

THE AFRICAN CHERRY (*PRUNUS AFRICANA*): FROM HOE-HANDLES TO THE INTERNATIONAL HERB MARKET¹

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Stewart, Kristine M. (*Department of Biological Sciences, Florida International University, University Park, Miami, FL 33199; Current address: Keith and Schnars, 6500 North Andrews Avenue, Fort Lauderdale, FL 33309; e-mail StewartKristine@msn.com*). THE AFRICAN CHERRY (*PRUNUS AFRICANA*): FROM HOE-HANDLES TO THE INTERNATIONAL HERB MARKET. *Economic Botany* 57(4):000–000, 2003. I studied the uses of the African cherry (*Prunus africana*) by four ethnic groups who live near the Kilum-Ijim Forest Preserve on Mount Oku, Cameroon. *Prunus africana* is valued for its timber, which is used for tool handles and for fuel, and it is an important wildlife food. However, its greatest value is for traditional medicines. Healers use the bark and leaves to treat more than 30 human ailments and several animal diseases and it is the most important plant used in their practices. This study is the first to document this importance, particularly for animal medicines. I also examined the growing worldwide herbal use to treat benign prostatic hyperplasia. Market demand has caused resource depletion and an erosion of traditional resource protection practices. Preservation of the species will depend on sustainable harvesting methods and on cultivation.

LA CERISE AFRICAINE (*PRUNUS AFRICANA*): DU MANCHE DE HOUE AU MARCHÉ INTERNATIONAL D'HERBES. J'ai étudié l'emploi de la cerise africaine (*Prunus africana*) par quatre groupes ethniques résidant près de la réserve forestière Kilum-Ijim sur le Mont Oku, au Cameroun. *Prunus africana* est prisé pour son bois, qui est utilisé pour fabriquer des manches d'outils, et comme combustible. C'est également un aliment important pour la faune sauvage. Pourtant, sa plus grande valeur est dans la médecine traditionnelle. Les guérisseurs en utilisent l'écorce et les feuilles pour traiter plus de 30 maladies humaines et plusieurs maladies animales; c'est la plante la plus importante utilisée dans leurs cures. Cette étude est la première à documenter cette importance, particulièrement dans le domaine des médicaments pour les animaux. J'ai aussi examiné son usage mondial croissant comme traitement de l'hypertrophie bénigne de la prostate. La demande économique a causé une dépletion des ressources et une érosion des pratiques traditionnelles de protection des ressources. La préservation de cette espèce exigera des méthodes de moisson soutenables ainsi que la cultivation.

Key Words: *Prunus Africana*; *Pygeum africanum*; Rosaceae; traditional medicine; veterinary medicine; benign prostatic hyperplasia; non-timber forest products; Mount Oku; Cameroon.

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The African cherry (*Prunus africana* (Hook. f.) Kalkm.) is a geographically widespread tree restricted to Afromontane forest habitats (White 1983). About 35 years ago, bark extracts were found to be effective in the treatment of benign prostatic hyperplasia (Bombardelli and Morazzoni 1997). Raw bark, macerated bark, or bark extracts are shipped to Europe and occasionally to the United States, where it is eventually sold in herbal formulations under its synonym *Pygeum africanum* (Fig. 1). Until recently, 70% of the world's supply of the bark came from Cameroon (Cunningham and Mbenkum 1993; Cun-

ningham et al. 1997). Because of growing international demand for its bark, *P. africana* was included in Appendix II of the Convention of International Trade in Endangered Species (CITES) as an endangered species in 1995. In March 2000, Plantecam, the sole bark extraction factory in Cameroon, owned by Groupe Fournier of France, closed its doors due to reduced harvest quotas on Mount Cameroon, business and political decisions in France and Cameroon, competition from other exporters, and depletion of the resource in the Bamenda Highlands.

Before *P. africana* became a source of a popular western medicine, Cameroonians knew it only for its timber and as a traditional medicine (Cunningham and Mbenkum 1993; Sunderland

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Fig. 1. Examples of *Prunus africana* products available in U.S. health food stores, sold its former scientific name, *Pygeum africanum*.

and Tako 1999). Today, it has additional value as a “cash crop” in a country with few opportunities to earn cash. The purpose of this paper is to document the uses of *P. africana* by the four ethnic groups (the Fulani, Kom, Nso, and Oku) who live near the Kilum-Ijim Forest Preserve, located on Mount Oku in the Northwest Province of Cameroon (Mount Oku is known locally as Kilum Mountain, the traditional name used the Kom, Nso, and Oku peoples for the forest on the Kilum massif and Ijim Ridge.

