content of between 26-39%.

The availability, ease of extraction, density of the wild plants etc will determine the supply of raw cane. The investment into quality, processing equipment, machinery and training will determine the supply of saleable furniture. A regular supply of suitable cane, with clear standards and grading, followed by value added processing, and marketing/export is needed to expand the market beyond the small numbers of affluent local and regional customers.

The volumes needed to serve the furniture manufacturers may simply not be available. Three people can process 500 plus canes 15 ft long per month. A small manufacturer may use between 10,000 - 240,000 canes per year. One chair can take 2 days to make, a sofa 6 days. Even if the volumes are available, the prices paid, the efficiencies and the costs of transport to the markets may keep the return to the producers and harvesters low.

The natural tendency will be for the primary market to be for raw/ minimally processed cane for use in the existing factories around the world. The possibility of working to ban the export of raw cane from the CARPE countries should be considered. For instance, it wasn't until the bans on raw cane by the Philippines and Indonesia that Japan invested heavily in the carpeting and matting factories of S. Kalimantan.

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TWISTED FLOWER

***Strophanthus gratus* (Hook.) Franch.**
Apocynaceae

Strophanthus gratus is fairly common to deciduous forest and secondary growth from Sierra Leone to Cameroon, and extending to Congo. It is a woody climber, or shrub, growing to 25 metres, with large bell-shaped white or purple flowers. The name "Strophanthus" is derived from the Greek word strophos – a twisted cord or rope – and anthos (flower). The seed is from 7 to 20 mm in length, light brown, with a greenish tinge.

Traditional Use

In Ghana, the leaves are used in a rub to treat fever and are an antidote for back-necked cobra bite. Mashed and pounded leaves are applied to guinea worm sores, and the leaf juice is used to treat ulcers. The root is used to treat venereal diseases. The seeds and wood are used in arrow and fish poisons (Abbiw, 1990). In many parts of West-Central Africa, *S. gratus* has important cultural and ceremonial uses, including as protection and to bring luck. Traditional names within Cameroon include Kerim (Korup) and Ejoku ja mfa (Oroko). A number of *Strophanthus* species are used to make arrow poisons.

Commercial Use

S. gratus seed yields the cardiotoxic compound ouabain. Many *Strophanthus* species yield the cardenolides strophanthins K, g, etc., which act as heart tonics. The strophanthins from different species

vary somewhat in chemical composition. The Apocynaceae family contains a number of plants yielding cardenolides and some of the most important cardiotonics. The seeds of *S. gratus* yield 3-7% of g-strophanthin – or ouabain. Ouabain was first isolated in crystallized form in 1877. It is used in preference to digitalis when more rapid action is required (Olivier-Bever, 1986). In addition to strophanthine (a glycoside), *S. gratus* contains the alkaloid inoiene, and the steroidal glycoside k-strophanthoside.

Raw Material Trade

In 1989/90 and 90/91 around 2,700 tonnes of *Strophanthus* were licensed for export each year from Cameroon (Besong, 1992). Plantecam currently exports fairly large quantities of *Strophanthus*, which has featured as one of its main species for the export market for decades. For example, between 1985/86 and 1990/91, 6.7 tons of seed were delivered to the Plantecam factory in Mutengene. Plantecam staff are working on the domestication of *S. gratus* within their compound in Mutengene.

Europe is the main destination of *Strophanthus gratus* fruit – Luxembourg and Belgium account for 38% of market (Cunningham, 1999). Other countries importing significant quantities of *S. gratus* seeds include Britain, France, Swiss, Germany, and US.

There are 28 species of *Strophanthus* in Africa and Asia, and the commercial drug is often comprised of a mix of the species. Primary commercial species include *S. kombe*, which grows in East Africa; *S. hispidus* (ptpreferred by the German market “because of their guaranteed purity”), *S. glabra*, *S. emini*, *S. courmontii*, *S. thallone*, and *S. Nicholsoni*. *S. gratus* is preferred by some because they are easily identified and yield strophanthin readily in crysstalline form (Grieve, 1999).