However, to be consistent with published maps, I will use the name Mount Oku in this paper). I also discuss its medicinal value in the treatment of benign prostatic hyperplasia and the implications for the conservation of the species in the wild. I present evidence that the international bark harvest has affected the traditional uses of the species and has also affected resource protection practices that protected the forest for generations.

METHODS

STUDY AREA

Mount Oku is a volcanic massif, located between 6°5' and 6°20' North and 10°20' and 10°36' East in the Bamenda Highlands of the Northwest Province of Cameroon (Fig. 2). The Kilum-Ijim Forest is primarily Afro-montane forest (Letouzey 1985) and lies between 2000–2900 m. Below 2000 m, the forest has been cleared for farms. Currently, about 300 000 people belonging to four ethnic groups inhabit villages surrounding Mount Oku: Fulani, Kom, Nso, and Oku. The latter three groups arrived in the area within the last 200 to 300 years (Koloss 1992; Neba 1987); groups of Fulani graziers migrated to the area in the 1920s from Nigeria

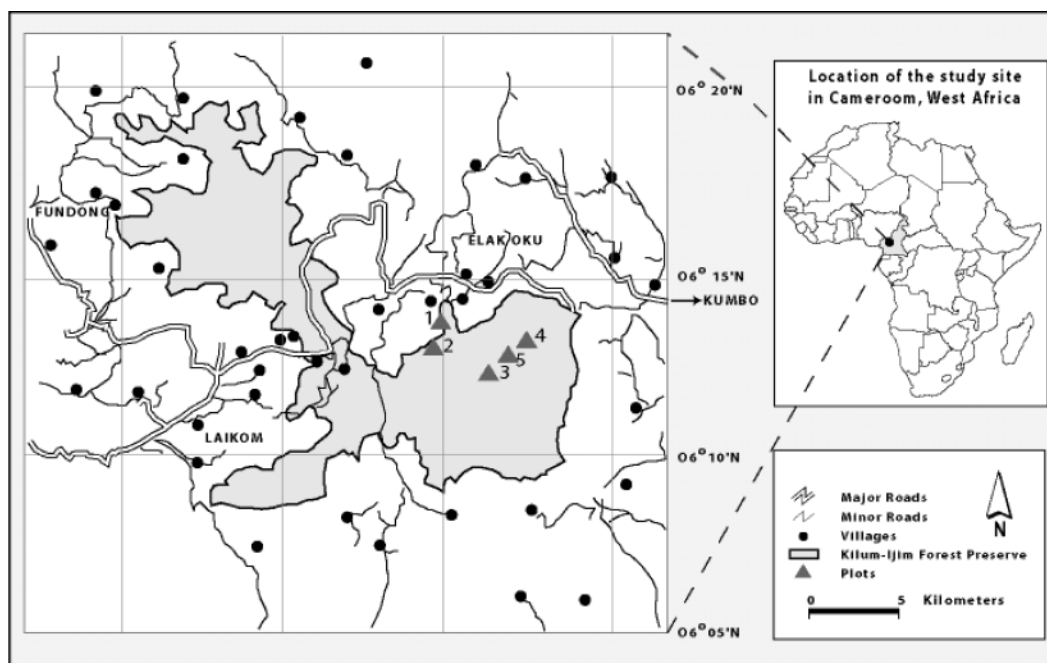


Fig. 2. Location map showing villages and the boundaries of the Kilum-Ijim Forest Project Preserve.

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Fig. 3. Hoe handle made of *Prunus africana* timber.

TABLE 1. LOCAL NAMES GIVEN TO *PRUNUS AFRICANA* BY THE FOUR ETHNIC GROUPS LIVING IN THE VICINITY OF MOUNT OKU. THEIR ENGLISH TRANSLATIONS ARE ALSO GIVEN. IT IS ALSO KNOWN BY ITS HERBAL NAME, *PYGEUM* (PRONOUNCED PIDGE'-UM).

Name	Language	English translation
<i>dalehi</i>	Fulani	plant that has many uses
<i>eblaa</i>	Oku	hoe handle tree
<i>elouo</i>	Kom	ax handle tree
<i>mowom</i>	Kom	bark is peeled
<i>sola</i>	Kom	peeling tree
<i>kanda stick</i>	Pidgin	bark tree
<i>kirah</i>	Banso	very hard wood

(Goheen 1992). The characteristics and origins of the four ethnic groups are described in Stewart (2001).

SPECIES DESCRIPTION AND ECOLOGICAL DISTRIBUTION

Prunus africana is a medium-sized to large canopy tree 30–40 m in height with immense, spreading crowns in older individuals. Older trees have dark, platy, resinous bark, while younger trees possess smoother bark, with prominent lenticels. Leaves, twigs, fruits, and bark emit a “cherry” odor when crushed, due to cyanogenic glycosides (Fraser et al. 1996; Kalkman 1965). The reddish color of mature fruits suggests it may be an important food source for birds (Howe and Westley 1986). *P. africana* occurs in montane regions of central and southern Africa and the islands of Bioko, São-Tomé, and Grande Comore (Kalkman 1965). Because of climatic changes the species has disjunct occurrences among the montane regions of Cameroon. These populations also differ genetically from one another (Barker et al. 1994). In Cameroon, it is generally found above 1000 m and is found above 2000 m on Mount Oku, which corresponds approximately to the Kilum-Ijim Forest Preserve boundary. It is most abundant near the upper forest/grassland border (2900 m).

INTERVIEWING METHODS

Studies on the traditional uses of *P. africana* took place during three field trips to Mount Oku during 1998 and 1999, totaling 12 months. My residence was in the village of Elak, near the center of Oku economic activity, and within a 30-

minute walk of the Preserve. To document the traditional uses of *P. africana* among the four ethnic groups, I conducted informal interviews using open-ended and structured questions. I interviewed four to six traditional healers from each ethnic group, including at least one women healer from each group. Healers included traditional doctors, herbalists, and midwives. I inquired about their uses of *P. africana*, the parts used, and methods of preparation. Interviews outside Elak involved day trips to the area near the city of Kumbo (Nso and Fulani) or several days in the Kom village of Laikom. I conducted the interviews in English or, in some cases, in Pidgin English, but employed translators with healers who spoke only their traditional language. Informants were not paid but small gifts are a traditional courtesy and were presented after each interview. Since bark harvest is currently forbidden on Mount Oku, I interviewed Oku and Kom bark harvesters who participated in a harvest that took place in the late 1980s. For details on the history of the bark harvest on Mount Oku, see Stewart (2001) and below.

RESULTS

Prunus africana is a versatile, multi-use tree that has a durable, dense wood that is favored for ax and hoe handles and for handles of various tools (Fig. 3). A strong hoe with a handle made from *P. africana* is present in nearly every household (although other woods are sometimes used due to restrictions of cutting live wood in the forest). The Nso use its timber for ceremonial spear shafts. Local names reflect its timber uses (Table 1). Because the wood is so strong,



Fig. 4. Carved trunk of *Prunus africana* used as a center pole to support a roof.

it is used as the center pole to support roofs (Fig. 4e) or for bridges; a phonetic variant of the Oku name *eblaa* (Table 1) means bridge. Nearly every household in the study area (to a lesser ex-

tent in the city of Kumbo) depends on wood from the forest for heating and cooking. *Prunus africana* is a preferred fuelwood species because it burns hot with little smoke. Since fires are built inside houses, this is an important attribute.

Prunus africana has probably been used for medicine for as long as the ethnic groups have been in the area. Traditional doctors told me that it has a long history of use for men's problems. Traditional remedies made from the bark, and to a lesser degree the leaves, are the most important use of the species (Table 2). All traditional doctors, both male and female, touted its use for a wide number of ailments. One doctor said, "We have thousands of plants here, *pygeum* is number one." Another claimed, "If not number one, it is number two."