Market Opportunities

- There exists a significant market for ouabain pharmaceutical products;
- Marketing and trade networks exist for the raw materials;

Market Constraints

- It is unlikely that pharmaceutical medicines (in contrast, for example, to botanical medicines, foods, beverages, and cosmetics) will be strong candidates for “green” or “fair trade” marketing schemes;
- The existing and potential relationship between *Strophanthus* raw material sourcing, conservation, and development remain unclear; it is likely that local communities benefit little from existing trade patterns and the exploitation of this species within Cameroon;
- Pharmaceutical markets are large, multi-national, and sophisticated; determination of sourcing strategies is based on cost and quality, and decisions are usually made far from the countries in which species grow; a relatively unresponsive and powerful market such as this is not ideal for small-scale or community based marketing projects.

Next steps

- Prior to initiating any marketing project, research should be undertaken to determine the nature and scope of existing raw material sourcing strategies – ecological impacts, management practices, trade networks, key players, value chain, etc.;

YOHIMBE

Pausinystalia johimbe

Rubiaceae

Pausinystalia johimbe , yohimbe, is a tree found in the forests extending from SE Nigeria, through Cameroon, Gabon, Equatorial Guinea, and Congo Brazzaville. Previously found in Nigeria, it is now all

but extinct there due to over-exploitation. *P. johimbe* occurs mainly in closed-canopy forest, which it appears to require for healthy recruitment (Sunderland et al, 1997; 1999). Both *P. johimbe* and *P. macroceras* are known as “yohimbe”. Both are fast-growing species, but neither reaches a diameter of more than 50 cm dbh. They do not occur together in the same place (Sunderland et al, 1997; 1999).

P. johimbe contains a mixture of alkaloids, the principle one being yohimbine. The presence of yohimbine in bark is highly variable, with optimum quality and concentration of alkaloids found in the bark of the main stem; yohimbine content was found to be as high as 3.42% in the rainy season and as low as 2.52 % in the dry season (Paris and Letouzey, 1960) . Alkaloids are not present in significant quantities until the tree is 15-20 years of age, at which time it can contain between 2-15% yohimbine (BPC, 1947; Sunderland et al, 1997).

P. johimbe bark collections take place almost exclusively in Cameroon, although increasing interest in sources in other countries exists. Yohimbe bark harvest is often linked to logging operations, which open forest area, and following which employees fell trees and strip yohimbe bark (Sunderland et al, 1999).

Traditional Use

Yohimbe is used traditionally to restore erections in impotent men, has been smoked as a hallucinogen, and used to treat angina and hypertension. Yohimbe is used as a performance enhancer for athletes and to increase the clarity of the voices of singers during long festivals. Yohimbe is also used as fuelwood, fish poison, and the inner bark as straps for hunting panniers. Yohimbe is consumed as powdered/ground bark, and is drunk as liquid, after bark is boiled in water with accompanying herbs. Both *P. johimbe* and *P. macroceras* are used traditionally, and in many cases the use of these species is not differentiated, although *P. johimbe* is considered superior by healers. Yohimbe is primarily consumed at a subsistence level, but bark is also traded within the region. Local consumption of yohimbe is on the rise, and is now widespread and common. Healers and traders have noted the scarcity of *P. johimbe*, which is rare, unreliable, and much more expensive (see review of ethnobotanical literature and reports from field research in Sunderland et al, 1997; 1999).