Prunus africana is employed for a number of ailments, but the most often elicited ailments reflected its anti-inflammatory and analgesic properties (Table 2). Many healers use it to treat malaria and other fevers. Many use it for gastrointestinal disorders ranging from stomach aches to intestinal parasites, especially for children. Many healers use it for a popular aphrodisiac reflecting its long use for men's problems. It is the predominant component of a mixture known as *yagee* by the Fulani and as *samba* by the Oku. Women's ailments also are treated, particularly menstrual and infertility problems. It often is included in tonics to promote general good health. The African concept of illness and healing is closely tied with their cosmology (DeSmet

TABLE 2. HUMAN MEDICINAL USES OF *PRUNUS AFRICANA* BY TRADITIONAL DOCTORS IN THE VICINITY OF MOUNT OKU. THE NUMBER OF TIMES THIS USE WAS ELICITED IS IN PARENTHESES.

AIDS (2)	Dehydration (1)	Impotence (1)
Angina (1)	Diarrhea (2)	Infertility (2)
Antibiotic (3)	Dysmenorrhea (4)	Irregular menstruation (1)
Antigonorrhoeic (4)	Energy booster (1)	Kidney disease (1)
Anthelmintic (1)	Epilepsy (1)	Mental illness (4)
Anti-inflammatory (2)	Eye disorders (2)	Midwifery
Antimalarial (6)	Fevers (2)	Miscarriage (1)
Antiparasiticide (2)	Gastrointestinal agent (7)	Nearsightedness (1)
Antirheumatic (3)	General body pains (6)	Obesity (1)
Antitussive (1)	Headaches (2)	Pneumonia (1)
Aphrodisiac (7)	Heartburn (1)	Prostate gland enlargement (3)
Arthritis (2)	Hemorrhage (1)	Purgative
Cardiovascular agent (1)	Hemorrhoids (1)	Tonic (5)
Circulation promoter (1)	Hypermenorrhea (5)	Witchcraft (5)
Cutting teeth (1)	Hypertension (1)	Wound healing (3)

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TABLE 3. ANIMAL MEDICINAL USES OF *PRUNUS AFRICANA* BY ETHNO-VETERINARIANS IN THE VICINITY OF MOUNT OKU.^{1,2}

New Castle Disease (poultry)	Fowl diarrhea	Cattle purgative ³
Fowl typhoid	Cowdriosis (Heartwater)	Wounds (antibiotic)
Fowl Pox	Haemoglobinuria	General tonic
Fowl cholera	Brucellosis	

Sources:

¹ Alhaji Eggi Sule and Alhaji Wakllu Amadu.

² Nshom and Tabey (1998).

³ Kalkman (1965).

1999; Iwu 1996). Thus, *P. africana* was often elicited for the treatment of mental illness, for illnesses caused by witchcraft, and in protection ceremonies.

The inner bark most often is used for medicines, although some doctors use the leaves and roots and, rarely, the seeds. Bark is used fresh, dried, or ground, although most doctors prefer fresh bark. Infusions are the most common method of preparation, although the ashes of bark and leaves sometimes are employed; ground bark could be directly placed on wounds to prevent infection. The bark most often is used alone but also mixed with a few to several other ingredients. Many doctors have a general tonic mixture that includes *P. africana* bark.

When a remedy calls for *P. africana*, the doctors gather it themselves in the forest or harvest it from trees within their compounds. Some doctors have access to community forests. Others obtain the bark from farmers who have trees available for harvest. Many keep a supply of dried bark, either whole or ground, for instances when a supply is needed immediately.

Other than a mention in Kalkman (1965) as a cattle purgative, the importance of *P. africana* as a remedy to treat domestic animals was not documented until this study. In the Mount Oku area, it is as important in the healing of animals as it is for humans and is considered to be the most important plant in traditional veterinary practices (Table 3). In addition to specific ailments, it is used routinely as a general tonic, where dried ground bark is mixed with feed in a 1:10 ratio (Alhaji Sule pers. comm.). Goats left to graze freely in the forest are claimed to be healthier than those raised in farms because they preferentially eat *P. africana* seedlings.