Pharmacology

Most medical research on yohimbe has been on the indole alkaloid yohimbine, rather than the whole extract (as it is used traditionally). Yohimbine inhibits contraction of blood vessels caused by adrenaline-mediated stimulation of the sympathetic nervous system (i.e. the flight or fight response). Specifically, yohimbine selectively blocks pre-synaptic alpha-2-adrenergic receptors, and blocks peripheral 5-HT receptors. Administration of 15-20mg per day has been shown to result in increased muscle tone and stimulation of sacral region of the spinal cord, as well as genital tissue. Yohimbine has shown benefit in cases of psychogenic impotence and vascular insufficiency. Adverse effects can include increased heart rate and blood pressure, dizziness, hallucinations (at very high doses), nausea, salivation, irritability, headache, and skin flushing (Pure World, 1999).

Trade in Raw Material

The trade in yohimbe bark is complex and varied. In their 1997 study, Sunderland et al found that the Yaounde market, for example, is fed by sources from the East of Cameroon. The majority of this bark is from *P. macroceras*, due to the poor representation of *P. johimbe* in this area. The highest population density of *P. johimbe* is found in the South Province which supplies Yaounde, Edea, and Douala with bark (50% of which is *P. johimbe*). The NW Province is primarily supplied by bark sourced from the Mamfe area, from which bark also goes to Douala.

Plantecam, a subsidiary of the French company Fournier Laboratories, is the sole supplier for yohimbe to the pharmaceutical company Boehringer Ingelheim (to which it supplied around 100 tonnes in 1997), as well as other companies overseas. Boehringer Ingelheim of Germany imports significant quantities of

yohimbe from Cameroon. In 1997 they commissioned ICRAF (International Council for Research in Agroforestry) to undertake a pilot study of the ethnobotany, ecology, and natural distribution of yohimbe, and to assess the effects of harvesting practices on populations (Sunderland et al, 1997).

Plantecam operations in Cameroon were commissioned as a Free Trade Zone in April 1995, which means that the company is not liable for national taxes or customs duty. Plantecam/Fournier Laboratories is wholly French-owned, and does not have Cameroonian shareholders. Annual turnover in 1997 was 1.5 – 2 billion CFA (Sunderland et al, 1997). Plantecam was investing in extraction capacity, in order to ship smaller quantities of raw material overseas (1 tonne bark = 1 kg yohimbine). Depending upon moisture content and quality, Plantecam pays suppliers between 125-280 CFA/kilo. Roadside prices paid to collectors are generally between 50 – 150 CFA. Prices paid to local collectors are often a third or half of the prices Plantecam pays per kilogram (Sunderland et al, 1999).

Yohimbe is collected by outside contractors, who supply material to Plantecam and others for sale overseas. Collections are made under licenses provided by the Forestry Department, with most contractors registered in Littoral, SW and South Provinces. In fact, however, the majority of collections are undertaken without licenses by independent contractors and local communities who are paid at the roadside for the delivery of bark. Suppliers to Plantecam between 1992-94 included: Ngah Dima, ITTC, ECIC, Ngako, Jahoung, KAMDEM, and Mme Lea (Sunderland et al, 1997).

Sourcing methods

Yohimbe bark harvests are undertaken in the rainy season (May-September). Bark is collected only from the main stem, and trees are often felled to speed harvests. It is estimated that 98% of the trees exploited are felled. Although larger individuals provide more bark, they are difficult to come by, and trees as small as 10cm dbh are harvested. Both *P. johimbe* and *P. macroceras* are harvested, and are difficult for many to distinguish in the forest. *P. macroceras* has substantially lower yohimbine content than *P. johimbe*. Current harvesting strategies for yohimbe are considered unsustainable (Sunderland et al, 1997). With 98% of trees destroyed in the harvesting process, the genus can regenerate and recruit well, but persistent exploitation will compromise long term health of populations. Sunderland et al recommend sustainable harvesting methods in the wild (stripping bark and allowing callus or re-growth bark), and cultivation (prolific quantities of seed; coppices well, ideal candidate for clonal propagation). ICRAF (International Centre for Research in Agroforestry), in collaboration with IRAD (Institute of Agricultural Research and development) are investigating the potential to domesticate the species – this includes improving understanding of the germination process, improving the genetic base of the species, and to develop techniques for the large-scale cultivation of the species using appropriate vegetative propagation techniques (Tchoundjeu et al, 1999).