DISCUSSION

WILDLIFE USE AND ECOLOGICAL VALUE

In addition to its value for its timber and its medicinal uses, *P. africana* is an important food source for frugivorous birds and mammals endemic to the Kilum-Ijim Forest Preserve and other montane forests in Cameroon (Cunningham and Mbenkum 1993). In the mid-1980s, the forests on Mount Oku, in addition to other montane forests of central Africa, were targeted for conservation because of their large numbers of endemic plant and animal species (Collar and Stuart 1985; Stuart 1986). In 1987, the International Council for Bird Preservation (IBCP; now Birdlife International) and the British Overseas Development Administration (ODA), recognizing the value of one of the few remaining montane forests in Africa, began the Kilum Forest Project and, in 1992, began the adjacent Ijim Forest Project. Today the Kilum-Ijim Forest Project is a combined effort of private and government agencies to protect the montane forest for these endemic species.

Fotso and Parrott (1991) documented *P. africana* as a food source for the Bannerman's turaco (*Tauraco bannermani*), a magnificently colored bird endemic to montane forests of the Bamenda Highlands. It is listed as endangered in the ICBP/IUCN Red Data Book (Collar and Stuart 1985). Other endemic birds known to feed on *P. africana* fruits are the Cameroon olive greenbul (*Phyllastreus poensis*) and the Cameroon Mountain greenbul (*Andropadus montanus*). The Preuss' guenon (*Cercopithecus preussii*), an endangered primate, is also known to eat *P. africana* fruits (Coulthard et al. 1995; Cunningham and Mbenkum 1993). Other wildlife species that have been seen to eat its fruits are listed in Table 4. In addition to these species, it

TABLE 4. WILDLIFE SPECIES OBSERVED TO EAT THE FRUIT OR LEAVES OF *PRUNUS AFRICANA* IN THE KILUM-IJIM FOREST.¹

Order ²	Family	Species	Common name
Primates	Cercopithecidae	<i>Cercopithecus preussii</i>	Pruess's guenon
		<i>Cercopithecus nictitans</i>	Putty-nosed guenon
		<i>Papio anubis</i>	Olive baboon
Rodentia	Sciuridae	<i>Paraxerus cooperi</i>	Cooper's green squirrel
	Muidae	<i>Cricetomys gambianus</i>	Gambian giant rat
Carnivora	Viverridae	<i>Viverra civetta</i>	African civet
Hydracoidea	Procaviidae	<i>Procavia ruficeps</i> (leaves only)	Large-toothed rock hyrax
Artiodactyla	Bovidae	<i>Cephalophus dorsalis</i>	Bay duiker
		<i>Cephalophus nigrifrons</i>	Black-fronted duiker
		<i>Tragelaphus scriptus</i>	Bushback
		<i>Tauraco bannermani</i>	Bannerman's turaco
Cuculiformes	Musophagidae	<i>Tauraco persa</i>	Green turaco
		<i>Columba arquatrix</i>	Cameroon olive pigeon
Columbiformes	Columbidae	<i>Turdus olivaceus pelios</i>	African thrush
Passeriformes	Fringillinae	<i>Linurgus olivaceus</i>	Oriole finch
	Pycnonotidae	<i>Pycnonotus tephrolaemus</i>	Mountain greenbul
		<i>Pycnonotus montanus</i>	Cameroon montane greenbul
		<i>Phyllastrephus poensis</i>	Cameroon olive greenbul
		<i>Onychognathus walleri</i>	Waller's red-winged starling
	Sturnidae	<i>Lamprotonis splendidus</i>	Splendid glossy starling

¹ Source: Field observations of E. Keming, M. Kemei, and I. Ndong, Kilum-Ijim Forest Project.

² Taxonomy according to Howard and Moore 1991 and Corbet and Hill 1991.

is likely that many other ground-dwelling rodents eat the large number of fruits or seeds that fall to the ground, but due to their nocturnal behavior little is known of their feeding habits.

Cunningham and Mbenkum (1993) suggested that overexploitation of *P. africana* might lead to the decline of these endemic species. However, since it has alternate-year fruiting phenology and varies in different parts of the forest (Stewart 2001), this may be an overstatement (Sunderland and Nkefor 1996). In addition, recent data on the phenology of major Kilum-Ijim forest species failed to identify any keystone food plants. Rather, the staggered fruiting of more than 40 animal-dispersed species provides food sources in all months of the year (Maisels and Forboseh 1999). In any case, whenever *P. africana* trees are fruiting heavily, they are an important food source (pers. obs).

Bee-keeping and honey production are successful programs begun by the Kilum-Ijim Forest Project. Several beekeepers told me of their preference for the golden-colored honey produced in hives placed near *P. africana* trees. Hives are moved seasonally to be near flowering trees.

HOUSEHOLD

The strength and durability of *P. africana* timber is reflected in the wide variety of uses throughout its range in addition to those observed on Mount Oku. In Uganda, household items that are made from the wood include mortars, pestles, and bee hive supports (Cunningham 1996), although beekeepers on Mount Oku told me that wood other than *P. africana* was favored for their hives. The timber is employed for window and door frames on Mount Cameroon (Iverson 1993). In West Africa, it is used for truck bodies, chopping blocks, bridge decks, cabinets, and furniture (Howe n.d.). In South Africa, the wood is used for making wagons (Palmer and Pitman 1972). In western Uganda, large trees are hollowed out to make "beer boats" to make banana beer. Other uses in Uganda were for pit-sawn lumber (trees >50 cm dbh), building poles (5–15 cm dbh), and bean stakes (1.5–5 cm dbh) (Cunningham 1996).

The preference for *P. africana* as a fuelwood has important implications for forest conservation. Management practices in the Kilum-Ijim Forest allow only deadwood to be removed for

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fuel. Smits and Ploegmakers (1998) studied the status of the availability of deadwood and found the four preferred species were *Carapa grandiflora* Sprague, *Cassipourea* spp., *Nuxia congesta* R.Br. ex Fresen., and *P. africana*. They found the removal of firewood exceeded the supply of deadwood. In other words, the cutting of live trees was becoming a common practice.

PHARMACOLOGY

Benign prostatic hyperplasia (BPH) is a non-cancerous enlargement of the prostate, common in men over the age of 50 (Tyler 1994). The prostate surrounds the urethra, the tube that drains the bladder. When the prostate becomes enlarged, urination becomes difficult or incomplete. The causes of BPH are not fully understood but are believed to be caused primarily by the conversion of testosterone to dihydrotestosterone (DHT) by the enzyme 5- α -reductase (Bartsch et al. 2000; Tyler 1994), although recent research suggests estrogens and growth stimulating hormones may be involved as well (Awang 1997). Testosterone is the main male hormone responsible for fertility, muscle strength, and masculine features, while DHT is important for prenatal fetus development and development of male sexual characteristics during puberty. Elevated levels of DHT in older men are implicated in the proliferation of smooth muscle and glandular epithelial tissues in the prostate (Bombardelli and Marazzoni 1997). Despite the alleged dominant role of DHT, other causes for BPH are being investigated. Over 10 000 studies of the causes and treatment of BPH are contained in the Medline database.

The extract from *P. africana* bark contains several pharmacologically active compounds (Catalano et al. 1984; Fourneau et al. 1996; Longo and Tira 1981) that may interfere with the development of BPH. These compounds are believed to work synergistically to counteract the biochemical and structural changes associated with the disease (Bassi et al. 1987; Bombardelli and Morazzoni 1997). Phytosterols (β -sitosterol, β -sitostenone) reportedly inhibit the production of prostaglandins in the prostate, which suppresses the inflammatory symptoms associated with BPH and chronic prostatitis (Bassi et al. 1987; Breza et al. 1998). Pentacyclic triterpenes (oleanolic and ursolic acids) are believed to inhibit the activity of glucosyl-transferase, an enzyme involved in the inflammation process. Fer-

ulic esters (n-docosanol and n-tetracosanol) reportedly lower blood levels of cholesterol, from which testosterone is produced (Bombardelli and Morazzoni 1997).

A number of studies have shown the effectiveness and safety of *P. africana* bark extracts to reduce BPH symptoms (reviewed in Bombardelli and Morazzoni 1997; Ishani et al. 2000). Both reviews included a number of open and double-blind, placebo-controlled clinical studies that demonstrated the efficacy and safety of *P. africana* extracts in the relief of symptoms, including frequent urination, painful urination, and urgency. The extracts are well tolerated in clinical studies, producing only minor side effects (mostly gastrointestinal).