Commercial Use

Interest in yohimbe outside of Africa was first recorded in Germany, where it was used as an aphrodisiac, as well as for treating painful menstruation and prostate inflammation with bladder complaints, and serving as a local anesthesia for eye, ear, and nose operations. Growth in the US herbal medicine market use of yohimbe came about in the 1970s (Foster, 1999). Prior to Viagra, yohimbe was the medicine of choice for impotency for millions of men around the world. Markets for products treating erectile dysfunction are substantial – it is estimated that 50% of men between the ages of 40 and 70 suffer from some degree of erectile dysfunction (Massachusetts Male Health Study).

Under US law, yohimbe is regulated as a dietary supplement, and yohimbine hydrochloride is an FDA-approved pharmaceutical drug for impotence. The American Urological Association's Clinical Guidelines Panel on erectile dysfunction classifies yohimbine as a second line treatment for organic erectile dysfunction (Pure World Botanicals, 1999). Germany's Commission E monograph does not recommend

yohimbe for impotence, citing mixed clinical evidence and the potential for adverse side effects, such as tremors, sleeplessness, high blood pressure, and rapid heartbeat (Tyler, 1999).

Yohimbe bark contains up to 6% of a mixture of alkaloids, the principal one being yohimbine (Tyler, 1993). Yohimbine was first isolated from yohimbe in 1896. The US FDA approved the use of yohimbine as a treatment for impotence, and the compound is now available in eleven prescription drugs including Aphrodyne, Erex, Yocon, Yohimex, and Yovital. A synthesized yohimbe pharmaceutical drug containing yohimbine hydrochloride has been available for decades. Yohimbine affects the autonomic nervous system and helps with male erection by increasing blood flow to the penis (Foster, 1999). Yohimbe tree bark has also been reported to increase energy and endurance, while building both strength and muscle mass by raising testosterone production. It is also used for weight loss. There is not sufficient medical evidence to prove these claims.

In 1995, the US FDA sponsored a study of 26 OTC (over-the-counter) yohimbe products and found only trace amounts of yohimbine in the products tested, ranging from 0.1 to 489 parts per million (PPM), probably not enough to have much effect, and much less than the average yohimbe content of yohimbe bark (7,089 ppm). As Varro Tyler reports, "There is almost a 100% chance that the yohimbe product you purchase over the counter will be worthless" (Milman, 1999).

More seriously, yohimbe has been linked to serious health problems, and steps are being taken in the US to better regulate yohimbe products. Included in the FDA "Unsafe List", it can cause anxiety, sleeplessness, and may react dangerously with a substance found in wine and cheeses, causing high blood pressure, nausea, and vomiting (Milman, 1999). The 1997 FDA safety rules for ephedra –containing products included advising against the use of ephedra products mixed with caffeine or yohimbe (Nutrition Science, 1997). Health Canada and the Health Protection Branch of the federal government banned the sale of yohimbe, along with dozens of other botanical products, due to safety concerns (Lake, 1998).

As a result, although the media attention on Viagra helped to create interest in botanical impotence drugs, concerns associated with yohimbe's safety have had a dampening effect on its widespread acceptance. Although yohimbe is the only botanical sex aid to be listed in the Physicians Desk Reference, and has been scientifically proven to improve sexual function, its side effects are considered as serious, if not more so, than those associated with Viagra. Those with hypertension, prostate problems, or heart disease - in effect those most likely to consume it - are warned against using yohimbe (EN, 1999). Ginkgo, garlic, ginseng, oatstraw (*Avena sativa*), muira puama, damiana and other botanicals tend to be promoted in the botanical medicine literature for wide spread use over yohimbe, although for specialists, yohimbe appears to be holding its own. (e.g. Haynes, 1998; Brody, 1998; Natural Way, 1998). In sum, yohimbe is considered a useful medicine, but one to be taken seriously and under the advice of a specialist, and not consumed through the wide-spread self-medicating botanicals market.