Allopathic medical therapy for BPH includes drugs and non-surgical or surgical treatments. Drugs include the anti-androgen finasteride (Proscar), a synthetic inhibitor of the enzyme 5- α -reductase (Rhodes et al. 1993), and a number of smooth muscle relaxants, which prevent pressure on the urethra. Non-surgical techniques include thermotherapy, stents, and balloon dilation. Surgery involves removal of excess tissue, and the invasiveness of the surgery varies with the severity of the hyperplasia. Because of a number of side effects from drugs and surgery, phytotherapy is an increasingly popular option. Several herbal preparations are effective; the most widely used is saw palmetto extract (*Serenoa repens* (Bartram) Small, Arecaceae; Bennett and Hicklin 1998). Whereas saw palmetto may act to inhibit 5- α -reductase and as an anti-androgenic and antiestrogenic (Wilt et al. 1998), *P. africana* appears to interfere in the concomitant inflammatory response in the prostate. Thus, some herbal formulations contain both products (Fig. 1) and others contain pumpkin seed extract (*Cucurbita pepo* L., Cucurbitaceae) or stinging nettle root (*Urtica dioica* L., Urticaceae). They are thought to be anti-inflammatory due to their β -sitosterol content (Berges et al. 1995; Klippel et al. 1997; Pegel 1997).

Saw palmetto products are one of the most rapidly growing sectors of the American herbal market (Brevoort 1998). This market is closely tied to present and future sales of *P. africana* products. Most *P. africana*-based herbals are sold within the European Union. However, as BPH becomes more prevalent in aging American men, and as the efficacy of the product becomes more widely known, the demand for *P.*

africana products in the lucrative American market is expected to grow as well (ICRAF 2000). The economics of the trade is addressed in Cunningham et al. (1997), but the interrelations of the two markets are beyond the scope of this study. However, both products are entirely wild collected. The ecological impacts of the harvest of saw palmetto fruits are unknown (Bennett and Hicklin 1998), whereas the effects of the *P. africana* harvest were addressed in Stewart (2001).

COMMERCIAL IMPORTANCE

Since its recognition as a medicinal tree of importance to western pharmaceutical companies, thousands of trees have been planted in farms, not only on Mount Oku but also on Mount Cameroon, in the Bamenda Highlands and in Kenya (Dawson 1997; Nkuinkeu 1998; Simons et al. 1998; Sunderland and Nkefor 1996). On Mount Oku, this is due to encouragement from the Kilum-Ijim Forest Project and the expectation of future income from sale of the bark. Thus, *P. africana* is treated as a "cash crop" and is often interplanted with coffee trees or as border trees along the edges of farm fields. This tendency is reflected in the newer local names for *P. africana*, such as *sola* and *kanda stick* (Table 2). Until the bark from the trees can be sold, tree limbs are used for household uses and small quantities of bark are sold to traditional doctors or used by the household itself for human and animal medicines. Others collect seeds for sale to nurseries that, in turn, raise the seedlings for sale to other farmers.

It is its importance to western pharmaceutical companies that affords *P. africana* its highest value. In a country with rampant unemployment, especially for young men, the sale of the bark is one of the few ways to earn money. It is tempting to participate in illegal harvests, even in protected areas like the Kilum-Ijim Forest (Stewart 2001). Until the Plantecam processing plant was closed, members of the Mapanja Harvesters Union on Mount Cameroon could fetch about \$8.50 U.S.D for a 32-kg headload of bark (\$0.26 U.S./kg). The price paid to illegal harvesters and the headload weight are unknown, although weights up to 70 kg are not uncommon (J. Ekati pers. comm.).

The market demand for the bark is high and is expected to grow. Herbals made from bark extracts are widely used in Germany where, in

1994, sales were US \$150 million (Gruenwald and Buttle 1996). Worldwide trade in *P. africana* remedies is now estimated at US \$220 million annually (Cunningham et al. 1997). Only one 8.8-ha plantation has been established on Mount Cameroon, although the need for alternative sources of bark has long been recommended (Cunningham and Mbenkum 1993; Cunningham et al. 1997; Dawson 1997; Sunderland and Nkefor 1996).