Yohimbe Products

Yohimbe is sold as both a pharmaceutical drug containing synthesized yohimbine hydrochloride, and as botanical medicine (as bark extracts or ground up bark). Yohimbe dietary supplement products are usually sold as capsules or tablets, but liquid extracts are also available. Yohimbe products are sold both for impotency, and as a fat-burner/muscle builder for men. Prescription drugs (today usually 5.4 mg per tablet) include Aphrodyne, Erex, Yocon (Palisades Pharmaceuticals), Yohimex, and Yovital, and over-the-counter botanical preparations like Yohimbe Power, Vigor Fit for Men, Inca Warrior Potent Male Formula, Yohimbe Backdraft, Men's X-Action Male-Performance Supplement, Super Man, Hot Stuff, and Yohimbe Concentrate. In addition to the botanicals and pharmaceutical industries, yohimbe is also featured increasingly in nutraceutical products designed to boost energy. For example, SoBe Beverages recently launched the Energy Drink, with Guarana, Yohimbe, and Agimime. In one advertising spot launched in 1999 by Sobe (South Beach Beverage, Norwalk, CT), the benefits of herbal ingredients, or

“functional beverages” is made explicit, including the sustained energy contribution of yohimbe to the SoBe energy drink (guarana provides instant energy, arginine enhances physical performance)(Khermouch, 1999).

Botanicals are playing an increasing role in nutraceuticals, particularly sports nutrition. Key botanicals used to increase endurance and energy include yohimbe ephedra, ma huang, guarana, kola nut and ginseng. Nutraceutical, or functional foods, include added ingredients that impart health benefits, and are growing rapidly in the mass market (Shugarman, 1999).

Companies marketing yohimbe products include: Univeral Labs, Twinlab, Ultimate Nutrition, Only Natural, Vitol, Solaray, and HerbPharm. It is difficult to compare prices between brands since the quality of capsulated powder and the concentration of liquid extracts varies greatly (www.yohimbe.org). An example of products and prices are those of Gaines Nutrition (Madaus):

Yohimbe Extracts, 1500 mg – 110T - \$39.99

Yohimbe Alcohol free extract – 1 fl oz. – \$9.95

Yohimbe extracts, 1000 mg – 50C – \$18.99

Yohimbe Bark powder (use with caution – *Corynanthe yohimbe*) – 1 lb – \$23.50

Yohimbe extract, 1000 mg (10 capsules free) – 110C – \$35.99

Suppliers of yohimbe raw materials to manufacturers include: AIDP, ATZ, Pure World Botanicals, and Stryka Botanics Co (USA); Nuova Linnea (Switzerland), Extractos Natra (Spain), and Schweizer Hall. A Nigerian company – Noga-Wills (Nig.) Ltd. specializes in the “supply of tropical rain forest products used in pharmaceutical and cosmetic industries internationally”. Advertised on the internet as available is a large consignment of *Corynanthe yohimbe* bark. The company also claims to have their “own large Tropical Rainforest reserves and a team of Traditional Medicine Practitioners, whose botanical knowledge of plant species are invaluable...We have special harvesting arrangements for our herbs, as well as....a valid registration certificate with the Corporate Affairs commission of Nigeria (RC No. 200724).

Substitute Products

A range of botanicals sold primarily for other purposes – like ginkgo, ginseng, garlic, and oat straw – are also sold as part of formulations intended to boost sexual performance. Damiana, muira puama, and ginkgo are widely recommended and sold as aphrodisiacs today.