COMMERCIAL HARVEST AND THE IMPACT ON TRADITIONAL PRACTICES

It is commonly stated that marketing non-timber forest products (NTFP), particularly plant-derived medicines, will help conserve tropical forests (Balick and Mendelsohn 1992; Grimes et al. 1994; Peters et al. 1989). This argument is based on the assumption that people will value a resource if it can be linked to a marketable product (Sheldon et al. 1997). However, Hall and Bawa (1993) reviewed several marketed species, including those used for local consumption, and found that they are not exploited on a sustainable basis. Browder (1992) examined extractive reserves and found tropical forests can only be conserved by balancing complex social needs. Clearly, development of a sustainably marketed NTFP must include consideration of economic, ecological, and social factors.

Economic and ecological sustainability are not always consistent. Economic growth, which is an increase in the quantity of a product, cannot be sustained indefinitely (Costanza et al. 1994). Over-harvesting may decrease populations while demand keeps prices constant or even increases them as the product becomes scarce (Cunningham 1991; Hall and Bawa 1993). In economic terms, the effects of unsustainable extraction take a long time to be detected, especially for long-lived trees. This appears to be the case for *P. africana* in Cameroon. It is an example of the development of an NTFP with no clear understanding of the sustainability of the harvest. In March 2000, after a mere 28 years of exploitation, Plantecam, the largest bark extraction factory in Africa and the only one in Cameroon closed its doors because of economic, political, and biological factors.

Until the late 1980s, hundreds of square kilometers surrounding Mount Oku were completely forested. Several factors, including cultural ones, caused the forest to dwindle to its

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current 10 000 ha. For generations, the secret society, known as the *kwifon*, oversaw the uses of forest plants and animals. The *kwifon* had sophisticated rules for managing watersheds, catchment areas, and fragile forest ecosystems. Certain sections (sacred forests) were reserved for the gods. On certain days of the week, called "country Sundays," no one was permitted to enter the forest for any purpose. Violators were threatened with serious illness or death unless an expensive cleansing ritual was performed. As long as the taboos were in place, the gods protected the forest and no one species was over-exploited (Fisiy 1994).

The breakdown of the traditional resource protection ethic (by the *kwifon*) began in 1976 when the Cameroon government issued a bark exploitation permit to Plantecam (then Plantecam Medicam) to harvest *Prunus* bark on Mount Cameroon. At first, trained workers appeared to sustainably harvest the bark. In 1985, Plantecam's monopoly was broken. In an effort to stimulate the industry, the government of Cameroon issued new permits to 50 entrepreneurs (Cunningham and Mbenkum 1993). Destructive harvests throughout the country ensued (including in the Kilum-Ijim Forest), with complete stripping and felling of trees. The traditional authority had no control over these outsiders. They violated the local norms with impunity, entering the forest even on country Sundays, and suffered no adverse consequences. The fear of sanctions by the forest gods dissolved (Fisiy 1994; Mbenkum and Fisiy 1992). Thus, harvest of *P. africana* bark contributed to the erosion of the resource preservation ethic that continues to this day. The recent establishment of locally managed community forests has encouraged the preservation of the forest mostly through the exclusion of outsiders (pers. obs.). This protected the remaining *P. africana* populations, although illegal incursions still occur (C. Asanga pers. comm). Currently, the Kilum-Ijim Forest contains one of the largest remaining populations of *P. africana* in Cameroon, second only to that on Mount Cameroon.

CONCLUSIONS

The demand for *Prunus africana* bark ranges from the few kilograms used by the healers of Mount Oku to the tons demanded by the international herbal market. The conservation of the Kilum-Ijim Forest will not depend on the viability

of *P. africana* populations. Its protection will occur in conjunction with the conservation of a complete, functioning forest ecosystem. Due to the planting of thousands of trees in local farms, it is far from biologically extinct. However, because of the huge market demand, the viability of the remaining populations is in doubt (Stewart 2001). Although Plantecam, the largest exporter, has closed, several others retain their licenses, and as long as there is an international market, the tree will continue to be exploited in ever more remote and inaccessible locations in Cameroon. I anticipate the harvest will expand to other countries within the species' range. The island of Bioko, just south of Cameroon, is currently being harvested (Sunderland and Tako 1999). As demand for the bark continues to increase, preservation of the species will depend on further research on ways to sustainably harvest it in the wild and on ways to cultivate it in plantations (Cunningham et al. 2002; Stewart 2001).

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