Damiana (*Turnera diffusa*, *T. aphrodisiaca*) is a shrub with aromatic leaves found throughout Mexico, Central and South America, and the West Indies. Mayan Indians used Damiana for “giddiness and loss of balance” and as an aphrodisiac. It is also used traditionally to treat colds, catarrh, and nervous disorders. In addition to its use in medicine as an aphrodisiac, Damiana is used as a flavouring in food products, including alcoholic and non-alcoholic beverages, baked goods, and deserts. Damiana was introduced into American medicine (as an aphrodisiac) in 1874 by a Washington DC druggist who sold 8-ounce bottles of the tincture. Between 1888-1947, Damiana leaf and elixir was listed in the US National Formulary, and for more than 100 years in Europe and North America has been associated with improving both male and female sexual dysfunction (www.rain-tree.com). No constituent responsible for claims of damiana as an aphrodisiac has ever been identified, and some feel that because it lacks significant physiological activity, it is nothing more than an ‘herbal hoax’” (Tyler, 1993).

Damiana leaves are sold in a variety of forms, and by a number of companies including Botanicals International (www.botanicalsintl.com), and as Damiana Liqueur, sold by Damiana Importing Inc. In Houston Tx. Damiana is also considered a treatment for depression, accompanied by a loss in libido. Damiana is also mentioned as a useful herb in preventing prostate cancer, hot flashes

Ginkgo (*Ginkgo biloba*) is a multi-faceted herb, which has been suggested by Varro Tyler (1999) as a possible treatment for impotence (“put the zing back in the sex lives of men whose erections are affected

by taking antidepressants”). Popularly used as a memory-enhancer, ginkgo increases blood flow throughout the body. In a 1989 study conducted by the Urology Clinic in Aachen, Germany, and published in the Journal of Urology, ginkgo was found to produce better results than the anti-impotence drug papaverine hydrochloride (Haynes, 1998).

Market opportunities:

- Demand is significant, and is outstripping supplies; demand is projected to grow in the coming years;
- Viagra has drawn attention to botanical aphrodisiacs and treatments for impotence;
- Existing trade networks exist for the bark;
- Improved and increased processing of material within Cameroon is underway;
- A few international companies have demonstrated concern over the long-term sustainability of yohimbe raw material sources;
- Research is underway to domesticate the species, and thereby supplement supply of raw material; research on ecology and sustainable management in the wild has also been initiated;
- Yohimbe is sold over-the-counter in markets that respond well to labeling of products according to environmental and social standards;

Market constraints

- Demand will be tempered by increasing concern associated with the side-effects associated with yohimbine;
- Existing trade networks, processing, and commercialization activities do not appear to significantly benefit local communities and those living in proximity to wild yohimbe;
- Although research is underway, the nature and extent of subsistence use, trade networks, and ecology are not well understood;
- Strategies for the sustainable management and sourcing of bark *in situ* are not yet in place, and more research is needed;
- It is not clear that the legal and policy context supports the sustainable management of yohimbe on a local or national level.

Next Steps

Yohimbe is a good candidate for a certification and labeling program – an area likely to play an increasing role in the botanical medicine market (plagued as it is by sustainability problems associated with many of its raw materials). Although tracking and chain of custody issues would prove challenging within Cameroon, yohimbe appears a good candidate for this approach, given its relatively high value, consistent international demand, concerns associated with quality and species identification (which can be addressed alongside sustainability issues), and relative ease with which it might be sustainably managed.

The ICRAF study (Sunderland et al 1997) concluded with recommendations that might also be considered by CARPE, including:

- identification manuals to distinguish between species;
- development of sustainable harvesting methods in the wild (bark regeneration; yohimbine content in callus bark, etc.);
- further inventories to provide greater insight into stocking levels;
- domestication programs (including assessment of farmer interest);
- market analysis;

An extensive “state of the knowledge” study of yohimbe ecology, management, and markets is underway within CARPE, which will help provide some of the extensive background information needed to pursue marketing and sustainable sourcing strategies for yohimbe (Sunderland, Cunningham, et al).

Examples of Yohimbe Products

Company	Product	What they say about the product
Nature's Herbs	Yohimbe Power	Certified Potency Yohimbe-Power contains 400 mg Yohimbe Extracts, standardized for 8mg Yohimbine per capsule. It offers all the naturally-balanced active principles while retaining and enhancing all the whole-plant synergistic benefits.
SoBe Beverages www.sobebev.com	Energy Drink (guarana, yohimbe, and argimime)	All SoBe beverages are specially formulated to uplift the mind, body, and spirit, with exotic teas and juice blends whose health benefits have been enhanced by the addition of herbs, nutrients, and other natural supplements.
Team Bodybuilding www.teambodybuilding.com/yohback.html	Yohimbe Backdraft	A team body building formula... contains Yohimbe Bark extract 10 x 25 mg Dioscorea, 20 mg Niacin, and 10 mg Boron. Enhances and maintains elevated testosterone levels, provides all the critical sapogens necessary for muscle growth, and expands capillaries for maximum muscle nutrient feed.
Advanced Labs (offered by Reach4Life Quality Products) www.reach4life.com/1617.html	Yohimbe Gold	Yohimbe Sublingual Extract "is the extract of the bark of the Corynanthe Yohimbe Schum., a rubiaceaceous tree growing in the southern Cameroon's district in Africa." It is an aphrodisiac and athletes report increases strength and muscularity. Each dropper full of Yohimbe Sublingual Extract formula (1cc) contains 850 mg of pure extract, which is equal to 12,000mg of raw herb bark.
Madis (Pure World) Botanicals South Hackensack, NJ 07606	Yohimbe PE 4% (4% total yohimbines)	Yohimbe PE 4% is an extract standardized to 4% total yohimbines (yohimbine \geq 2.5%), sold as a red-brown powder with characteristic odor and taste. The assay method employed is HPLC (with yohimbine standard), maltodextrin as an excipient, and moisture content at not more than 5%.
Nature's Sunshine Products/Back to Health www.bth.4the.net/NSP/Xaction.html	Men's X-Action Male-Performance Supplement	Contains a synergistic herbal combination that enhances male performance energy, featuring muira puama stem concentrate (<i>Ptychopetalum olacoides</i>) and yohimbe bark, in a unique herbal base that includes arginine, damiana leaves, oat straw, saw palmetto. Muira puama and yohimbe have long been valued for supporting and stimulating the nervous system.
Ashaninka http://ashaninka.com	Inca Warrior Potent Male Formula	"Ancient Weapon, New Battle" – Inca Warrior Potent Formula is a combination of tropical plants traditionally used by sexually active men of all ages, including: Damiana, Guarana, Maca, Marapuama, Suma, Chuchuhuasi, Yohimbe, and Catuaba.

Cyberseeds Cyberseeds.com	Yohimbe seeds	“Herbs for Impotence – Alternatives to Viagra”. Include Damiana, Gingko biloba, Ginseng, and Yohimbe. They do not have a source for yohimbe seed, although the others are available online.
Milagro www.tfg-marketing.com/viagra/impotency.htm	Mialgro for Men	Milagro is a natural male potency pill that provides total systemic support for men who wish to stay healthy, strong, and virile for decades to come. The balanced formula nutritionally supports increased desire, erectile dysfunction, ejaculatory control, and improved fertility. Includes a specially engineered combination of Zinc (30 mg), L-Arginine hydrochloride (2,800 mg), Yohimbe bark extract (800 mg), DHEA (50 mg) and a comprehensive herbal blend (includes damiana, muira puama, ginseng, oat straw).
Fit America/Vigor Fit www.vigor-fit.com	Vigor Fit for Men	Each capsule contains 480 mg of a proprietary blend of: Ginseng root, Damiana leaf, Saw palmetto berries, Muira-puama root, Gjeta kola herb, Fo ti root, Sarasparilla root, and yohimbe.

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